General Introduction
Medicines are major contributors to health when used appropriately, and they waste resources and endanger health when overused or used incorrectly. The overall aim of this thesis is to obtain evidence on effective policies to improve use of medicines through impact analysis of the health system reform policies in China. The evidence can hopefully be used by either the Chinese government or other relevant countries to develop or to adjust their health system reform policies more effectively and efficiently in improving use of medicines.

**CHINESE HEALTH SYSTEM: STATUS AND TRENDS**

**Health profile**
Mainland China has 31 provincial administrative regions, which include 23 provinces, five autonomous regions, and four municipalities directly under the central government. By the end of 2013, mainland China had a total population of 1.36 billion, of which 630 million (46.3%) lives in rural areas, and 269 million (19.8%) are migrant workers. The main health problems are cancer, heart disease, cerebrovascular disease, respiratory disease, injury and poison, which account for 85.9% of the total deaths. Non-communicable diseases contributed to 82.0% of the national disease burden.

**Organization and governance for health**
The Chinese health system is organized along four administrative levels: national, provincial, city and county. The state is responsible for overall health policy, while decisions about funding and provision of health services are mainly made at local levels. The state allocates earmarked funding to the poor areas. At the national level, the National Health and Family Planning Commission (NHFPC, formerly named Ministry of Health) is the core agency for health. It is responsible for health legislation, planning and resource allocation, supervising health services and health professionals. The China Food and Drug Administration (CFDA, formerly named State Food and Drug Administration) has the responsibility of supervising the industries of food and medicines. Other ministries also play vital roles in health services and health security, which include the Ministry of Human Resource and Social Security (MoHRSS) and the Ministry of Civil Affairs (MCA). Each local level has its own health, food and medicines, and social security authorities, which are directly administered by the local government and under the technical guidance of respective upper level authorities.

**Health financing**
Public financing dominated the Chinese health system under a planned economy before the economic reform. All citizens were covered by either the free Government Insurance Scheme (GIS), or Labor Insurance Scheme (LIS), or the Rural Cooperative Medical Scheme (RCMS). After implementing the "opening up" policy in 1978, the rapid economic and technological development led to soaring health expenditures. Meanwhile, the government's health
budget declined, and LIS and RCMS almost collapsed. Financing of health service delivery became increasingly dependent on medicines mark-up (which was allowed by the government as compensation for the declined government subsidy) and out-of-pocket payments. In 2001, the national total health expenditure (THE) accounted 4.6% of GDP. In that year, the share of the government budget for health declined to the lowest level of 15.9% of the total health expenditure, and out-of-pocket health expenditure reached its highest level of 60.0%. The remainder concerned social health expenditures including social and private health insurance, etc.¹

A new social health insurance system was established in 1998, firstly for the urban employees to replace the LIS. In most areas, GLS was incorporated into the urban employee program, and civil servants were granted with supplementary benefits. The urban employee program is financed by premium contributions from both employers (6% of the employee’s wage) and employees (2% of their wage). The retired are exempt from premium contribution. The resident program started with the urban residents in 2007, covering those who are not formally employed. RCMS was re-built in 2003 as the New Cooperative Medical Scheme (NRCMS), and has been integrated with the urban resident program in an increasing number of areas. Both programs are jointly financed by government subsidy and individual contributions. The current social health insurance system consists of the urban employee program and the resident program, which are managed by MoHRSS, and both pool their risks at the municipal level. The NRCMS is managed by NHFPC, with risks pooled at county level. The government also allocates medical assistance funds to subsidize the poor to join either the resident program or the NRCMS, which is managed by MCA. The health security system is jointly financed by the tax-based government health budget, social health insurance contributions, out-of-pocket payments, and private health insurances. NHFPC, MoHRSS and MCA develop the health budget together with the Ministry of Finance (MOF). The risk pool funds reimburse a fixed proportion of health expenditures and limit annual payments to six times the annual average wage of urban employees in the city concerned, and CNY 100,000-200,000 (US$ 17,000-33,000, exchange rate=6) in the county concerned. Expenses exceeding this ceiling are covered by either supplementary insurance schemes or paid by the patient out-of-pocket. Patients with financial difficulties can apply for support by a medical assistance fund from the local agencies of MCA. Local governments are responsible for making up any social risk pool fund deficits. Fee-for-Service is the prevailing provider payment method. Provider payment reforms have been piloted with an aim to shift away from the traditional retrospective fee-for-service (FFS) system to prospective payments, including capitation, global budgets, case-based payments, fixed price per outpatient visit and per inpatient day, etc. Most of the payment initiatives are experimental, and thus have not led to a fundamental change in some providers’ perverse financial incentives.⁵

