Developing comprehensive and integrated health system reform policies to improve use of medicines
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Document Version
Publisher's PDF, also known as Version of record

Publication date:
2015

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):
Sun, J. (2015). Developing comprehensive and integrated health system reform policies to improve use of medicines [Groningen]: University of Groningen

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Chapter 2

Setting the Scene: the Pharmaceutical Sector and Medicines Use

2.1 Pharmaceutical Policy in China: Issues and Problems–Background Paper for the Study on China’s Health System Reform

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Gang Qu
Wen Chen

Report prepared for the Chinese government for the national health system reform
WHO Archive
ABSTRACT

This policy review comprehensively examines China’s pharmaceutical policy, covering the whole pharmaceutical sector, from medicines registration, production, distribution, to medicines utilization and administration. The aim of this paper is to describe and examine main problems existing in the pharmaceutical sector, and to analyze the socio-economic and institutional factors associated with these key problems. The paper ends with several policy recommendations that can be adopted by the Chinese government to tackle the problems and to address the challenges in developing a healthy pharmaceutical sector.
INTRODUCTION

Since its launch of the economic reform in late 1970s, China’s economy has developed rapidly. The annual growth rate of GDP has been maintained at an average level of 14% over the past two decades. Living standards of vast majority of the Chinese population have increased significantly, and over 550 million people have been moved out of the poverty. However, access to basic health care of most Chinese population has not been improved in a way that matches its economic growth. The problem has particularly become serious for the poor, owing largely to a rapid rise of medical care costs and lack of health insurance coverage. In addition the quality of care also varies greatly among different service providers and in different areas.

The national health account studies show that China spent 4.7% of GDP on health care in 2004, of which 44% was on pharmaceuticals. Such a share of pharmaceutical expenditure is high in the world, compared to an average of around 15% in the OECD countries. Patients in China tend to be treated in a costly way, and in some cases, the extra cost are not warranted from a medical perspective. Overuse of medicines is a well-known problem in Chinese hospitals, since pharmaceutical sale have been a key part of the revenue in general, and also a major contributor to bonus of doctors. In other words, the more medicines doctors prescribe, the higher income they can earn. Such a perverse financial incentive has huge implications for quality and cost of health care. One study found that only less than one percentage of medicine prescriptions was actually reasonable in the studied village clinics. Over-prescription has also placed an unnecessary financial burden on many poor families not covered by health insurance.

Over the past two decades, China’s pharmaceutical industry has also been greatly developed. More than 4,600 pharmaceutical manufacturers, 12,000 wholesalers and 270,000 retailers, produce and sell more than ten thousand western and traditional Chinese medicines. Both central and local governments have seen pharmaceutical industry as one of key economic sectors driving robust development of the economy. These manufacturers are producing mainly generics and/or traditional Chinese medicines. However, some cheap and less profitable essential medicines are no longer produced and available on the market.

Over the past decade, there have been many studies in China looking at the use of medicines and its socio-economic affecting factors. However, few international publications have comprehensively examined China’s pharmaceutical policy covering the whole process of pharmaceutical registration, production, distribution, and utilization and administration. Against this background, this paper aims to describe and examine the main problems existed in the Chinese pharmaceutical sector, and to analyze the socio-economic and institutional factors associated with these key problems. The paper ends with several policy recommendations that can be adopted by the Chinese government to address the problems and challenges for developing a healthy pharmaceutical system.
ECONOMIC REFORM AND IMPLICATIONS FOR THE PHARMACEUTICAL SECTOR IN CHINA

The economic reform has led to a transformation of China from a planned economy to a market oriented one. The government funding to health facilities has become less important since mid 1980s, representing the decreasing ratio of government budget to total hospital revenue. Health facilities have increasingly relied on service fees from users who may or may not be covered by health insurance. Supplying more diagnostic tests and medicines is one of the key means to cover the operational cost, and to increase the income of health professionals via legal or illegal methods (bonus payment, medicines sales commissions and kickbacks). Using fee-for-service as a main provider payment method has been worsening the situation. As a result, the health expenditure has risen rapidly. The average annual growth rate of the total health expenditure in China was up to 18.2% over the period of 1991-2004, while the average growth rate of GDP was only 9.3% and the average GDP per capita growth rate was 8.2% in the same period.8

China has kept low prices for most health services through government regulation. The prices are not set based on cost, except for medicines and “new” high-technology services. For which, the price can be set at a higher level than actual cost, to allow for a profit margin. Chinese hospitals are allowed to mark up medicines by 15-20% above the wholesale price (30% for Chinese herbs).9 In addition, the use of fee-for-service, as a major provider payment method also significantly contributed to the supply-induced demand. According to one study,10 it has contributed from 85.5% to 90.3% of the total health expenditure in two relatively well-off Chinese counties in 1992.

China’s economic reform has also brought a good opportunity for pharmaceutical industry to develop in an impressive way. In early 1980s, there were only 839 pharmaceutical manufacturers in China, producing around 1,200 western medicines. In addition, there were about 540 traditional Chinese medicine manufacturers producing about 600 traditional Chinese medicines. The number rose remarkably to over 4,600 western pharmaceutical manufacturers in 2005. Only 3,731 of them got GMP certificate in 2004. The total pharmaceutical product value increased from CNY 10 billion (US$ 3.1 billion, exchange rate=3.2) in 1985 to over CNY 446 billion (US$ 55 billion, exchange rate=8.1) in 2005.11 The pharmaceutical industry has played an important role in developing local economies and creating jobs for local government. Nevertheless, China has too many small/middle-size pharmaceutical manufacturers, most of which can only produce generics and/or traditional Chinese medicines.

Pharmaceutical policy
Prior to the economic reform in China, the government was responsible for making a production plan of pharmaceuticals (e.g. types and quantity of medicines) for all the state-owned pharmaceutical manufacturers. Likewise, the government also established a network
for the supply and distribution of all pharmaceuticals. Under this system, the state-owned pharmaceutical distributors and companies at different levels were responsible to sell medicines to health facilities across the country. At that time, manufacturers were not allowed to sell products directly to health facilities.

