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China's Health System Reforms: Review of 10 Years of Progress

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BMA House, Tavistock Square
London, UK, WC1H 9JR
Email: editor@bmj.com
Tel: +44 (0) 20 7387 4410
Fax: +44 (0) 20 7383 6418

BMI - Beijing
Room 335
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China's encouraging commitment to health

But reforms must be extended to deliver better outcomes

In 2009, the Chinese government published *Opinions on Deepening Health System Reform*,¹ a political commitment to establishing an accessible, equitable, affordable, and efficient health system to cover all people by 2020.²

Health is a public right in China, and the health service is delivered and regulated by central and local governments.³ As the second largest world economy with a population of 1.4 billion, China has seen its economy grow over the past 40 years followed by challenges from emerging health problems such as non-communicable diseases, an ageing population, and people's rising expectations about health.

Difficulties with health financing, healthcare delivery, and public health made health service reform urgent. In 2003, 45% of the urban population and 79% of the rural population were not covered by social health insurance schemes,⁴ limiting access to healthcare and increasing financial burden. Out-of-pocket payments accounted for more than 50% of health expenditure.⁵

The financing model for public hospitals and primary healthcare facilities was distorted by incentives from drug mark-ups, leading to overprescription and irrational use of medicines, particularly antibiotics. Inappropriate financial incentives also hampered primary care practitioners in providing a high quality service to patients.⁶ Consequently, patients bypassed primary care with public hospitals providing over 80% of health services and consuming half of all health expenditure.⁷

Limited public health services were provided before 2009, with most focused on maternal and child health and control of infectious diseases.⁸ Therefore, the 2009 reforms focused on strengthening the capacity of primary care, expanding social health insurance, delivering an essential public health package, revamping the public hospital sector, and improving the essential medicines policy.⁹ Promoting universal health coverage was a central pillar of the reforms.

Towards universal health coverage

This BMJ collection of articles (<https://www.bmjjournals.com/china-health-reform>) analyses the achievements and challenges of the

health system reforms that started in 2009. Government investment in healthcare increased after the reforms. Total health expenditure grew from 5% of gross domestic product (GDP) in 2009 to 6.4% of GDP in 2017.⁹ China expanded its three main social health insurance schemes to cover more than 95% of the population. Out-of-pocket expenditure dropped to 29% of total health expenditure in 2017 and is projected to reach 25% by 2030.¹⁰ Differences in maternal and infant mortality rates between rural and urban areas were reduced.⁹

Primary care facilities now provide essential public health services to all citizens. These are co-funded by central and local governments and are free at the point of delivery. An expanded public health package was designed to integrate health education, non-communicable diseases, and mental illnesses, with particular focus on the health of elderly people and rural women.⁸

The reforms changed the financing model for public hospitals and primary care facilities. A performance based salary system was introduced to realign incentives for primary care practitioners, separating physician income from drug prescription in an attempt to encourage better quality services.⁶ To compensate for revenue loss from drug sales, the government funded a reimbursement scheme to cover the deficit in primary care⁶ as well as increasing fees for medical services and subsidies for public hospitals.¹¹ By introducing a policy of tiered charges and co-payments for medical consultations, for example, Beijing saw a reduction in outpatient volumes in tertiary care and greater use of primary care.¹²

An essential medicines list was created to regulate prescriptions, combined with enhanced antimicrobial stewardship to curb misuse of antibiotics. As a result, the rate of antibiotic prescription in both inpatients and outpatients decreased in tertiary hospitals.¹³

Health system reform is complicated, and it can be especially challenging for low and middle income countries with huge populations, such as China. Although systemic approaches have helped with progress and pushed the reforms forward, many problems remain. China's health system reform is a complex and long term

challenge. The capacity and use of primary care providers are inadequate, and better collaboration between different health sectors is essential to provide integrated care. Further reform should focus on building competency and realigning incentives to recruit and retain primary care practitioners. The current separate financing mechanisms for treatment, covered by social health insurance, and prevention, covered by a basic public health services package, should be combined to bolster universal health coverage and contain health expenditure, thereby encouraging hospitals to provide more public health services. An effective performance evaluation system is also needed to assess health outcomes and quality of care.⁹

A well functioning health system of high quality and efficiency is integral to China's desire to improve population health and shift to a national development model that prioritises health. This ambition is embodied in China's commitment to achieving Healthy China 2030, a statement of political will to prioritise population health and respond to global commitments related to realising the United Nations sustainable development goals.¹⁴ After a decade of progress since the health reforms of 2009, ongoing challenges in health require China to further extend its health system reforms and meet the growing health expectations of its people.

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Qingyue Meng, professor¹

Daoxin Yin, China editor²

Anne Mills, professor³

Kamran Abbasi, executive editor²

¹Peking University China Center for Health Development Studies, Beijing, China

²The BMJ, London, UK

³London School of Hygiene and Tropical Medicine, London, UK

Correspondence to: K Abbasi
kabbasi@bmj.com



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What can we learn from China's health system reform?

Qingyue Meng and colleagues assess what China's health system reform has achieved and what needs to be done over the next decade

The Chinese central government started a first round of health system reform in 1996. The effectiveness of the reform was questioned after several years of implementation for a number of reasons. Firstly, complaints from the public about access to and affordability of healthcare increased. At that time, most people had no financial health protection and made high out-of-pocket payments for healthcare, which accounted for about 60% of total health expenditure. A large proportion of the population could not afford the healthcare they needed.^{1,2} Secondly, the outbreak of severe acute respiratory syndrome in China in 2003 highlighted the importance of health for human development, and the government began to recognise the contribution of the health system to overall social and economic development. Thirdly, a leading state research institute published a report in 2005 which concluded that the 1996 health system reform had failed, which provoked more discussions about reform.

To respond to the concerns about the health system, the Chinese government began to plan another round of health system reform in 2007 and asked national and international organisations to provide reform proposals. Several ministries, coordinated by the National Development and Reform Commission and Ministry of Health, worked together to produce the

master policy document for the reform. In March 2009, the Central Committee of the Communist Party of China and the State Council issued the *Opinions on Deepening Health System Reform*.³ The aim of the reform was to establish an equitable and effective health system for all people (universal health coverage) by 2020 by strengthening healthcare delivery, health security, and provision of essential medicines.

China's health system reform is a large scale, long term social endeavour from which many lessons will be learnt. Analysis of the reform is important to help consider options for the future after this round of reform finishes in 2020. In this article we assess the achievements of the main reform policies, identify areas that need attention, and propose reform strategies for the next decade.

Main reform policies

China has a three tiered system for healthcare delivery: health organisations and providers operate at county, township, and village levels in rural areas, and at municipal, district, and community levels in urban areas. The public health sector is the main healthcare provider. In 2017, 82% of inpatient care was provided by public hospitals.¹ China has three main basic health insurance schemes—rural and urban resident based health insurance, which is funded mainly by government subsidies (about 70% of the total funds), and employee based health insurance funded by employer and employee contributions.

China's health system reform in the past decade covered five main areas: social health security, essential medicines, primary healthcare, basic public health service package, and public hospitals. The reform policies were designed to tackle access to healthcare and financial protection. Table 1 outlines the main reform policies, and their progress and challenges.

Financing reforms focused on expanding healthcare coverage and the benefit package of the social health insurance

schemes for the population. Integration of the health insurance schemes for urban and rural residents is underway. Because of the large differences in per capita premiums and sources of funds, integration of the resident and employee based health insurance schemes is not planned.

Removing mark-up on drug prices as a source of financing for health providers is an important part of the policy reform on essential medicines. Reliance of hospitals on this price mark-up as a source of income had led to considerable overuse of drugs. Additional government subsidies and social health insurance funding have been the main way to compensate for the removal of mark-ups.

Strengthening the capacity of the primary healthcare system—mainly the rural village clinics, town health centres, and urban community health stations and centres—has been a priority of the reform. The government has made large investments and issued policies to attract and retain qualified health professionals in the primary healthcare system.

The purpose of the basic public health service package is to provide everyone with a defined healthcare package, regardless of income, residence, or other characteristics. The package is financed by a government per capita allocation mainly from the central government for low income provinces, and from local government (provincial and county) for high income provinces. The values of the fund and the package are adjusted every year.

Reforming public hospitals is important to tackle the problem of access to healthcare and financial protection because public hospitals account for more than 60% of total health expenditure.¹ This reform is particularly difficult because of the need to balance the interests of the public hospitals, which are mostly responsible for their own finances, and the rest of society.

To implement the reforms, the State Council set up a State Council Health System Reform Office to coordinate the relevant ministries to develop specific reform policies—for example, hospital

KEY MESSAGES

- China's round of health system reform in 2009 has made good progress
- Almost everyone is covered by the social health insurance system and basic public health service package, and unmet health needs and inequities have decreased
- Improvement in the quality of primary healthcare, further reform of public hospitals, better use of health resources, and integration of healthcare delivery and financing systems are still needed

payment reform and remuneration policies for primary healthcare workers—and annual work plans to guide implementation of the reform activities by ministries and provincial governments. The office's annual evaluation of the performance of the ministries at the central level and the provincial governments influences promotion of leaders and allocation of government subsidies.

Achievements

Table 1 gives an overview of the main achievements and challenges of the reform in the five priority areas. Here, we highlight changes in government and social health

expenditure and changes in unmet health needs and disparities in maternal and infant mortality as the health output and outcome.

Increased public funding for health

Financial contributions for health from government and through the social health security system have increased. Total health expenditure as a proportion of the gross domestic product changed little between 2000 and 2008 (4.57% in 2000 and 4.55% in 2008), but increased from 5.03% in 2009 to 6.36% in 2017.¹ Trends in total health expenditure from 2000 to 2017 show faster increases in health expenditure by the government and social

health insurance system than from out-of-pocket payments (fig 1). Between 2000 and 2005, more than 50% of total health expenditure came from out-of-pocket payments; since then the proportion of health expenditure from out-of-pocket payments has declined and was 28% in 2017.¹ Government health expenditure increased by ¥10-20bn (£1.14-2.28bn; €1.29-2.59bn; \$1.45-2.89bn) every year between 2000 and 2006, and by ¥100-150bn every year between 2009 and 2017.¹ Health expenditure by the social health insurance system increased rapidly and accounted for 42% of total health expenditures in 2017.¹ Social health insurance expenditure exceeded out-of-pocket payments in 2010; and gov-

Table 1 | Summary of the main reform policies and their progress and challenges, 2009-18

Reform priorities	Main reform policies	Progress	Challenges
Social health security	Expanding and sustaining population coverage of the social health insurance system Extending the health service package of the social health insurance system Extending medical aid and social assistance programmes for eligible poor people and those with catastrophic medical expenditure Introducing a critical illness insurance scheme Integrating basic health insurance systems of rural and urban residents Reforming the payment system	95% of the population covered by social health insurance schemes by the end of 2017 ¹⁴ Per capita fund for resident based health insurance increased from ¥100* in 2008 to ¥700 in 2018, about 70% from government subsidies ¹ Catastrophic illness insurance systems established in all provinces Integration of rural and urban basic health insurance systems underway	Ineffective use of purchasing power including use of the payment system to control cost increases and improve quality of care
Essential medicines	Removing price mark-ups of drugs as a source of financing Formulating a national list of essential medicines and reforming the drug procurement system Promoting rational use of antibiotics	See public hospital progress below Rates of antibiotic use in inpatient and outpatient care decreased by 50% in selected tertiary hospitals ⁵	Unfinished reform of the bulk procurement system for drugs
Primary healthcare	Increasing investment in the primary healthcare system Mobilising human resources for primary healthcare by changing incentives Expanding capacity for educating and training general practitioners (more university places for family medicine and more training programmes) Removing drug mark-ups as a source of financing Creating a contracting system for general practitioners	¥965bn invested in primary healthcare ¹ Reliance of primary healthcare providers on drug mark-ups reduced. Government budgets for community and township health centres increased by about 20% ¹	Lack of effective incentives to attract and retain primary healthcare workers Difficulty in supporting a tiered healthcare system
Basic public health service package	Providing basic public health service package to all people through government subsidies Supporting programmes to control the main public health problems	Regular government budget support provided for the package Per capita allocation for the package increased from ¥15 in 2009 to ¥55 in 2017 ^{6,7}	Low quality of public healthcare provided in poor areas
Public hospitals	Replacing fee for service by an alternative payment system Improving pricing policies and removing mark-up of drugs as a source of finance for all public hospitals Encouraging the creation of consortia or alliances of healthcare providers Establishing a tiered service delivery system (tertiary, secondary, and primary healthcare providers with clearly defined functions) Encouraging the use of clinical pathways and guidelines	Share of drug income of total hospital income reduced from 42% in 2008 to 30% in 2018. Reliance on price mark-ups on drugs reduced. Government budgets for public hospitals increased by 1.5% ¹ Clinical pathways for 442 diseases were developed by the end of 2015 and 65% of secondary and tertiary hospitals implemented case based payment reform by the end of 2017 ^{8,9} Tiered healthcare system started by 95% of municipalities by the end of 2017 ¹⁰	Escalating costs of medical care Overuse of healthcare and technologies

*1¥=£0.11, €0.13, \$0.14.

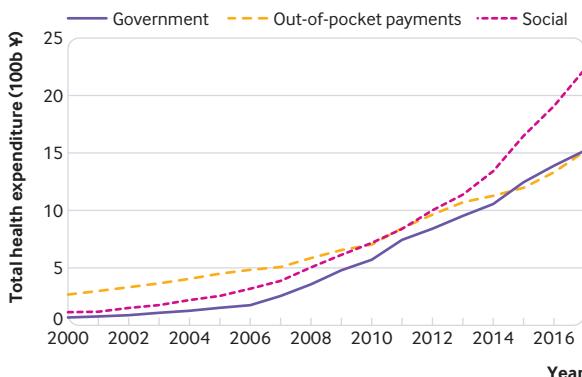


Fig 1 | Total health expenditure by source, 2000-17¹ (1¥=£0.11; €0.13; \$0.14)

ernment health expenditure exceeded out-of-pocket payments in 2015.

Low income provinces and counties have received additional government health subsidies. In low income counties, 80% of the funds for the rural health insurance scheme came from government subsidies, half from the central and half from provincial governments, and 100% of the funds for the basic public health programmes came from higher level governments.¹¹ During the reform period, social health insurance schemes and the basic public health service package were extended to cover everyone.¹¹ Providing universal coverage by expanding social health insurance schemes and public health programmes was possible mainly because of additional and continuing financial support from the government.