Similar to other products in the pre-economic reform period, prices for medical services and medicinal products are set by the government far below the real cost, aiming to secure the
affordability and accessibility of services and medicines. However, new and highly sophisticated technologies (including brand medicines) are allowed to have high prices. Health service prices of non-profit health providers are set by the local government according to the guidelines developed at the central level, and exempt from tax. For-profit health providers are allowed to set prices for services based on market conditions. Government-owned non-profit health providers receive a government subsidy in exchange for performing social functions of delivering public health and medical services. The quantity and quality of their outputs are determined by the government-specified inputs.

Health service provision
Health services are mainly provided by the public system, which covers 90% of emergency and inpatient services. The historically dual structure of the social and economic development of China led to a split of urban and rural areas, and many rural areas are lagging behind urban areas, also regarding health systems development. Health institutions at different levels have different responsibilities. The urban health delivery system consists of tertiary and secondary hospitals, and of community health centers which are the basis of the health delivery system, and are responsible for curative and rehabilitative services. These services are defined and funded by the government via a “pay-for-performance” approach. Secondary and tertiary hospitals at municipal, provincial and national level support the sustainable development of community health centers by providing technical support, emergency and specialist services, along with carrying out medical education and scientific research.

In the rural areas, the health service delivery system keeps the “three tired structure” which was built in the period of the planned economy. The three tiers are county hospitals, township health centers and village clinics. Township health centers and village clinics mainly provide care for common, prevalent diseases and primary public health services. County hospitals are responsible for acute care and basic health service, and for technical support for township health centers.

Health reform
Recognizing the importance of health as a human right and health sector development as the engine of future economic growth, the Chinese government has launched ambitious reforms to achieve universal health coverage. The target was to ensure universal access to basic health care, as was written in a top-level government document in 2009. Within three years, the coverage of the basic health insurance system and the range of insurance benefits have rapidly increased throughout the country. This is expected to greatly reduce the share of out-of-pocket health expenditures.

Three years after the reform, the government announced to the world that China had achieved universal health coverage for the whole population in 2012. THE raised to over 5.4% of GDP,
the share of government budget for total health expenditures reached a level of 31.3%, and of out-of-pocket health expenditures dropped to 33.4%. Sustained growth in health spending has accompanied China’s rapid economic growth over the past decade. Considerable progress in improving health outcomes was reached at the early development stage (1960-1980), when the average yearly GDP growth rate was 5.7% and the average life expectancy increased with 24 years from 43 to 67 years within 20 years. However, improvement of health outcomes got slower after 1980, when China experienced the most rapid economic development (1980-2010). The average GDP growth rate was about 9.9% while the average life expectancy only increased with 7 years from 67 to 74 years within 30 years. During the same period (1980-2010), health progress in China lagged behind countries that had either similar life expectancy levels (Colombia, Malaysia, Mexico, and South Korea, whose average life expectancies had increased with 7–14 years) or had much higher life expectancy figures (Australia, Japan, and Singapore, whose life expectancies increased with 7–10 years during the same period). Life expectancy is expected to increase with one more year between 2011 and 2015, six years after the national health system reform.

Pharmaceuticals

The China Food and Drug Administration (CFDA) is the national regulatory agency in charge of approving new medicines and granting permission for production (active pharmaceutical ingredients, formulations and re-packing) and distribution (wholesalers and retailers). The CFDA is also responsible for providing information about medicines, giving permission to carry out clinical trials, monitoring adverse drug reactions, etc. The authorization is valid for five years and can then be renewed for subsequent five-year periods.