After the economic reform, new regulations and decrees regarding the production and distribution of medicines were developed to help introducing more market mechanisms into the state-owned pharmaceutical manufacturers, in order to promote the development of the pharmaceutical industry. In September 1984, “The Drug Administration Law” was issued, aimed to ensure the quality, safety and efficacy of medicines under the context of transforming China’s planned pharmaceutical sector into a market-oriented one. Since 1990s, an increasing number of issues and problems related to pharmaceutical production, registration, distribution, and utilization emerged. The following three sections are devoted to illustrate what the main problems are, how serious they are, and what factors they are associated with.

**Pharmaceutical registration, production and pricing**

Under the market-oriented economy, Chinese pharmaceutical manufacturers have the autonomy to decide what products and how much they would produce. It is not surprising that manufacturers develop their production plans according to market demands and profit gains, although the production of some special medicines is still strictly regulated by the government. The State Food and Drug Administration (SFDA) is responsible for reviewing and approving new medicines on the ground of quality, safety and efficacy. The National Development and Reform Commission (NDRC) is mandated to set and regulate the prices of new medicines based on self-reported production costs suggested by the manufacturers. Prices of medicines listed by the national health insurance programs are also set by NDRC.

As described above, health expenditure in China has increased significantly since the economic reform. Over the past two decades, it was the individuals, not the government, who have mainly born the financial burden emanating from the rapid rise of medical care costs. Part of increased spending was contributed by the advanced health technologies that have brought higher quality of care, but some of the increased expense was just caused by over-use of medicines and diagnostic tests. Many studies found that there were an increasing number of people who were unable to get access to basic health care. The equity in access to and financing of health care were worsening. In order to reduce the financial burden of medicines expenditure, there were 20 rounds of medicines price cutting since 1997. The prices of a number of selected medicines (mostly were essential medicines) were cut down significantly. However, patients did benefit from the price cuttings. Pharmaceutical manufacturers stopped producing the products which were subject to price cutting, and shifted to other products. A study found that, one third of 1,500 essential medicines was out-off-stock in Beijing, and 30% of which were no longer produced
by any Chinese pharmaceutical manufacturers. Such a phenomenon is common in other areas as well.

Pharmaceutical manufacturers are keen to register “new products” to evade price cutting for more profits. The “new products” are unfortunately non-innovative, just modifications of dosages and/or packaging, but are not subject to price cutting any more. Until the end of August 2006, SFDA granted 176,000 medicine approvals, among which the majorities are new dosages and/or packages. For example, until the end of February 2007, SFDA issued more than 200 approvals of Levofloxacin injection. On the contrary, no manufacturers would be willing to produce less profitable product like Vitamin D2. It was replaced by two activated Vitamin D (Alfacalcidol and Calcitriol). As a result, the daily treatment cost rose from less than CNY 1 to 10-15 (US$ 0.1 to 1.4-2.1, exchange rate=7.3).

Another important factor that has been affecting the production of medicines in China is the medicines lists developed by different health insurance schemes. Although the national essential medicines list was already developed by MoH in responding to the World Health Organization’s Action Program for Essential Medicines, it has not really influenced on the production and use of medicines in China due to the lack of relevant policy support. Instead, medicines list developed by the insurance programs play a key role in guiding the production. The Ministry of Labor and Social Security (MoLSS) develops the reimbursable medicines list for the urban employee basic medical insurance (BMI). It consists of 1,901 medicines, of which 823 are traditional Chinese medicines. Rural co-operative medical scheme (RCMS) is managed at county level, and each county may have its own medicines list for reimbursement.

The quality of locally produced medicines in China has been improved gradually during the past decade since the reinforcement of the national drug regulatory authority in 1998. However, given such a huge number of pharmaceutical manufacturers, the supervision capacity may not be adequate enough for appropriate overseas. Quality issue and even counterfeit medicines emerged outstandingly. Counterfeit medicines are global public health problems causing death, disability and injury to adults and children, which plague both developing and developed countries. Developed countries with effective regulatory systems and market control always keep a low market value (less than 1%) of counterfeit medicines. While in countries where there is weak regulatory function, 10-30% of medicines on sale can be counterfeit. In China, 332,000 cases of counterfeit medicines and medical devices were investigated in the distribution chain in 2006, which were worth about CNY 0.6 billion (US$ 73 million, exchange rate=7.8); four manufacturers were revoked of the production licenses and 142 were requested to stop

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*One medicine product may have a number of registration numbers approved by the SFDA for different manufacturers, different dosages and/or package, etc.*
production; 160 distributors were revoked of the distribution licenses and 114 were shutout; 86 GMP certificates and 135 GSP certificates were withdrew; 440 counterfeit medicines production venues were eradicated. Some new characteristics of counterfeit medicines cases in China are seen as increased cases in R&D process, submission of fake dossiers, non-compliance of standard operation procedures in production process; distorted distribution system, etc.

Strong government regulation in the pharmaceutical chain is essential to safeguard the population against counterfeit medicines. Meanwhile, it also makes this sector particularly prone to corruption. If the drug regulatory authority enjoys un-supervised and un-checked power, loopholes would definitely arise. A chaotic registration process for new medicines and medical devices has been reported as a major cause for the rapid increase of medicine prices in China. Bribery paves the way for easy registration of so called “new products” to evade price regulation.

**Pharmaceutical distribution**

There have been significant changes in pharmaceutical distribution systems since the economic reform. As said above, the government previously organized a network for the supply and distribution of all medicines made by Chinese manufacturers. Prior to the reform, the state-owned wholesalers were responsible for purchasing medicines from manufacturers. Three levels of medicines wholesalers (province, prefecture and county) had been established to supply pharmaceuticals to hospitals at respective levels. Dong described a clear flow of distribution of medicines in China within the old system. The advantages of this distribution network were to have effective control and monitoring of medicines quality and price. Dis-advantages as pointed by Dong were the lack of competition and bureaucratic procedures, which might associate with poor management and storage.

