The London School of Economics and Political Science

An analysis of inequities and inefficiencies in health and healthcare in China

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Declaration

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Statement of conjoint work

I confirm that Chapters 3 was jointly co-authored with Dr. Panos Kanavos, who provided guidance on the structure of the chapter. The introduction, literature review, econometrics analysis, discussion and conclusion were all written and carried out by me. Chapter 6 was jointly co-authored with Dr. Xun Wu, who provided guidance on research ideas and empirical strategies. The introduction, literature review, econometrics analysis, discussion and conclusion were all written and carried out by me.

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Abstract

China's remarkable economic growth heralds substantial improvements in population health for the Chinese people. While economic growth in some respects acts as a positive stimulus to the health sector, it also brings challenges to the health system, in particular, a widening inequity in healthcare across the social spectrum, rising healthcare costs and low efficiency in health provision. The overarching aim of the thesis is to investigate whether inequities and inefficiencies exist in China's healthcare system. It then seeks to understand, whether and to what extent a newly developed social health insurance scheme—the New Rural Cooperative Medical Scheme (NCMS)—responses to issues of inequities and inefficiencies in China's healthcare system. This thesis uses a variety of analytical tools, such as the Concentration Index, Decomposition Analysis, Two-part Regression Analysis and Differences-in-Differences analysis. Data from a longitudinal individual level survey—the China Health and Nutrition Survey of 2004, 2006 and 2009—are used.

The findings of this thesis suggest that inequalities in health and health care in China are ubiquitous and favouring better-off socioeconomic groups. Health status for the urban poor is surprisingly worse than their rural counterparts; more than two-thirds of the inequalities for the rural population are driven by socioeconomic factors. In rural areas, the NCMS was introduced to improve equity in access to healthcare and financial protection to rural farmers in 2003. This thesis finds that, even though the coverage of the NCMS reached more than 97% in 2009, the poor were still less likely to use formal care, such as preventive care, and were more likely to use folk doctor care compared with the rich. They may also have difficulty in meeting the costs of care that they need, and have to pay a substantial fraction of their incomes on healthcare.

This thesis also finds that the NCMS may exacerbate the problem of inefficiency in healthcare provision because the scheme may lead to cost escalation in healthcare. Outpatient treatments for the NCMS participants incur significantly higher pre-reimbursement per episode costs than those for the uninsured. This pre-reimbursement inflation in costs is most noticeably observed at village clinics and

township health centres—the backbone of the health system for poor rural farmers—than at county and municipal hospitals.

This thesis urges policy makers to explore ways to improve equitable access and control supplier-induced demand in health care in China. In terms of the NCMS, it is important to improve the benefit package for both outpatient and inpatient care, and to offer additional benefits for the poor households. The government should also reform provider payment mechanism, regulate provider behavior, as well as implement other measures to prevent over prescribe of medicines and over supply of healthcare.

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This thesis is dedicated to my parents.

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List of abbreviations

ATP	Ability to Pay
CDC	Chronic Disease Card
CHNS	China Health and Nutrition Survey
CHARLS	China Health and Retirement Longitudinal Survey
CI	Concentration Indices
CMS	Cooperative Medical Scheme
CSMBS	Civil Servant Medical Benefit Scheme (Thailand)
DID	Difference-in-differences
DRG	Diagnosis-related group
FFS	Fee-for-Service
GDP	Gross Domestic Product
GIS	Government Insurance Health Scheme
GSCF	Gansu Survey of Children and Family
HCFP	Health Care Fund for the Poor (Vietnam)
HI	Horizontal Inequity
HSM	Heckman Selection Model
LIS	Labour Insurance Health Scheme
LPM	Linear Probability Model
MAR	Missing at Random
MASN	Medical Assistance Safety Net (China)
MCAR	Missing Completely at Random
MNAR	Missing Not at Random
NCMS	New Rural Cooperative Medical Scheme (China)
NPL	National Poverty Line
OLS	Ordinary Least Square
OOP	Out-of-pocket
PSM	Propensity Score Matching
PRC	People's Republic of China
RII	Relative Inequity Index
RSBY	Rashtriya Swasthya Beema Yojna (India)
SHI	Social health insurance
SISBEN	Sistema de Identificación de Potenciales Beneficiarios de Programas Sociales (System to Identify Potential Social Program Beneficiaries) (Spain)
UC scheme	Universal Coverage Health Care Scheme (Thailand)

UEI	Urban Employee Insurance (China)
URI	Urban Resident Insurance (China)
VIF	Variance inflation factors
WHO	World Health Organization
2PM	Two-part Model

Glossary of terms in Chinese

Chi jiao yi sheng	Grass-root doctors
Di bao	The impoverished
Hukou	Personal register
Min jian yi sheng	Folk doctor
Min gong	Migrant workers

Note on the structure of the thesis

This thesis conforms to the requirements of a doctoral thesis from the London School of Economics and Political Science. Guidelines state a minimum of three papers of publishable standard—in addition to introduction and conclusion chapters—not exceeding 100,000 words. Accordingly, this thesis presents an introduction chapter, where motivation, background and an overview of research questions were given. In order to facilitate the understanding of the papers, the second chapter provided a detailed background discussion of China's healthcare system. Chapters 3, 4, 5 and 6 were presented in the style of journal articles and are thus termed 'papers'—form the main body of the thesis. Three of these four papers have been published or accepted in peer-reviewed journals. Paper1/Chapter 3 is published in *BMC Public Health* (Yang and Panos, 2012). Paper2/Chapter 4 is a published paper in *International Journal for Equity in Health* (Yang, 2013). Paper 3/Chapter 5 is under review by *Applied Economic Perspectives & Policy*. Paper 4/Chapter 6 is published by *Health Policy and Planning*. Chapter 7 presents policy recommendations, future research agenda as well as limitations of the study.

1 Introduction

1.1 Motivation

Health outcomes are invariably and markedly worse among the poor (World Health Organization, 2008, World Health Organization, 1996). Efforts to reduce health inequity, together with improving the average level of population health, form a large part of health policies in both developed and developing world, and these largely focus on reducing socioeconomic inequalities/disparities in health outcomes and access, as well as inequities relating to fairness in health financing, which cause access problems.

In China, the issue of inequities in health and healthcare has engendered great interest in recent years. China has experienced remarkable economic growth since its sweeping market reforms in 1978. The economic development has heralded substantial improvements in population health for the Chinese people, but the increase in prosperity has been uneven, resulting in widening healthcare disparities. A growing body of research confirms a persistent and widening health inequity between the rich and poor (Akin *et al*., 2004, Gao *et al*., 2002, Liu *et al*., 2012b, Luo *et al*., 2009, Meng *et al*., 2012, Yip and Hsiao, 2009a). According to the official statistics, from the 1980s to the early 2000s, the poor Chinese suffered higher rates of mortality and morbidity compared with the rich; they also used fewer health services despite having greater needs (Centre for Health Statistics and Information, 2008). Insurance coverage was far from sufficient, and the majority of the rural Chinese farmers lacked insurance. Healthcare finance was dominated by out-of-pocket (OOP) payments, which were unaffordable for most Chinese households generally and for poor households specifically (Gu 2008).

In China, the regional disparities have been widening since the market-oriented reform in the early 1980s. The rapid economic growth and dramatic social and political system transitions have assumed different magnitudes in different regions, being deeper and more comprehensive in the urban areas (Sun *et al*., 2011). Empirical evidence also suggests a widening gap in health status between urban and

rural residents in the transitional period, correlated with increasing gaps in income and health care utilization. It is noted that life expectancy is 74.2 years in urban areas compared with 69.6 years in rural areas (Zimmer *et al*., 2010, Sun *et al*., 2011). China also has substantial disparities across a range of child-health indicators. Rural infant mortality rates are nearly five times higher in the poorest rural counties than in the wealthiest counties—123 versus 26 per 1000 livebirths in 2006, respectively. Further, there are substantial urban-rural differences in terms of healthcare systems and insurance schemes, which are believed as common factors leading to inequalities in health. These trends are associated with changes in health care financing and organization, including dramatic reduction of insurance cover for the rural population and relaxed public health.