Improved access to healthcare and decreased health inequality

Before the introduction of the social health insurance schemes, a large proportion of the population did not access healthcare even when needed, mainly because of financial barriers. Between 2003 and 2008, the proportion of patients who were advised by doctors that they needed treatment in hospital but did not use inpatient care decreased by 4.5% (from 29.6% to 25.1%).¹² The proportion decreased by 8.0% between 2008 and 2013 (fig 2).¹² The proportion of patients who needed hospital care but could not afford it declined from 17.6% in 2008 to 7.4% in 2013.¹² Changes in proportions of unmet needs for outpatient care were similar to inpatient care. Extended coverage of the population through social health insurance schemes and increased availability of healthcare are the main reasons for the greater accessibility to healthcare.¹³

An important reform target was reduction in health disparities and the country has

made substantial health improvements. For example, differences in the maternal mortality rate between low, middle, and high income provinces (categorised by per capita gross domestic product) decreased from 2005 to 2017 (fig 3). Differences in maternal mortality rates between urban and rural areas also decreased, from 28/100 000 live births between 2000 and 2008 on average to 2.3/100 000 live births between 2009 and 2017 on average.¹ Differences in the infant mortality rate between rural and urban areas also narrowed. In 2000, the difference in the infant mortality rate between rural and urban areas was 25.2% (37% in rural areas and 11.8% in urban); by 2017, the difference was only 3.8% (7.9% in rural areas and 4.1% in urban).¹ Support by social health insurance schemes for childbirth in a health facility which targeted low income areas helped improve maternal and child health outcomes in poorer areas and reduce health disparities.¹⁴

Challenges

The health system in China is more complex than that of many other countries because of the country's large population and regional diversity. China has made good progress in its health system reform but challenges remain.

Low use and capacity of primary healthcare providers

The low use and capacity of primary healthcare providers has two main reasons. Firstly, the quality of care given by primary healthcare providers is inadequate. From 2005 to 2015, the proportion of healthcare services provided by primary care decreased by 7%.¹⁵ In 2010, 5.6% of the doctors in township health centres had a formal medical education (five years of medical school),¹⁶ which increased to only 10% in 2017.¹ Incentives to attract and retain more qualified health professionals in the primary care system are essential to improve quality of care.¹⁷ Secondly, the fee-for-service payment system in hospitals gives hospitals an incentive to try to attract and retain patients who could otherwise use primary healthcare providers.

Increased cost of medical care and inefficient use of resources

Medical costs have increased more rapidly since 2009. In general hospitals, medical expenditure per patient discharged increased by 17.2% between 2005 and 2008, and by 22.1% between 2010 and 2013.¹⁶ Changes in costs for outpatient care were similar. In general hospitals, medical expenditure per outpatient visit increased by 15.5% between 2005 and 2008 and 21.7% between 2010 and 2013.¹ The proportion of out-of-pocket payments for healthcare decreased, but the financial burden of using healthcare did not fall much, especially for poor households.¹⁸ The share of drug costs in total hospital expenditure has fallen, but overall hospital expenditure is still increasing.¹⁹

When health insurance coverage is universal, a moral hazard situation arises—healthcare providers may overprovide and healthcare users overuse health services. This situation and the fee for service payment system are argued to be the main factors driving overprovision of healthcare in China and the resulting waste of health

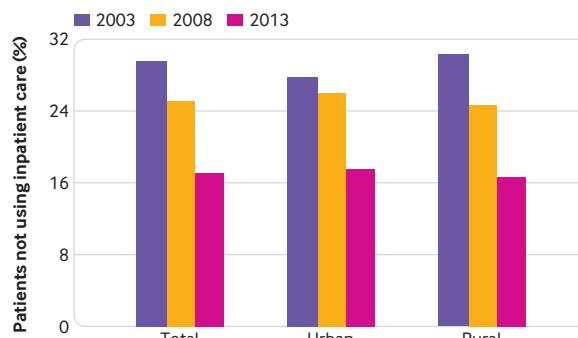
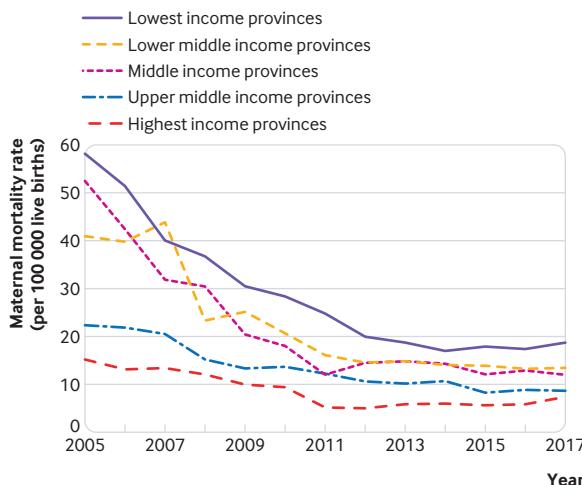


Fig 2 | Percentage of patients who did not use inpatient care when needed¹²

Fig 3 | Maternal mortality rate by income level of provinces, 2005-17¹

resources.²⁰ Fig 4 shows China's ranking in the world for per capita health expenditure (health input), under 5s mortality rate, and life expectancy at birth (health outcomes). China ranks lower on per capita health expenditure (that is, it spends relatively less) than on the other two indicators, so the country has better health outcomes at lower cost; in other words it is relatively efficient. However, the differences in the rankings are decreasing, indicating that China's relative efficiency in using health resources is decreasing.

Allocation of government subsidies is mainly based on service volume and activities rather than health outcomes. In addition, health resources are skewed to the hospital sector rather than primary and preventive care, although these two services are important determinants of efficiency. In 2016, the rate of hospital admission in China was 16.4%, higher than the average for countries of the Organisation for Economic Cooperation and Development,

which implies that China needs to examine the appropriateness of inpatient care, including overuse and misuse of healthcare services.¹²²

Insufficient coordination and fragmented systems

To improve population health and achieve "health in all policies," coordination and cooperation between related sectors are important. More effective mechanisms are needed to improve intersectoral coordination for health. Delivery of health services should be people centred, integrated, and cost effective, and ensure continuity of care. However, many of the health institutions lack motivation to cooperate with others. Even though medical consortiums and alliances are encouraged by the government and have been piloted in many places, mechanisms to coordinate health institutions to provide continuing care have not been properly established.

The financing system is fragmented with separate financing for different health programmes and population groups.²³ The reform has tried to allow health insurance to be portable for all people, but most rural migrants in cities still need to go back to their home town to access insurance benefits.

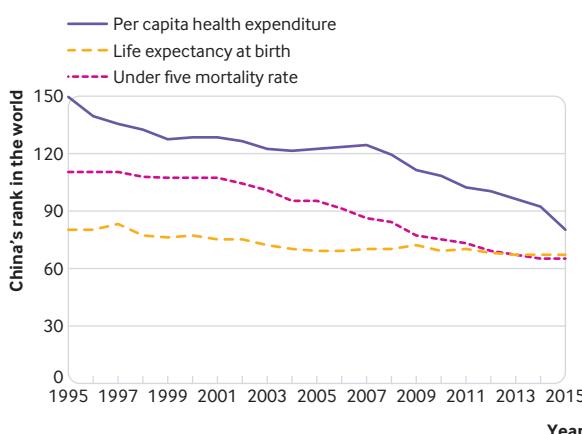
Areas for further reform

Integrated health system based on primary care

Coordination between different sectors should be strengthened to make health in all policies workable and achievable. The current reform has shown that success requires effective collaboration between related sectors led by a strong coordinating authority. The existing hospital centred healthcare system should be transformed to a system based on primary care, where health providers are closely connected and coordinated to offer continuing and integrated care. Both organisational and functional structures of healthcare institutions should be changed. People should be able to receive good quality and convenient healthcare from nearby health providers. Integration of health services and a three tiered structure of primary, secondary, and tertiary providers should be developed with primary care as the foundation. A collaborative relationship between primary healthcare and hospital sectors is essential. A competent health workforce is also important; government efforts should continue to focus on incentives (financial rewards and professional development opportunities) to attract and retain qualified health professionals in the primary healthcare system.

Consolidated health financing system

Strategies to achieve universal health coverage can provide direction for integrating financing sources for both curative and preventive care. The current separate financing mechanisms, where health insurance schemes cover curative care only and the basic public health service package covers preventive care only, can be combined to encourage hospitals and clinics to offer more preventive care services. When integrating the rural and urban health insurance schemes, policies should be developed to ensure protection of poor and rural people. Reform of the payment system should be accelerated and cost containment and quality improved. Incentives should be adapted to strengthen the primary healthcare system.

Fig 4 | China's world ranking for per capita health expenditure, mortality among children 5 years, and life expectancy at birth, 1995-15²¹

Monitoring and evaluation system

The government should recognise the importance of establishing an effective performance evaluation system for implementation of a Healthy China strategy. Quality of care and health outcomes need to have sufficient weight in the evaluation system. The main health indicators should be included in the social and economic development agenda and in the performance evaluation of government at central and local levels. A health impact assessment system should be developed to generate more resources and effort from all related sectors to achieve better population health.

Conclusion

China has implemented a comprehensive health system reform over the past decade which focused on strengthening the capacity of primary care, extending and improving social health insurance coverage, providing basic public health services to everyone, reforming public hospitals, and improving medicines policies.

Both central and local governments have mobilised substantial political and financial resources to implement the reform. Almost everyone has been covered by the social health insurance system and basic public health service package. Mark-up of drug prices has been stopped in public hospitals and primary healthcare providers. Unmet health needs and inequities in some health indicators have decreased.

Some challenges remain. The quality of care in primary healthcare has not improved greatly, mostly because of the inadequate training of the healthcare providers. The cost of medical care is still increasing as a result of incomplete reform of public hospitals including ineffective utilisation of the payment system. Inefficient use of health resources is prevalent mainly because of overuse of healthcare and uneven distribution of health resources. Healthcare delivery and financing systems are fragmented because of constraints in the governance structure.

Building a well coordinated and integrated health system based on primary care and an evaluation system based on health outcomes is needed to further develop the health system in China.

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Qingyue Meng, professor¹

Anne Mills, professor²

Longde Wang, professor³

Qide Han, Professor⁴

¹China Center for Health Development Studies, Peking University, Beijing, China

²London School of Hygiene and Tropical Medicine, London, UK

³China Association of Preventive Medicine, Beijing, China

⁴Health Science Centre, Peking University, Beijing, China

Correspondence to: Q Meng
qmeng@bjmu.edu.cn



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Realigning the incentive system for China's primary healthcare providers

Although reforms have reduced incentives to overprescribe, more needs to be done to link performance to quality and ensure primary care doctors are adequately paid, say **Xiaochen Ma and colleagues**

Primary healthcare is the foundation of an effective health system.¹ A strong health workforce is widely recognised as a prerequisite for healthcare and an important determinant of health system performance.² The performance of health professionals is determined by their competencies (for example, their medical knowledge and skills) and the incentives they are provided.³

China moved to a market economy in the 1980s. The role of government has been substantially reduced in all economic and social sectors, including healthcare.^{4 5} As a result, government subsidies that were available to primary care providers in the earlier centralised economy have been greatly reduced, and these providers have had to act as for-profit entities. At the facility level, in order for primary healthcare facilities to survive financially, they were allowed a 15% profit margin on drugs by the government. At the individual level, the income of primary healthcare doctors was linked to the revenue generated by the facilities they worked for.³ This incentive system resulted in primary healthcare doctors overprescribing drugs and high costs for diagnostic tests such as

magnetic resonance imaging and computed tomography.³ This situation led to growing concerns about the quality of care, rising cost of healthcare, and a public distrust of the health system, particularly primary healthcare facilities.^{4 6}

In order to deal with these public concerns, China started to reform its primary healthcare system as one of five key areas in its health system reforms which began in 2009.⁷ The reform focused on separating the operating revenue of primary healthcare facilities from their drug sales and realigning the incentives of primary healthcare providers with the public objective of improving the quality and efficiency of services. In this analysis, we summarise the policies that have been introduced over the past decade to provide incentives for primary healthcare professionals, discuss the achievements

and gaps of the reform, and recommend possible actions to further progress.

Realigning incentives in primary healthcare

Box 1 summarises the main policies on incentives for primary healthcare providers. A set of policies was introduced to stop drug mark-ups as a source of financing for primary healthcare facilities.⁷ The mark-up used to be 15% of the drug sales. To compensate for the loss of revenue, the government established a comprehensive reimbursement scheme that provides financial subsidies to fully cover the deficit.⁹

A performance based salary system, fully funded by the government, was introduced to realign the incentives of primary healthcare professionals.⁸ The performance based salary is split into a basic salary (60–70% of the total salary) and a performance based bonus (30–40%). Later policies indicated that the future salary reform

Box 1 | Main policies on reforming incentives for primary healthcare providers

2009: Opinions on deepening health system reform⁷

- Aim: introduce a zero drug mark-up policy in all primary healthcare facilities

2009: Implementation of a performance based salary at primary healthcare facilities and public health institutions⁸

- Aim: establish a performance based salary system for primary care health professionals

2010: Establishment and optimisation of reimbursement scheme for primary healthcare facilities⁹

- Aim: implement a comprehensive reimbursement scheme in primary healthcare facilities

2011: Establishment of a general practitioner system¹⁰

- Aim: establish a general practitioner system and expand their career development path

2012: Guidelines on deepening health system reform during the 12th five year plan period¹¹

- Aim: increase the performance based bonus proportion of the total salary appropriately to increase the variation in total income distribution among primary healthcare employees

2013: Opinions on optimisation of the essential medicines policy and operating mechanism for primary health care facilities¹²

- Aim: permit primary healthcare facilities to allocate their operating profits to employee benefit fund and bonus fund

2016: Plan on deepening health system reform during the 13th five year plan period¹³

- Aim: permit healthcare organisations to set their wage level above the ceiling of public funded organisation, and to use their operating profits for employee bonuses

2018: Opinions on optimising the training and incentive mechanism for general practitioner¹⁴

- Aim: set the total performance salary for primary healthcare facilities at a reasonable level to bring the remuneration of general practitioners to the same level as hospital doctors with similar qualifications within the same district or county

KEY MESSAGES

- China changed the incentive system of primary healthcare providers as part of its 2009 healthcare reforms
- Drug mark-ups were replaced with government subsidies and a performance based salary system was introduced
- Incentives are still weak or misaligned and the use of primary healthcare facilities has decreased since 2010
- Further reforms should include a performance based salary system with an evaluation system linked to quality, adequate total pay, and career development opportunities for primary care professionals

would look to increase the proportion of the performance based bonus^{11 12} and raise the total income for primary healthcare professionals.^{13 14} The main reform in the primary healthcare salary system changed the source of income and its objective. Before the reform, the income was connected with the drug mark-up, which encouraged volume of prescriptions. Since the reform, income has been funded by the government, which was designed to motivate primary healthcare practitioners to focus on providing good quality services.