After the reform, both distributors and manufacturers are allowed to sell medicines directly to hospitals and pharmacies. In other words, each of the 4,600 pharmaceutical manufacturers can also act as distributor. Most distributors are with small size. It appears to have too many distributors in the pharmaceutical distribution system, which is not easy to be well regulated.

Most pharmaceutical manufacturers have been actively promoting their products, using a variety of ways including sending medical representatives to promote prescriptions in hospitals. Commissions, kickbacks, or gifts are given to hospital managers and/or doctors who purchased or prescribed their products. Senior doctors are supported by pharmaceutical companies to participate in international conferences as a reward of prescription. Such activities have greatly influenced prescription behaviors. The financial incentives given by the manufacturers to hospitals and doctors might have resulted in purchasing less effective but expensive medicines, inappropriate prescriptions and poly-pharmacy. In addition, advertising has also affected the choice of medicines by both service providers and users, as found in other countries.
The number of retail pharmacies across the country also increased greatly over the past two decades after the introduction of the market economy. In 2006, 270,000 retail pharmacies were registered with the drug regulatory authority. This enabled conveniences of access to medicines of the Chinese population in both urban and rural areas. According to the national health account study, about 20% of medicines expenditure was associated with retail pharmacies. Although regulations on controlling the distribution system have been put in place, the implementation is still problematic, especially at low levels. In practice, most rural retail pharmacies, particularly at the county and township levels, often do not have any technical supports from qualified pharmacists. This has huge implications of the quality and safety of care.

In 2004, SFDA issued a regulation requiring that antimicrobials cannot be purchased without prescription in retail pharmacies. Such a policy aimed to improve medicines use (e.g. prevent the over-use of antibiotics). In fact, only a few number of pharmacies have well followed up the regulation. In most pharmacies, particularly in the rural areas, patients can still buy various antibiotics without a prescription. Lacking of capacity for monitoring and supervision on such a large number of pharmacies led to a failure of effective implementation of this regulation.

**Appropriate use of medicines**

Inappropriate use of medicines is a major problem worldwide. World Health Organization estimates that more than half of all medicines are prescribed, dispensed, or sold inappropriately, and that half of all patients fail to take them correctly. Overuse, under use, or misuse of medicines has resulted in wastage of scarce resources, poor quality and unnecessary costs of health care.

Inappropriate use of medicines is also a serious problem in China. Many studies demonstrated inappropriate use in different health facilities at different levels since early 1990s. Common problems include too many medicines given in one prescription; inappropriate use of antibiotics and steroids, abuse of intravenous drip. In 2005, a prescription inspection was conducted in seven secondary and tertiary hospitals in Zhuhai area. The result showed that 58% of outpatient services were prescribed with injectables. Over 80% of prescriptions of the Departments of Pediatrics, Respiration Internal Medicine and Surgery used antibacterial injectables. The main factors attributed to these mal-practices in medicines use include 1) perverse financial incentive; 2) lack of clear official guidelines and corresponding review for treatment of common diseases; and 3) lack of knowledge of doctors or pharmacists at the grassroots level.

The national essential medicines list has not been influential to the prescribing behavior. Instead, the medicines lists developed by insurance programs have had greater impact on doctor’s prescribing behaviors and patient choices. Cheap and effective essential medicines may not
be included in the reimbursement lists. Sometimes this is because of adverse events due to inappropriate use of some first line medicines (e.g. persisting use of gentamycin with a large dosage for a long time, especially intravenous injectables, led to deafness of many children). The health authority then decided not to recommend the use of these medicines. In fact, if these medicines had appropriately been used, such negative consequences would have been avoided in most cases.

RECOMMENDATIONS TO ADDRESS THE CHALLENGES

The above section has described and analyzed main problems associated with pharmaceutical registration, production, distribution and appropriate use. Apparently, many issues and problems need to be adequately addressed in order to establish an effective and efficient pharmaceutical sector in China in the near future. Given the limited space of the paper, this section will focus its main attention to the following issues.

Developing appropriate National Medicines Policy

The pharmaceutical sector is complex. Many stakeholders and different interests are involved in pharmaceutical sector. A case-by-case solution targeting an individual problem often fails to achieve the expected results. The goals of individual policies may be somewhat inconsistent or even mutually conflicting. Moreover, the interests of different entities often interfere with each other. Therefore, many countries have chosen to develop national medicines policy (NMP) in order to integrate policies across different areas of the pharmaceutical sector, and to guide the whole process of medicines research and development, production, distribution and utilization.

Given the current situation in China and the problems in its pharmaceutical sector, it is urgently needed and highly desirable to set up a comprehensive NMP, which can consolidate individual policies, and give clear direction for the development of pharmaceutical sector to serve the health and well being of the people. It can define and record national objectives in the pharmaceutical sector, address problems in an integrated way, set national priorities and strategies, and guide different stakeholders work in a collaborative way. Based on this general policy, concrete policies in specific fields can be adjusted and refined.

The government needs to develop a balanced policy in promoting both the development of pharmaceutical industry and access to essential medicines. Under the auspices of the State Council, the National Development and Reform Commission, the Ministry of Finance, together with the Ministry of Health and the Ministry of Labor and Social Security, need to work together to develop effective and adequate regulations on essential medicines pricing, distribution and procurement.
Pharmaceutical sector has been regarded as one of the key economic pillars to push a fast growth of local economy. A rapid development of pharmaceutical sector can be good for the growth of GDP, an important indicator used for the performance assessment of local politicians. It is not surprising to see that in the 11th Five Year Plan, indicators related to the total product values of the pharmaceutical sector and the jobs associated with the sector were included. As a result of such policies coupled with the economic transition, there have been an increasing number of pharmaceutical manufacturers set up across the country. Most are small or middle size, and cannot reach an optimal economy of scale.