The National Health and Family Planning Commission (NHFPC) plays a role in the formulation of national medicines policy, selection of national essential medicines, and regulation of the use of medicines in health facilities. Secondary and tertiary hospitals are required to set up a Drug and Therapeutics Committee to make recommendations concerning the development of formularies, procurement and stock, and clinical use of medicines. Medicines are reimbursed by the basic health insurance programs together with other health services. Medicines covered by the insurance programs are selected by MoHRSS based on the national essential medicines list but with a broader scope. The maximum retail prices of reimbursed medicines are set by the National Development and Reform Commission (NDRC). Cost-plus pricing was the main method for price setting for a long time, but value-based pricing has been explored more recently. Cost–effective analysis of medicines for pricing and reimbursement decision making is still in an exploring stage. Patients get medicines mainly from health facility pharmacies rather than from retail pharmacies. Medicines stocked by public health facilities are procured by provincial pooled tendering, which is managed by provincial health authorities. Retailers and private health facilities are always run privately as chains, and have their own procurement systems. Buying antimicrobials from retail pharmacies is only possible with a prescription.
There is no formal generic substitution policy at any level in the country. Health facilities are required to stock two strengths for one active ingredient, which are always one cheap generic product and one brand product with higher price. Physicians usually write brand names on the prescription although there is a policy to require generic names for prescription. Both health facility pharmacies and retail pharmacies dispense branded products.\textsuperscript{14} Medicines are reimbursed by the basic health insurance programs for a fixed proportion of their cost, no matter whether they are expensive brand off-patent products, less expensive branded generics, or cheap generic generics.

Establishing a secured pharmaceutical supply system on the basis of the national essential medicines system is one key component of the national health system reform. The national essential medicine system is seen as one of the five most important components of the health system reform.\textsuperscript{7} A policy for the public health facilities to prescribe essential medicines with “zero-mark-up” has been carried out in urban community health centers across the country since July 2011.\textsuperscript{9} The central government formulates and issues the national essential medicines list, and regulates the categories and quantities of essential medicines used at all levels of public health facilities.

The pharmaceutical industry is encouraged and supported by the government with special policies to secure the market supply of essential medicines. Research and development of innovative medicines are highly encouraged by the government, especially biotech products.\textsuperscript{16} Modern integrated logistics and chain-store systems for the distribution of medicines are promoted by the government as well.\textsuperscript{17}

In conclusion, universal access to essential medicines has generally been secured through universal coverage of the basic health insurance, but a strengthened benefit packages and a more pro-poor perspective are needed to secure more equal access. The “safety net” is to be reinforced to prevent catastrophic pharmaceutical expenditures of the poor families. Perverse incentives in the health systems lead to seriously inappropriate use of medicines in a setting with scarce health resources. This requires innovative and integrated system reforms to remove the perverse incentives and to promote a more evidence-based medicines use.

**WHY PERFORMING IMPACT ANALYSIS TO INFORM HEALTH SYSTEM REFORM?**

Health system reform is complex and dynamic. Reforms therefore require sound evidence and careful analysis to guide the initial policy development and subsequent policy adjustments, thus increasing the chances of success. Impact analysis is a distinct methodology that is used in the
process of health policy and program formulation and implementation. Such practices can help to identify the causes of poor performance, and may suggest how new policies may improve the design and effectiveness of the policy.\textsuperscript{18} Many countries have requested government agencies, independent regulatory agencies, consumer organizations, or other organizations in society to conduct formal and/or informal monitoring and evaluation of new health legislations and health reform policies. Such monitoring and evaluation projects are conducted in different dimensions such as health financing, health service delivery, health technology and products, human resources, governance, information, etc., in order to identify niches for health policy change and gain a better understanding of levers for change. Good examples of this have been well documented by the International Network for Health Policy and Reform, which mainly covers OECD countries. This includes impact evaluation of changes to pharmaceutical benefit scheme pricing on government and consumer medicines expenditures in Australia, an impact evaluation of separating medicines prescribing and dispensing on medicines use in South Korea, etc.\textsuperscript{19}

In addition, given the population size and geographic disparity of a country, it is hard for the central government of a country with a large population and huge geographic disparities to implement health system reforms in a uniform way. Most reforms are implemented incrementally, in order to try out new ideas and methods. This enables the government to reduce the risk of making mistakes, and gives time to various stakeholders to adapt to the changes brought about by the reform.\textsuperscript{20} The most recent wave of health system reform in China follows such an approach as well. The central government announced broad policy statements and reform strategies, and the local governments are supposed to develop their own implementation plans and to experiment with different models within their local context. Many local innovative health system reforms have therefore been initiated and tested. From time to time, the experiences and lessons are collected to enable rapid learning by key stakeholders, and feedback to the decision-making process. Tracking paths of policy implementation and making timely observation of the policy effects will help policy makers, implementers and regulators to capture the non-linearity and diversity of policy implementation.\textsuperscript{21} The success, failure and/or any pre-conditions of local experiments are also valuable for the central government and the other local governments. The information can indicate to the government which new policy could be expanded to broader areas, and under which conditions. This way, good models are identified for promotion and scaling up. National policies and strategies may also change on the basis of feedback from local experiences, which keep changing as a result of learning from pilot projects.\textsuperscript{22}