Parallel concern began to surface in other areas of China's health system, in particular regarding inefficiency in health provision. In the early 1980s, China's Ministry of Health initiated a series of national health reforms, the aim of which was to decentralize responsibilities in health management, and to improve productivity through financial incentives to medical staff. Hospitals were encouraged to follow the policy of "financial autonomy" to use drug and service revenues to compensate for the losses from the government subsidies. By the early 1990s, most of these hospitals were fully responsible for their own profits and losses. State-owned hospitals in aggregate were expected to cover 85% or more of their costs from fees (World Bank, 1997). These hospitals had responded by prescribing expensive drugs and providing high technology medical procedures for patients to generate profits. This, unsurprisingly, resulted in an increase in prices of health services, and became a serious problem for the rural population, who at that time were not covered by any social health insurance (SHI). In 2008, 45.8% of *pinkun* (poor) households in rural areas reported financial difficulty or high medical costs as the main reasons for forgoing care (Centre for health and information, 2008).

China entered the new millennium facing great challenges in the health sector, but the 2000s was marked a significant break of two decades in which the Chinese government's attention was predominately occupied by economic development. A series of health policies were enacted based on the government's new approach of building a "*balanced and harmonious society*"(Xinhua, 2012b). In 2003, the New

Rural Cooperative Medical Insurance Scheme (NCMS) was introduced to improve equity in access to healthcare and financial protection to rural farmers regardless of individual characteristics such as gender, job status, education, pre-existing conditions, and level of wealth. The scheme was first implemented as a pilot project, and was then scaled up quickly and dramatically to a national level. Despite the fact that the NCMS had shown some encouraging impacts such as improving insurance coverage, problems associated with inadequate financial protection and high health co-payments, especially for the rural poor, persist (Akin *et al*., 2004). Scholars argued that reimbursement rates were still low among NCMS participants, especially for outpatient care (Sun et al., 2009a). This may lead to high co-payments and substantial contributions through private financing from individual patients. Such costs may pose obvious threats to households. Further, while there exists a wide gap in health needs as well as financial status among the NCMS participants, the scheme requires the same premium to be paid, and offers the same benefit package to all participants. The effects of the NCMS on reducing inequity in catastrophic payments and health payment-induced poverty will therefore be limited. Scholars also argued that this newly-developed social health insurance scheme may be associated with inefficiency in health provision, such as supplier-induced demand of healthcare (Eggleston and Yip, 2004, Yip and Hsiao, 2008b).

The overarching research question of this thesis is to investigate whether inequities and inefficiencies exist in China's healthcare system, and to what extent the rural insurance scheme responses to these issues. Specifically, inequity in healthcare are evaluated through three main health variables, i.e. health outcome, health service use and health finance. These variables are frequently used and cited in policy documents and the literature as key dimensions to evaluate a health system (Roberts, 2004, O'Donnell *et al*., 2008b). For health outcomes, age and gender standardised health inequality is measured. This measurement refers the proportion of health differentials attributable to socioeconomic variation, such as lack of resources, a less nutritious diet, poor living standards, etc. For health use, horizontal inequity is measured. It refers to inequity in health use between people with the same healthcare needs. For health financing, catastrophic health payment and health payment-induced poverty are measured.

This thesis pays particular attention to one issue that has received very little attention in empirical health research in China—cost escalation problem under NCMS. It offers an empirical investigation to demonstrate that insurance may induce health costs.

Based on the above discussion, this thesis seeks to test a set of hypotheses as follows:

1) The degree of inequalities in health outcomes is more pronounced in rural areas compared with the urban areas. This may be correlated with widening inequalities in income and socioeconomic status between urban and rural residents in China.
2) The expansion of the NCMS does not necessarily lead to equitable access to care, because the reimbursement rates set for formal care is relatively low, co-payments is likely to become one of the barriers to impede access to formal care, especially for the rural poor.
3) The NCMS may have limited impact on reducing catastrophic health-payments and health payment related poverty for outpatient care, because the reimbursement rate for outpatient care is relatively low, and premium contribution and benefit package are the same for all participants irrespective of their incomes.
4) The inclusion of outpatient care in the NCMS benefit package may not lead to a reduction of health cost; on the contrary, this may lead to an increase of costs. This is because that the current provider payment mechanism is based on a fee-for-service (FFS) system, which may give perverse incentives to providers and is not conducive to cost containment.

1.2 The case study of China

The geographical focus of this thesis is China. China is chosen for various reasons. Theoretically, being the first and only country in East Asia to adopt Socialism as the governing ideology, the Chinese government has used the term: “serve the people” and “eliminate social classes” as its governing principals, and considered equity as an important goal in China’s social sector.

The history and development of China's healthcare system offers an interesting background to the investigation of equity and efficiency in health provision. When the new republic was founded in 1949, health provision was largely based on an egalitarian approach. However, following the market-oriented reform in 1978, China started to adopt a liberal approach to govern its health sector. The old commune-based rural health insurance started to collapse in the 1980s. By the early 2000s, except the urban residents who were formally employed in private or public sectors, the majority of the Chinese population lacked insurance coverage. Healthcare became extremely unaffordable for the majority of the population. Scholars argued that China's healthcare system was bedeviled by "a defective pricing system, increasing budget constraint, and widened inequality in healthcare" (Huang, 2000).

The nature and scale of the health equity challenges the Chinese policy makers faced at the start of the 2000s offers a particularly rich context to allow for evaluations of the new initiatives. The health disparities between the rich and poor have been amplified for the past few decades. The poor Chinese tend to suffer high rates of mortality and morbidity, and use fewer health services compared to the poor (Centre for Health Statistics and Information, 2008) These inequalities may reflect differences in constraints between the poor and the rich, such as lower incomes, lack of insurance coverage, and poorer health related knowledge, etc. Many rural villages lack access to clean water and adequate sanitation; in urban areas, city slums are often unable to provide basic necessities, leaving people at risk for water, sanitation, and hygiene-related diseases (Hussain, 2003). It is worrisome that the poor in China, no matter whether they live in urban or rural areas, are systematically experiencing worse health and insufficient resources to maintain good health compared with their rich counterparts (O'Donnell *et al*., 2008).

A number of policies were introduced in the 2000s in response to the health equity challenges. Among these initiatives, the launch of the NCMS was a phenomenal. The scheme was first piloted in a few provinces, and expanded rapidly throughout the whole country. Within less than five years, the NCMS reached more than 90% of the rural population (Babiarz *et al*., 2012, Hao *et al*., 2010, Lei and Lin, 2009). The NCMS had a very clear equity goal. It was envisaged to achieve universal health access by providing services to the rural population—accounting for approximately

70% of the total population. The insurance policy document, published in 2003, defined the NCMS as a mechanism through which the state should guarantee equitable access to healthcare for all the rural population irrespective of individual characteristics such as gender, job status, education, pre-existing conditions, and level of wealth. Covered services included inpatient care, some catastrophic outpatient care and preventive care (Ministry of Health China, 2002). When the scheme was first launched in 2003, the intention of the NCMS was to provide financial protection against catastrophic inpatient care for rural farmers, and many cost-effective outpatient interventions were not covered. In 2007, the scheme extended its benefit package to some outpatient services (Ministry of Health P.R.China *et al*., 2007) . This extension was designed specifically to improve equity in access to basic healthcare.

Although the equity goals are clearly stated in the policy documents, these goals have not yet been sufficiently addressed by the design of the insurance. The NCMS is intended to provide equitable and affordable healthcare for all rural populations, but in reality, all the participants receive the same benefit package. This is particularly problematic because the poor usually have greater health needs, and are likely to spend a larger fraction of their income on health compared to the rich. Further, the NCMS patients can reimburse approximately 10% to 40% of their medical bills depending on what drugs and services they use (Barber and Yao, 2011). This means that a large fraction of health bills is payable out-of-pocket by the patients, and these costs may be unaffordable and create access barriers for the poorer patients.

Aside from the equity issue of the NCMS, the scheme may also encourage inefficiency. The current Chinese healthcare system is operated mainly on a fee-for-service (FFS) basis, which is one of the major changes resulting from the profound market-oriented health reform in the 1980s. This FFS system allows health facilities to supplement their budgets by making profits from drug sales and health service provision; it also encourages the provider to supply sophisticated care wherever possible. Such a problem may become even more accentuated when a third party—health insurance—reimburses part of the health costs as incurred by the patients (Wagstaff, 2007b, Wagstaff and Lindelow, 2008). Hospitals are motivated to

prescribe expensive medicines and sophisticated diagnosis procedures to insured patients because part of their health bills are covered through insurance claims. It is argued that the NCMS, designed to protect patients from health shocks, may actually lead to unnecessary provision of care under the current Chinese healthcare system, hence leading to affordability problems (Meng *et al*., 2005).