Needless to say, the development of pharmaceutical sector has significantly contributed to the economy and employment and improved the availability of medicines in many regions of China. However, vigorous development without appropriate plan always led to vicious competition. In some provinces, this has been one of the main factors indirectly push a rapid escalation of health care costs over the past decades. Such a situation might have also been indirectly associated with the poor affordability and accessibility of health care by a majority of the Chinese population in recent years. This implies that senior politicians and policy-makers at both national and regional levels need to rethink the necessity and importance of rebalancing the economic development with the health objectives.

However, if the perverse incentives (hospital revenues rely on medicines sales) are not removed, even if the NMP is formulated, the problem of inappropriate use will remain. Actions are needed to strengthen the drug regulatory and supervision functions, to reform the distorted pricing system, to change the provider payment, etc., in order to create appropriate incentives for producing and appropriate use of quality essential medicines.

**Strengthening registration, production and pricing of medicines**

Regulation on medicines registration, production and distribution should be stricter and more robust under the guidance of clear national goals and objectives for the pharmaceutical sector. The capacity of the drug regulatory authorities should be further strengthened to secure better enforcement of laws and regulations. Twenty times of price cutting has not been helpful in addressing the escalation of medicines expenditure and the issue of affordability of essential medicines. To encourage the production of cheap and effective essential medicines, appropriate incentives should be granted to the manufacturers. Better coordination between the health insurance programs and the pricing authority is needed to secure that reimbursed medicines are cost-effective.

**Creating appropriate incentives for appropriate use of medicines**

The health financing mechanisms need to be reformed to remove the perverse incentives and to create positive incentives for appropriate use of medicines. De-linking the income of doctors with the revenue generated from medicines sale is vital for this. In recent years, several
experimental studies in different areas have demonstrated this. With the support from DFID, UK and the Government of China, four Chinese cities (Chengdu, Shenyang, Yinchuan and Xining) have developed effective community health service system aiming to provide affordable and effective basic health care to the urban residents. Doctors working in these community health facilities have been paid salary and bonus. The later payment is linked with his/her performance assessment, instead of revenue generation. Apparently, use of medicines in these centers has been more rationalized after the separation of income from revenue generation. Another example is the community health centers of Changning District, Shanghai where the district government and the urban BMI scheme use global budget, plus indicators (e.g. capped expenditure per outpatient visit), to purchase public health/preventive services and essential clinical services, respectively. Doctor’s income is no longer associated with their revenue generation. The impact of such a reform is clear. The average expenditure per outpatient visit declined 25%-10.7% in 2006 comparing with that in 2005.

With such a pre-condition that perverse incentives are removed, traditional clinical based approaches will be more effective in promoting quality use of medicines. As far as possible, treatment should be evidence-based and accounting local economic realities. Standard Treatment Guideline (STG) should be officially launched by the government following with intensive trainings at all levels of use around the country, and periodically updated based on the comments from the grassroots. Essential Medicines List (EML) and formularies could be used as another useful tool to promote quality use of medicines. It has been generally accepted that the selection of medicines should be based on a list of common conditions and the treatments of choice for these conditions are as defined in STGs. Drug and Therapeutics Committee in hospitals should play an important role at grass root level in promoting appropriate use of medicines.

Evidence-based policy making
Before any reform decisions making, at least an effort should be made to describe and quantify the problems. An indicator-based assessment should be followed by more detailed studies on individual medicines or specific diseases, and the availability/affordability of essential medicines. A time-series of such surveys is extremely useful to monitor the performance with defined targets, and this can also serve as a baseline for the planned interventions. Decision makers will benefit from getting these quantitative data to understand accurately the major problems, which could help to make appropriate reform policies.

CONCLUSION

The pharmaceutical sector of China experienced a rapid development following the economic reform. Emerging issues of medicines R&D, registration, pricing, distribution and clinical use in the new market economy environment are to be addressed with more rigorous and
effective regulation policies and strategies. It is critical to remove the perverse incentives in the health systems to create a clear policy environment for promotion of quality use. Developing appropriate National Medicines Policy to balance the economic development with the health objective is essential for a healthy pharmaceutical development. Strengthening medicines registration, production and pricing, creating appropriate incentives for appropriate use of medicines, and promoting evidence-based policy making are the pressing actions for the government at this stage.

REFERENCES


Setting the Scene: the Pharmaceutical Sector and Medicines Use

2.2 Availability and Use of Essential Medicines in China: Manufacturing, Supply, and Prescribing in Shandong and Gansu Provinces

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Dennis Ross–Degnan
Anita Wagner
ABSTRACT

The current health system reform in China launched in 2009 tackles the problem of access to appropriate medicines for its 1.3 billion people by focusing on providing essential medicines to all. To provide evidence for the reform process, we investigated the manufacturing, procurement, and prescribing of essential medicines in two provinces. We conducted surveys in 2007 of all manufacturers (n=253) and of 59 purposively selected retail pharmacies and 63 hospital pharmacies in Shandong and Gansu provinces. The production and supply of essential medicines, as well as factors underlying decision making about the production and supply were assessed. We also reviewed prescriptions (n=5,456) in health facilities to assess the use of medicines. Overall, manufacturers in Shandong and Gansu produced only 62% and 50%, respectively, of the essential medicines they were licensed to produce. Of a randomly selected 10% of essential medicines, retail pharmacies stocked up to 60% of western products. The median availability in hospital pharmacies ranged from 19% to 69%. Manufacturer and retail pharmacy managers made decisions of medicines production and stock on economic considerations, while hospital pharmacy managers cited clinical need. Between 64% and 86% of prescriptions contained at least one essential medicines. However, over prescribing of antibiotics (34%-77% of prescriptions) and injectables (22%-61%) for adult non-infectious outpatient consultations was common. We found that manufacturers, retail pharmacies, and hospital pharmacies paid limited attention to China’s 2004 national essential medicines list (NEML) in the decisions of manufacturing, procurement and stock of essential medicines. We also found that prescribing of essential medicines was frequently inappropriate. These results should inform strategies to improve affordable access to essential medicines under the current health system reform.
BACKGROUND

China spent 4.5% of Gross Domestic Product (GDP) on health care in 2007. Although total health expenditures have been modest relative to GDP, pharmaceutical expenditures account for a significant proportion, averaging over 40% in the past two decades. In contrast, the average percentage in OECD countries was around 15%.