In addition to financial incentives, non-financial incentives are also important to motivate primary healthcare professionals.¹⁵ In 2011, a national guideline was issued on establishing a general practitioner (GP) system by 2020.¹⁰ To help build this system, policies on career development of primary healthcare professionals emphasised that the GPs should have more promotion opportunities. Years of work and other requirements need to be adjusted to better evaluate GPs' qualifications for promotion.¹⁶

Progress made and challenges remaining

The financing mechanism no longer relies on drug mark-ups. Both central and local governments have invested more in primary healthcare providers, including subsidies to compensate for the loss of revenue from removal of drug mark-ups and financial arrangements to deliver basic public health services.¹⁷ For rural primary healthcare facilities, the share of direct government subsidies in revenue rose from 23% in 2010 to 37% in 2017. For urban primary healthcare facilities, the share increased from 25% in 2010 to 45% in 2017 (fig 1).¹⁸

The number of primary healthcare professionals has steadily increased and so have their salaries. Helped by government financing and the establishment of the GP system, the total numbers of health professionals, practising doctors, and registered nurses increased by 31%, 28%, and 65% respectively between 2010 and 2017.¹⁸ In addition, the average annual salary for primary healthcare professionals increased about two and half times, from ¥22 000 (£2838; €2508; \$3190) in 2010 to ¥57 000 in 2017 (fig 2). In addition, social benefit programmes were expanded to include primary healthcare professionals.¹⁹

Despite the evidence of the positive effect of the policies, more work needs to be done to realign incentives for primary healthcare practitioners to improve quality of care. An unintended result of the reforms is that the use of primary healthcare as a proportion of total healthcare use has declined over the

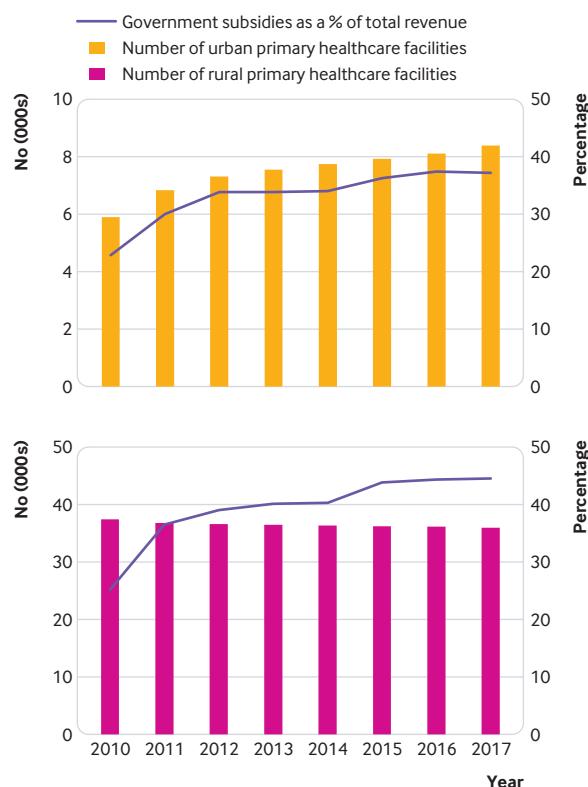


Fig 1 | Number of primary healthcare facilities and government subsidies as a percentage of total revenue, 2010-17¹⁸

past 10 years. Outpatient and inpatient visits to primary healthcare facilities as a percentage of the total number of visits to healthcare facilities—primary healthcare facilities and hospitals—decreased from 62% and 28% respectively in 2009 to 54% and 18% in 2017 (fig 3). Patients chose to bypass the primary healthcare system in favour of hospitals, which suggests that the quality of health services in primary healthcare facilities was still unsatisfactory.⁶

A recent study using standardised patients to assess the quality of care in primary healthcare found poor clinical

performance and that an important barrier to delivering good quality care was the gap between medical knowledge and clinical practice.²⁰ This gap, known as the know do gap, is found in many primary healthcare systems in the developing world and may be a result of weak or misaligned incentives that fail to motivate primary healthcare professionals to deliver good quality care even when they have the correct knowledge.²¹ Lack of knowledge and medical incompetence are also reasons for poor care, which reflect gaps in medical education and inservice training opportunities.⁶

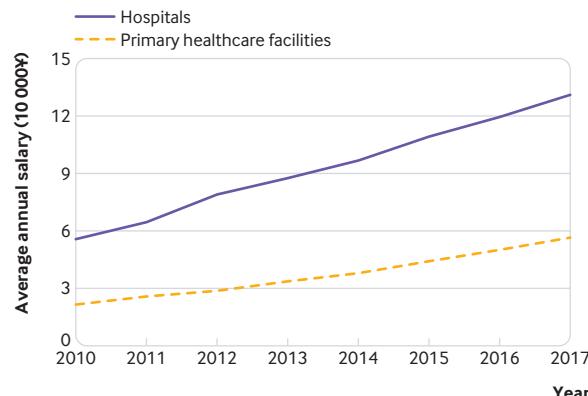
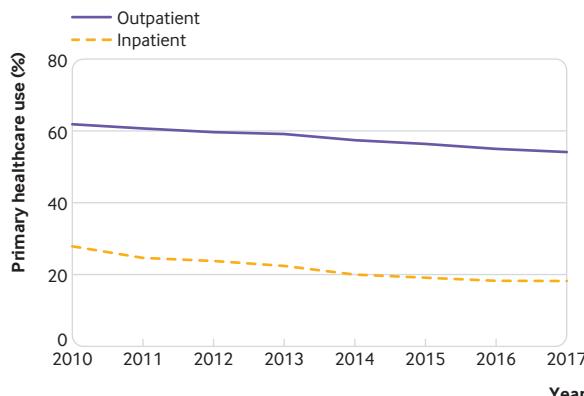


Fig 2 | Average annual salary in primary healthcare facilities and hospitals, 2010-17.¹⁸
1¥=£0.114; €0.129; \$0.145

Fig 3 | Use of primary healthcare as a percentage of total use of healthcare facilities, 2010-17¹⁸

What should be done to further progress?

Moving forward, China has an historic opportunity to establish its GP system and people centred integrated care system. The country should make use of the policy momentum to strengthen its system of incentives. We highlight three policy recommendations for further progress.

Firstly, based on the experience of implementing the performance based salary system, this should be accompanied by a functioning evaluation system linked to quality. Although monitoring and evaluation based on the quality of service were built into the reform, in practice, many primary healthcare facilities linked their performance indicators to service volume rather than quality of services provided.²² In addition, no meaningful variation existed in the bonus salary. Because primary healthcare managers were concerned about fairness,¹⁹ many facilities distributed the bonus salary equally to all healthcare professionals. This acted as a disincentive for primary healthcare doctors to individually deliver a higher quality of care. Further reform of the performance based salary system should consider adding a component in the evaluation system that is tied to both volume and performance quality indicators so that it generates variation in individual performance bonus. By doing so, the performance based salary system would

motivate primary healthcare professionals more effectively.

Secondly, more policies should be considered to ensure an adequate total income for primary healthcare providers. Even if the performance based salary were implemented properly, the total income of primary healthcare providers is still low, which makes it difficult to motivate primary healthcare doctors. The salary of healthcare professionals, and particularly primary healthcare doctors, in China is not attractive compared with the average occupation (table 1). Although salaries in primary healthcare facilities have improved, the salary gap between health professionals working in primary healthcare facilities and public hospitals has widened over the past decade (fig 2). Without increasing the pay of primary healthcare professionals to an acceptable level, any effort to motivate them by adding a performance based mechanism will not improve job productivity and morale in the long term.²⁴ In fact, a recent policy modification has considered improving the total salary.^{14,16} In countries of the Organisation for Economic Cooperation and Development, the average salary of GPs is comparable to the average salary of physicians and surgeons and two times higher than the average salary of all occupations (Table 1). As China's economy continues to grow, setting a salary standard

for GPs comparable to those internationally should be considered as a long term goal.

Thirdly, non-financial incentives, especially career development opportunities for primary healthcare professionals, should be strengthened. Although improvement of salaries may be a greater priority, non-financial incentives are weak—for example, opportunities for career development are scarce. Limited promotion prospects and an unclear career development path are common for primary healthcare providers.²⁵ At the same time, primary healthcare facilities no longer provide a wide range of clinical services—such as minor surgery or childbirth services—and this has reduced the opportunities for primary healthcare practitioners to update and improve their clinical knowledge and practice.¹⁹ A review of the GP system in the UK showed that clinical content—especially if it is intellectually stimulating—is associated with job satisfaction.²⁶ In addition, strategies to reform payment methods, education, and training of GPs (not discussed in detail here) are also important to reform the system of incentives.

Conclusion

Primary healthcare is the foundation of an effective health system but efforts to strengthen primary healthcare in low and middle income countries are limited.²⁷ China's experience shows that incentive systems are important for a fully functioning primary healthcare system. Relying mainly on the market economy has generated inappropriate incentives that have led to overprescription of drugs and overuse of advanced diagnostic tests, and relying mainly on government interventions has resulted in weak incentives for primary healthcare providers. Over the past 10 years, despite achievements in removing drug mark-ups as a main source of financing for primary healthcare facilities, gaps still remain in realigning the incentives for primary healthcare providers. Further reforms should consider connecting the performance based salary system to an

Table 1 | Health sector and primary healthcare sector wages in China and OECD countries

Country	Level	Measurement	Wage (\$)	Relative wage
China	All occupations	National average annual wage for all occupations ¹⁸	10 232	100% (reference)
	Healthcare sector in general	Average annual wage for health and social services sector ¹⁸	12 166	118%
	Primary healthcare	Median annual wage for community and township health centres ⁶	7 118	70%
	Primary healthcare	Median annual wage for village clinics ⁶	3 707	36%
OECD	All occupations	National average annual wage for all occupations ²³	40 099	100% (reference)
	Healthcare sector in general	Average annual wage for physicians and surgeons ²³	103 907	259%
	Primary healthcare	Average annual wage for general and family practitioners ²³	85 084	212%

evaluation system linked with quality, ensuring adequate total salaries, and providing career development opportunities for primary healthcare professionals.

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Contributors and sources: XM and XL conceived the paper. XM did the data analysis and drafted the manuscript. HW, LY and LS revised the manuscript. XM has researched health issues in developing countries, mainly in the setting of rural China. HW has over 30 years of experience in health policy globally, with a focus on health economics, financing and systems in developing countries. LY is an expert on health economics and health policy research, with a focus on public health, national medicine policy and health technology assessment. LS has a long research interest in health policy and health services, with a focus on primary care, health disparities and vulnerable populations. XL has expertise in health issues in China with a research focus on human resources. XM is the guarantor.

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Xiaochen Ma, lecturer¹

Hong Wang, senior programme officer²

Li Yang, associate professor³

Leiyu Shi, professor⁴

Xiaoyun Liu, professor¹

¹China Center for Health Development Studies, Peking University, Beijing, China

²Bill and Melinda Gates Foundation, Seattle, USA

³School of Public Health, Peking University, Beijing, China

⁴Johns Hopkins University Bloomberg School of Public Health, Baltimore, USA

Correspondence to: X Ma
xma@hsc.pku.edu.cn



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Strengthening public health services to achieve universal health coverage in China

Better integration of public health and medical services and greater focus on quality of services are needed to make further progress on health outcomes, say **Beibei Yuan and colleagues**

China's Equalization of Basic Public Health Services (EBPHS) policy sets out financing and governance measures designed to ensure access to health services for all its citizens.¹ EBPHS is one of five priority areas for action in the comprehensive health system reform launched in 2009 in China, with a target date of 2020 to achieve universal health coverage.²

Primary health providers provided some public health services before 2009 (table 1), and these services have contributed to improving maternal and child health and controlling infectious diseases. However, providers lacked the funding, motivation, and capacity to expand public health services to deal with the full range of public health problems and new challenges from chronic disease. This was a major constraint to promoting universal coverage of essential health services. Here we consider what the EBPHS has achieved since its introduction in 2009 and its future challenges.

KEY MESSAGES

- The equalisation of basic public health services policy aims to promote universal health coverage through strengthening the public health system
- The policy has increased coverage and reduced disparities between areas of lower and higher economic development, although progress varies among services
- The policy does not give enough attention to quality of public health services, especially management of non-communicable diseases
- To accelerate progress the EBPHS policy should seek to achieve a better match between services package and funding levels, create appropriate incentives for health providers to improve the quality of care, and promote better synergy between public health initiatives and health services

Key elements of EBPHS policy

The EBPHS has two strands covering basic public health services and targeted public health programmes, each with different methods of finance and delivery (table 1). The basic public health services package sets out the minimum services for all citizens. The packages do not include any medical treatment, only monitoring and other management. The initial package of nine categories in 2009 had been expanded to 14 categories by 2017 (table 1). Local governments can expand the minimum package based on local population's health problems and the government funding at their disposal. Primary healthcare institutions (box 1) are responsible for delivering these services to all residents, free at the point of use. The costs are shared between central and local government, with a minimum funding for the basic package of ¥15 (£1.70; €2; \$2) per person in 2009³ and ¥55 in 2017.⁴

In addition to the basic health services package, crucial public health programmes seek to counter important infectious diseases and meet the needs of disadvantaged populations (table 1). These services are funded primarily by central and provincial governments and delivered by public health institutions.¹³

EBPHS sought to achieve universal availability and promote a more standardised delivery of health services to all citizens. To achieve this governments earmarked funding to cover the full costs of the basic service package (the accumulated government input reached ¥300bn in 2016⁴). The minimum funding per capita increased by 17.6% a year on average from 2009 to 2017, greater than the average annual increase in total health expenditure (14.1%) over this period.⁵

To ensure that all primary healthcare institutions got the minimum required funding, central government contributed more funding to less developed regions, where local government's budgets are more constrained (table 2). In addition, the central government issues national guidelines for each type of service⁶ and

organises regular training to support their use, especially supporting less qualified health providers, such as village doctors. Lastly, EBPHS strongly emphasises the need to track performance and has designed explicit performance targets to ensure the uniform enforcement of the service packages.