The analysis of the NCMS provides useful insights and valuable knowledge for Chinese policy makers, who are concerned with issues of health inequity, and are interested in improving the design of their health equity programmes. Accomplishing nearly universal insurance coverage is a commendable achievement, but it is debatable whether the goals of improving equitable access and fairness in finance can be achieved solely by implementing a SHI programme. It is also important to look at the design of the insurance, as well as to consider various structural problems embedded in the healthcare system, which may lead to inefficient provision of care and poor quality of services.

China's experience with health equity reforms in the 2000s is expected to offer lessons for similar reforms in Latin America, Southeast Asia and other middle-income countries around the world (Knaul and Frenk, 2005, Li *et al*., 2011), and contribute to the debate of health equity and social health insurance in the literature of health policy analysis. The following section discusses the analytical framework used in this thesis.

1.3 Analytical framework

1.3.1 Inequity in healthcare

As one of the objectives of this thesis is to study inequity in health and healthcare, it is important to define which equity perspective is employed in this thesis to guide the analysis.

Health inequality is a generic term used to designate differences, variances, and disparities in the health achievements of individuals and groups (Murray *et al*., 1999), while health inequity usually refers to "the distribution of resources and other processes that drive a particular kind of health inequalities between more and less

advantaged social groups", in other words, a health inequality that is "unjust or unfair" (Braveman and Gruskin, 2003). Health equity is an ethical concept of social justice or fairness, which is grounded in principles of distributive justice and consonant with human rights principles (Braveman and Gruskin, 2003, Sen, 2002, Whitehead, 1991). Two different ideological perspectives concerning ensuring individuals' right to healthcare prevail in the current debate on equity in health and healthcare. Libertarians think that government involvement in securing healthcare resources and ensuring healthcare access should be minimal. Healthcare ought to be provided according to willingness or Ability to Pay (ATP), and people should be able to use their own income and other resources to get more or better healthcare (Williams, 1993, Masseria *et al*., 2010) The egalitarian viewpoint, by contrast, is concerned about equal distribution in healthcare, and suggests a public-dominated approach in funding healthcare. This approach points out that everyone in the society has the right to have the same access to care, and healthcare should be financed and allocated on the basis of need and not the ATP (Allin and Hurley, 2009) . In a widely cited paper, Whiteheads (1991) suggested that "health inequities as differences in health that are unnecessary, avoidable, unfair and unjust". Mooney (1983) defines seven different definitions of equity of healthcare, including "equality of expenditure per capita; equality of inputs per capita; equality of input for equal need; equality of access for equal need; equality of utilization for equal need; equality of marginal met need; and equality of health", among which "equity of access for equal need" and "equality of utilization for equal need" are two most commonly used definitions in the healthcare literature. These definitions have also been suggested as working definitions for policy makers. In the domain of health policy making, although the debate between libertarian and egalitarian ideologies has not been resolved in practice, studies showed that policy makers are more likely to favor an egalitarian approach in equity of healthcare (Allin *et al*., 2009) . In OECD countries, there appears to be broad agreement among policy makers that healthcare arrangement should be based on health need rather than the distribution of income (Wagstaff *et al*., 1999).

China's health reforms of the 2000s reflected many key elements in the egalitarian approach. In 2002, the Central government and the State Council published the "*Rural Healthcare Act*" (Ministry of Health China, 2002). It indicated that the

NCMS should cover catastrophic illness and ensure equitable access to healthcare for Chinese farmers. From 2004 to 2012, the equity goal of the NCMS and was emphasised in all annual Government Reports published by the central government (Xinhua, 2012b). In the National People's Congress in 2007, the Chinese government publicly acknowledged that the market-oriented healthcare reforms in the 1980s and the 1990s were considered "unsuccessful", and that the reforms failed to improve access and reduce health costs for the Chinese people. The Congress emphasised that one of the key principles of the new health reforms in the 2000s was to improve health equity. Specifically, this included "universal health insurance coverage", "equal access to healthcare for equal needs", and "affordable health for all" (Xinhua, 2007). In May 2013, the State Council of China re-stated that the objectives of the health reforms in China. These included "improve equitable access to healthcare for equal needs", "provide financial protection for the Chinese people against catastrophic illness", "ensure equitable access to healthcare for the rural and urban population" and "enhance universal coverage of health insurance and high quality of care for all"(Xinhua, 2013).

Based on the discussion above, the egalitarian approach is clearly reflected in the health initiatives in the 2000s, and this approach is also adopted in this thesis to guide the analysis. In addition, this thesis builds upon the framework and methodology of health equity measures developed by O'Donnell, Wagstaff, Van Doorslaer, and Erreygers (O'Donnell *et al*., 2008b, Erreygers, 2009, Wagstaff, 2009a). I identify three key health variables for the analysis: health outcomes, health service uses, and health finance. By inequity in health outcomes, I mean age and gender standardised health inequities. By inequity in health use, I measure horizontal inequities. By inequity in health finance, I measure catastrophic health payments and health payment-induced poverty.

Age and gender standardised inequities in health outcomes

It is noted that a proportion of health differentials attributable to natural biological variation, such as age and gender, is inevitable. However, much of the differential between different groups in society cannot be solely attributed to biological variations. For instance, because of a lack of resources, the poor may have less nutritious diets, live in unsafe and overcrowded housing, or take dangerous and dirty

work. Thus, equity in health outcomes can be defined as "the absence of systematic disparities in health (or in the major social determinants of health) between social groups who have different levels of underlying social advantage/disadvantage—that is, different positions in a social hierarchy"(Braveman, 2010).

Inequity in health has been discussed by many international organizations and scholars. A WHO report clearly stated that "individual's needs, rather than their social privileges, should guide the distribution of opportunities for well-being…the pursuit of equity in health is to avoid gaps in health status between groups with different levels of social privileges"(World Health Organization, 1996). Murray *et al*. (1999) considered health inequalities as "any avoidable differences in health among any individuals, who should be grouped a priori according to their socioeconomic status". Braveman (2006) also stated that: "Equity in health should be operationally defined as narrowing avoidable disparities in health and its social determinants between groups of people who have different levels of underlying social advantage".

Using the above definition to guide the analysis, health can be defined as any state of physical and mental wellbeing. Inequity in health can be explained by (i) demographic factors that are related to biological variations in people's health status, such as gender and age, (ii) socioeconomic factors that are related to unfair and unjust variation in health, including household living conditions, income, workplaces and healthcare, and interventions and programmes that may affect the distribution of health. It is noted that policy may be less concerned with inequalities arising from demographic factors, because these are usually reasonable and acceptable. When measuring age and gender standardised health inequities, we are only concerned with the degrees of inequities that are associated with socioeconomic factors. These are the health inequities that policy makers would like to avoid.

Horizontal inequities in health use

Horizontal equity is often interpreted as the principle of equal access to healthcare for equal need. In other words, the distribution of medical care should be "independent of the distribution of income, wealth or any other form relating to an individuals' socioeconomic status" (LeGrand, 1991). People with same health need should be entitled with the same treatment, regardless of their socioeconomic status,

age, ethnicity and other characteristics. This also implies an equal distribution of the available health services across the socioeconomic spectrum based on healthcare needs. Violation of the horizontal equity principle means that health use is systematically associated with differences in ATP rather than health needs. Therefore, if two persons are in equal need of healthcare, it would be considered as unjust and unfair if the rich one were to receive treatment (Wagstaff *et al*., 1991b).

It is also essential to look at two concepts concerning horizontal equity, namely access and need. While a consensus on the definition of access to healthcare is yet to be found, utilization, is often (though inappropriately) used as a proxy for measuring access (Allin *et al*., 2009, Mossialos and Oliver, 2005). In empirical research, utilization can refer to any kind of health use (e.g., outpatient care, inpatient care, bed days, etc.). Need is a rather elusive concept, because defining and measuring the needs that are related to individual's health problems will be a difficult and highly complex tasks (Oliver and Mossialos, 2004).