Although the central government invited several international organizations to conduct a review of the most recent wave of health system reforms, there is as yet no well designed and institutionalized mechanism in China to conduct regular policy impact analysis at both central and local levels. In addition, the health system reforms in China are quite extensive and implemented progressively. Few were systematically evaluated. To our knowledge, there are no internationally
Chapter 1

published studies which present evidence on the impact of the reforms in sequence, displaying the pathway of reform process from simple and individual policy changes to complex and integrated system reforms. There are only few early appraisals of the reforms internationally published in 2009, 2012 (targeting the central level), and 2014 (targeting the local level).

WHY FOCUS THE HEALTH SYSTEM REFOMR IMPACT ANALYSIS ON MEDICINES USE?

Challenges of inappropriate medicines use

Pharmaceutical policies have a significant impact on health system performance. They influence the health of the population, public satisfaction with the health system, the level of out-of-pocket payments and total health expenditures. They also determine the financial burden to both individuals and the public. By 2014, global annual medicines spending reached nearly US$1.0 trillion, and is forecasted to reach nearly US$1.3 trillion by 2018, with an annual growth of about $70 billion (7%) in 2014. Medicines expenditure accounts for as much as 67% of total health expenditures in some countries. At the same time, medicines constitute three of the top ten sources of waste of scarce health resources. Overuse, incorrect use, and disregarding cost-effective use all carry additional costs.

China represents 46% of the “pharmerging” markets, and is already the world's second largest pharmaceutical market, with per capita spending anticipated to grow by over 70% in the next five years. China is now the strategic focal point for many multi-national pharmaceutical companies. Inappropriate use of medicines also brings huge challenges to China. Since the mid-1990’s, the national medicines expenditure has always been between 40% and 50% of the national total health expenditure (THE). It was 43.5% in 2006, much higher than that of the median of the low-income countries defined by the World Bank in the same year (29.5%) and twice the level of the global median (23.1%). Thirty to fifty percent of the medicines consumed in hospitals are antimicrobials, around 70% of inpatients are treated with antimicrobials. The consumption of antimicrobials and infusions per capita is far higher that of high income countries (HICs) and the severity of inappropriate use of medicines is even more critical in China than in some low income countries. The consumption of antimicrobials in the primary care is even higher. In 2008, 57% of prescriptions in primary care facilities contained antimicrobials, 39% contained infusions, and the average number of medicines per prescription was 3.1. The levels of these indicators are poorer in China than the global medians obtained by the World Health Organization from a survey conducted in primary care facilities during 1990-2009. These surveys showed a median proportion of prescriptions with antimicrobials of 38.2%, 42.8% and 48.7% in high and upper middle, lower middle, and low income countries, 11%, 15% and 23.2% for infusions, and 2.3, 2.6 and 2.5 for the average number of medicines per prescription. By contrast, when comparing the THE per capita in China with most of the other countries, Chinese patients proportionally spend too much on
medicines. In 2011, the THE per capita in China represents US$ 265 at purchasing power parity, less than the global median (US$ 442) and the global average (US$ 899). It is only one-third of the average in upper middle income countries (US$ 830), and 6% of the average in HICs (US$ 4,246).

Inappropriate use of medicines therefore wastes limited health resources. This brings a huge financial burden to the government, the society, and the individuals, and also carries certain health risks. The number of deaths caused by adverse drug reactions (ADRs) is not known in China. The official data in US mention over 100,000 deaths (0.03%, number of the population of 0.3 billion) caused by ADRs in 1994. On that basis it is not difficult to make a rough estimate of the number of China, which has about five times of the population in US and a more serious misuse of medicines.