Central government allocates funding for training (¥80m a year) and performance assessment activities (¥65m a year).⁴

Progress towards service coverage and equity

Two measures were selected to assess the changes in coverage and equity after implementation of the EBPHS—child health surveillance and management of type 2 diabetes. Both are also indicators for monitoring universal health coverage.⁷ Child surveillance is key to improving children's health, a widely accepted measure of health system performance. Management of type 2 diabetes reflects the increasing burden from non-communicable diseases. Another reason for choosing these measures was that data were available before and after implementation of EBPHS, enabling examination of national trends. Given that the two measures are core services, their coverage and equity trends are likely to reflect the consequences of implementation of EBPHS.

The child surveillance programme, which comprise newborn home visits, regular physical examination, and promotion of child growth, expanded from covering 74.6% of all children under 3 years in 2008 to 90.9% in 2016.⁵ Figure 1 shows the narrowing gap in coverage across regions with different economic development.

The management of patients with type 2 diabetes includes screening, regular follow-up, and health education. The number of patients covered increased from 18.5 million in 2011 to 31.2 million in 2017 (fig 2).⁸ The average annual increase in patients covered was 7.3%, which is higher than the average annual increase in the number of patients with diabetes (4.1%) over the same period.⁹

However, the rate of increase in coverage was not linear, stalling in 2013 before rising

Table 1 | Basic public health services and public health programmes provided before and after EPHS

Basic public health services		Public health programmes		
	Before 2009	Added after 2009	Before 2009	Added after 2009
Available services	<ul style="list-style-type: none"> Child health surveillance (0–36 months) Maternal health Vaccination Reporting and handling of infectious diseases 	<ul style="list-style-type: none"> Establishing health records for all citizens Health education Care for older people Hypertension and type 2 diabetes Severe mental illness Coordination of health and hygiene monitoring (eg, food safety; from 2011) Traditional Chinese medicine (2015) Tuberculosis (2015) Free contraceptives (2017) Health literacy and smoking cessation (2017) 	<ul style="list-style-type: none"> Prevention and control of tuberculosis and AIDS National immunisation programme Rural facility delivery Cataract surgery for poor patients Reconstructing water supply and lavatories Eliminating endemic fluorosis 	<ul style="list-style-type: none"> Hepatitis B vaccine for children under 15 years old Folic acid supplements before and during early pregnancy Breast and cervical cancer screening for rural women
Financing	Unstable, limited programme based budget from different levels of governments and dependent on local government's finance	Funds collected from the central and local governments; higher national payments to less developed regions	Funds are mainly collected from central and provincial government; less developed regions receive higher national payments	

again after 2015.¹⁰ Possible explanations for this are lack of accurate data because many patients with diabetes are not diagnosed and a lack of comparability across different years with more patients being detected through EPHS.¹¹

Figure 3 shows that inequalities in coverage of diabetes management remain between regions with different socioeconomic development, although the differences have narrowed considerably.^{7 12 13} The coverage of diabetes management is higher in the western areas with lowest economic development, mainly because of larger and timely subsidies to these areas by the central government.

Strengthening EPHS

Moving forward, EPHS should focus on quality of services to ensure future progress. Using health outcomes as a proxy indicator for service quality, different trends were found for child health and diabetes: mortality of children under 5 years fell from 20.6/1000 in 2008 to 13.3/1000 in 2016.⁵ However during this period mortality from non-communicable diseases increased from 4.8/1000 to 5.7/1000.¹⁴

Blood glucose control in patients with diabetes reflects the quality of services for non-communicable diseases. Data show that the control rate has remained persistently low. (The administrative data show it was 58.4% in 2014 and 57.9% in 2016,¹⁰ but resident surveys indicate much lower rates—ranging from 8% to 38%¹⁵⁻¹⁷ in some rural areas). Considering the complex health system context, we make some recommendations for improving the low quality of services.

Better matching between service package design and funding

Although the current level of financing and the systems to equalise distribution support the expansion of services to all citizens, they provide limited scope for ensuring the quality of care. The funding made available for EPHS was determined politically, not based on the analysis of costs. It did not go through a robust priority setting process for selecting a rational services package. Equalisation processes did not sufficiently take into account the different costs and existing service capacity in regions with different levels of development. A study of one province calculated the costs of the EPHS

package as \$7.31 and \$8.65 per capita in urban and rural areas respectively. These costs were higher than funding level, which was \$3.97 for residents in all areas.¹⁸

To make further progress on quality of services, an explicit and formalised priority setting process should be developed to refine the service package and ensure it reflects better the available funding. This process should also take into account the different needs and costs across regions.

Performance assessment to focus more on quality indicators

EPHS has achieved a rapid expansion of the basic services package but some strategies may have compromised quality of care to some extent. For example, the strict and frequent performance assessments and linking the allocation of the funds with performance generated substantial pressure to implement the services package. However, these performance indicators were mainly focused on processes such as developing follow-up lists and filling health record forms, and they might have reduced the incentives of health workers to focus on improving quality of care and health out-

Box 1: Public health services in China

Public health is broadly defined as all social efforts to prevent diseases and improve population health.¹⁹ In China, however, public health services are usually understood from the perspective of the services or activities provided by public health institutions, which are distinguished from medical services.

Public health institutions—These include centres for disease control and prevention, specialised diseases prevention and control institutions (such as tuberculosis hospitals or institutes of parasitic diseases), maternal and child care institutions, centres for health education, blood centres, and health inspection authorities

Public health services—Prevention and control of communicable and chronic diseases, monitoring and health epidemic emergency response, prevention and control of endemic diseases and environment related disease, maternal and child healthcare, family planning, health education and health surveillance, blood collection and supply, sanitary and health inspection, and basic public health services provided by primary care institutions.

Primary care institutions—Comprising community health centres and stations in urban areas and township hospitals and village clinics in rural areas. They are grassroots institutions providing both public health services and medical services to community residents.²⁰ Public health workers within the institutions provide the basic public health services package and clinical doctors provide diagnosis and treatment

Table 2 | Distribution of national payments to provinces as proportion of total funding for basic health services according to level of development in 2017

	Lowest	Low	Middle	High	Highest
No of provinces	12	10	3	4	2
Average GDP per capita (¥)	45 577	47 589	69 670	99 771	1 278 140
% of budget from national funding	80	60	50	30	10

comes.⁴ More indicators of service quality need to be added to the EPHS policy to assess the performance of service providers, moving providers' focus from process to the quality of care and health outcomes of residents.

Better integration of public health and medical services in primary care

The fragmented delivery of the EPHS service packages has become a bottleneck for realising its potential to improve population health. There are limited synergies between the public health services in EPHS and routine medical services offered by primary healthcare institutions, reflecting a broader pattern of fragmentation within the Chinese health delivery system² (box 1). For example, the management of non-communicable diseases covered under EPHS includes developing health records, updating records after follow-ups, and health education but does not include clinical services like prescription and adjustment of medicines. Although the primary care institutions provide all these services, the public health workers (in charge of EPHS services) and doctors (in charge of medical treatment) work in separate departments and there are limited mechanisms for them to cooperate in providing integrated care for prevention, treatment, and health promotion. This is likely to have hampered the improvement of health outcomes in patients with non-communicable diseases.

Further progress in meeting the goals of EPHS would be aided by ensuring that public health workers and medical

doctors cooperate by working together as a family care team. This will help to improve continuity and quality of management of complex conditions and achieve better population outcomes.

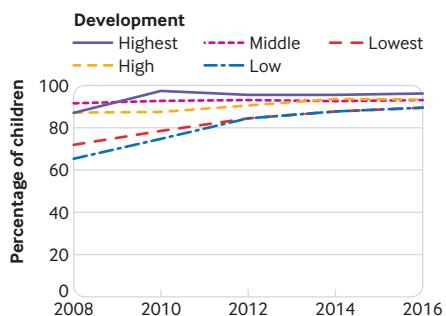
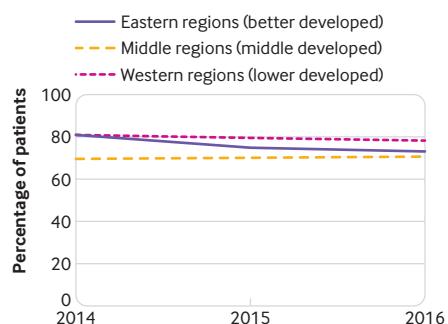
Support from overall health system reforms

Finally, the lack of quality in some EPHS services also stems from some longstanding challenges in China's overall health system. One of the biggest challenges is the lack of qualified health workers in primary care.² This is aggravated by a lack of measures to effectively motivate health workers,²¹ who experienced a higher workload as they began to deliver new services under EPHS.^{22 23} Consequently, the further improvement of the EPHS has to rely on reforms of the overall health system, especially strengthening and motivating the primary care workforce, integration of health service delivery, and consolidation of financing arrangements.

Wider implications

EPHS is a multifaceted policy that has been implemented throughout China since 2009, with the goal of strengthening public health system and accelerating progress to universal health coverage. Given its broad scope, its precise effect is difficult to assess, and the outcomes have varied for different types of service categories. There are indications that EPHS has improved coverage and reduced inequalities between lower and higher developed provinces. However, the quality of some services, such as management of non-communicable disease, remains low despite increased access.

China's experience with the EPHS policy provides important lessons for other low and middle income countries seeking

**Fig 1 | Proportion of children under 3 years old in China covered by child health surveillance programme by level of development of province, 2008-16⁵****Fig 3 | Percentage of patients with type 2 diabetes receiving managed care according to development of province, 2014-16¹⁰**

to expand essential health services to achieve universal health coverage. It shows the importance of strong government commitment, reflected in guarantees for government financing and enacting of appropriate regulations and incentives for effective implementation. However, simply equalising the funding levels and ensuring that the service package is universally available and a duty for providers is not enough. With rapid expansion, the challenges of maintaining quality become more acute and can potentially undermine the ultimate health outcomes of the scheme. It is vital to monitor and address the use and quality of services for different population subgroups in order to improve the health of the entire population.

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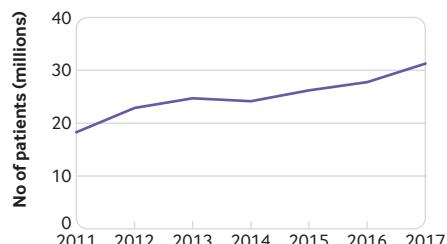
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Beibei Yuan, associate professor¹

Dina Balabanova, associate professor²

**Fig 2 | Total numbers of patients with type 2 diabetes in China receiving managed care, 2011-17⁹**

Jun Gao, regional adviser³

Shenglan Tang, professor⁴

Yan Guo, professor⁵

¹China Center for Health Development Studies, Peking University, Beijing, China

²London School of Hygiene and Tropical Medicine, London, UK

³World Health Organization, Manila, Philippines

⁴Duke University, Durham, NC, USA

⁵School of Public Health, Peking University, Beijing, China

Correspondence to: BYuan
beibeyuan@bjmu.edu.cn



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Enhancing financial protection under China's social health insurance to achieve universal health coverage

Hai Fang and colleagues highlight the need for better financial protection for poor people

Universal health coverage means that all individuals and communities should get the quality health services they need without incurring financial hardship.¹ It has three dimensions: population coverage, covering all individuals and communities; service coverage, reflecting the comprehensiveness of the services that are covered; and cost coverage, the extent of protection against the direct costs of care.²

The UN sustainable development goals in 2016 committed countries to achieve universal health coverage by 2030 with a focus on essential health services and financial protection.³ A recent report by the World Health Organization and the World Bank showed that China had a fairly high score for coverage of essential health services on 16 health indicators but a low score for financial protection to reduce the risk of illness induced poverty.⁴

China started comprehensive health system reforms in 2009, and in another article in this series Meng and colleagues provide a detailed review of these.⁵ An important goal of China's health system reforms was to achieve universal health coverage through building a social health insurance system. We examine China's progress in enhancing financial protection of social health insurance and identify the

main gaps that need to be filled to fully achieve universal health coverage.

What was proposed in the 2009 reform?

The 2009 health system reforms proposed a universal health insurance system that consisted of three main social health schemes: urban employee basic medical insurance (UEBMI), urban resident basic medical insurance (URBMI), and rural new cooperative medical scheme (RNCMS), with other supplementary insurance and private insurance (table 1).⁷ The 2009 reforms aimed to cover all the Chinese population with one of the three basic schemes to give them greater financial protection. In 2016, the urban resident and rural schemes merged to form the urban rural resident basic medical insurance (URRBMI) to improve administrative efficiency.⁸

To give added protection to patients with critical illnesses, catastrophic medical insurance (also called critical illness insurance or *Da Bing Yi Bao*) was initially launched in 2012 and implemented nationally in 2015. It covers patients with critical illnesses whose out-of-pocket expenses are more than the average disposable income per capita in the local area, providing extra reimbursement and removing the benefit ceiling.

The medical aid programme (also called medical financial assistance or *Yi Liao Jiu Zhu*), which was launched in 2003 in rural areas and expanded to urban areas in 2005, provides a further safety net. It was designed to provide medical aid to the poorest people by paying their medical insurance premiums and reducing out-of-pocket expenses after receiving reimbursement from the basic social health insurance schemes and catastrophic medical insurance. Funding for medical aid is mainly from governments, welfare lotteries, and social donations.⁹

China also invested a substantial amount of public funds in health services. Government healthcare budgets financed building and renovating government primary care facilities, subsidies to

replace provider revenues generated from drug dispensing, purchase of medical equipment for public hospitals, expansion of public health services, and training and continuing medical education. These investments into the public health system increased the number of health workers from 3.48/1000 population in 2003 to 6.47/1000 in 2017 and the number of hospital beds from 2.34/1000 in 2003 to 5.72/1000 in 2017, among other effects.⁶⁻¹⁰ Government investments also helped keep the prices of healthcare services low.

