Developing comprehensive and integrated health system reform policies to improve use of medicines
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General Discussion
Chapter 6

The aim of this thesis is to use policy impact analysis to obtain evidence on effective health system reform policies to improve the use of medicines. To that end, the status and trends of the Chinese health system, as well as the challenges of the Chinese pharmaceutical sector, and the rationale for making an impact analysis of various components of health system reforms on medicines were analyzed. Next, effects were analyzed of various strategies to promote appropriate use of medicines. This thesis aims to answer the following research questions:

1. What are the general strengths and challenges of the Chinese pharmaceutical system?

2. What are the effects of clinical educational interventions on medicines use, with a focus on antibiotics?

3. What are the effects of various financing reforms on the use of health services and medicines within the health system reform framework?

4. What are the effects of integrated system reforms on the use of health services and medicines within the health system reform framework?

In this final chapter, the main findings are presented and discussed, followed by a review of possible policy implications for more efficient reforms towards improving the use of medicines. Some methodological challenges of pharmaceutical policy impact analysis are discussed, and areas for further research are identified.

**MAIN FINDINGS**

**Research question 1: What are the general strengths and challenges of the Chinese pharmaceutical system?**

The overall situation of the Chinese pharmaceutical system was described in Chapter 2. The Chinese pharmaceutical system has experienced a rapid development following the economic reform. Emerging issues in medicines R&D, registration, pricing, distribution and clinical use in the new market economy environment needed to be addressed with more rigorous and effective regulation policies and strategies. We found that, before the most recent wave of nationwide health system reforms starting in 2009, prescribing of medicines, especially antibiotics, was frequently inappropriate; too many medicines, especially too many antibiotics and injectables were prescribed. We also found that distorted incentives in the health systems are the key drivers of inappropriate use, and that it is critical to remove these in order to create a clear policy environment for appropriate use. We also found that the lack of an appropriate national medicines policy to align economic development with health
objectives is another obstacle towards the development of a healthy pharmaceutical system. The strengths of the Chinese pharmaceutical system are that access to essential medicines has generally been secured through universal coverage of the population with basic health insurance. The challenges are that benefit packages need to be further strengthened, and that a pro-poor perspective is needed to secure more equal access to quality care (including quality use of medicines). In addition, the “safety net” function is to be reinforced to prevent catastrophic pharmaceutical expenditures of poor families.

Research question 2: What are the effects of clinical educational interventions on medicines use with a focus on antibiotics?

Clinical educational interventions on the use of antibiotics and the effects of these interventions were analyzed in Chapter 3. Limited effects were observed for clinical educational interventions to improve the use of antibiotics: after the interventions, huge gaps remained between actual performance and internationally agreed guidelines. Our studies found that although the most strict and intensive nationwide interventions significantly reduced antibiotic use in Chinese hospitals, their use remains far from scientifically sound. Simple restriction of use did not lead to scientifically sound and cost-effective use of antibiotics. The general dislike of basic and cheaper antibiotics like penicillins and other narrow scope antibiotics seems deeply rooted.

Research question 3: What are the effects of various financing reforms measures on the use of health services and medicines within the health system reform framework?

This question was addressed in Chapter 4. The effects of the two most important financial components of the health system reform: the allocation of increased government subsidy and the reform of the medicines mark-up and provider payments were analyzed. Removing the mark-up on the sale of medicines is one approach to reverse the perverse incentive of relying on medicines sales of health facilities, in order to eliminate one important driver of inappropriate use. We found that an appropriate financial allocation with government subsidy to offset the lost medicines revenue can help to resolve the infrastructure, staffing and salary issues, and can have an important impact on the use of medicines. In Beijing, a fixed government subsidy to primary care completely delinked providers’ income from medicines mark-up, as no surplus was allowed to be kept by the primary care. There was neither an incentive to generate more revenue nor one to procure medicines outside the essential medicines list. This enabled more use of essential medicines, and helped containing the rising costs of medicines. However, this approach did not create any incentive for keeping sufficient work enthusiasm and motivation. Another allocation approach kept the government subsidy in place but also allowed mark-ups of non-essential medicines. Here the perverse incentives were not totally removed, and no change in the use of medicines was observed.
Another type of financing reform concerned changes in provider payment within the basic health insurance programs. Shifting from a retrospective “fee-for-service” payment towards a prospective capitated payment removes the motivation of inappropriate use of medicines and cost inflation. We found that in Qianjiang, such a provider payment shift contained rising medicines costs without any unintended results such as increased patient referrals and hospitalizations. However, this single financial reform did not significantly change prescription behavior.

Research question 4: What are the effects of integrated system reforms on the use of health services and medicines within the health system reform framework?