In 2005, a study of Public Security Concerns of Irrational Use of Antibiotics estimated that the additional hospital medicines costs due to inappropriate use of antimicrobial is CNY 21.8 billion (US$ 2.7 billion, exchange rate=8.1). The additional hospitalization cost is CNY 42.0 billion (US$ 5.2 billion), the additional medicines costs and hospitalization costs brought by the resistance due to inappropriate use of antimicrobials are CNY 3.7 billion (US $ 0.5 billion) and 1.3 billion (US $ 0.2 billion) respectively. Conducting a multi-factor adjustment, the hospitalization costs of the resistance group is 1.5 times of the sensitive group (non-resistance). With the median hospitalization costs of CNY 7,445.5 (US$ 919) per patient, the additional hospitalization costs brought by resistance can be estimated at CNY 28.9 billion (US $ 3.6 billion,). Based on the actual mortality rate of the patients with resistant bacterial infections (11.7%) and the average mortality rate of general infections (5.4%), the additional deaths brought by the resistance due to inappropriate use of antimicrobials may be around 489,000 per year for the country as a whole. The productivity loss can be estimated at CNY 4.7 billion (US$ 0.6 billion), and the annual medical costs brought by ADRs due to inappropriate use of antimicrobials can be estimated at CNY 1.9-9.1 billion (US$ 0.2-1.1 billion).

**Pressure of increasing public funding efficiency**

In response to the World Health Organization’s advocacy for investments in health, especially aiming for universal access to quality services, an increasing number of emerging economies are now striving toward universal health coverage (UHC). The World Health Report 2013 highlighted the challenge of expanding health services with constant attention to causes of waste and inefficiency that can be reduced through smart policies and wise decisions. In an increasing number of low and middle-income countries (LMIC), the emphasis has shifted from “under funding for health” in the past towards “efficiency and effectiveness of the increased investment in health”, following the example of most high income countries (HICs). In addition, providing access to high-cost specialty medicines for prevalent chronic conditions, such as cancers, poses a growing ethical and economic challenge for policy makers at all levels of income.
In the settings where UHC is achieved, and increasingly relying on public funding, efficient use of a defined amount of financial resources is therefore critical for competing with other sectors requesting for public funding. In addition, external pressures from the competing programs also force the insurance to raise efficiency. As a third party payer, health insurance agencies have the leverage to determine types and costs of care they pay for, to negotiate prices of medicines, to dictate quality standards (including better provider prescribing and more cost-effective use), to react to unethical promotion practices, and to demand for supply channel efficiency, etc.

Under the current health system reform, the Chinese government has been continuously increasing its investment in health, aiming to reach universal coverage of the basic health care system. Like in other countries, efficient use of government funding has been increasingly relevant for the success and sustainability of the health system reform. Increasingly, the Chinese Ministry of Finance asks about the efficiency when additional funds for health are requested. Improving the use of medicines plays an important role in this effort, as medicines are one of the major drivers of quality, safety, equity, and cost of care.

In addition, following the achievement of UHC in China, the basic health insurance programs have been the major payers for the medical and medicines expenditures. In 2011, the total expenditure of the basic health insurance programs was CNY 654.1 billion (US$ 104, exchange rate=6.3), accounting for half of the total health facility revenues. In some areas, this share has reached 80%-90\%.

With the increasing financial pressure of improving the benefit package (including continuously increased payment by insurance, covering more and more high-cost medicines and other high-tech health interventions), the basic health insurance programs have been adopting more initiatives to contain cost, including the cost of medicines.

**Need of effective policies to improve medicines use with health system perspective**

A major step towards improving use of medicines was taken in Nairobi in 1985 at an international conference, when an action plan to improve the use of medicines worldwide was discussed, and later adopted by the 1986 World Health Assembly. This triggered a series of actions to improve the use of medicines that are still relevant today: international guidelines to develop national medicines policies, programs to strengthen regulatory authorities, teaching materials for health care professionals, good procurement and distribution practices, and global standards for information about medicines, etc. Following these recommendations, World Health Organization also urged Member States to “consider establishing and/or strengthening a dedicated national programme and/or multidisciplinary national body, guided by a broad-based, long-term, independent steering committee, involving civil society and professional bodies, to monitor and promote appropriate use of medicines.”

Twelve core interventions are recommended by the World Health Organization to promote quality use of medicines, in which “avoidance of perverse financial incentives” and “multi-disciplinary activities” are emphasized. Several key blocks of the
health system-leadership and governance, financing and information are highlighted in addition to the traditional clinical approaches like guidelines and essential medicines list. Addressing the problems of medicines use with a health system perspective has been increasingly stressed globally.