What has been achieved in financial protection since 2009?

The expansion of health insurance improved access to and use of healthcare. In 2011, China achieved near-universal health insurance coverage, with more than 95% of the Chinese population covered by health insurance.¹¹ The percentage of people who were reported a "need" for hospital admission but did not receive inpatient care decreased from 29.6% in 2003 to 25.1% in 2008, and to 17.1% in 2013.¹² The average number of outpatient visits per capita increased from 1.7 in 2003 to 5.9 in 2017, and the annual inpatient hospital admission rate (the number of admissions in the country divided by the total population) also increased from 3.6% in 2003 to 17.6% in 2017.^{6,13,14} Use of outpatient services in China was comparable with the global average, but admission rates were much higher.¹⁵

Drop in out-of-pocket health expenses

The expansion of health insurance coverage in China reduced the share of out-of-pocket health expenses in total health expenditures. In China, national health expenditures are categorised according to three health funding sources: government budgets (including health service investments and social health insurance subsidies), social expenditures (including individual and employer contributions to social health insurance, private health insurance contributions, and social donations), and out-of-pocket spending.⁶ High

KEY MESSAGES

- China has achieved near-universal health insurance coverage, which has greatly increased access to and use of health services
- Financial protection for poor populations needs to be enhanced as they are more likely to have catastrophic health expenses
- Increased spending on health will not improve financial protection without further measures to increase health system efficiency, strengthen primary care, and reform provider payment systems

Table 1 | Main features of China's three basic social health insurance schemes⁶

Scheme	Launch year	Covered population	Coverage rate in 2015	Pooling level	Premium contribution
Urban employee basic medical insurance	1998	Urban employees and retired	95%	City	Employee and employer
Urban resident basic medical insurance*	2007	Urban non-employed and self employed	95%	City	Individual with government subsidies
Rural new cooperative medical scheme*	2002	Rural people	99%	County	Individual with government subsidies

*Merged in 2016 to form the urban rural resident basic medical insurance (URRBMI).

out-of-pocket health expenses often mean low financial protection.

Figure 1 shows that the share of out-of-pocket health expenses in total health expenditures fell from 56% in 2003 to 29% in 2017. It is projected to decrease to 25% by 2030.¹⁶

Enhanced financial protection for poor populations

Catastrophic medical insurance and medical aid were effective in supplementing the basic social health insurance schemes and provided extra financial protection to a range of vulnerable groups, including people who are poor; chronically ill or disabled, disadvantaged by geographical factors, very young, or frail and old. By 2017, more than a billion people in China were covered by catastrophic medical insurance and 11 million people received extra benefits of more than ¥30bn (£3.4bn; €3.9bn; \$4.3bn).¹⁷ The insurance reduced the average proportion of out-of-pocket expenses after reimbursement from basic social health schemes by about 10%.¹⁸ In 2017, through medical aid, 56.2 million people (4% of the population) received subsidies to pay for their social health insurance premiums, and 35.2 million people (2.5%) received on average ¥757 (about 12% of average inpatient spending per admission in 2017) to cover out-of-pocket expenses.⁶

What should be done to further progress?

Reduce out-of-pocket health expenses

Although the proportion of health expenditures accounted for by out-of-pocket payments is decreasing, the payments

remain fairly high. Figure 1 shows that the amount of out-of-pocket health expenses per capita continued to increase. In 2013, out-of-pocket expenditure per inpatient admission represented 33% and 30% of annual disposable for the population covered by RNCMS and URBMI, respectively.¹²

High out-of-pocket spending is one of the main reasons for catastrophic health expenses and low financial protection in China.^{14 19} Catastrophic health expense is often defined to occur when a household's total out-of-pocket health payments is 40% or more of the household's capacity to pay (ie, net income after essential spending).²⁰ According to this definition, the incidence of catastrophic health expenses in the total population was 12.2% in 2003, 14% in 2008, and 12.9% in 2011.¹⁴ Though no national official statistics for catastrophic health expenses were released after 2011, studies using regional data suggest that the rate of catastrophic health expenses has not declined since 2011 (table 2).

To reduce out-of-pocket expenses, eventually the entire social health insurance system should be further consolidated.²⁶ Currently, there are two separate social health insurance schemes: URRBMI covering the urban non-employed and self employed population and rural population, and UEBMI covering the urban employed population and retired people. The out-of-pocket expenses for URRBMI are much higher and more likely to lead to catastrophic health expenses than the UEBMI.¹² Consolidating the schemes and their risk pooling levels as well as equalising the benefit packages

through more government funding, would substantially reduce out-of-pocket expenses for urban non-employed and self employed people as well as rural populations. However, this increased government spending on healthcare will not be sustainable without further measures to increase health system efficiency, strengthen primary care, and control provider behaviour through reform of the payment systems.

Catastrophic medical insurance and medical aid should be expanded

Catastrophic health expenses disproportionately affect deprived populations. Table 2 shows that the incidence of catastrophic health expenses for the poorest fifth of the population was much higher than for the richest fifth. Household spending on health as a percentage of total household consumption expenditures also increased in both urban and rural areas, as shown in figure 2, but the increase in household expenditures on health seems to have been greater in rural than in urban areas (rural areas tend to be relatively underdeveloped).

Catastrophic medical insurance currently does not target poor people, and medical aid is relatively small in scale. Pilot studies using regional data have not shown that catastrophic medical insurance reduces the incidence of catastrophic health expenses.^{27 28} Catastrophic medical insurance was designed to reduce the out-of-pocket burden for patients with critical illnesses but it currently covers all patients with critical illness, providing extra financial protection, as long as their out-of-pocket expenses are more than the average disposable income per capita in the local area. The cost sharing rate of catastrophic medical insurance (currently 50%) is identical regardless of the patient's economic status, but poor people have a higher disease burden and need more financial protection.¹² Not everyone eligible for catastrophic medical insurance will have catastrophic health expenses. To better protect vulnerable people, further increase in funding should be more focused on poor people, such as by linking benefit eligibility to household disposable income instead of an absolute threshold. The cost sharing rate could also be lower for poorer people.

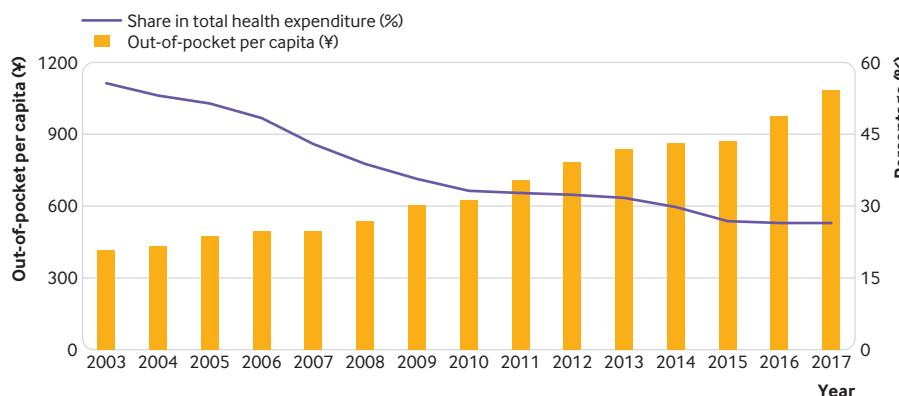
**Fig 1 | Level and share of out-of-pocket expenses in total health expenditures, 2003-17**

Table 2 | Incidence of catastrophic health expenses between 2003 and 2016

Reference	Year	Region	Population	% incurring catastrophic health expenses*		
				Poorest	Average	Richest
Meng et al ¹⁴	2003	National	All	N/A	12.2	N/A
Meng et al ¹⁴	2008	National	All	N/A	14	N/A
Meng et al ¹⁴	2011	National	All	N/A	12.9	N/A
Xu et al ²¹	2013	Shaanxi Province	All	22.4	15.8	12.9
Sun et al ²²	2014	Inner Mongolia	Rural	N/A	17.5	N/A
Wang ²³	2014	National	Rural	31.6	15.8	5.7
Xu and Chu ²⁴	2015	National	≥45 years old	N/A	16.5	N/A
Jing et al ²⁵	2016	Shandong Province	Type 2 diabetes	17. ^{1†}	13.8 [†]	9. ^{3†}

N/A=not available.

*The poorest is the bottom fifth of the distribution of household income and the richest the top fifth.

†Study reported the lowest 25% and highest 25% rather than fifths.

Medical aid in China covers only a minority of patients with catastrophic health expenses, although it aimed to cover everyone whose needs were not met by basic social health insurance schemes and catastrophic medical insurance. In 2011–16, medical aid covered around one quarter of the patients with catastrophic health expenses. It continued to impose benefit caps. Medical aid should be further expanded to cover all those who still incur catastrophic health expenses after catastrophic medical insurance reimbursements. It should also cap out-of-pocket expenses for extremely poor people (ie, poverty alleviation household, *Jian Dang Li Ka Hu*) as determined through strict eligibility criteria based on household disposable income, fixed assets, financial assets, real estate, etc.

Conclusions

By achieving near-universal population coverage of social insurance China has improved access to and use of health services and reduced the proportion of out-of-pocket spending. Although the Chinese government attempted to provide additional financial protection, catastrophic health expenses for poor people are still high. This group should be targeted within the current insurance system to enhance

financial protection in China. Such targeting requires a clear and integrated policy encompassing the basic social health insurance schemes, catastrophic medical insurance, medical aid, and improved healthcare efficiency. Protection of poor people from healthcare costs in health poverty alleviation (*Jian Kuang Fu Pin*) should be regarded as an important element of targeted poverty alleviation (*Jing Zhun Fu Pin*) in China, to break the vicious cycle of illness induced poverty (*Yin Bing Zhi Pin*) and return to poverty because of illness (*Yin Bing Fan Pin*).

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Hai Fang, professor¹

Karen Eggleston, senior fellow^{2,3}

Kara Hanson, professor⁴

Ming Wu, professor⁵

¹China Center for Health Development Studies, Peking University, Beijing, China

²Shorenstein Asia Pacific Research Center, Freeman Spogli Institute for International Studies, Stanford University, Stanford, California, USA

³National Bureau of Economic Research, USA

⁴Faculty of Public Health and Policy, London School of Hygiene and Tropical Medicine, London, UK

⁵Department of Health Policy and Management, School of Public Health, Peking University, Beijing, China

Correspondence to: Hai Fang
hfang@hsc.pku.edu.cn

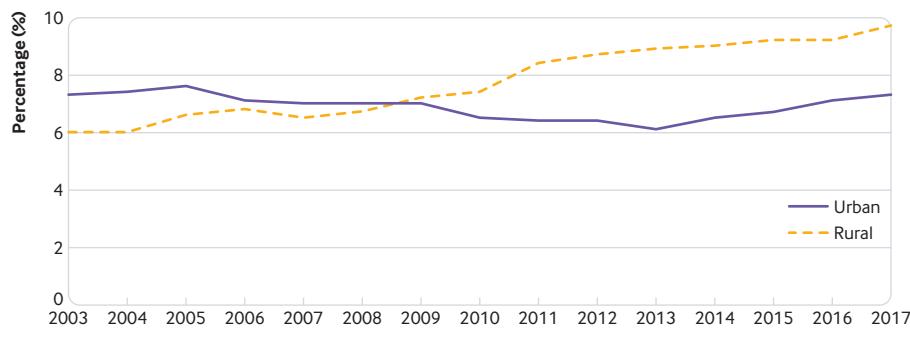


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**Figure 2 | Household spending on health as a percentage of total household consumption expenditures, 2003-17**

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Reforming public hospital financing in China: progress and challenges

Jin Xu and colleagues describe the effects of the financing reforms of public hospitals and suggests steps to further progress towards equitable, efficient, and good quality care.

Public hospitals provide most healthcare services in China. They employ 64% of licensed doctors, deal with 82% of inpatient admissions and 40% of ambulatory visits, and account for about half of China's total health expenditure.¹ However, before 2009 public hospitals were faced with a perverse incentive structure that encouraged inefficient use of medical resources.²⁻⁴

A distorted funding system

Public hospitals in China historically received funding mainly through service charges, drug sales, and government budget allocation (fig 1). In addition, the government also set the prices for pharmaceuticals and medical services provided in public hospitals. Service charges were low for most basic medical services (such as surgery, diagnosis, therapy, and nursing) but highly profitable for services involving advanced technologies such as computed tomography and magnetic resonance imaging.⁵ Hospitals also received cross subsidy (that is, non-direct subsidy for medical ser-

vices using profit allowed for other chargeable items) from a proportional mark-up (roughly 15%) on drugs they dispensed.⁶ Service charges were collected from either social health insurance funds or individual patients on a fee-for-service basis. In other words, hospitals were rewarded for each additional service item provided.

As the government had neglected its fiscal responsibility to public hospitals since the 1980s, public hospitals became responsible for their own balance sheets.⁷ They relied increasingly on profits from excessive prescription of expensive medicines and uses of advanced technologies, contributing to escalating medical spending and financial burden on patients. By the early 2000s, the pharmaceutical sales revenue accounted for more than 40% of total revenue of public hospitals.¹ Along with expanding coverage of social health insurance, the total revenue of public hospitals more than tripled from 2002 to 2008.¹

To reorient the management and services of public hospitals towards public interests and enhance service efficiency and quality, the Chinese government listed public hospitals as one of five key areas in its health system reforms.⁸ Since 2009 the government has introduced policies to increase hospital budget allocation, adjust pricing of pharmaceuticals and medical services, reform payment methods, reinforce planning and governance, re-establish a referral system, and

increase the role of the private sector.⁹⁻¹³ The government saw public hospital financing reform as an important lever to modify hospital service provision and guide distribution of medical resources.¹⁴

Our analysis focuses on what has been proposed and achieved in reforming public hospital financing in the past decade. We also discuss remaining challenges and propose recommendations for further reform.

Financing reform

The financing reform focused on four inter-related areas: removing the drug mark-up, increased budget allocation, adjustments of fee schedules, and reforming payment methods. Various explorative pilots took place in selected areas before the reform rolled out (box 1).