Zhuhai’s experience in designing the outpatient benefit package with capitated provider payment (Chapter 5) supported the concept that universal health coverage (UHC) needs to be achieved in three dimensions: the degree of population coverage, the range of service coverage and the level of financial risk protection. Our studies found that the creation of one pooled fund for universal access to a minimum primary care outpatient benefit package increased the efficiency of the participating health insurance funds. Coordinated reform policies supporting each other and creating the appropriate incentives could help to achieve UHC with a secured level of quality of care. The method of capitated payment for the contracted primary care providers raised their cost awareness, and helped to reduce the escalation of costs. But a simple prospective provider payment change alone did not secure the quality and efficiency of care. A carefully designed pay-for-performance system is needed to create the appropriate incentives, and to ensure that the payment reforms do not lead to unintended effects.

DISCUSSION OF THE MAIN FINDINGS

Universal health coverage (UHC) and healthy pharmaceutical systems

Developing appropriate national pharmaceutical policies to secure health objectives

Our findings showed that developing an appropriate national medicines policy that aims to match the economic development with the health objective is essential for the development of a healthy pharmaceutical system. The pharmaceutical policies of countries always have multiple objectives. Health is regarded as a fundamental human right by the United Nations,¹ and the goal of sustainable improvement of the standard of health is therefore at the centre of a pharmaceutical policy. High performance national pharmaceutical policies require the coordination of interrelated objectives, clarity of policy goals and objectives, awareness of policy instruments and options, and understanding of policy impacts and interactions.² In its practical application, conflicts between various components of the policies are common, particularly when certain aspects of pharmaceutical policies are set by various government
agencies with fractured responsibilities. This is even more so in countries with a large population and huge geographical, demographical, social and economic disparities, like India and China.³

Our studies found that the changing Chinese pharmaceutical policies unfortunately failed to be integrated but generated several inconsistencies. For example, pharmaceutical policies with contradictory goals have created distorted market incentives in the health systems. Our studies also found that the government intends to develop a strong local pharmaceutical industry to contribute to the economic development; that selling medicines has been used as a tool to cross-subsidize public health providers as a compensation of declined government investment; and that price caps have been regarded as a means to secure access for the poor. This combination of policies has created a vicious cycle with multiple perverse incentives. The viability of the pharmaceutical industry came to rely on “under the table” deals with health service providers, instead of appropriate returns following normal marketing exercises. Health service providers had to rely on medicines sales rather than on the quality of health care services. The availability and accessibility of life-saving essential medicines was neglected as no profit could be made with low-priced medicines. The affordability of medicines for the poor was not secured as low-priced medicines were not made available anymore. Even with continuous price caps, the financial burdens of neither the government nor the society nor individuals were relieved.

Promoting efficient use of medicines to secure financial viability

Our studies demonstrated inefficient use of medicines in China; unnecessary and incorrect use is quite common. Prescribing of medicines, especially antibiotics, is frequently inappropriate. Too many medicines, especially too many antibiotics and injectables, are prescribed. Our studies also noted that these problems have not fundamentally changed after the national health system reforms. These findings are supported by extensive other empirical studies about medicines use in China, which were internationally published three to five years after the health system reforms.⁴¹⁰ Use of medicines is one of the major drivers of quality, safety, equity, and cost of care in the health systems of low and middle-income countries (LMIC).¹¹ The problems of inappropriate use of medicines in China are even more serious than in many other (LMICs).¹²⁻¹⁴ Pharmaceuticals constitute a major expenditure of the health systems, including out-of-pocket payments by the poor. The pharmaceutical system therefore has a significant role in determining the economic burden on the government, the society and individuals.¹⁵ Medicines also constitute three of the top ten sources of waste of scarce health system resources.¹⁶ The problem of inappropriate use of medicines therefore has been creating a huge challenge for China—a country with the world largest population but limited health resources per capita.
Following the most recent wave of the health system reforms, China claimed to the world that it achieved UHC. Analysis of the progress towards UHC with selected indicators also shows positive trends. According to an estimation by IMS, China is expected to have the highest growth of medicines expenditure in the world, where per capita spending will grow by over 70% during 2015-2020. The subsequent efforts of China to expand access, promote inclusiveness, and advances in innovation will all have a bearing on the use of medicines. Without considering the non-compliance of clinical guidelines, which may bring additional cost due to adverse drug reactions or resistance, on the basis of over-use alone UHC in China would already not be sustainable. The experience of South Korea in implementing UHC and its dilemma of spiraling costs should be carefully considered by China. The challenge for China now is to expand health services with constant attention to causes of waste and inefficiency that can be reduced through smart policies and wise decisions. The sooner effective interventions are identified and implemented, the sooner the risk of financial unsustainability of UHC is reduced.