Despite much ensuing debate regarding health need, it is clear that understanding, defining, measuring and comparing the needs that are related to individual health problems/illnesses is an important task. Much work needs to be undertaken to develop a generally accepted working definition of need, but two components stand out as important: (1) The pre-treatment health condition of an individual (with greater illness equating to greater need), and (2) the capacity to benefit from health care of an individual (with the amount of healthcare resources required to exhaust an individual's capacity to benefit from health care determining the size of their need).

These two aspects of need can sometimes conflict with one another. For instance, there may be no effective treatments (that is, little or no capacity to benefit) for some highly debilitating illnesses (that is, high levels of pre-treatment ill health); for example, permanent physical disability. For the second component of needs, it is assumed that there can be a need for healthcare only if there are grounds for believing that healthcare will enhance health, prevent its deterioration, or postpone death. These are the benefits sought from healthcare, and it follows that healthcare is only needed when there is a capacity to benefit. However, it is worth noticing that there may not have a fixed or unique treatment. Thus, of the various choices of

treatments available, the treatment needed is considered "*to be the most appropriate in the particular circumstances of the case, which is that which is the most cost-effective. The amount needed is that sufficient to exhaust capacity to benefit*" (Culyer, 2001). Nevertheless, it is important to notice that both aspects are potentially important, and a clear operational definition that combines them in a manner that generates general acceptance is an important area for future research and consensus.

In practice, health economists rely on demographics and health status variables (e.g., self-assessed health, morbidity indicators, activity limitations, etc.) to act as proxies for health need (O'Donnell *et al*., 2008b). Horizontal inequities will then be measured by the degree to which utilization is still related to income after differences in health needs across the income group have been standardized for (O'Donnell *et al*., 2008b).

Catastrophic health payment and health payment-induced poverty

A sound financing system should ensure a fair distribution of the burden of health costs, protect households against health shocks, and improve access to health services by promoting an equitable distribution of public expenditures (Abel-Smith, 1994, Doorslaer *et al*., 1993). However, in many developing countries, health finance is still dominated by OOP payments. Households without full health insurance coverage usually face a risk of incurring large medical care expenditures when a household member falls ill. If the healthcare expenses are large relative to the resources available to the household, these expenses may disrupt the living standards of the household. Households may have to reduce expenses on necessities such as food as a result of such large health expenditures (O'Donnell *et al*., 2008b, Yi *et al*., 2009). In some extreme cases, health expenses may lead to poverty. A household at a time of illness may divert expenditures to healthcare to an extent that its spending on basic necessities falls below the poverty line. For those who are already below the poverty threshold, they may sink further into poverty because of the adverse effects of illness and related expenses on their income and other welfare (O'Donnell *et al*., 2008b).

One concept in fairness in health finance is to avoid catastrophic health payments and health payment-induced poverty. World Health Organisation (WHO) (2005) has

suggested catastrophic payment is likely to occur when co-payments for service requiring substantial OOP payments or when the household has a low ATP. It is noted that when healthcare costs had to be met by OOP payments, households of low income, with elderly, disabled, or chronically ill members are more likely to be confronted with catastrophic health payments compared with others (World Health Organization, 2005). Prepayment mechanisms, such as social health insurance, are designed to reduce the chances of catastrophic payment. However, in many cases, prepayment mechanisms are not sufficient to cover all health needs, for instance, when the insurance benefit package is incomprehensive, or when only a certain range of services are covered, etc (Yip and Hsiao, 2009b). In the absence of comprehensive and effective prepayment mechanisms, the poor and the disadvantaged may face high risks of both financial hardship and ill health.

1.3.2 Inefficiency in a FFS health system

In healthcare, efficiency measures whether resources are being used to obtain the best value for money (Palmer and Torgerson, 1999). In many developing countries (China included), healthcare is financed through a FFS system, where inefficiency in healthcare is considered a problem. A WHO 2010 report identifies three levels of inefficiencies that were commonly seen in FFS systems (World Health Organization, 2010). The first level is through health technologies and pharmaceuticals. Unlike systems where the budget is fixed, a FFS health system usually has no strong incentive to constrain the use of drugs or medical devices. One area that attracts growing policy concern is the irrational use of medicines, which may take many forms, such as poly-pharmacy, failure to prescribe in accordance with clinical guidelines, or inappropriate self-medication. Another form of inefficiency in the use of medicines concerns the under-utilization of generic medicines, which have equivalent efficacy yet are substantially cheaper compared with branded medicines. The second level of inefficiency in healthcare is through hospital care. It is noted that some important sources of inefficiency may emerge at the institutional level. Excessive inpatient admissions and length of stay and unnecessary use of examinations that occur on an outpatient basis are considered as inefficiency in hospital management (World Health Organization, 2010). Such over-use may also lead to problems of equity, particularly among people with health needs who are unable to pay, which is also considered as inefficiency in the long term as

individuals' health status can persist or worsen and they would have to access hospital services as a more severe case than if they had presented earlier. Moreover, corruption and fraud are also considered as forms of inefficiency in healthcare (World Health Organization, 2010). These may include corruption in the payment system and in the pharmaceutical supply chain, embezzlement and theft from health budgets or user-fee revenues, etc.

1.3.3 SHI and equity and efficiency in health provision

For the past few decades, efforts have been made to improve equitable and affordable access to healthcare in the developing world. In particular, SHI is a potential instrument for protecting the participant from health risks, because it is effective in reaching a large number of poor people. Countries with SHI are making vigorous efforts to extend coverage to the informal sector, usually (rural) farmers and their families (Wagstaff, 2007b). In 2003, Mexico introduced the *Seguro Popular* Scheme, a voluntary health insurance program providing health coverage to a previously excluded population (Blanco-Mancilla, 2011). Within the *PhiHealth* SHI scheme, the Philippines launched a tax-financed scheme for the poor. Also in 2003, Vietnam introduced the Healthcare Fund for the Poor (HCFP), a SHI programme where poor and disadvantaged groups were enrolled at the taxpayers' expense in the SHI for formal sector workers (Wagstaff, 2007a). China also implemented a government subsidized rural SHI in 2003 to offer financial protection to rural farmers.

In the literature, it is argued that in areas where most people are deprived of access to healthcare, introducing SHI can make a substantial difference (Wagstaff, 2007b). The risk of hospitalization can be shared by the larger community, while low-cost high frequency care can be provided within the extended family. However, studies also argue that many SHI schemes may not be able to fully reflect the interests of the poorest. Under SHI, risk pooling is often small, adverse selection is commonplace, and the schemes are often heavily reliant on government subsidies, meaning that financial and managerial difficulties arise, and the overall effects seem not to be assured (Jutting, 2004).

One of the most important functions for SHI is that it reduces health costs and provides financial protection to households. Individuals may face a certain level of probability of being sick and they may also be aware of the potential reduction in wealth caused by the health payments from being sick. In order avoid such risk, individuals may choose to pay a corresponding premium to secure a certain level of wealth equal to the expected wealth in the absence of insurance (Wagstaff and Lindelow, 2008). However, in reality, it is not certain that health insurance always reduces health expenses. It may reduce the expenses for healthcare, but at the same time increase utilisation. In other words, when patients are aware of the types and the extent of health services they could receive, they may derive utility from health status and financial wealth, and additional medicines and interventions that may possibly increase their chance of a recovery. In this case, the more generous the insurance coverage is, the higher might be the individual's demand for health services because the price is reduced through insurance. This is known as ex post moral hazard (Dusansky and Koc, 2010, Feldman and Dowd, 1991, Arrow, 2001). Further, health insurance may cause the providers to shift the patients' demand curve to the right. It raises an incentive for doctors to provide more care because payment is dependent on the quantity of care, rather than quality of care. Consequently, out-of-pocket (OOP) payments would increase because of having insurance. These are usually common under a FFS system in which health providers have financial incentives to prescribe expensive medicines and diagnostic procedures, or in transitional low- and middle-income countries where regulations are either absent or barely enforced and the health sector is often under-funded (Chen, 2006, Latker, 1998, Eggleston *et al.*, 2008, Zhan *et al.*, 1998). In a recent WHO report (2010), irrational use of drugs and over-use of medical procedures, investigations and equipment are listed among the leading sources of inefficiency relating to health system inputs in developing countries.