Despite high pharmaceutical spending, China experiences substantial problems in access to medicines, due to both the lack of availability of essential medicines and to the high cost of and preference for branded products. Perverse financial incentives to service providers lie at the core of these problems. A large proportion of hospital revenue comes from profits from pharmaceutical sales, often the most important source of income at county and lower level hospitals and health centers. Service providers make greater profits on higher priced pharmaceuticals, since the mark-up rate is fixed by government regulation. Hence, Chinese doctors tend to over prescribe medicines, in particular expensive medicines, to maximize revenue generation for their institutions and bonus payments for themselves.

For over 30 years, the World Health Organization (WHO) has advocated an essential medicines list for member states. Every two years since 1977, WHO has updated the Model List of Essential Medicines with about 300 products, which countries are expected to adapt to their needs. China’s Ministry of Health developed its first National Essential Medicine List (NEML) in 1981, aiming to ensure the adequate supply, distribution, and appropriate use of essential medicines. The 2004 NEML consisted of 1,260 Chinese herbal preparations and 773 chemical and biological medicines products. However, appropriate supporting policies and mechanisms needed for the NEML to achieve its intended objectives have been lacking in the areas of manufacturing, supply, reimbursement and use of essential medicines.

To guide the pharmaceutical sector, Chinese authorities have formulated a series of policies on pharmaceutical research and development, product approval, production, distribution, utilization, pricing, and insurance coverage. Of these, price management and insurance coverage have been the two most important measures influencing the availability and use of essential medicines. Controls on medicines price have been promulgated 27 times since 1997, but the measures have not had significant impact in reducing the financial burden of service users. One reason is that manufacturers stop producing medicines that no longer had yield targeted profits, and hospitals and doctors are not keen to use them for similar reasons.

Few studies have examined the availability and use of essential medicines in China, one of the four key health sector components targeted in China’s ambitious 2009 health system reform
plan. In this paper, we provide evidence to answer the following research questions: 1) To what extents are essential medicines produced by Chinese manufacturers; 2) How available are these medicines in retail and hospital pharmacies? 3) How frequently and appropriately are essential medicines prescribed in Chinese health facilities?

**METHODS**

We conducted the study in Shandong and Gansu provinces, which are representative of the eastern (more developed) and western (less developed) regions of China respectively. To understand the availability of essential medicines, we conducted surveys in manufacturers, hospitals, and retail pharmacies in 2007. To understand medicines use patterns, we reviewed selected prescriptions collected from the studied hospitals. Table 1 contains an overview of the information collected from each data source. The study was funded by the World Health Organization, which agreed to the use of these data for academic research.

**Table 1** Data sources for manufacturer, pharmacy, and prescription surveys

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<tr>
<th>Provinces (population, n)</th>
<th>Shandong (92 million)</th>
<th>Gansu (17 million)</th>
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<tbody>
<tr>
<td><strong>Manufacturers, n</strong></td>
<td>Primary 217</td>
<td>Secondary 36</td>
</tr>
<tr>
<td>Study hospitals, n</td>
<td>Primary 15</td>
<td>Secondary 8</td>
</tr>
<tr>
<td>Prescriptions surveyed, n</td>
<td>Primary 982</td>
<td>Secondary 1687</td>
</tr>
<tr>
<td>Prefecture GDP/capita</td>
<td>High</td>
<td>Middle</td>
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<tr>
<td>City-level retail pharmacies, n</td>
<td>With insurance contracts 2</td>
<td>Without insurance contracts 3</td>
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<td></td>
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| Health facility pharmacy survey
| All manufacturers in Shandong and Gansu provinces registered with the SFDA were requested to report to SFDA the essential medicines which were licensed by them for production and those which they actually produced in 2004 and 2005. We did not obtain data on non-essential medicines. In the structured interviews, we also asked the chief executives of these manufacturers which factors most influenced their production decisions.

**Health facility pharmacy survey**

We selected representative non-random samples of 10% of the primary, secondary, and tertiary care hospitals in each province. Hospital levels differ by technical capacity. Primary hospitals (known as urban community health centers and rural township health centers) deliver comprehensive primary care and limited inpatient care for common diseases. Secondary hospitals (known as urban district hospitals and rural county hospitals) are responsible for basic medical care, emergency care, and technical instruction to primary hospitals. Tertiary hospitals provide diagnosis and treatment for complex diseases and technical instructions to secondary hospitals.
In each health facility, we reviewed pharmacy procurement records to calculate the percentage of essential medicines to all western medicines purchased. We also assessed the availability of selected essential medicines in pharmacy stocks. Using structured questionnaires, we interviewed pharmacy managers about the reasons for procurement and stock of essential medicines.

**Retail pharmacy survey**

Hospital pharmacies dispense medicines for both outpatient and inpatient services. Retail pharmacies are managed by licensed pharmacists, can also dispense over the counter (OTC) and prescription medicines. We divided all prefectural level cities in the two studied provinces into three groups with high, middle, and low average GDP per capita. We randomly selected one studied city to represent each socioeconomic group; in each selected city, we purposively selected two insurance contracted retail pharmacies and three retail pharmacies without insurance contracts. We then purposively selected one middle GDP county (the administrative level below the prefectural level) in each studied city; in each selected county, we selected five representative retail pharmacies. In total, we surveyed 59 retail pharmacies, 30 in Shandong and 29 in Gansu province.