To promote the appropriate use of medicines, the Chinese government introduced and implemented a series of regulations and strategies. However, in general their effects on improving the use of medicines were limited. These policies and regulations included requests to retail pharmacies to sell antimicrobials only with prescriptions in 2003, and developing clinical pathways, standard treatment guidelines and clinical use guideline of antibiotics and other medicines in 2004. A national antimicrobials clinical use and resistance monitoring network was created in 2005 to collect, analyze and report routine data from tertiary hospitals. Prescriptions were formally regulated in 2007, and pharmacy administration in health facilities was further strengthened in 2011. A national medicines use monitoring network was set up in 2009 to collect medicines use data from the secondary health facilities, and to recommend interventions for improving medicines use. The types of antimicrobials to be stocked and used in different levels of health facilities were clearly defined and national targets of antimicrobial clinical use were set in 2012.

Although there have been numerous policies issued for improving medicines use during the past ten years, and national medicines use monitoring networks and a national expert committee for quality use of medicines have been in place for some time, the problem of inappropriate use of medicines remains fundamentally unresolved. In 2010, the proportion of national pharmaceutical expenditure to the total national health expenditure was still 40.3%, with the average proportion of outpatient and inpatient medicines cost still at 50.7% and 43.4% of expenditure of public hospitals. This is an unacceptably high level. Among the top 20 adverse drug reaction reports of allopathic (“Western”) medicines in 2010, 15 are from anti-infectious medicines; the top-three are levofloxacin, azithromycin, and ceftriaxone; 73.6% of the adverse drug event reports are infusions, indicating the severity of inappropriate use of infusions (often with antibiotics).

The main reason for the lack of success in improving prescribing is that intervention strategies have remained limited to executive orders and one-time inspections within the scope of clinical educational interventions. The pharmaceutical sector is a complex sector, with many stakeholders and different interests involved. Policy interventions on medicines use by any one actor will impact the behavior of others. Because of the special nature of the sector, a case-by-case solution targeting an individual problem often fails to achieve the expected result, as the goals of individual policies may be somewhat inconsistent or even mutually conflicting. Moreover, the interests of different entities often interfere with each other. Fragmented and vertical approaches rather than integrated strategies with health system perspective, a lack
of association between clinical and social sciences, or neglecting the behavior characteristics of prescriber and patients, will never solve the problem of inappropriate use effectively and sustainably.

In addition, the Chinese health system still suffers from perverse financial incentives, which also promote the inappropriate use of medicines. These perverse incentives include government subsidy approaches (limited resources focus on tertiary hospitals and infrastructure constructions), distorting pricing policies (the level of medical service price is far below the real cost, while the levels of large scale medical equipment diagnosis, medical supplies and medicines are much higher than the real cost), and the revenue of medicines sales is used as a major source of financing for public health facilities. Additional problems are insufficient public resources for a “fee-for-service” payment mechanism, unsound medicines procurement mechanisms without appropriate incentives for facilities to procure low-priced medicines, and a “reversed-proof” responsibility for medical disputes which encourages a defensive, high-prescription attitude of doctors.

These perverse incentives distort the behaviors of health professionals and intensify inappropriate use of medicines. A wider health systems approach is needed to achieve long term, equitable and sustainable results. The global movement toward universal coverage has the potential to create necessary incentives for both providers and patients in changing their behaviors of using medicines. It is urgent to explore the relationships between such behaviors and health financing mechanisms.

There is an opportunity for the national health system reform to address these perverse incentives. The top decision makers are clearly committed to change medicines revenue as a major source of financing for health facilities, and have required health insurance programs to develop innovative strategies to create other incentives for appropriate use of medicines. These measures include expanding coverage to both inpatient and outpatient services; increased diagnosis, treatment and dispensing fees to make up for the loss of medicine sales revenue; changing payment methods from retrospective fee-for-service to prospective capitation-based payments; and supporting polices to secure the quality of care, including the appropriate use of medicines.

In summary, given the importance of informing the health system reforms through impact analysis, and considering the critical role of pharmaceuticals in the reforms and the huge challenges of inappropriate use of medicines, it is essential to perform a systematic impact analysis of health system reforms on medicines use in China. However, previous reviews have shown the lack of systematic scientific studies to evaluate the effects of pharmaceutical policies and strategies in low and middle income countries. Systematic formal evaluation of new
medicines policies has not yet been established in China. The studies included in this thesis therefore respond to the increasing need of informed health and pharmaceutical policy. They assess several components of the health system reforms and cover both the intended and unintended effects of the reform policies.