Drawing from the above perspectives, two main themes of this thesis are identified: inequity and inefficiency. I use the aforementioned health equity measurements, i.e. age and gender standardised inequity, horizontal equity, catastrophic health payments and health payment-induced poverty, to unpack the key dimensions of health inequities. The above measurements are based on the egalitarian definition of measuring health equity, which is suitable for this thesis because many of the health

initiatives in the 2000s, including the NCMS, are based on the egalitarian concept. Inefficiency in healthcare is also discussed. This thesis provides suggestive evidence that SHI may encourage supplier-inducement in health provision. This thesis finds that NCMS is associated with increases in total costs in covered services, and may encourage inefficiency in healthcare.

The following section discusses the plan of this thesis.

1.4 Plan of the thesis

The objectives of this thesis are to investigate whether health inequities and inefficiencies exist in China's healthcare system, and to what extent the rural insurance scheme addresses or relates to issues of inequity in healthcare and inefficiency in health provision in the rural China. Paper 1/Chapter 3 provides an empirical investigation of income-related health inequalities in urban and rural China. Paper 2/Chapter 4 looks at the effects of the NCMS on equitable access to healthcare. Paper 3/Chapter 5 examines the incidence and severity of catastrophic payments and health payment-induced poverty under the NCMS. Paper 4/Chapter 6 explores the issue of cost escalation under the NCMS. An introduction of the empirical chapters/papers is presented below,

Paper 1/Chapter 3: income-related health inequalities in rural and urban China

In China, the regional disparities have been widening since the market-oriented reform in the early 1980s. The rapid economic growth and dramatic social and political system transitions have assumed different magnitudes in different regions, being deeper and more comprehensive in the costal and urban areas (Sun *et al*., 2011). Studies have shown that life expectancy is 74.2 years in urban areas compared with 69.6 years in rural areas (Zimmer *et al*., 2010, Sun *et al*., 2011). Further, China has substantial urban-rural differences in healthcare systems and insurance schemes. These have also been considered as common factors leading to inequalities in health.

Paper 1 provides an empirical investigation of income-related health inequalities in urban and rural China. It seeks to understand the degree of income-related health

inequality between the rural and the urban populations, and the major factors contributing to that inequality. Specifically, the objectives of Chapter 3 are:

- To quantify income-related health inequalities in rural and urban China;
- To identify demographic and socioeconomic factors that influence health inequalities;
- To discuss the policy implications that can be drawn from the findings.

Paper 2/Chapter 4: The NCMS and equity in access to healthcare

Health services and health interventions are a means to either detect signs for health deterioration, maintain health, or return people to prior states of health. In many cases, equity in health service use is often seen as closely aligned with "access", and "equal utilization to equal need" is commonly used to measure access (Allin *et al*., 2009, Mossialos and Oliver, 2005). SHI has the potential to lower financial barriers of access to healthcare, since the financial risks of healthcare are shared among insurance participants and health cost will be reduced at the point of healthcare use (Yip and Berman, 2001). In particular, SHI might influence utilisation by reducing the expenses for healthcare at the time of purchase to increase utilisation.

As aforementioned, one recent change in the rural China is the introduction of the NCMS – a government-subsidized health insurance scheme. The main objective to launch NCMS is to provide universal coverage and to improve equity and access to healthcare for the rural population. However, it is difficult to say whether the implementation of the NCMS is adequate to improve equal access to healthcare and existing literatures have demonstrated both positive and negative findings in terms of the impacts of the NCMS on health (Yip and Hsiao, 2009a, Yip *et al*., 2009, Yip *et al*., 2012, Babiarz *et al*., 2012, Babiarz *et al*., 2010, Dai *et al*., 2011).

Paper 2 measures the extent to which the NCMS affects healthcare utilisation on the rural population in China. It also investigates the determinants of the distribution of healthcare use and the characteristics of the users for different services, taking into account the effects of the NCMS on reducing inequity in health use. Specifically, the objectives of this paper are:

- To compare the magnitude of inequities in health use in 2004 (before the national rollout of NCMS) and 2009 (after the expansion of NCMS across the rural China), considering two types formal healthcare (outpatient care and prevention care) and one type of informal healthcare (folk doctor care);
- To investigate the determinants of patterns of healthcare use and the characteristics of the users for different services by taking into account the contribution of the NCMS to the level of inequity in health use;
- To provide policy implications on the design and arrangement of the NCMS.

Paper 3/Chapter 4: The NCMS, catastrophic payments for outpatient care, and health payment-induced poverty

The form of financing of healthcare has a tremendous effect on the distribution of burden of payments. In most low- and middle-income countries with relatively limited prepayment mechanisms for healthcare, e.g. health insurance, healthcare financing still largely relies on direct payments, often known as OOP payments. These payments may impede people from receiving the care they need or encourage them to postpone the use of care; when the payments increase to a level, they may become a source of financial hardship that forces individuals or households to cut back their daily expenses and consumption, sell assets, or, worst of all, trap them in long-term debts or drive them into poverty (Kavosi *et al*., 2012, Van Doorslaer *et al*., 2007).

The NCMS was originally designed to cover catastrophic inpatient care when it was first launched in 2003. However, by 2007, most counties had expanded the insurance benefit package beyond inpatient care to outpatient services, especially catastrophic outpatient care (Babiarz *et al*., 2010). Outpatient care is considered the most frequently used and accessible form of healthcare in rural China. An investigation of the impacts of the NCMS on catastrophic outpatient costs and health payment-induced poverty is of significant importance in the context of China where ill health has already become one of the leading causes of household impoverishment (Whitehead *et al*., 2001). The objectives of Paper 3 are:

- To measures outpatient OOP payments by using two threshold approaches, one requiring that the payments do not exceed a pre-specified proportion of

income, the other requiring that the payments do not drive households into poverty;

- To compare the differences of the incidence and severity of catastrophic health payments and health cost-induced impoverishment in outpatient care before and after the NCMS reimbursement;
- To measure and compare the distribution of catastrophic payments across income groups before and after the NCMS reimbursement;
- To discuss the role of the NCMS in achieving fairness in health financing in rural China.

Paper 4/Chapter 6: The NCMS and cost escalation for outpatient care

Although the most basic argument for insurance is that it reduces health costs and provides financial protections to the households (Wagstaff and Lindelow, 2008), it is yet not obvious that health insurance always reduces health expenses or how far health insurance helps to reduce health expenses. Scholars argued a generous insurance scheme may induce the individual's demand for health services because the price is reduced through insurance. As for the providers, health insurance may cause the providers to provide more services; OOP payments may also increase because of increased insurance levels (Chen, 2006, Latker, 1998, Eggleston *et al*., 2008, Zhan *et al*., 1998).

In terms of the NCMS, despite this impressive performance, serious questions remain regarding the impacts of NCMS on the rise of healthcare expenditures and in particular on whether the program has actually led to a reduction in patients' OOP payments. Participants would like to see a reduction in OOP payments for health services used; but the availability of reimbursement for costs through insurance claims may have induced healthcare facilities and doctors to prescribe more expensive drugs or provide unnecessary treatments, thus actually increasing overall healthcare costs. Specifically, the objectives of Paper 4 are:

- To investigate whether outpatient costs has increased since 2004;
- To measure the impacts of the NCMS on outpatient costs;
- To investigate how patterns of costs for outpatient care differ among different types of healthcare facilities under the NCMS.

1.5 Data and general methods

1.5.1 China Health and Nutrition Survey (CHNS)

Survey design

This thesis draws on data from a longitudinal household survey dataset, the CHNS (North Carolina Population Center, 2009). CHNS is an ongoing, publicly available, international collaborative project between the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. The survey was designed to investigate the impacts of the health, nutrition, and family planning policies that were implemented nationally and locally, as well as to see how the changes in China's economic and social development are affecting the health and nutrition status of its population. Specifically, CHNS contains four sub surveys, i.e., the household survey, individual survey, nutrition and physical examination survey, and community survey. This thesis uses data from the household survey and individual survey. These two surveys contain questions on socioeconomic status, i.e., gender, age, region, education, marital status, occupation, region, and ethnicity. They also contain a set of questions on health outcomes and health services utilization, data on insurance coverage, medical providers, and health facilities that the household might use under selected circumstances. Questions about accessibility, time and travel costs, and perceived quality of care along with questions on immunizations, use of preventive health services, and use of family planning services are also asked.