In the studied pharmacies, we assessed the availability of the studied essential medicines. The research team visited each pharmacy to collect the above data and to interview pharmacy managers about their rationale for procurement and stock of essential medicines and their understanding of the essential medicines concept.

**Selection of survey medicines**

To assess the availability of essential medicines in retail and hospital pharmacies, we randomly selected 40 traditional Chinese medicines (107 unique dosage forms) and 77 western medicines (98 unique dosage forms) from 1,260 traditional Chinese medicines and 773 western medicines listed on the 2004 NEML. Since product strength is not indicated on the NEML, we included any available strength of the studied western medicines. Although the availability of Chinese herbal preparations improves access to medicines especially in rural primary care, western medicines are the treatment of choice for the majority of Chinese patients.

**Prescription review**

Using clinic records, we reviewed outpatient prescriptions in each studied hospital on a random day in 2006, following the survey methods recommended by the World Health Organization for investigating prescriptions in health facilities. This survey sought to characterize the proportion of prescriptions with essential medicines in routine adult outpatient care, as well as the rates of specific potentially inappropriate prescribing practices, including poly-pharmacy and over prescribing of antibiotics and injectables. We systematically selected 100 prescriptions in each
Chapter 2

health facility. If fewer than 100 prescriptions were issued, we included all prescriptions issued on the study day. To assess the prescribing of western medicines, we excluded herbal products. To examine the potential over prescribing of antibiotics and injectables, we excluded prescriptions for children, adult emergency care, and adult cases treated in hospital infectious disease clinics.

Data analysis
Data were analyzed by using SPSS version 13.0. We summarized data on production as the percentage of licensed essential medicines manufactured, and identified the top 10 most frequently manufactured essential medicines. We summarized the supply of essential medicines in pharmacies by category (traditional Chinese medicines on the NEML, western medicines on the NEML, and medicines on the WHO EML). We listed the factors most frequently cited by the manufacturer chief executives and pharmacy managers for the decision of production of essential medicines. We also described the frequency of inappropriate prescribing using standard medicines use indicators.59

RESULTS

Manufacturing of essential medicines
Shandong manufacturers averaged 20 essential medicine product licenses in 2005, with about 60% of licensed products actually produced (Table 2). In Gansu, manufacturers averaged 41 licenses but only 50% of the products were manufactured in 2005. The proportion of essential medicines produced was not associated with manufacturer sales volumes. Among manufacturers that failed to report sale volumes, the proportion of licensed products actually produced was very low (1.1%).

Table 2 Essential medicines production as percentage of licenses held by manufacturers in Shandong and Gansu provinces in 2005, by manufacturer sales volume

<table>
<thead>
<tr>
<th>Annual sales volume, CNY*</th>
<th>Shandong Manufacturers, n</th>
<th>Essential medicines licenses held, n</th>
<th>Licensed essential medicines produced, n (%)</th>
<th>Gansu Manufacturers, n</th>
<th>Essential medicines licenses held, n</th>
<th>Licensed essential medicines produced, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10 million</td>
<td>54</td>
<td>440</td>
<td>271 (62)</td>
<td>13</td>
<td>262</td>
<td>102 (39)</td>
</tr>
<tr>
<td>10-30 million</td>
<td>51</td>
<td>778</td>
<td>463 (60)</td>
<td>12</td>
<td>610</td>
<td>306 (50)</td>
</tr>
<tr>
<td>30-100 million</td>
<td>48</td>
<td>1117</td>
<td>665 (60)</td>
<td>5</td>
<td>455</td>
<td>273 (60)</td>
</tr>
<tr>
<td>100-500 million</td>
<td>35</td>
<td>1292</td>
<td>872 (67)</td>
<td>3</td>
<td>136</td>
<td>57 (42)</td>
</tr>
<tr>
<td>&gt;500 million</td>
<td>12</td>
<td>622</td>
<td>399 (64)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unknown</td>
<td>17</td>
<td>91</td>
<td>1 (1)</td>
<td>3</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>217</td>
<td>4340</td>
<td>2671 (62)</td>
<td>36</td>
<td>1489</td>
<td>737 (50)</td>
</tr>
</tbody>
</table>

Note: *On Jan 1, 2007, near the time of the survey, the conversion rate was CNY 7.80 to US $ 1.00.
In Shandong and Gansu provinces, the five factors mentioned by manufacturers as the most influential on the production decisions were market demand (81%, 94%), production cost (79%, 89%), price (65%, 50%), market share (54%, 56%), and profit margin (54%, 53%). Whether or not the medicines were listed by the social health insurance programs (32%, 25%) or listed in the NEML (20%, 25%) were less important.

At least one manufacturer produced 579 (28.5%) and 230 (11.3%) of the essential medicines on the 2004 NEML in Shandong and Gansu provinces respectively. The most frequently produced product was glucose injection (produced by 117 manufacturers in Shandong and 18 in Gansu).

In Shandong, among the top ten most frequently manufactured products, eight were western medicines and six were injectables. Paracetamol tablets, a widely used pain reliever for adults and children, was among the top ten most frequently licensed products (by 36 manufacturers),