Clinical educational interventions and prescription behavior in complex health systems

Our findings have demonstrated the limited effects of clinical educational interventions before and at the early stage of the health system reforms. In our study settings, clinical educational interventions, even linked to managerial measures, were obviously not enough to counteract the deep-rooted perverse incentives. Rather than simple restriction of use, more sophisticated and comprehensive policies are needed when hospital financing is heavily dependent on medicines sales, and prescribers themselves also gain additional income from dispensing or selling medicines. In addition, the reversed proofing responsibility for medical disputes also encourages a defensive and high-prescription attitude of doctors. These powerful factors greatly influence their prescription behavior and are not fundamentally resolved through clinical educational and even managerial interventions.

The lack of positive effects of clinical educational interventions that we studied confirmed that prescription behavior is determined by a variety of internal and external, social, economic and cultural factors. The effectiveness of interventions on prescribing depends to a large degree on the content, delivery mechanisms, intensity, context and implementation environment. Interventions on medicines use can be put into several categories, including clinical educational, managerial, financial and regulatory measures. Effective interventions are always broad-based with multiple dimensions, adapted to a particular situation, and addressing local barriers to change. No single intervention can be recommended for all behaviors in any setting. The most extensive review of experiences from developing countries concerning medicines use surveys and studies (1990–2009) found that interventions undertaken to combat inappropriate use of medicines that have been of a clinical educational nature, have had a
relatively small impact and have usually not taken into account the determinants of behavior. Our studies about interventions on antibiotic use in Chinese hospitals also confirmed this. A combination of interventions, involving managerial as well as educational components appears to be more effective than a single intervention. Successful interventions on the use of medicines have to address the socio-economic and cultural factors, and adapt to specific settings with a coordinated strategy package. This is particularly true in complicated health systems like our study settings in China.

**Financing mechanisms and prescription behavior**

Our findings about the effects of the two most important financial components of the health system reform (Chapter 4) showed the importance of financing mechanisms in changing prescription behavior. In many resource poor LMICs where health systems are not appropriately funded and regulated, economic factors can be important barriers to compliance with guidelines. How health care is financed and how health care providers are paid substantially affects treatment decisions, because the financing mechanisms create different incentives for health care providers. New and more sophisticated financing mechanisms have evolved with units of payment becoming broader, and prices for bundles of services set on a prospective basis.

**Allocation of government subsidy**

The experience of Beijing presented in Chapter 4 confirmed that sufficient government expenditure ensures the base for promoting appropriate use of medicines. Studies in other areas of China also demonstrated that a secured government subsidy to primary care helps promoting the use of essential medicines and containing the rising trend of medicines costs. However, the input-based direct government subsidy and retrospective service-based provider payment might not create the necessary incentives to increase efficiency. Yip and her colleagues also noted that the fundamental difficulty of eroded medical professional ethics has not been tackled in any of the experiments so far. Secured government funding may help to resolve the infrastructure, staffing and salary issues. However, prescription behavior will still not be fundamentally improved through increased government funding only. Avoidance of perverse financial incentives is one of the core policies to promote appropriate use of medicines. As long as the perverse incentives of generating revenue and the distorted pricing system are not changed, prescribing patterns will never become optimal.

**Provider payment incentives**

Our study in Qianjiang presented in Chapter 4 showed that the cost containment objective was achieved through provider payment reforms. This fits with many other local health insurance provider payment reforms in China that have shifted from a passive bill payer (which
encourages the over-supply of expensive treatments) to a service “purchaser” approach, using payment methods other than fee-for-services to encourage cost-consciousness. Provider payment reforms have been mostly effective in influencing health expenditure patterns, 38 and have been implemented in both high income countries (HICs) and LMICs to contain health care costs.

Any successful provider payment reforms should contain irrational escalation of costs without compromising the quality of care. In addition to cost, many other factors must also be addressed in health care provider payment reforms. These include the unintended effects of aggregated and prospective payment methods, such as reduced service quality, reduced service, and excluding sick patients. 39-41 Evidence of cost containment through provider payment methods has been reported, but very little is known about its impact on these other dimensions, including the quality of care. More comprehensive strategies are needed to secure the quality of care when containing the cost.

Integrated system reforms and prescription behavior
Our findings about the basic health insurance reforms in Zhuhai described in chapter 5 proved that integrated system reforms of the insurance programs helped in improving the use of medicines. The impact of such reforms on prescription behavior heavily depends on the comprehensive and careful design of the supporting policies. An appropriate pay-for-performance system with specific indicators of quality of care (including quality use of medicines) is especially critical for effective prescription behavior improvement.