The Chinese government reduced drug mark-up (except for herbal traditional Chinese medicines) in public hospitals incrementally until it was removed entirely in 2018 (box 1). It also set a target of reducing the proportion of pharmaceuticals in total hospital revenue to 30%.¹³ Increased prices for medical services would cover 40-90% of the revenue that hospitals lost from removing the mark-up, depending on provincial contexts; 10-50% would be covered by additional government subsidies, with the remainder borne by hospitals through efficiency gains from improved management (see web appendix).

For government subsidies, the actual arrangement depended on the municipal or

KEY MESSAGES

- Perverse financial incentives for public hospitals contributed to the inefficient use of medical resources in China before 2009
- Financing reform focused on removing drug mark-ups, increased budget allocation, adjusting fee schedules, and reforming payment methods
- The reform has substantially reduced hospitals' reliance on profit from pharmaceutical sales, while progress on the other measures is insufficient
- The varied quality of care, increasing hospital dominance, and growing costs to patients requires further reform
- We recommend consolidating the leadership in financing reform, implementing value based strategic purchasing, and allowing public hospitals greater management autonomy

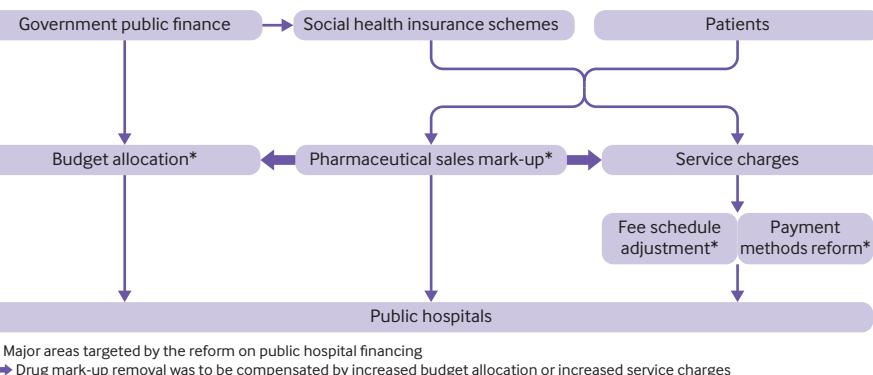


Fig 1 | Revenue sources of public hospitals and reform objectives from 2009 to 2018

Box 1 | Summary of key reform policies for public hospital financing, 2009-18

2009: Central Committee of Communist Party of China and State Council (*Zhongfa* [2009] No 6)

To set up pharmaceutical services fee; adjust fee schedule; increase government budget allocation

2009: State Council (*Guofa* [2009] No 12)

To specify short term (2009-11) reform priorities:

To incrementally remove drug mark-up from hospital financing; to set up pharmaceutical services fees and include them in social health insurance benefits; to increase service prices; to provide budget allocation to subsidise public hospitals for infrastructure, major equipment, disciplinary development, retirees' pension, and a range of public health activities

2011: National Development and Reform Commission, Ministry of Health (*Fagaijiage* [2011] No 674)

To implement disease based payment pilots for common diseases with standardised clinical pathways and clear treatment benefits

2012: State Council (*Guofa* [2012] No 11)

To launch disease based payment combined with clinical pathway

2012: Ministry of Health (*Weinongweifa* 2012 No 28)

To shift new rural cooperative medical schemes from fee-for-service towards mixed payment

2012: Ministries of Human Resources and Social Security, Finance, and Health (*Renshebufa* [2012] No 70)

To launch global budget control for social health insurance schemes, with sharing of surplus or deficit proposed

To explore capitation payment, disease based payment, etc

2015: State Council General Office (*Guobanfa* [2015] No 33)

To roll out comprehensive public hospital reform in about 2000 counties, including payment system, reducing use of fee-for-service

2015: State Council General Office (*Guobanfa* [2015] No 38)

To roll out comprehensive public hospital reform in about 200 pilot cities, including payment system, reducing use of fee-for-service

2015: State Council General Office (*Guobanfa* [2015] No 70)

To implement tiered healthcare system and use payment structure to incentivise secondary and tertiary hospitals to refer patients with defined diagnoses and stable conditions to primary care facilities

2017: State Council General Office (*Guobanfa* [2017] No 55)

To implement mixed payment:

- Inpatient care: using mainly disease and diagnostic-related-group (DRG) based payment, while long term and chronic hospital admissions can be paid by the day
- Ambulatory care: exploring capitation based payment for both hospital and primary care services held by primary care facilities
- Fee for services for cases that are not suitable for bundled payment
- Adding a points system to the current global budget control and starting to change the unit of global budget control from facilities to all facilities within an area

2017: Ministry of Finance, Human Resource and Social Security, National Commissions of Development and Reform, and Health and Family Planning, State Administration of Traditional Chinese Medicine and State Commission Office of Public Sectors Reform (*Guowaitigaifa* [2017] No 22)

To remove drug mark-up (except for traditional Chinese herbal medicines) in all public hospitals

2018: Central Committee of Communist Party of China

To establish National Healthcare Security Administration (NHSA), incorporating the responsibility for urban basic medical insurance schemes previously under the Ministry of Human Resources and Social Security, the responsibility for the new cooperative medical schemes previously under National Health and Family Planning Commission, the responsibility for managing prices for pharmaceuticals and medical services of the National Development and Reform Commission, and the responsibility for medical assistance of the Ministry of Civil Affairs into this new administration

2018: NHSA (*Yibaobanfa* [2018] No 23)

To launch national pilots of DRG based payment

county governments that were responsible for the hospitals. Provincial governments, which set prices for medical services, introduced a "general consultation fee" for each patient visit or admission to substitute drug mark-up (see web appendix). In addition, some provinces increased the prices of professional services.¹⁵

Although fee-for-service remained the predominant payment method, the country has been moving towards a mixed payment scheme.¹⁶ A global budget control was launched nationwide in 2012,^{13 17} setting an annual reimbursement cap for each

health facility. Generally, the caps were to some extent arbitrary and based on historical revenues.¹⁸

About two thirds of hospitals implemented disease-based payment¹⁹ for conditions with well-defined admission criteria and treatment procedures. Under disease based payment, hospitals received a fixed reimbursement for treating patients with certain diseases and were also rewarded if they had a high proportion of cases registered and compliant with standard clinical pathways. Some local governments also piloted payment based

on diagnosis related groups (DRGs), which distinguishes diagnoses further by their clinical procedures, costs, complexities, individual patient factors, etc.²⁰ Others piloted a prospective global budget for integrated delivery systems incorporating hospitals and primary care facilities (dubbed "medical alliance"), which were paid a fixed annual amount by social health insurance. Hence, the hospitals were rewarded for cutting costs and investing in prevention while maintaining health status of the population in collaboration with primary care facilities.

The financing reform was implemented along with broader reform. The government emphasised the importance of systemic and coordinated reform in pharmaceutical manufacture and distribution, social health insurance, and hospital organisation. One result was the establishment of the National Healthcare Security Administration (NHSA) in 2018. The NHSA not only assumed administrative responsibility for all social insurance schemes but also incorporated previously separated purchasing power, including price setting, procurement, and provider payments.²¹ From 2015, the reform was also linked with a systemic effort to develop a referral system with multiple tiers of services, including both hospitals and primary care facilities, as government recognised the need to move away from over-reliance of medical services on hospitals (box 1).

Achievements

Removal of the drug mark-up seems to have decreased pharmaceutical sales. By 2017, pharmaceuticals accounted for 31% of public hospitals' revenue, down from above 40% before 2009, just as profit from pharmaceutical sales contributed an increasingly smaller proportion of hospitals' disposable revenue (net revenue after payment to pharmaceutical suppliers) (fig 2). A nationwide analysis showed a 6.5% decrease in drug expenditures per visit, and a 9.5% decrease in drug expenditures per admission because of the mark-up removal.²² The budget allocated to public hospitals increased from ¥5.2bn to ¥23.5bn, though its proportion of hospitals' disposable revenue (ie, earnings after paying pharmaceutical suppliers) was stable around 12.6% (fig 2).¹ Adjustment of fee schedules seems to have compensated for the lost mark-up overall. Revenue from medical services in county hospitals increased by 8.2% after mark-up removal, with their total revenue unaffected.²² The same study also found no observable effect on patient visits and admissions. In Beijing, the service fee adjustment encouraged a substantial number of patients to seek care at primary care facilities.¹⁵

Along with the payment reforms, annual growth rates of hospitals' disposable revenue went down from 19.9% between 2008 and 2012 to 11.7% between 2013 and 2017 (fig 3). A local DRGs based payment pilot reduced patient charges per admission without compromising the quality of care.²⁴ The bundled payment pilot for medical alliance suggested early signs of improved coordination of care

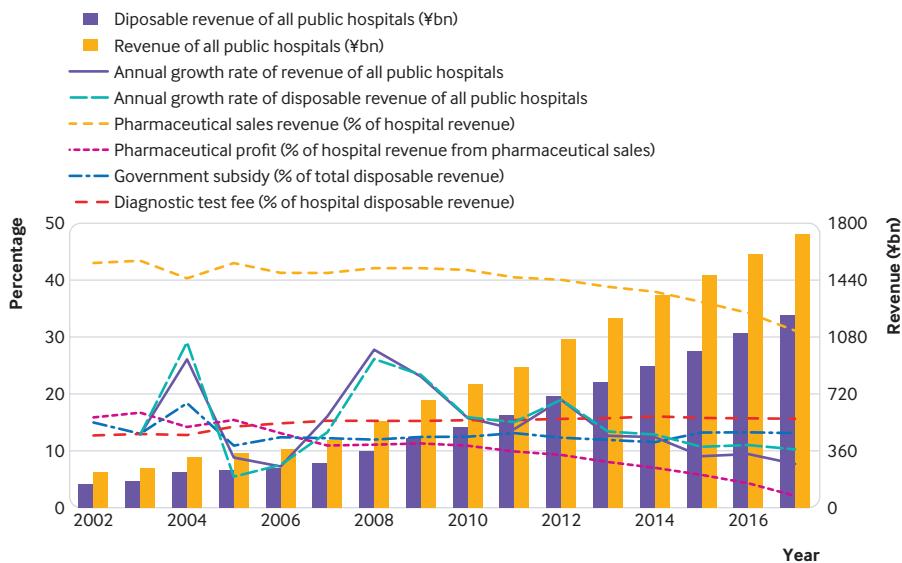


Fig 2 | Revenues of public hospitals and growth rates, 2002-17.¹ Data for government owned hospitals under the health sector were used from 2002 to 2007, as data for all public hospitals (which includes those owned by state owned enterprises, etc) were not reported for these years. Pharmaceutical sales profit=hospital revenue from pharmaceutical sales (using total inpatient and outpatient charges on medicines)-pharmaceutical fees paid by hospitals to pharmaceutical suppliers. Revenue has been adjusted by dividing the original data (based on current prices) with the inflation rates calculated from consumer price index numbers since the base year (2002) according to the China Statistical Yearbook 2018. Total disposable revenue=total revenue-pharmaceutical costs

for chronic diseases but short term costs increased.²⁵

Remaining challenges

Despite the financing reform, quality and efficiency of hospital services are still sub-optimal. Substantial variations still exist in the quality of hospital care in China.^{26 27} Meanwhile, hospitals in China continue to expand rapidly. From 2008 to 2017, the number of visits to hospitals increased by 93.1% compared with an increase of 49.5% to primary care facilities. Hospital admissions rose by 2.4 times from 2008 to 2017 (10% on average annually). Hospital revenue was 5.2 times that of all primary care facilities in 2017, up from four times in 2008.¹ Indeed, the number of hospital beds in China is fast approaching the OECD average (fig 3).

Several problems also remain with the financing system. Budget allocation is tied to capital investment and local fiscal capacity rather than the needs of facilities or the population.²⁸ In addition, the changes to payment scheme have not been entirely successful. Hospitals compensated for loss of income from the drug mark-up by using more diagnostic tests,²² potentially leading to overdiagnosis. Although budget controls have slowed down the growth of insurance spending, hospitals seem to have shifted cost to patients, resulting

in rising out-of-pocket expenditure.²⁹ A greater move to disease based payment could have improved the quality of care and contained costs by incentivising clinical standardisation, but the limited coverage of standard clinical pathways restricted the application and effectiveness of this system.^{30 31} Other payment methods, such as those using diagnosis related groups, are yet to scale up.

Technical barriers have prevented use of value based purchasing. Fragmented information systems and lack of rigorous evaluation weakened the evidence base for financing hospitals.³² Bundling payment across facilities and the redistribution of surplus or deficit within network facilities require effective measurement of performance within facilities, which is also lacking.

In addition, the reforms are yet to address two fundamental challenges. One is the discordance among agencies that supervise hospitals and pay for their services (using either fiscal budget or insurance funds). A pilot of a comprehensive financing reform in Beijing showed the importance of leadership structure in facilitating the design and implementation.¹⁵ The other challenge is that hospital managers lack the autonomy to carry out internal changes (eg, hiring/firing and salary) and establish new professional norms.³³ After all, all

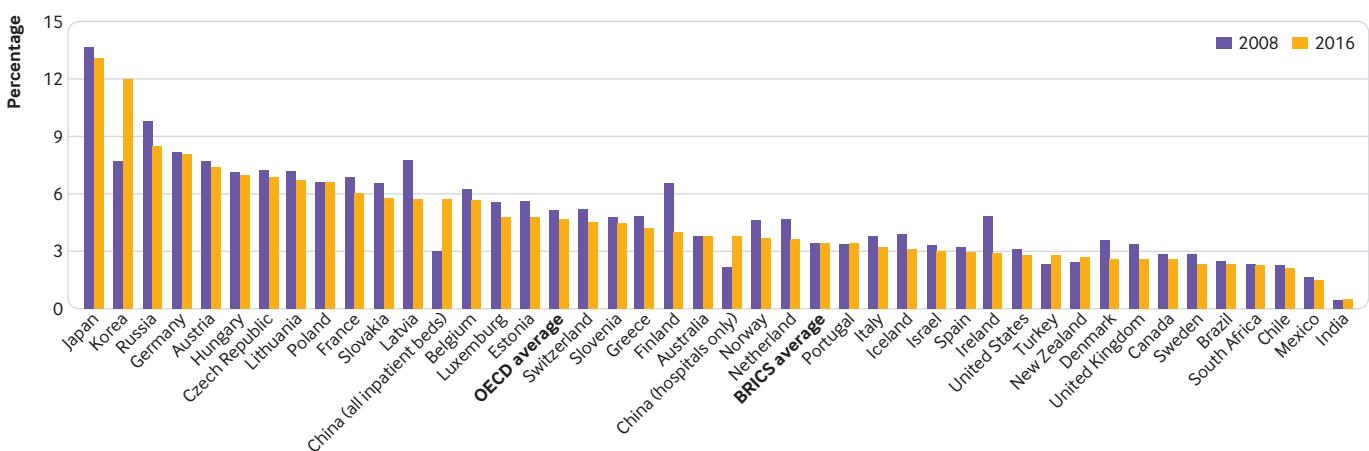


Fig 3 | Hospital beds per 1000 population in countries in the Organisation for Economic Cooperation and Development (OECD) plus BRICs (Brazil, Russia, India, China, South Africa), 2008-16^{1,2,3}

Note: For 2016, 2015 data are used for US, 2013 data for India, and 2011 data for South Africa. Note, in China, primary care facilities also have a lot of inpatient beds. Many of them have overlapping functions with hospital beds. This is included as "China (all inpatient beds)".

payment methods have flaws.³⁴ Financing reform is better seen as the means to build institutions to help hospitals and doctors become agents for patients, rather than the end itself.³⁵

Recommendations

Our analysis suggests several steps towards improved public hospital financing.