The surveying provinces were included in the survey: Liaoning, Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou (Figure 1.1). A multistage, random cluster process was adopted as the sample strategy in the surveyed provinces. Stratified by income level (low, middle, and high), a weighted sampling scheme was used to randomly select four counties in each province. The provincial capital and a lower income city were selected when feasible. Villages and townships within the counties and urban and suburban neighborhoods within the cities were selected randomly. From 1989 to 1993 there were approximately 190

primary sampling units, and a new province and its sampling units were added in 1997. The survey included about 4,400 households covering 19,000 individuals.

Published work using CHNS

CHNS has been used extensively in studying health and nutrition in China (Akin *et al*., 2004, Chen *et al*., 2007, Chen and Meltzer, 2008). More recently it has been used in studying the effects of NCMS on health payment-induced poverty and on spending related to catastrophic illness (Wagstaff, 2009b, Wagstaff and Lindelow, 2008). The survey data are ideal for our purposes because the last three rounds of the survey (2004, 2006, and 2009) cover the entire period from the inception of NCMS in 2003 through the early years after its expansion in coverage in 2009 and also contain important questions regarding utilisation and costs of outpatient care. This information is particularly important for Paper 2, 3 and 4, which investigate the impacts of the NCMS on access and finance in healthcare.

Figure 1.1 Map of the participating provinces of CHNS

Source: China Health and Nutrition Survey (2009)

1.5.2 Methods

One question central to health equity analysis is *how should health inequity be measured?* Early health research focused on medicine and the life sciences, which provide clinical solutions as a main objective (Östlin *et al*., 2011). Although such research still remains important and fundamental, the understanding of the socioeconomic origins of disease, ill health and its distribution, generally and almost always fall outside the domain of biomedical research (Marmot and Commission Social Determinants, 2007). The emergence of medical sociology and critical anthropology in the late 1990s started to address the issue of the unequal distributions of societal resources, e.g. economic and social resources, power and prestige, and how these impacted on population health and health use in a society (Marmot and Commission Social Determinants, 2007, Singer, 1995, Baer *et al*., 2012); however, these approaches generally lacked an interest in providing the evidence-based research for interventions/policies directed at improving population health and alleviating inequity.

The past few decades have seen an emergence of interests of health research for health economics (Masseria *et al*., 2010, Van Doorslaer and Jones, 2003, Wagstaff *et al*., 1991a, Watanabe and Hashimoto, 2012, Wagstaff *et al*., 2000, Kakwani *et al*., 1997, O'Donnell *et al*., 2006). The increased popularity of health equity in economics can be explained by a number of factors, such as an increase of interest in health equity from policy makers, donors, international organisations, and others (World Health Organization, 2004a). As more focus has been placed on policies and interventions to reduce inequities, researchers in this field have begun to receive more attention. In terms of technical aspects, the availability of household data, the development of computer power and the analytical tools to quantify inequities, have all contributed to the growth of health equity research (Asada, 2007, van Doorslaer *et al*., 2000, Wagstaff *et al*., 2001b, Kakwani *et al*., 1997). Kakwani (1980) first introduced and discussed the measurement of income distribution and poverty with application to policy evaluation in the book "*Income inequality and poverty: methods of estimation and policy applications"*. In a paper published by *Journal of Econometrics* in 1997, Kakwani *et al*. (1997) extended the discussion to the use of Concentration Indices (CI) and the Relative Index of Inequality (RII) and why these two indices are superior to others used in health equity literature. O' Donnel *et al*.

(2008b) introduced various aspects on how inequalities in health and healthcare can be measured. These methods, which were based on CI, are widely used by international organisations, government bodies, and academic institutions to measure equity in health and healthcare (Watanabe and Hashimoto, 2012, Wagstaff, 2005b, Somkotra and Lagrada, 2008, Allin *et al*., 2010). It has been used, for example, to measure socioeconomic related inequality in health status and healthcare utilization in Spain (Hernandez-Quevedo and Jimenez-Rubio, 2009) and child malnutrition in Vietnam (Wagstaff *et al*., 2003). The Concentration Curve gives a straightforward visual presentation of the distribution of a health variable across income groups.

This thesis uses Concentration indices and Decomposition Analysis to measure health inequities. This method has the advantage of measuring income or socioeconomic related health inequity across the income groups. It provides a holistic assessment of inequality rather than calculating mean health for each income quintile as is common in existing literature (Qian, 2010, Deaton and Paxson, 1998, Feng and Milcent, 2009, Sato, 2012). Moreover, this method also allows further analysis of the contributing factors that generate inequities, such as Decomposition Analysis.

In this thesis, Papers 1, 2, and part of Paper 3 use the methods of Concentration Indices and Decomposition Analysis (Wagstaff *et al*., 1993, Kakwani *et al*., 1997). The analysis of Paper 4 is based on various health econometric methods. The following provides an overview of basic concepts and steps to construct a Concentration Index, and Decomposition Analysis. It also discusses other health econometric methods used in this thesis. Detailed methods will be discussed separately in each chapter.

Concentration Indices and Decomposition Analysis

The methods to calculate and construct a Concentration Curve and Index involves five basic steps: (1) estimate a model of the determinants of a health variable, using a set of demographic and socioeconomic variables; (2) predict (indirectly) age- and sex-standardized health for each health variable or need-standardized health use for each health use variable; (3) calculate the Concentration Indices for the populations; (4) calculate the non-demographic/socioeconomic-related inequalities/inequities of

health; (5) decompose health inequalities/inequities.

Standardization of health variables

Standardization of the health variables was the first step, so as to enable a reasonable estimation of health inequality. It is noted that variations in health are associated with a number of factors. In the literature, these factors are usually categorized as demographic inequalities, e.g. age and sex factors, and inequalities/inequities arising from circumstances beyond the individual's control, e.g. economic resources and access to healthcare. Policy may be less concerned with inequalities arising from demographic factors, e.g. demographic variation, because these are usually reasonable and acceptable. Therefore, a measurement of socioeconomic-related health inequality, to control for demographic differences or identify only non-demographic differences, would be desirable for policy formation. In order to measure socioeconomic-related health inequalities that reflect only non-demographic health differences, indirect standardization of health variables is used. The aim of indirect standardization is to subtract the variation in health which is driven by demographic factors or demographic variation, and capture only the health inequality driven by non-demographic factors (O'Donnell *et al*., 2008b). Papers 1 and 2 will discuss in detail how this standardization is carried out.

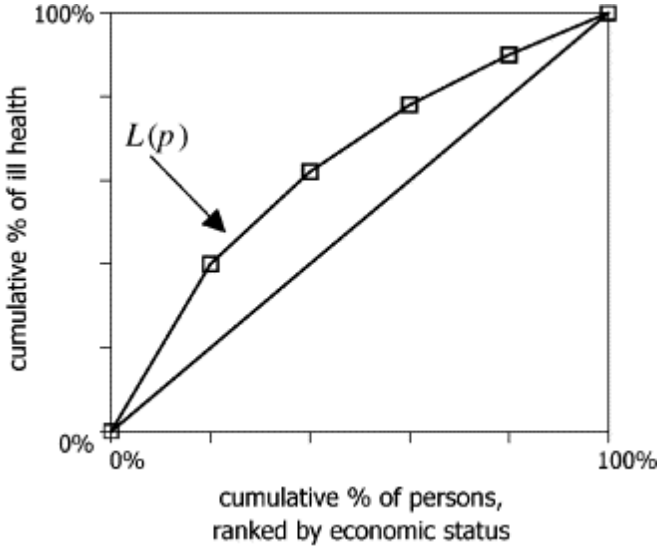
Concentration Curve and Concentration Index

Concentration Curves show the share of health accounted for by cumulative proportions of individuals in the population, ranked from poorest to richest. Figure 1.2 illustrates an example of ill health Concentration Curve. The Y-axis shows the variable for the cumulative percentage of ill health, while the x-axis shows the cumulative percentage of population ranked by economic status. The curve plots shares of the health variable against economic status. In Figure 1.2, if ill health were to take higher values among poorer people, the curve would lie above the line of equality (45-degree line). If, by contrast, ill health were to take a higher value among richer people, the curve would lie below the line of equality (Wagstaff *et al*., 2001b, O'Donnell *et al*., 2008b).