The important role of insurance programs
Like what we found in Zhuhai (chapter 5) the basic health insurance programs play an important role in helping improve the use of medicines. The pooled basic health insurance funds have become the key source of revenue for all levels of public health facilities in China after the achievement of UHC. In 2011, the national basic health insurance expenditure accounted over 50% of the total medical and medicines revenues of all levels of health facilities, and even reached 80%—90% in some areas. 42-44 A large amount of government funding was newly allocated to the health sector in the first three years of the national health system reform (CNY 850 billion, US$ 125 billion, exchange rate=6.8). 45 The government decided that most of this additional finance should be used to subsidize those that were not already covered by the basic health insurance programs in both urban and rural areas. 46 Increased government investment in health also led to shifting resource allocation towards performance-based government procurement (supply side) and subsidy to the vulnerable groups to pay for basic health insurance (demand side). With continued expansion of access to more comprehensive services and strengthening of benefit packages, the issue of efficient use of the insurance funds emerged. As the third party payer, the health insurance
programs must be responsible for the viability of the insurance funds, and play a more and more important role in resource allocation, creating incentives and constraints, regulation and supervision.

Our findings are in line with those of a study of Chen et. al. in primary care facilities in China, which measured the changes of prescription patterns under the economic incentives created by the reform, and strongly suggests that payers need to be involved in the health care financing reform. The study found that the overall changes were not significant, two years after the implementation of the national essential medicines system reform in which health insurance programs were not comprehensively involved. It seems that the removal of a perverse economic incentive alone would not lead to improvement of health providers' prescribing patterns. The lack of payers' and providers' meaningful involvement in the reform process possibly contributed to the lack of significant change in prescribing behaviors.

**Pay-for-performance based capitated provider payment**

We found that in Zhuhai (Chapter 5), a combination of pay-for-performance system with the capitated budgets for primary care providers helped in raising the awareness of cost of the providers. However, inappropriate prescribing of antibiotics and injectables remained prevalent, although it partially improved. According to Gold and Felt-Lisk’s recommendations of using physician payment reform to enhance health system performance, broadly speaking a well-designed prospective payment system would promote safe, effective, patient-centered, timely, efficient, and equitable care. This suggests that additional and more explicit incentives to improve the quality of care (including the quality use of medicines) should be incorporated into the provider payment system. Such clear and specific quality of care indicators were missing in Zhuhai's pay-for-performance based capitated provider payment system. That may explain why Zhuhai did not fully achieve the prescription behavior change objective of the reform.

Our findings in Zhuhai (Chapter 5) also indicated that to reach appropriate financial incentives through health care provider payment reforms, designers of health insurance programs need to have the necessary managerial and technical capacity. The year-end settlement policy in Zhuhai is a good example of this. The policy was set intending to secure the quantity of services under the capitated payment system (promoting motivation), but brought an unintended side-effect of artificial cost inflation at the end of the financial year. There might be more appropriate measures to secure the quantity of service and to promote motivation rather than controlling the actual expenditure. This reflects the limited capacity of the insurance programs in creating a system of appropriate performance indicators. The question of what dimensions of performance need to be addressed is large and complex. However, with the huge capacity and experience constraints in China, especially at primary
care level, most performance indicators are only related to cost control and service volume, which have only a weak association with health outcomes. It is not yet clearly established how much of a provider's income has to be linked to quality-related performance to induce a behavioral change in treatment.18

Our findings about the intended and unintended effects of the financial year-end settlement policy in Zhuhai also indicated that strong incentives for some services may reduce the quality of other services. There is already some evidence in China that providers make up outcomes that give them higher performance assessment scores.18 Maynard and his colleagues99 argue that the international literature is not clear as to how large the incentives (rewards or penalties) must be to generate needed behavioral change and what are the opportunity costs, including the costs of good monitoring and objective data. Like our findings in Zhuhai (chapter 5) demonstrated, many primary care reforms in China claim that they tie performance to activities or quantity of services rather than objective or measurable indicators of quality. As a result, without specific targets on the quality of care, the incentives for the pay-for-performance based capitated provider payment system differ little from those of fee-for-service payment in Zhuhai. The pay-for-performance system, in order to be cost-effective, can best be applied to services for which the quality and outcome are clear and easy to measure. Clearly defined evidence-based treatment protocols can be used for performance assessment.18

STRENGTHS AND METHODOLOGICAL CHALLENGES

Strengths of the thesis
The set-up of this thesis follows the development of the health sector reform program in China, starting with simple and individual reforms and moving towards more complex and comprehensive reforms. As far as we know, this thesis is the first comprehensive study comprising of a series of empirical research projects about the effects of China's most recent health system reforms on medicines use. The studies cover the various components of the reforms in different stages at either central or local level. The key components of these reforms include: clinical educational interventions on use of medicines, financing reforms like removing the mark-ups on medicines, allocation of government subsidies to health care providers, shifting the health care provider payment from retrospective to prospective method, exploring pay-for performance system linking with prospective health care provider payments; and designing new benefit packages to achieve universal health coverage. This thesis tracks the pathway of the reforms in sequence, from clinical educational interventions to individual financing reforms, and to integrated system reforms with a health system approach to improve the quality of care (including medicines use). It also analyzes the complexity of medicines use problems and the necessity to address the long lasting problems in China with an integrated health system approach.
To our knowledge, the thesis also presents the first study in China in which routinely collected health system data, including insurance claims data, have been systematically collected and analysed to assess the impacts of health system reforms in China. Our careful documentation and evaluation of various reform components has very important implications for other areas of China, which are seeking to improve access to health services and financial protection through universal health coverage. The strengths of the thesis include the use of data from different sources to construct relevant policy indicators, a strong quasi-experimental design to assess change in selected indicators, and references to relevant Chinese documents to make this information accessible to non-Chinese experts.