Consolidate leadership in financing reform of public hospitals—To address the current fragmented decision making and discordance in policies, further reform requires unified leadership of financing reform and joint purchasing of health services by the NHSA, the National Health Commission, and the Ministry of Finance, etc. and their corresponding agencies at local levels. These agencies should pool fund according to local context, set up joint supervision of hospitals' behavior and performance, and allow fund-receiving hospitals greater flexibility to decide how they use the resources.

Remove the technical barriers to strategic purchasing—National and regional governments need to build an integrated health information system that also allows monitoring of quality and outcome. This means standardisation of information system and sharing of data between health agencies and social health insurance agencies. Governments should finance independent research bodies and provide them with access to data to monitor and evaluate the effects of reform policies.

Adopt value-based strategic purchasing to align incentives with need, quality, and outcome—Payment for outpatient care should be changed from fee-for-service

with a global budget cap to capitation with risk adjustment. The capitation budget should cover both primary care facilities and the outpatient department of hospitals. Payment for inpatient services should be based on diagnosis related groups. Provider payment should reward better quality and outcomes.

Adjust the mechanism of budget allocation—Budgets should be needs based and equalised across the country with an additional top-up related to quality and outcome, rather than tied to capital investment. The government should harmonise budget allocation for public hospitals with other channels of financing (particularly insurance) and with allocation to primary care facilities. Some hospitals may need additional short term subsidies to relieve the shock from losing the drug mark-up and facilitate their transit towards value-based service delivery.

Increase public hospital management autonomy—Public hospital directors should have the autonomy to handle human resources matters, including hiring and firing, salaries, etc. Wages for medical professionals should be sufficient and rely less on financial incentives,¹⁶ providing a nurturing environment for professionalism and evidence-based clinical practice. A greater portion of professional wages should be fixed, complemented by a performance-based top-up.

Conclusion

The removal of the long established drug mark-up policies constituted a milestone in China's public hospital reforms. Meanwhile, government budget allocation is still

ties to capital investment and local fiscal capacity, the fee schedule is insufficiently adjusted, and progress on reforming payment methods has been patchy. As a result, hospitals have become increasingly dominant in China's health system and provided services with varied quality and at growing costs to patients. For the next stage of reform, we recommend consolidation of leadership in financing reform, removing the technical barriers towards strategic purchasing, implementing value-based purchasing, adjusting the mechanism of budget allocation, and greater autonomy in hospital management.

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Contributors and sources: JX specialises in health policy and systems research and focuses on primary care strengthening in the context of hospitals' dominance. WJ and KZ specialise in payment methods, social health insurance policies and health financing in general. SK and HF have studied and published widely on health financing and economics. JX and HF conceived the framework of the paper. JX conducted literature review and data analysis, and wrote the first draft. All authors provided critical review on drafts of the paper.

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Jin Xu, lecturer¹Weiyan Jian, associate professor²Kun Zhu, associate senior research fellow³Soonman Kwon, professor⁴Hai Fang, professor¹¹China Center for Health Development Studies, Peking University, Beijing, China²Peking University Health Science Centre, Beijing, China³Chinese Academy of Fiscal Sciences, Beijing, China⁴Seoul National University, Seoul, Korea

Correspondence to: J Xu

xujin@hsc.pku.edu.cn



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Web appendix: Table of provincial policies for compensating loss of revenue from removal of drug mark-up

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Rational use of antibiotics in the context of China's health system reform

Despite improvements in antibiotic use in tertiary hospitals, problems remain in other parts of the health system, say **Ping He and colleagues**

China spends a high proportion of its total health expenditure on drugs.¹ In 2006, almost half (42.7%) of the total expenditure on health was on medicines.² It has a serious problem with irrational use of medicines—that is, medically inappropriate or ineffective drug treatment practices.³ The main types of irrational use are polypharmacy, misuse of antibiotics, overuse of injections, failure to prescribe according to standard treatment guidelines, and inappropriate self medication.⁴ It is estimated that around half of antibiotics are unnecessarily prescribed.⁵ Overuse and misuse of antibiotics is one of the key contributors to antimicrobial resistance.⁶

Perverse financial incentives for healthcare facilities and physicians have been widely recognised as the major cause of overprescription of antibiotics.⁷ In the late 1970s, China's market oriented economic reform reduced the role of the government in financing healthcare services.⁸ To compensate for the reduced subsidy, the government officially allowed a 15% or more mark-up on medicines for health facilities.⁹ Since a bonus system

rewarded physicians based on the monetary values of drugs they prescribed, physicians had a strong financial incentive to overprescribe and oversell antibiotics.¹⁰ The high frequency of irrational use of antibiotics is also exacerbated by decades of misperception that antibacterial medicines are the panacea for all infections.¹¹

China embarked on a comprehensive health system reform in 2009. Improving the rational use of antibiotics was a key objective of the national essential medicines system, which was one of five major policies in the 2009 reform.¹² The policy reform intended to curb the use of antibiotics by unlinking the financial relation between drug prescription and physician income, and by reducing the rate of antimicrobial resistance through comprehensive stewardship of prescribed antibiotics. This paper looks at antibiotic use after the reform and considers how to make further progress on rational use of antibiotics.

Major reform policies

Since the 2009 health system reform, the Chinese government has been committed to tackling the irrational use of antibiotics by enhancing antimicrobial stewardship. A series of regulations and clinical guidelines for rational use of antibiotics were issued after the reform, and a comprehensive surveillance network including over 1000 member hospitals was built up to control antimicrobial use and resistance.¹³

In 2011, the Ministry of Health launched a national campaign for the rational use of antibiotics,¹⁴ and in 2012 it enacted and implemented a decree to regulate the clinical use of antibacterial agents. Based on an internationally recognised model of antimicrobial stewardship, this decree included comprehensive regulations on selection, procurement, prescription, and use of antibiotics. The decree also put emphasis on monitoring to ensure the enforcement of these regulations, so it is recognised as the most exacting decree for antibiotic management in China.^{15,16} In the

same year, the Ministry of Health updated the national guidelines for antibiotic use in clinical practice for public hospitals and mandated hospitals to regularly review and evaluate antibiotic prescriptions of these hospitals.¹⁷ The national guidelines for antimicrobial therapy implemented in 2012 were revised in 2017.¹⁸ Meanwhile, appropriate antibiotic use and the bacterial resistance surveillance network, which was established in 2005, have been greatly enhanced owing to a rapid increase in the number of member hospitals since 2011.¹⁸

Additionally, as one of five key elements of the health system reform, the national essential medicines system focused on compiling a generic essential medicines list, prioritising rational use of drugs by regulating the delivery, distribution, and reimbursement of these drugs. The zero mark-up drug policy removed the profit margin from drug sales and aimed to control overprescription practices by separating the profit of physicians from drug prescription. The policy was initially piloted at primary care institutions in 2009 and then expanded to county hospitals in 2012.¹⁹ To support the implementation of the national essential medicines system, a centralised bidding procurement system for drugs was established at provincial level, in which most western medicines at public health institutions were traded and registered in the online system.²⁰

Achievements and challenges

Reduction in antimicrobial consumption at tertiary hospitals

After the national campaign for the rational use of antibiotics, studies repeatedly reported a reduction in the overuse of antimicrobial agents at tertiary hospitals.^{21,22} The figure shows a decrease in the rate of antibiotic use in both inpatients and outpatients, as well as in the rate of combined use of antibiotics in inpatients at 192 core member tertiary hospitals in the Center of Antibacterial Surveillance. In addition, the intensity of antibiotic use, measured by defined daily dose per patient days, decreased from 2005 to 2017, especially after the national cam-

KEY MESSAGES

- Since the 2009 health system reform, China has paid considerable attention to antibiotic control through strengthening national antimicrobial stewardship and establishing the National Essential Medicines System
- While a national campaign of antimicrobial stewardship was effective in reducing the consumption of antimicrobial agents at tertiary hospitals, the drug policy reform did not improve current problems of antibiotic overuse in primary care and rural settings
- Improving rational use of antibiotics requires not only cross sector coordination and comprehensive intervention but also participation of multiple stakeholders, particularly active engagement from healthcare providers and patients

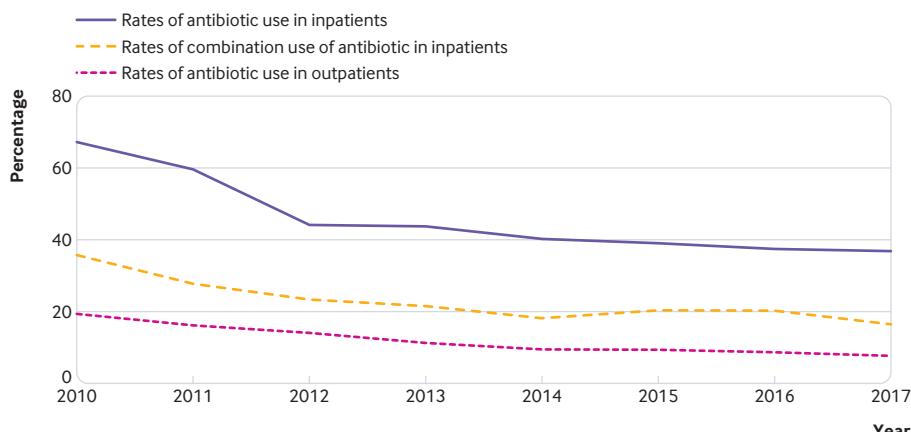


Fig 1 | Trends in rates of antibiotic use in China¹³

paign on the rational use of antibiotics was implemented in 2011.¹³

The rational use of antibiotics campaign, which includes decrees, administrative regulations, clinical guidelines, and drug and incentive policies, built up a regulatory and fiscal framework to curb irrational use of antibiotics. These measures guarantee continuous administrative regulations and the decree has legal effect for compliance or enforcement. For instance, the World Health Organization issued the Notice on the Directory of the Hierarchical Management of Clinical Use of Antimicrobial Agents in 2011. In the same year, a draft version of the Administrative Measures for Clinical Use of Antimicrobial Agents was issued by the legislative affairs office of the State Council, and it was released as Ministry of Health decree 84 in 2012, making it compulsory. The decree includes the general rules, organisations, their duties and responsibilities, management of the clinical use of antibacterial drugs, supervision and oversight, legal liability, and supplementary provisions. After the national campaign, in 2015 the National Health and Family Planning Commission (formerly the Ministry of Health) updated the national guidelines for antibiotic use in clinical practice and set prescription targets for secondary and tertiary hospitals, requiring them to regularly review and evaluate their prescriptions.²³

Less progress at primary care facilities and county hospitals

The zero mark-up drug policy was first implemented at primary care institutions and then at public hospitals. Earlier evaluations on primary healthcare facilities found that the policy failed to reduce irrational use of antibiotics in Hubei province.²⁴ Further research, using nationwide data on

primary care facilities, confirmed a lack of improvement on rational use of antibiotics after the zero mark-up drug policy reform.²⁵ Subsequent studies at county hospitals showed similar and consistent results. For example, none of the recent evaluations in Guangxi,²⁶ Anhui,²⁷ and Hubei²⁸ provinces found improvements on the overuse of antibiotics after the zero mark-up drug policy was implemented at county hospitals.

There are two reasons why the policy did not improve the overuse of antibiotics. Firstly, active physician participation in the interventions is essential to effectively control overuse of antibiotics. In China, the biggest barrier to reducing antibiotic overuse was found to be a lack of qualified physicians,^{25 29} and their poor diagnostic abilities led to unnecessary antibiotic prescriptions at primary care facilities, especially in rural areas.³⁰ Furthermore, patients have begun to expect antibiotic treatment.³¹ In addition, after the zero mark-up drug policy reform, the salary and compensation system at county hospitals was not changed, and physicians' income remains dependent on the quantity and revenue of services they provide.⁴ Without changing the profit seeking motivation for public hospitals, piecemeal remedies such as the zero mark-up drug policy will not reduce the overprescription behaviour of providers.

Secondly, patients' knowledge, preference, and demand are important in rational use of antibiotics. Patients consider antibiotics to be a panacea for infections,³² leading to willingness to consume antibiotics and exerting pressure on physicians to prescribe more and newer antibiotics. The zero mark-up drug policy theoretically eliminates the drug prescription profit to providers, but it has the potential to increase consumption of antibiotics owing to better affordability for the patient. Therefore,

without interventions to change patients' perceptions of the advantages and disadvantages of antibiotic use, the zero mark-up drug policy may not improve overuse of antimicrobials.

Primary care and rural settings have been neglected

Antimicrobial stewardship during the past decade primarily targeted urban tertiary and secondary hospitals instead of primary care facilities. Despite a decline in antibiotic use at tertiary hospitals, there is little evidence of its improvement in primary care settings. The current rates of antibiotic use are still far higher than the global average and the WHO standard.¹ A systematic review reported that irrational use of antibiotics was more serious in rural areas than in urban areas, as well as more serious at primary care facilities compared with secondary and tertiary hospitals.⁴

Suggestions for making further progress

Improving rational use of antibiotics requires not only comprehensive interventions, including regulations, health and economic policies, healthcare delivery transformation, and clinical guidelines³³ but also the participation of multiple stakeholders, in particular the active engagement of both physicians and patients.²⁵ We offer a set of recommendations to improve rational use of antibiotics at the system, provider, and patient level.