Related directly to the Concentration Curve, the Concentration Index gives a measure of the magnitude of inequality in a health variable. It is defined as twice the

area between the concentration curve and the line of equality. A negative value indicates a disproportionate concentration of the health variable among the poor, and a positive value indicates the opposite (O'Donnell *et al*., 2008b). As health economists have found that the traditional Concentration Indices may not be the best estimation of income-related inequities for binary/categorical health variables, the Erreygers's Concentration Index is proposed and has proven to provide more accurate estimation for binary dependent variables (Erreygers, 2009, Wagstaff, 2009a). These methods will be discussed in detail in relevant papers/chapters in this thesis.

Figure 1.2 Ill health Concentration Curve



Source: Wagstaff (2001b)

Decomposition Analysis

Decomposition Analysis is used in order to understand the factors that drive health inequalities. These factors may reflect differences in constraints between the poor and the rich – lower incomes, less access to health insurance, living conditions that may promote the spread of disease, etc. Using a regression-based decomposition method, the Concentration Index can be decomposed into the contribution that individual factors make to health inequality (O'Donnell *et al*., 2008b). In terms of decomposing Erreygers's Concentration Index, it is necessary to transform the health variables. The empirical chapters will discuss how the decomposition analyses are carried out under different scenarios.

Other econometrics methods

Many of the health variables in this thesis are not continuous or fully observed, for example, discrete variables (e.g. health use variables in Papers 1 and 2) and censored variables (e.g. health cost variables in Paper 4). Analyses of these dependent variables require nonlinear estimation. In this thesis, a number of parametric nonlinear estimations are considered. The following section discusses various models used to analyse these variables.

Probit Model

Paper 2 models health utilization variables. The nature of the variable calls for a non-linear estimation. An Ordinary Least Square (OLS) model is typically interpreted as the increase in the value of a dependent variable given a single unit increase in the associated explanatory variable. This interpretation does not hold when the dependent variable is binary. In statistics, a Probit model is a regression model where the dependent variable only takes two values, 1 or 0. The model is often used to estimate the probability that an observation with particular characteristics will fall into a specific one of the categories (Wooldridge, 2012). The Probit Model is estimated using the standard maximum likelihood procedure.

Two-Part Model (2PM) and Heckman Selection Model (HSM)

2PM and HSM are used to model health costs variables (limited dependent variables), which are continuous over most of their distribution but have a mass of observations at one or more specific values, such as zero (Jones, 2007, Wooldridge, 2012). Specifically, the 2PM comprises a Probit or Logit Model for the probability that an individual reports any cost data on healthcare and a Linear Probability Model/OLS that applies only to the subsample with nonzero observations, to estimate correlations of the positive level of expenditure (O'Donnell *et al*., 2008b, Jones, 2007).

The Heckman Selection model also includes two parts. The first is a Probit Model that predicts the probability that an individual reports any health costs. The second is a linear regression model conditional on the nonzero observations. It is assumed that the error terms of the two models come from a bivariate normal distribution, and this will then allow for a correlation between the two error terms to correct sample

selection bias. The HSM can be estimated by maximum likelihood estimation (Jones, 2007, O'Donnell *et al*., 2008b).

Difference-in-differences (DID) Analysis

DID analysis is a quasi-experimental technique used in econometrics that measures the effect of a treatment or an intervention at a given period in time (Stock and Watson, 2011, Wooldridge, 2012). In this thesis, DID is used to measure the effects of the NCMS on health costs. Health costs are observed for two groups for two time periods. One of the groups, the treatment group, is covered to the NCMS in the second period but not in the first period. The second group, the control group, is not covered by the NCMS during either period. The DID estimator shows the difference between the pre-post, within-subjects differences of the treatment and control groups. This method can apply to repeated cross sections or panel data (Stock and Watson, 2011).

Propensity Score Matching (PSM)

Combining DID methods together with PSM has been increasingly used in impact evaluation (Wang *et al*., 2009b, Blundell *et al*., 2005, Ravallion, 2008, Wagstaff, 2007a). One of the most important premises of using DID to imply causal relationships is that treatment should be randomly assigned to the population. However, it is evident that, for observational data, the estimate of a causal effect obtained by comparing a treatment group with a non-experimental comparison group can lead to bias because of problems such as self-selection or some methods used by the researcher in choosing the assigned treatment units (Dehejia and Wahba, 2002, Caliendo and Kopeinig, 2008). PSM is used in this thesis to correct for this problem. This method involves pairing observations in treatment and control groups that are similar in terms of their observable characteristics. When the relevant differences between any two observations are captured in the observable characteristics, which occurs when outcomes are independent of the treatment conditional on these observed characteristics, PSM can yield an unbiased estimate of the treatment effect (Caliendo and Kopeinig, 2008, Dehejia and Wahba, 2002, Rosenbaum and Rubin, 1983).

Dealing with missing data

As common to most individual level survey data, CHNS has missing values. There are several types of missing data. The first type is missing completely at random (MCAR), which means that an observation (X_i) is missing is unrelated to the value of X_i or to the value of any other variables. However, the estimated parameters will not be biased by the absence of the data. The second type of missing data is that the missingness does not depend on the value of X_i after controlling for another variable, which we call missing at random (MAR). We can still produce unbiased parameter estimates without needing to provide a model to explain missingness. The third type is classed as Missing Not at Random (MNAR) (Drettakis, 1971, Enders, 2010). Traditional ways of dealing with missing values include listwise deletion, pairwise deletion, mean substitution, etc. The most commonly used methods to deal with missing data nowadays are through Maximum Likelihood or Multiple Imputation.

The calculation of CI is based on the distribution of a health variable in relation to income variable. Income data are comprehensive for CHNS. These data were gross annual household income aggregated from all sources including: gardening, farming, livestock/poultry, fishing, handicraft and small commercial household business inflated to 2009 (the latest available wave of the survey at the time of writing). There was no missing value for income data.

It is noted that imputation can only be carried out when the missing values can be predicted by a set of variables with complete values. However, for CHNS, missing values are observed for demographic and socioeconomic variables that are commonly use to carry out imputation. This makes the imputation difficult. In these cases, deletion methods are used in this thesis.

In the empirical chapters, ways of dealing with missing values are discussed depending on the nature of the missing data.

1.6 Contributions of this thesis

This thesis presents empirical investigations for understanding equity and efficiency in China's healthcare system in the 2000s. As mentioned in the beginning of this

chapter, China's new emphasis on a harmonious and balanced society reflects a concern regarding inequities in the health sector, particularly the association between income inequalities and health. Although a number of initiatives for reducing health inequity have been developed within the past few decades, it is technically difficult to set out a variety of analytic tools to quantify those inequities. Even less is known about whether inequities are widened or narrowed through the years, and what the causes or factors are that may generate these health inequities— in other words, the contributions of inequities from different sources. This thesis moves beyond the general statements of health inequity to monitor inequities over time, and to examine the factors that influencing inequities in China in the 2000s. It does so by adopting econometric methods to measure inequities in health and healthcare in China, particularly to use Concentration Indices and Decomposition Analysis to quantify the degree of inequities.

In this thesis, inequalities in health outcomes between the rural and the urban China are discussed. Trends in the distribution of health outcomes provide some useful clues as to how the health system is working, and what the factors are that influence the unequal distribution of health outcomes in different regions of China. Income inequalities have grown considerably in the past few decades in China. If health and healthcare are negatively associated with income, this may suggest ways to improve the health of the population through the implementation of redistributive policies such as SHI.

The Chinese government is looking into SHI as a means of ensuring access to healthcare and protecting patients from financial risks (Yip and Berman, 2001, Babiarz *et al*., 2010), one empirical contribution of this thesis is to offer an investigation into the impacts of the NCMS on equity in access to healthcare and fairness in health financing. The impacts of the NCMS on equity in access to healthcare and fairness in health finance have not been well-assessed in the existing literatures, even though there is a clear public interest case for taking an equity perspective in investigating the form of access and financing. It is important to understand what the factors are that influence access to health care, whether and to what extent the NCMS affects the patterns of utilisation for different socioeconomic groups. This thesis also examines the impacts of the NCMS on OOP payments,

which is proven to have reached to a catastrophic level for many rural farmers. Based on the study results, this thesis makes a few policy recommendations on improving the design of the scheme, including improving benefit package and providing the poor with additional benefits.