The lack of one consistent longitudinal source of data also highlights one of the strengths of our final study of this thesis, namely the use of different types of routine data collected by different actors in the system to study impacts of policy interventions. The results present proof of concept that existing data from different sources can be used to inform health policy in China. More advanced study methodologies are now needed to better document the most effective interventions. The collaborations of all government agencies to contribute data for this study with academic partners exemplifies multi-stakeholder engagement, which is essential for studying and improving health systems over time.

**Methodological challenges**

**Sample characteristics and selection bias**

In the first study described in this thesis, the selected regions, manufacturers, health facilities and pharmacies for the survey were with secured representativeness. The reviewed prescriptions were systematically selected from a random day of the studied year. This might bring prescription selection bias due to the seasonal change, differences in patient attendance across months, weeks and working days within the same hospital. If the reviewed prescriptions were selected across the studied year, the potential bias could be reduced.

In another two early studies described in this thesis, we used a simple random sampling method to select facilities, which might not have the selected facilities adequately representative of the characteristics of scale and operation status of the health facilities. We stratified the facilities by administrative district before sampling in Beijing, which helped to attribute the above factors to some extends more adequately. The risk of potential selection bias might be higher in Qianjiang due to the constraints that reform was implemented in several stages, and there were only a small number of facilities that started the reform in the first group. These did not allow us to do any stratification of the facilities.
A later study described in this thesis collected data on antibiotics use from selected Chinese hospitals. Ideally, we would have used the existing Chinese national monitoring network data to conduct this study but these were not available. The selected hospitals are part of the 35 hospitals who firstly reported data to the national monitoring network. This may have concerned relatively advantaged settings, as the selected hospitals may have more motivated clinical pharmacists to conduct routine monitoring and audit of antibiotic use, and thus actually be better than the average of all hospitals. This implies that the problems that we noticed may still be an underestimation of the real situation.

The last study described in this thesis targeted the insured population voluntarily enrolled in a new primary care benefit in Zhuhai. There might be a potential selection bias when we compared the population enrolled to the new benefit with the overall insured and the overall resident population. As the new benefit is voluntary, there might be a potential adverse selection by patients, i.e., unhealthy population is more willing to enroll than the healthy one. Such selection bias may lead to over estimation of the primary care service utilization and cost of this population.

In addition, due to the constraints of availability of insurance claims data before the introduction of the new benefit, we had to approach to individual primary care facilities to ask for baseline data. As the primary care facilities were designated by the new benefit at different time points over the course of five years, there were only a limited number of primary care facilities set up electronic database before 2009. To obtain electronic data before 2009, we only identified four individual health facilities that could provide electronic data to replace the missing insurance claims data before the introduction of the new benefit. This may not be fully representative of all the facilities designated by the new benefit; but these were the best data available.

**Quality of data and information bias**

The early study in Shandong and Gansu was jointly conducted by the research team and the local health administrative and regulatory authority officials. Such collaboration facilitated in some way the willingness of manufacturers, health facilities and retail pharmacies to provide concrete data and information. To secure the interview quality, all data collectors and interviewers were trained with standardized interview tools.

In order to facilitate data collection, another two early studies presented in this thesis heavily relied on existing health administrative data in Beijing and Qianjiang. Although the Health Bureaus organized regular trainings for health facilities to conduct appropriate data collection and reporting, possible quality problems may still exist. However, these are likely to be limited in size because of the quality assessment.
General Discussion

The later study presented in this thesis used antibiotics data directly extracted from routine electronic databases of the selected hospitals, which greatly improved the validity of the data. Another benefit of this study is that the outcome measures of this study are mostly in line with what the national monitoring network used, and all the studied hospitals are members of this network. This enabled us to validate the extracted data through comparing what they reported to the network. In addition, to reduce the potential errors led by human factors in different hospitals, the data provided by each studied hospital were double checked by two researchers by graphing and comparing with the others over time.

The last study presented in this thesis in Zhuhai used multiple sources of health system data which have been routinely collected. As our major data source, the health insurance claims data is a large high quality whole population database, which leads to sufficient power for precise estimation and measurement, and reduced the potential errors by human factors in the process of data extraction and prescription.