Firstly, we recommend that the central government should establish an effective system with cross sector coordination and an integrated surveillance network to improve rational use of antibiotics. The first step is to expand the antimicrobial surveillance network from tertiary and secondary hospitals to all healthcare facilities, and to systematically evaluate the effect on curbing antibiotic use. The second recommended step is to initiate an inter-sector stewardship system on antimicrobials. For example, it is imperative to establish a shared information system between healthcare and agricultural departments to coordinate the monitoring and management of antibiotic use in humans and animals.

Secondly, the policy goal of reducing antibiotic use should be aligned with incentives for healthcare facilities and physicians. One important approach is strengthening the strict implementation of antimicrobial stewardship regulations at hospitals. The most important strategy is eradicating the motivation to overprescribe or overuse antibiotics through increased government subsidies, payment reforms,

and incentive mechanisms. Motivating physicians to improve rational use of antibiotics is also essential. For physicians at primary care facilities, the recommended approach is to improve their knowledge of antibiotic prescription; and for physicians at hospitals, the optimal approach is to change their profit seeking salary systems.

Thirdly, it is equally important to educate patients, caregivers, and the public on the knowledge and perception of antibiotic use. One intervention is to educate patients and caregivers when they are seeking healthcare services. Another approach is to educate the public about the negative consequences of overuse of antibiotics through the media.

Conclusion

China's health system reform has made great efforts to reduce the use of antibiotics during the past decade. While a national campaign on antimicrobial stewardship was effective in controlling antibiotic use at tertiary hospitals, the zero mark-up drug policy did not have definite effects at primary care facilities and county hospitals. Further improvement on the irrational use of antibiotics needs a systems approach that integrates the national antimicrobial stewardship network, healthcare providers, and the public.

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Ping He, assistant professor¹

Qiang Sun, professor²

Lizheng Shi, professor³

Qingyue Meng, professor¹

¹China Center for Health Development Studies, Peking University, Beijing 100191, China

²School of Health Care Management, Shandong University, Shandong Jinan 250012, China

³School of Public Health and Tropical Medicine, Tulane University, New Orleans, LA 70112, USA

Correspondence to: Ping He
phe@pku.edu.cn



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Containing medical expenditure: lessons from reform of Beijing public hospitals

Beijing's reforms have succeeded in reducing hospitals' reliance on drug sales and shifting patients to primary care, say **Xiaoyun Liu and colleagues**

Public hospitals in China (tertiary and secondary hospitals) have strong incentives to make a profit from drug sales and high value medical consumables, and this has become a target for change over the past decade.¹ Since 2009, China has been piloting public hospital reforms to reduce these incentives, as part of an overall reform of the health system.² Several initiatives have been undertaken, focusing on governance and management structures, compensation mechanisms, and provider payment methods.³ While these reforms have made some progress, the challenges of increasing medical expenditure and a heavy reliance on drug sales have not been adequately dealt with; nor has the profit driven behaviour of the public hospitals been sufficiently

reversed.^{3,4} Patients continue to bypass primary healthcare to seek expensive secondary and tertiary healthcare, even for conditions that are not serious.⁵

Central government has encouraged local governments to pilot innovative interventions to gain experience in this important field of health system reform. In this context, Beijing municipal government initiated a comprehensive public hospital reform in 2017 to contain the rapid increase in medical expenditure. This paper presents this innovative case study of public hospital reform in Beijing to draw from the experience and lessons learnt.

What was proposed in the Beijing public hospital reform?

Beijing has a large population of 21.7 million, and in 2017 the gross domestic product per capita was ¥128 927 (£14 785; \$18 662; €16 760), ranking first in China. It has 116 tertiary hospitals, more than any other city in China. Public hospitals in Beijing play a more dominant part in providing medical services than in other regions of China. Among all outpatient visits in Beijing in 2016, 63% were at public hospitals and only 27.1% were in primary healthcare settings, much lower than the national average of 55.1%. In 2016, more than 45.1% of revenues in tertiary public hospitals in Beijing were from drug sales, while the national average was 38.9%.⁶

The Beijing municipal government started a comprehensive public hospital reform in April 2017 (see table 1 for details) aimed at promoting use of primary healthcare services, containing the escalating medical expenditure, and reducing the proportion of revenues from drug sales to rebuild an appropriate compensation mechanism for public hospitals.⁷ Dual leadership of the National Health Commission and Beijing municipal government was set up to coordinate the policy development and implementation process. The Beijing Health Commission acted as the implementation organisation to coordinate with other sectors, including

departments of finance, civil affairs, and social security.

The reform focused on price adjustment of drugs and medical services. Based on national guidelines, the 15% mark-up from drug sales was removed in all public hospitals to reduce reliance of public hospitals on profits from drug sales. Prices of 435 medical service items were adjusted to guide health professionals' service provision behaviour, with increased prices for surgical operations and traditional Chinese medicine services and decreased prices for medical investigations (for example, computed tomography (CT) and magnetic resonance imaging (MRI)). In addition, the Beijing reform set up innovative medical consultation service fees to better compensate public hospitals' financial loss from the zero mark-up policy for drugs and to better reflect doctors' professional values.

To encourage use of primary care services, the reform improved the availability of medicines at primary healthcare facilities, especially for patients with chronic diseases. The medical consultation service fee is a tiered charge: tertiary hospitals, secondary hospitals, and primary healthcare facilities. Patients' co-payments on medical consultation service fees at primary healthcare facilities are less than those at secondary and tertiary hospitals.

The reform design was based on experiences from a pilot reform in five public hospitals starting in 2012.⁸ Potential financial gains and losses at public hospitals were estimated to inform the design of price adjustment.

What has been achieved since the reform began?

Results on flow of outpatients and length of stay of inpatients

One of the most important achievements of the Beijing public hospital reform is that it managed to redirect the flow of outpatients from tertiary hospitals to community health centres.⁹ One year after the reform, there was an 11.9% decrease in

KEY MESSAGES

- In 2017, Beijing implemented a comprehensive public hospital reform which focused on separating drug sales from hospital revenues and adjusting the prices of medical services. The aim was to reduce the heavy reliance of public hospitals on drug sales and to contain the escalating medical expenditure
- The reform succeeded in reducing drug sales as a proportion of total hospital revenues and redirected the flow of outpatients from tertiary hospitals to community health centre.
- An unintended consequence of the reform, however, has been an increasing use of magnetic resonance imaging and computed tomography
- An alignment of incentives between public hospitals, health workers, and patients was a key driver of these changes
- The experiences gained from the Beijing reform may help inform further reforms of public hospitals in China and in other countries with similar systems

Table 1 | Reform measures at public hospitals in Beijing

Reform measures	Descriptions of reform measures
Zero mark-up of drug sales	15% mark-up from drug sales removed in all public hospitals
Medical consultation service fees	A tiered schedule: higher level hospitals and senior physicians can charge higher service fees. For example, the consultant service fee for an outpatient visit is raised from ¥5 to ¥50 in tertiary hospitals, ¥30 in secondary hospitals, and ¥20 in primary healthcare facilities (for junior physicians). Patients' co-payment on medical consultation service fees are ¥10, ¥2, and ¥1 respectively. For senior physicians, the new consultant service fee is ¥80, ¥70, and ¥60, respectively
Price adjustment	Prices of 435 medical service items are adjusted, with increased prices for surgical operations and traditional Chinese medicine services and decreased prices for medical investigations (eg CT and MRI). All these services with changed prices are covered by social health insurance schemes. The co-payment level remained the same
Availability of medicines	More types of medicine, especially for non-communicable chronic diseases, are available at primary healthcare facilities The length of prescriptions for patients with non-communicable diseases is extended from one month to two months at primary healthcare facilities

outpatient service volumes in tertiary hospitals, while the primary healthcare facilities had a 15.0% increase. Figure 1 shows the increasing trend of outpatient visits in primary healthcare facilities based on an analysis of interrupted time series.¹⁰ As a comparison, over the same period outpatient service volumes in the entire country had a 6.1% increase in tertiary hospitals and a 1.4% increase in primary healthcare facilities.⁶

Two possible reasons may explain these positive results.⁹ Firstly, the higher consultant service fee and higher co-payment in tertiary hospitals compared with primary healthcare facilities provided an incentive for some patients with minor illnesses to use primary healthcare services instead of tertiary services, especially older patients whose outpatient visits were mainly to refill their prescriptions for non-communicable diseases. Secondly, the increasing availability of more essential medicines for non-communicable diseases and prescriptions for a longer period (up to 2 months) at primary healthcare facilities may attract more patients to use primary healthcare services.

The potential revenue loss from drug mark-up pushed public hospitals to improve their efficiency in use of resources

and service provision. As a result, the average length of stay for inpatient services fell from 8.9 days to 8.3 days in tertiary hospitals and from 10.0 days to 8.8 days in secondary hospitals.

Results on cost containment and public hospitals' revenue structure

The reform led to a slowed rate of growth for medical expenditure and a changed structure of public hospitals' revenues.¹⁰ The annual growth of total health expenditure fell from 6.94% before the reform to 4.73% afterwards.⁶ In tertiary hospitals the proportion of drug sales in total hospital revenues fell from 45.14% to 36.98%; in primary healthcare facilities, the proportion decreased by 2.79% (table 2).

The shift in outpatient volume from tertiary hospitals to primary healthcare facilities was the main mechanism for the slowed rate of growth of medical expenditure. Patients with more severe diseases still received outpatient care in tertiary hospitals, which may have increased the cost per visit. This contributed 13.1% to the growth of total outpatient expenditure in tertiary hospitals; the decrease in outpatient service volumes contributed -11.9% to this growth. As a result, the annual

growth of total outpatient expenditure was only 0.4%.¹¹ The promotion of primary healthcare services helped to leave more health resources at tertiary hospitals for patients with more severe conditions.

The reduction in the proportion of drug revenues in total service revenues was due mainly to removal of the 15% drug mark-up. This may help reverse the longstanding distorted incentive towards drug sales in public hospitals. For most hospitals, loss of revenues from the drug zero mark-up policy can be compensated for by adjusting the service consultation fee, among other price adjustments.¹⁰

What should be done now to further progress?

Beijing has made a huge step towards containing medical expenditure through the public hospital reform. While these experiences are useful for other parts of China and other countries with similar systems, Beijing needs further efforts to consolidate its health system reforms.

Further regulations to reduce unnecessary use of high value medical investigations and consumables

The decreased price of CT and MRI scans aimed to reduce the reliance of public hospitals on revenues generated from these expensive medical investigations. However, profit driven behaviour of public hospitals cannot be fully dealt with overnight. Public hospitals may shift costs from medicines to other high value medical consumables or clinical processes.¹² A 35.7% increase in MRI in tertiary hospitals and a 41.47% increase in secondary hospitals was noted after the reform (fig 2). This may be because hospitals are trying to increase their CT and MRI service volumes to compensate for the financial loss due to the price reduction.⁹

To overcome this unintended consequence, health authorities and health insurance agencies should strengthen regulations to reduce unnecessary use of these high cost medical investigations and consumables. Price adjustment of more service items and provider payment

**Fig 1 | Interrupted time series of outpatient visits to primary healthcare facilities in Beijing (2016-2017)**

Table 2 | Proportion of drug revenues in total service revenues in public hospitals in Beijing (%)

	Pre-reform	Post-reform	Change
Tertiary hospitals	45.14	36.98	-8.16
Secondary hospitals	52.03	44.25	-7.78
Primary healthcare facilities	83.77	80.98	-2.79

reform should be implemented to further reduce the profit driven behaviour of public hospitals and health workers.

Strengthening primary healthcare capacity

The Beijing reform has succeeded in directing some patients with mild illnesses from tertiary hospitals to primary healthcare facilities. Primary healthcare providers have higher workloads of outpatient services than before the reform. Without sufficient investment, the quality of primary healthcare may decrease.

Primary healthcare facilities need to strengthen their capacity to provide good quality health services to accommodate the increasing workloads after the reform. This includes improving quantity and quality of human resources, financial and non-financial incentives, and other quality assurance mechanisms.⁵

Monitoring and evaluation on quality of care and health outcome

The Beijing reform has closely monitored key indicators from a sample of public hospitals each day since the policy implementation. A research team from Peking University led an independent evaluation on the policy process and results. The monitoring and evaluation activities are helpful in drawing lessons learnt from the reform. However, these activities mainly focus on service utilisation and medical expenditure. The achievement of the reform on cost containment and more use of primary healthcare services should not be at the expense of service quality and

health outcomes. Long term monitoring and evaluation activities should be conducted to evaluate the impact of the reform on quality of care and health outcomes.

Conclusions

The Beijing reform of public hospitals used price adjustment to contain the rise in medical expenditure. It achieved its objectives mainly through encouraging patients with mild illnesses to use primary healthcare services rather than tertiary hospitals. Alignment of incentives among different stakeholders including public hospitals, health workers, and patients have been the key drivers of these changes. As China is yet to develop a gate keeping system, as is found in most developed countries, the reform in Beijing helps set a pioneering example of using pricing reform in public hospitals to contain rising medical costs and promote the establishment of a tiered service delivery system.

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Xiaoyun Liu, professor

Jin Xu, lecturer

Beibei Yuan, associate professor

Xiaochen Ma, lecturer

Hai Fang, professor

Qingyue Meng, professor

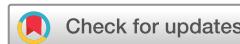
China Center for Health Development Studies, Peking University, Beijing, China

Correspondence to: X Liu
xiaoyunliu@pku.edu.cn



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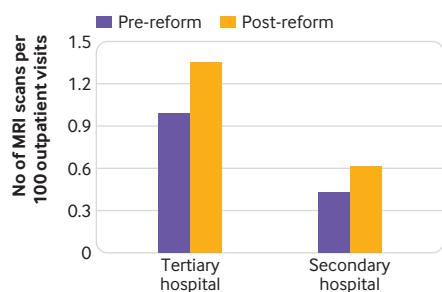


Fig 2 | Number of magnetic resonance imaging scans per 100 outpatient visits in secondary and tertiary hospitals