**OBJECTIVE AND RESEARCH QUESTIONS**

The objective of this thesis is to obtain evidence on developing effective policies to improve medicines use in China, through an analysis of the impact of health system reform. The thesis describes the status and trends of Chinese health system; analyzes the challenges of the Chinese pharmaceutical system; elaborates the rationale for making an impact analysis of various components of health system reform policies on medicines; measures the effect of clinical educational interventions and financing reforms to promote appropriate use of medicines over the period of 2008-2012; and measures the effects of integrated system reforms on the use of health services and medicines. The thesis ends with an analysis of the possible policy implications for the Chinese government, which may also be relevant for other governments engaged in similar system reforms.

The specific research questions addressed in this thesis are:

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?

**OUTLINE OF THE THESIS**

This thesis consists of eight studies, divided over four chapters. Following the General Introduction in Chapter 1, Chapter 2 sets the scene of the overall situation of pharmaceuticals and medicines use in China. Chapter 2.1 describes and examines the main problems existing in the whole chain of provision of pharmaceuticals, from registration, production, distribution, to utilization and administration, and analyzes the main socio-economic and institutional factors associated with these key problems. The paper ends with several policy recommendations to the government in tackling the problems and addressing the challenges of developing a healthy pharmaceutical sector. Chapter 2.2 reports on measuring the availability and use of essential medicines in two provinces of China just at the time when the most recent wave of health system reform was launched in 2009. The results can be regarded as a baseline measurement for the
national health system reform. The discussions in this study intend to identify strategies to improve affordable access to essential medicines under the reform.

Chapter 3 describes clinical educational interventions on antibiotic use and the effects of these interventions. Chapter 3.1 focuses on antibiotic prophylaxis in Chinese hospitals, reporting on a systematic review of intervention studies on antibiotic prophylaxis in clean or clean-contaminated surgery in Chinese hospitals from 2000 to 2012. Chapter 3.2 concerns the Plan of Action for Sino-Swedish Health Cooperation 2011-2014 of the Sino-Swedish Working Group on Antibiotic Resistance. This plan aims to apply Swedish expertise to antibiotic resistance containment in China. The study analyzes changes in the patterns of antibiotic use in Chinese hospitals, and compares these with Chinese national targets and with antibiotic use in Swedish hospitals.

Chapter 4 includes two studies on the effects of the "medicines zero mark-up policy" which aims to remove the reliance of providers on medicines sales, and “provider payment reform” which intends to shift from retrospective payment to cost sensitive prospective payment. These two studies target the most important financial components of the health system reforms, which aim to remove the perverse incentives for medicines overuse and cost escalation, and to create a positive incentive for cost-effective use and cost awareness. The studies both focus on primary care where the two reform components were initiated, one in urban area, and the other in a rural area. Chapter 4.1 reports on the effect of implementing three different health care financing mechanisms in Beijing community health facilities in parallel with the introduction of "medicines zero mark-up policy". This study analyzes the cost containment effect and its effect on the operation of community health facilities. Chapter 4.2 reports on the effect of shifting the provider payment from a fee-for-service system to capitation payment in Qianjiang (a less developed county in western China). The NRCMS of Qianjiang regarded the provider payment as a tool to contain cost escalation and to change prescription behaviors at the beginning of the reform. Key measurements included cost, prescription behaviour, hospitalization and referral rate, and provider income.

Chapter 5 records the initiatives of one special economic development area (zhuhai) in developing integrated health system policies to improve medicines use. Chapter 5.1 documents local experiences in designing and improving the basic health insurance system from the dimensions of population coverage, service coverage and financial risk protection. This paper describes the development of Zhuhai’s basic health insurance system chronologically. It analyzes the background and the key components of the common disease outpatient benefit package, and makes a comparison with outpatient benefit packages of other areas of China and four neighboring countries. Chapter 5.2 presents the first study in China in which routine data from various sources were systematically collected and analysed to assess the effect of a local health insurance reform programme. Longitudinal data from the health insurance organizations, the
health administrative bureau, and primary care facilities were used to assess trajectories in outpatient visits, inpatient admissions, cost per common disease outpatient visit, and prescribing indicators over time. The results highlight the fact that existing data from different sources can be used to inform health policy.

In Chapter 6, a general discussion reviews the results of the studies in the light of the research questions and identifies some lessons learnt. It also reviews the possible practical implications of the research outcomes and formulates a number of practical recommendations for further promoting universal access to basic health care, in a cost-effective and sustainable way. Some methodological challenges for policy impact analysis are also identified and discussed. An executive summary in English, Netherlands and Chinese is presented in the end of the thesis.

REFERENCES