**Causality, confounding control and study design**

Unlike testing the efficacy of a medicinal product, investigating the efficacy of a particular policy intervention is complex, due to the variety of possible causes of any observed trend. Randomized double-blind experiments are the gold standard by which effectiveness is measured in clinical disciplines, but they can be impossible to implement when it comes to social policy assessment. Controlled before-and-after studies and interrupted time-series studies are two types of quasi-experimental designs, in addition to randomized experiments, to improve the quality of information for decision-makers. These are scientific study designs for situations where no control group is possible (e.g. measuring the impact of a national policy), as in our studies. In such cases analyses of interrupted time series are the strongest design. This adds to the validity of our findings.

Among the four key policy impact analysis studies as described in this thesis, the study designs were improved progressively, starting from early simple “before and after comparison” with non-perfect control group, moving to the strongest quasi-experimental design to evaluate the longitudinal effects of policy interventions. This gradual improvement may be interpreted as a beneficial effect of a continuous quality monitoring.

In our early studies in Qianjiang and Beijing, with the only available annual average data and reforms implemented in stages, the assessment was restricted to a rough trend analysis rather than a longitudinal study. The comparison among different groups of facilities which started the reform in different stages helped to control the confounding policies effects to a certain extent. The annual average data for Qianjiang was influenced by the effect of
reforms in facilities which started to reform in different times during the year. Although the contributors were small comparing with overall Qianjiang and could be neglected, the average data of overall Qianjiang was still not a perfect controller.

The later studies presented in this thesis (antibiotics use in hospitals and Zhuhai) used a fully longitudinal design. These studies are among the first in China using different sources of routine administrative data. A segmented regression analyses of interrupted time series data was used to measure changes in the level and trend overtime, and to conduct cross-sectional comparisons against external standards. This adds to the validity of our findings.

Another advantage of our studies presented in this thesis (antibiotic use in hospitals and Zhuhai) is that we conducted a chronological policy review around the studied time period. This kept tracks of all relevant policies that were introduced or implemented at the same time as our targeted policy interventions. It also helped in explaining the largely varying results that might be the effect of underlying factors. The interactions between various policies, and their respective contribution to the observed changes of measurement outcomes were considered as possible hidden contributing factors.

**IMPLICATIONS**

**Implications for policy and practice**

*Appropriate institutionalization*

Our studies of the impact of interventions on improving the use of medicines at the early stage of the health system reform found that simple and isolated interventions had very limited effects, whereas we found some positive effects of some more extended interventions programs. This implies the need of multi-disciplinary and multi-faceted approach. As shown in Chapter 3, the Swedish Strategic Program against Antibiotic Resistance (STRAMA) is a good example of such an approach. A multi-disciplinary and multi-faceted approach is needed to develop, implement and evaluate interventions to promote appropriate use of medicines.

Our finding that a multifaceted and multidisciplinary approach is relatively successful also implies a need for a relatively strong coordination, given the very strong financial and societal interests of this issue. To achieve this, a dedicated body to coordinate the policies, strategies, activities between the various stakeholders is needed at both national and regional levels. The new body may involve as many stakeholders as possible, including government, health professionals, academia, pharmaceutical industry, consumer groups and non-governmental organizations. We recommend that the decentralized, segmented government agencies related to medicines use (including various medicines use and
resistance monitoring networks) work towards better integration and coordination, sharing resources and information.

**Sufficient public funding**
Like many other studies,35,36,38,52 our study (chapter 4) has shown that secured government funding has supported the implementation of the "medicines zero mark-up policy", by relieving the financial burden of the community health centers in Beijing. This funding has removed the perverse incentive of relying on medicines sales to generate revenue. This implies that an appropriate level of public financing for sufficient and competent health personnel is critical to improving the use of medicines. This is the precondition for any effective program. We also found that additional incentives are needed to address the issues of eroded professional ethics and motivation.

**Financial incentives**
Our findings have demonstrated that perverse financial incentives are one of the most important factors leading to the inappropriate use of medicines and rising costs in China; the distorted pricing system for medicines and medical care is at the root of the problem. This implies that to fundamentally change the inappropriate prescription behaviors, perverse financial incentives must be removed where possible. This may be reached through reforms in the pricing system, shifting from the current “cost-plus” government price control system to a system of value-based pricing of medicines, raising the price of medical services, and increasing the salary scale of health care professionals.

We also found that insurance programs as the third-party-payer, using provider payment as a financial leverage, were able to raise cost awareness of the primary care providers in Zhuhai (Chapter 5). Economic factors are important barriers to guideline compliance in resource-poor settings,32 and financing mechanisms create different incentives for health care providers.32 How health care is financed and how health care providers are paid therefore substantially affects their treatment decisions. This implies that it may be necessary to involve and strengthen the role of the basic health insurance programs in relevant health care financing reforms.