<table>
<thead>
<tr>
<th>Medicine (name, dosage form)</th>
<th>Shandong Manufacturers with license, n</th>
<th>Manufacturers producing, n</th>
<th>Gansu Manufacturers with license, n</th>
<th>Manufacturers producing, n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose injection</td>
<td>177</td>
<td>117</td>
<td>Glucose injection</td>
<td>20</td>
</tr>
<tr>
<td>Sodium chloride injection</td>
<td>96</td>
<td>64</td>
<td>Xiaoyao pills</td>
<td>22</td>
</tr>
<tr>
<td>Glucose and sodium chloride injection</td>
<td>88</td>
<td>59</td>
<td>Liu Wei Di Huang pills</td>
<td>20</td>
</tr>
<tr>
<td>Banlangen granule</td>
<td>31</td>
<td>25</td>
<td>Bao He pills</td>
<td>17</td>
</tr>
<tr>
<td>Vitamin C injection</td>
<td>57</td>
<td>23</td>
<td>Gui Fu Di Huang pills</td>
<td>17</td>
</tr>
<tr>
<td>Metronidazole tablet</td>
<td>36</td>
<td>22</td>
<td>Bu Zhong Yi Qi pills</td>
<td>21</td>
</tr>
<tr>
<td>Norfloxacin capsule</td>
<td>37</td>
<td>21</td>
<td>Guipi pills</td>
<td>16</td>
</tr>
<tr>
<td>Ribavirin injection</td>
<td>35</td>
<td>21</td>
<td>Cen Su pills</td>
<td>15</td>
</tr>
<tr>
<td>Liu Wei Di Huang pills</td>
<td>30</td>
<td>21</td>
<td>Fuzi Lizhong pills</td>
<td>17</td>
</tr>
<tr>
<td>Metronidazole injection</td>
<td>29</td>
<td>20</td>
<td>Huang Lian Shang Qing pills</td>
<td>16</td>
</tr>
</tbody>
</table>
but was not among the top ten most frequently manufactured ones (by ten manufacturers). Among the top ten most frequently manufactured products in Gansu, glucose injection was the only western medicine (Table 3).

**Supply of essential medicines**

**Retail pharmacies**

Of the 140 western essential medicines randomly selected from the 2004 NEML, 49 (35%) and 69 (49%) were not available in any investigated retail pharmacy in Shandong and Gansu. Among the 41 NEML listed products not found in either province, 21 were injections, including diagnostics like technetium and iodohippurate, as well as products like potassium phosphate which require administration in hospital settings. However, essential medicines like salbutamol and sodium valproate syrups, used to treat asthma and epilepsy in children, respectively, were also not available. About two-thirds of the pharmacies stocked only 17% and 12% of the selected essential western medicines in Shandong and Gansu, respectively.

Of 107 essential traditional Chinese medicines, 7 (7%) and 19 (18%) products were not for sale in Shandong and Gansu provinces, respectively, including five which were not available in either province. About two-thirds of the pharmacies stored 45% and 46% of Chinese products in Shandong and Gansu, respectively.

Pharmacy managers in Shandong and Gansu reported that the top four factors determining their procurement decisions were market demand (90%, 100% respectively), price (90%, 83%), profit margins (73%, 45%) and market share (53%, 45%). Whether or not medicines are reimbursable by the social health insurance (33%, 34%) or listed in the NEML (10%, 21%) were again less important. In addition, more than 40% of pharmacy managers in each province did not know the NEML and 60% did not consider it in procurement decisions.

**Hospital pharmacies**

Essential medicine products constituted 67% (standard deviation, SD 27%), 72% (SD 22%), and 80% (SD 10%) of the western medicine products purchased in 2006 by primary, secondary, and tertiary care hospital pharmacies in Shandong, respectively. Of the randomly selected essential medicines products, pharmacies in Shandong primary care hospitals supplied a median of 26% and tertiary care hospitals 69% of the western medicines on the NEML; in Gansu, these figures were lower at 19% and 38% respectively (Table 4). However, supply in Shandong varied widely. One hospital pharmacy had less than 20% of the studied Western essential medicines, while another had more than 80%. Regardless of hospital level, half of the pharmacies carried about 25% of the Chinese NEML products. In Gansu province, no hospital pharmacy stocked more than 60% of Western essential medicines. Six NEML
products were not available in any surveyed hospital pharmacy in both provinces (pipotiazine injection, capreomycin injection powder, ritonavir oral liquid, compound salvia miltiorrhiza pills, niuhuang shangqing capsule, and buzhong yiqi decoction).

The most frequent reason for not stock the selected essential medicines across hospital levels was lack of clinical use for the products (in Shandong 64%, 58%, and 52% and in Gansu 62%, 69%, and 70% of primary, secondary, and tertiary hospitals, respectively, followed by availability of clinical alternatives (Shandong: 31%, 32%, 41%; Gansu: 28%, 28%, 22%).

Table 4 Availability (median percentage, 25th, 75th percentiles) of selected essential medicines in the sample of hospital pharmacies

<table>
<thead>
<tr>
<th>Level of Care</th>
<th>NEML-Chinese</th>
<th>NEML-Western</th>
<th>NEML-Chinese</th>
<th>NEML-Western</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary care</td>
<td>25% (21%, 36%)</td>
<td>26% (23%, 30%)</td>
<td>33% (17%, 33%)</td>
<td>19% (16%, 20%)</td>
</tr>
<tr>
<td>Secondary care</td>
<td>23% (20%, 33%)</td>
<td>47% (45%, 51%)</td>
<td>29% (22%, 34%)</td>
<td>30% (24%, 34%)</td>
</tr>
<tr>
<td>Tertiary care</td>
<td>23% (21%, 29%)</td>
<td>69% (61%, 74%)</td>
<td>23% (22%, 24%)</td>
<td>38% (37%, 43%)</td>
</tr>
</tbody>
</table>

Note: NEML means National Essential Medicines List.

Prescribing of essential medicines

Overall, as shown in Table 5, the average number of medicines prescribed per patient was lower in Shandong province and decreased by hospital level (an average of 3.2 medicines in primary, 2.5 in secondary, and 2.0 in tertiary level hospitals in Shandong, compared to 5.3, 3.9, and 2.6 in Gansu). However, despite prescribing fewer medicines, the costs per prescription (and thus cost per medicine) increased substantially by hospital level.

While the percentages of essential medicines prescribed ranged from 64% in tertiary facilities in Shandong to 86% in primary hospitals in Gansu, large proportions of prescriptions contained an antibiotic (between 34% in tertiary care hospitals in Shandong and 77% in primary care hospitals in Gansu) or an injection (from 22% in tertiary care to 61% in primary care hospitals in Gansu). The percentages of prescriptions containing an antibiotic or injection were higher at lower levels of hospital care in both provinces.