Our findings showed that a simple shift from retrospective to prospective payment did not fundamentally change the prescription behaviors in Qianjiang. It also did not work with a weak “pay-for-performance” system in Zhuhai, as both of them paid little attention to the quality use of medicines. This implied that provider payments used to create an appropriate financial incentive for cost-effective quality care must be linked with a pay-for-performance system based on specific quality indicators, rather than on a simple cost containment indicator.
Our finding that the year-end settlement policy of Zhuhai insurance programs brought an undesirable side-effect of artificial cost inflation at the end of the financial year implies that it is urgently needed that the budget management capacity in some specific issues be increased at all levels of governments and insurance programs. These issues include the actuarial valuation to rate the pre-payment, and creating a comprehensive pay-for-performance indicator systems based on treatment guidelines and process outcome of specific major conditions, service volume, patients’ satisfaction, etc. In addition to capacity building, the result of our studies in Zhuhai also imply that, in order to include quality indicators into the pay-for-performance based provider payment system, the insurance agencies will need to work more closely together with the health administrative agencies in developing and implementing the clinical pathways for disease diagnosis and treatment (including medicines treatment), and use these as a base for the quality of care driven pay-for-performance system. Linking prescription audit and other quality of care control measures with health facility accreditation may be a good approach.

**Evidence-based clinical guidelines**
Evidence-based standard clinical guidelines are critical tools in promoting the appropriate use of medicines. Our studies described in Chapters 3 found that one of the main factors that the antibiotic clinical use guideline was not well complied was the guideline itself - it was not operational for some issues, and there were contradictions between different guidelines. This implies that institutionalization of a mechanism for developing evidence-based standard clinical guidelines, making them acceptable to multiple levels of professionals, and keeping them operational can contribute to the improvement of medicines use.

**Integrated health system approach**
Our findings about the impact of various interventions on improving use of medicines showed that clinical educational interventions hardly changed the prescription behaviors, and confirmed that isolated reform initiatives have limited effect. This may imply that effective interventions on medicines use have to address the key determinants of prescribing behaviors. More strategic approach carrying a health system perspective is needed. Demands from either the patients or the health professionals need to be considered. This includes mobilization of technical and public resources to educate both the health professionals and the public on prudent use of antibiotics and other medicines; promoting monitoring and evaluation of medicines use and relevant policies with appropriate methodologies to better inform medicines policy making; building harmonized relationship between different stakeholders in the health system, etc. Our studies presented in Chapter 3 found that doctors are risk-averse for high-risk patients, leading to a defensive use of antibiotics. This is one important reason for over-use of antibiotics and inappropriate antibiotic prophylaxis.
This implies that there may be a need to adjust the legislation of placing the responsibility of proof on doctors in medical disputes about unexpected infections, in order to enable a better patient-doctor relationship and reduce the unnecessary use of antibiotics.

**Information and data sharing**

Our studies in Zhuhai as described in Chapter 5 have used multiple existing databases, with each data source providing information of additional value. This implies that existing data from different sources (including the insurance claim system, health administrative reporting system and specific medicines use monitoring systems) can be used to inform policy making. Our studies in Beijing, Qianjiang and Zhuhai all used routine electronic data shared by health administrative authorities and local insurance programs. Without their support, our studies would have needed much greater financial means and other resources to facilitate the data collection. A route may be to make annual reports of various monitoring networks available to the public. Making raw data for academic research may be beneficial to improving the health system.

**Implications for future research**

*Regular assessment of the health system reform and medicines use*

Our studies have targeted several key components of the health system reforms in China over a limited time period only, and have showed several components to be effective but other ones to be ineffective. Such practices provide evidence of the most effective reform initiatives, which can better inform the health system reform decision makers and promote evidence-based policy adjustments. A mechanism of regularly gathering and evaluation of new health system reforms is to be created at both the national and local level. A platform is to be set up for posting these reform policies and the impacts assessment results on line and make it publicly accessible. This can serve as a strong tool of evidence-based health policy-making through the comprehensive and rigorous analysis of the dynamics of health care system reforms.

Our studies in Zhuhai as presented in Chapter 5 have found that specific quality indicators about prescription behaviors were missing in Zhuhai’s pay-for-performance system for the capitated provider payment. This may explain the unacceptable high use of antibiotics and injectables after the reform, even though the cost awareness of health care providers was raised. Although the insurance programs conducted regular inspections to the affiliated health facilities, they did not include a comprehensive indicator system to check the quality of care. This implies that, a set of standardized quality of care (including appropriate prescriptions) indicators is to be developed for insurance programs to be used for routine management and supervision. It would be ideal if these indicators could satisfy the needs of both quality control and cost containment. National targets are also necessarily to be set for
these core indicators, to direct all stakeholders towards a gradual improvement of the use of medicines. A real-time database can be used to identify problems in general prescribing and quality of care, and to design appropriate interventions and to measure the impact of those interventions. Like it is being done in Oman and in many high incoming countries, a secondary evaluation of these indicators is needed for targeting interventions for managing the rational use of medicines. These secondary evaluations can by conducted by age, by level of care, by geographic area, by category and diagnosis. The routine analysis results of these indicators can also be used by either insurance programs or health authorities as a reference for various administrative and management purposes.