DISCUSSION

Our analyses showed that manufacturers in Shandong and Gansu provinces did not produce at least 40% of the products on the 2004 NEML for which they held production licenses, with their production decisions determined primarily by economic considerations. Many essential medicines are not perceived as profitable because of low demand, as well as price and mark-up controls. Most retail pharmacies stocked less than 20% and most hospital pharmacies between 20% and
74% of randomly selected Western products on the NEML, depending on the province and hospital level of care. While retail pharmacies cited primarily economic reasons for their purchase decisions, hospital pharmacies most commonly cite lack of clinical utilization as the reason for not stocking medicines on the NEML. However, clinical and economic motivations are closely related. Pharmacies tend to stock what is prescribed, and prescribing is motivated in part by financial incentives. Clinicians in hospitals favor prescribing of higher cost medicines not subject to price controls because they generate greater revenues. This puts added cost burden on patients, especially for those without insurance who pay for all medicines out-of-pocket and also on both urban and rural health insurance funds.

A fairly high percentage of the medicines prescribed in adult hospital outpatient encounters were included on the 2004 NEML, which is not surprising given that the list contained 773 western essential medicines compared to the 300 on the World Health Organization Model Essential Medicines List. Antibiotics and injectables were very commonly prescribed. World Health Organization estimates that guideline-based care would result in rates of antibiotic use in routine outpatient care of 20% or less and rates of injection use of 5% or less. A recent WHO global review reported that the median rates of outpatient antibiotic and injection prescribing were 46% and 19%, respectively, for all published studies conducted between 2004 and 2006. These compare with the observed rates of antibiotic prescribing of 45% in Shandong and 59% in Gansu, and rates of injection prescribing of 34% and 38% in the two provinces, respectively. Thus, overprescribing of antibiotics and injectables in these two provinces is particularly inappropriate, in light of global standards.
Our study has several limitations. We did not collect data on non-essential products manufactured and thus we cannot assess the proportion of essential medicines manufactured among all medicines produced. We assessed the supply of the studied NEML medicines, rather than all NEML products. Although we randomly selected NEML medicines, it is possible that the studied medicines are not representative of all essential medicines. In addition, since the NEML does not specify whether medicines are appropriate for inpatient or outpatient care, some of the NEML medicines may not be expected to be stocked in retail pharmacies. Lastly, because we did not have diagnostic information related to individual prescriptions, we could not assess appropriateness of prescribing in relationship to the condition treated.

These limitations are not withstanding, the present data illustrate key challenges faced by the Chinese health care system. First, there are competing interests between the pharmaceutical industry’s profit orientation and the government’s objective of securing access to affordable essential medicines for the public. Over the past three decades, provincial and municipal governments have promoted the pharmaceutical industry as a pillar for economic growth and job creation, without emphasizing its responsibility in helping to secure access to essential medicines.

Second, the current medicines pricing system has failed to stimulate competition in the production of essential medicines. The pricing authority strictly controls the price of generics, while allowing higher prices for branded generics and much higher prices for originator products. To avoid price controls, manufacturers have shifted registration and marketing to branded generics. The data from Shandong province, where the pharmaceutical industry is an important component of the economy show that manufacturers give priority to Western injectables, among the more expensive products on the NEML.

Third, hospitals and doctors have no incentives to use relatively inexpensive generic essential medicines. Since Government funding only accounts for about 10% of hospital funding, hospitals and health care providers have relied on out-of-pocket payments by individual patients or health insurance reimbursement. Health facilities generate greater profits through prescribing of medicines with high mark-ups not subject to price control. The more medicines doctors prescribe, the higher the income hospitals and doctors receive. Such perverse incentives have been a major obstacle in promoting appropriate use of medicines.

Consistent with other studies, we find that essential medicines constitute a reasonably high proportion of the medicines prescribed in hospitals. However, some prescribing of essential medicines can be inappropriate, such as prescribing injectables for common conditions which can be safely treated with oral medicines or antibiotics for non-bacterial conditions in which they
are not indicated. In addition to the economic incentives to overprescribe expensive medicines, a lack of knowledge among patients about essential medicines and the absence of effective training on appropriate use of medicines for health care professionals likely contribute to high levels of inappropriate use.

The Chinese Government has embarked upon major changes to overcome these challenges. In August 2009, the Ministry of Health issued a new National Essential Medicines List for primary health care institutions, consisting of 205 western generic medicines and 102 traditional Chinese products. By 2012, all primary health care institutions with government subsidies in urban and rural areas will be required to stock and dispense these essential medicines with “zero mark-up”. A maximum retail price will be set by the National Development and Reform Commission for each essential medicine and medicines with the same ingredient will have the same price, no matter whether the product is the originator, a branded generic, or a non-branded generic. All essential medicines will be covered by both urban and rural insurance schemes, and these medicines will be reimbursed at higher rates. Given the problems in the supply and use of the much larger 2004 NELM observed in this study, it will be important for the Government, insurance schemes, and health care institutions to establish policies and incentives that facilitate the use of the new NELM in manufacturing, procurement, and prescribing decisions at each level of the health care system.

**CONCLUSION**

In conclusion, we found that manufacturers, retail pharmacies, and hospital pharmacies paid limited attention to China’s 2004 NELM in their decisions to manufacture, purchase, and stock essential medicines. We also found that prescribing of essential medicines was frequently inappropriate. These results should inform strategies to improve affordable access to essential medicines under the current health system reform.

**ACKNOWLEDGEMENT**

We acknowledge the World Health Organization funded the study. We thank Xiaohua Ying of Fudan University for support of the field survey and data collection and Dong Chen of Fudan University for data processing and analysis. We also thank Richard O. Laing of WHO for his comments about the first draft manuscript.

**REFERENCES**