**Further in-depth incentive studies**

Our studies have targeted two key components of the financing reforms: government subsidy allocation and capitated provider payment. In addition, our impact analysis of these financing reforms on the quality of care has only focused on limited traditional medicines use indicators, like the proportion of essential medicines prescribed, the proportion of prescriptions with antibiotics and injectables, etc. In reality, various other financial incentives are implemented as well, and this holds too for the quality of care. There are only few experiments in China with re-aligning incentives for health care providers on the basis of these studies. Preliminary evidence suggests a potential to produce cost savings, but evidence of their effect on quality and health outcome is limited. This implies that a systematic review and impact analysis of the incentives for quality care in China is critically needed. These incentives can target either the supply side (health care facility and health professionals) or the demand side (patients) in different settings. Research is needed to study how to optimize these incentives, in order to correct for the current financial distortions in the health system. These incentives include appropriate pricing policies for medicines and medical services, and new approaches to government subsidies, health insurance reimbursement policies, health insurance payment methods to health care providers, taxes and tariffs.

**Mixed approach with quantitative and qualitative methods**

The studies presented in this thesis have included extensive interviews with different stakeholders and key informants. The obtained information was used in the discussion to elaborate, illustrate and clarify the research findings and some contradictions from the quantitative analysis. This component of quantitative research might be further enriched if it were combined with more formal qualitative methods, which can contribute to better understanding of the underlying reasons of any variation in outcomes. Mixed methods in social science research are defined as a technique that combines quantitative and qualitative research. It helps to reduce researcher bias, thereby increasing the credibility of the findings. There has been an increasing acceptance of the concept of mixed methodology research.
techniques, methods, approaches, concepts or language into a single study. Such mixed methods are needed for future impact analysis studies, in order to expand the breadth and range of quantitative research, and to help understand not only whether and to what extent, but also why certain changes took place.

**ATC/DDD system for comparative drug utilization study**

Our findings about the comparison of antibiotic use in Chinese and Swedish hospitals (Chapter 3) have found that the Chinese medicines classification system is only partially in line with the global Anatomic Therapeutic Chemical (ATC) system, so our comparison could only target limited ATC categories of antibiotics. This implies there is a need for China to adopt the international ATC classification system, in order to be able to improve prescription monitoring systems. International comparative drug utilization studies can help countries to exchange and share information, and to use the experiences of other countries in their own efforts to improve the use of medicines. The Anatomic Therapeutic Chemical (ATC) / Defined Daily Dose (ATC/DDD) system is recommended by the World Health Organization as a tool for drug utilization research in order to improve quality use of medicines. One component of this is the presentation and comparison of drug consumption statistics at international and other levels. Though providing much new information, our studies on medicines use still only mapped a general situation of medicines use, and lacked more detailed drug utilization studies for specific diseases. This implies there is a need to collect and analyze disaggregated data in terms of gender, age and geographic area, targeting specific diseases, in order to facilitate international collaboration and to allow for better international comparisons.

**CONCLUSION**

China’s pledge to provide affordable, equitable access to quality basic health care for all its citizens is laudable, and its reforms in the medicines area may serve as a useful model for other countries. Now that universal access to basic health services and essential medicines has largely been achieved, future challenges include stronger risk protection of individuals, and appropriate incentives for better efficiency and quality of care.

Removing remaining perverse incentives (e.g. those where hospitals and doctors rely on the sale of medicines to compensate for low salaries of health workers or lack of other institutional revenue) is the pre-condition for any successful and sustainable reform in the medicines area in the Chinese health care systems. Creating appropriate incentives through carefully designed and comprehensive health financing reforms in both the supply side (health care provider financing) and the demand side (reimbursement to patients) is now one of the top priorities for China to improve the efficiency and cost-effectiveness of health care. It is now necessary to design an effective bundled payment system with mixed
approaches, as well as a comprehensive pay-for-performance indicator system with specific quality of care targets.

Before any reform decisions are made, it is necessary to at least conduct a mapping and quantification of the current state of the problem. Indicator-based assessments followed by more detailed studies on individual medicines or specific diseases and on the availability/affordability of essential medicines, are also needed.

Strong quasi-experimental studies with time-series data are extremely useful to monitor progress towards defined targets, and can also serve as a baseline for newly-planned interventions. From these quantitative data, decision makers will be able to understand accurately their major problems, design appropriate reforms and monitor their impact.

Our thesis has given proof of concept that routinely collected data from different sources can be used to construct relevant policy indicators. Combining routine health system and health insurance reimbursement data can show us the impact of policy changes and can contribute to the evaluation and improvement of health system reform policies in China.
REFERENCES