This thesis is among the first to provide empirical evidence that SHI may be associated with cost escalation in China. It demonstrates that the NCMS may actually induce over-consumption of drugs and over-use of health services, in turn creating affordability problems. It is noted that the current Chinese healthcare system is financed through a FFS system. State-owned hospitals derive most of their revenues by over-prescription of expensive drugs and over-utilization of health services that are billed to the SHI. Examining this practice presents policy makers with evidence of the association between the NCMS and cost escalation, and reveals the endogenous problems of the unregulated healthcare system in China. The study results are expected to feed back into the policy process in thinking of future reform options on reforming provider payment mechanism, implementing price regulations, etc.

The following chapter provides a background discussion of China's healthcare system, the insurance reform, with a focus on equity and efficiency issues in China's healthcare system.

2 Background

Healthcare in China

China's healthcare system poses substantive problems in terms of equity and efficiency within its healthcare system (Akin *et al*., 2004, Gao *et al*., 2002, Gao *et al*., 2001, Li and Yu, 2011, Liu *et al*., 2012a, Lu *et al*., 2007, Meng *et al*., 2012), but it is difficult to assess these issues without a good understanding of the history and the reforms of China's healthcare sector. This section provides an overview of China's healthcare sector as well as a detailed discussion of the social health insurance reform. It first discusses the evolution of China's healthcare system from the 1950s to 2000s. It then moves to provide some basic knowledge of China's healthcare system as well as challenges policy makers faced in the 2000s, followed by a discussion of the SHI system in China. This chapter provides essential knowledge to facilitate the understanding of the papers for the rest of the thesis.

2.1 China's healthcare system in a historical context

2.1.1 State-centred period: from 1949 to 1978

The People's Republic of China (PRC) was founded in 1949. After centuries of feudalism, colonialism, wars with Japan, and civil war, the country was troubled with many problems such as poverty, inadequate sanitation and housing problems in the 1950s. The health status of the population was extremely low and healthcare resources were very scarce. Health facilities and professionals were few, and basic sanitation and public health provision was limited. Life expectancy at birth was 37 years, infant mortality approximately 250 per 1,000 live births, and maternal mortality was at 150 per 100,000 in 1949 (Anson and Shifang, 2005).

After the founding of the PRC, former Chairman Mao Zedong established socialist rule, the basis of which was originally from Marx, Engels and Stalin's communist ideology. As improving the health of the population was a critical priority of the country's new leaders, Mao made concerted efforts to reduce inequalities and to achieve universal welfare by enacting a welfare social security system. A set of

revolutionary health policies, as defined by the Ministry of Health in 1959, were initiated. These policies were based on four guiding principles, one of which explicitly stated that the provision of healthcare should be based on an egalitarian approach, with the most resources channeled to the lower socioeconomic class—"workers, farmers and soldiers" (Economic Intelligence Unit, 1998). Mao also invented China's industrial and agricultural 'work units' and created a rural co-operative health insurance, which was operated on the basis of the People's Commune,[1] to cover the healthcare provision at these 'work units'. During that time, 510,000 physicians, 1.46 million Barefoot Doctors[2] (Chi Jiao Yi Sheng) and 2.36 million health workers were trained (Wang, Zhang and Wang 2007:11). Basic health standards improved almost immediately and continued to improve throughout the Maoist period. From 1952 to 1982, infant mortality fell dramatically, and live births and life expectancy increased approximately twofold. The most remarkable features of these achievements were that they were accomplished without a corresponding growth in the economy, and were based on the fair distribution of extremely limited health resources and prioritisation of preventive public health. The Maoist health system became a model emulated in various ways across the developing countries (World Bank, 1997).

2.1.2 Transformation of the healthcare system in China: from 1978 to 1996

The opening-up policy initiated by former Chinese leader Deng Xiaoping,[3] led China's economy into a new era. Over the past 30 years, the annual increase of GDP in China is, on average, by more than 8%, but China has paid a heavy price for it in terms of ballooning inequalities (South China Morning Post, 2013). The market-based economic reform had an enormous influence over China's social, economic and political life, including the healthcare sector. Inequalities were no longer considered negative so long as the country sustained economic growth. As urged by the former Communist Party leader Deng Xiaoping, who was an enthusiastic

[1] The people's commune (Chinese: 人民公社) was the highest of three administrative levels in rural areas of the People's Republic of China during the period of 1958 to 1982-85 until they were replaced by townships. The communes had governmental, political, and economic functions.

[2] Barefoot doctors (Chi Jiao Yi Sheng) are farmers who received minimal basic medical and paramedical training and worked in rural villages in the People's Republic of China. Their purpose was to bring health care to rural areas where urban-trained doctors would not settle. They promoted basic hygiene, preventive health care, and family planning and treated common illnesses.

[3] Deng Xiaoping (22 August 1904 – 19 February 1997) was a politician and reformist leader of the Communist Party of China who led China towards a market economy.

advocate of the market economy, "let some people get rich first" was considered legitimate and should be encouraged.

The economic reforms pushed the country towards a market economy and altered the country's healthcare in ways that affected the population's health. In 1985, China's Ministry of Health initiated a series of national healthcare reforms, the aim of which was to gradually decentralise responsibilities in health management and regional development, to expand existing facilities and to improve productivity through financial incentives to medical staff as well as to encourage individual responsibility towards healthcare (Wang, Zhang and Wang 2007:138). According to Dong (2003), the reform resulted in three major changes:

- First, it limited the public funds for healthcare by covering only basic personnel wages and new capital investments; therefore, allowed the private market to play a role in the healthcare sector.
- Second, the government gave hospitals and other health providers a large degree of financial independence and autonomy; hospitals were allowed to make profits through the provision of medical service, and sales of pharmaceutical products.
- Third, the government allowed private ownership of health facilities and private medical care practices.

In the 1980s, the central government started to withdraw direct funding to state-owned hospitals, and by the early 1990s, most of these hospitals were fully responsible for their own profits and losses. State-owned hospitals in aggregate were expected to cover 85% or more of their costs from fees (World Bank, 1997). These hospitals responded by billing the insurance system for prescription drugs and high-technology medical procedures. Hospital corruption, including over-prescribing and over-providing medical services and demanding illicit profits from medical instrument purchases, was pervasive (Anson and Shifang, 2005, Wagstaff *et al*., 2009d, Eggleston and Yip, 2004). In order to generate enough revenue, most hospitals established complex systems of incentives to encourage prescribing expensive medicines on the part of medical doctors and the use of medical services beyond what was required on medical grounds (Economic Intelligence Unit, 1998, Yang, 2009).

In terms of health insurance, the old commune-based rural health insurance started to collapse in the 1980s. By the early 2000s, except for the urban residents who were formally employed in the private or public sector, the majority of the Chinese population lacked insurance. The provision of services was purely based on ATP rather than health need. Private spending accounted for a large proportion of total health spending, and most private spending was from OOP payments (Gu, 2008). At that time, health insurance coverage was far from sufficient, and healthcare financing was dominated by OOP payments. The increasing healthcare costs have engendered great discontent among ordinary people (Gu 2008).

2.1.3 Market-oriented health system: from 1996 to the early 2000s

From 1996 to the early 2000s, China's healthcare reform has been deepened and extended, with the introduction of more radical mechanisms and policies. At the patients' level, the government continued to appeal to the general public to "stand up" and to take "individual responsibility" for their well-being (Latker, 1998). Insurance coverage was extremely low. Except the urban employed, the majority of the Chinese people, including the urban unemployed and the whole rural population, were not covered by any SHIs. Personal payment for healthcare increased from 21.65% in 1982 to 39.81% in 1992 and to 57.72% in 2002. Private spending accounts for a large proportion of total health spending, and most private spending is from OOP payments (Gu, 2008). According to Gu (2008) an increasing the Chinese population cannot afford healthcare services. In 1993, only 5.2% of people could not afford outpatient care when they were sick; however, the number increased to 13.8% in 1998 and 18.7% in 2008. Increasing healthcare costs have engendered great discontent among the ordinary people, and has become one of the "top" social issues in China (Gu, 2008).

2.1.4 The paradigm shift: from the early 2000s to present

The unprecedented rate of marketisation has brought notable problems in China's healthcare sector. In 2006, the government officially acknowledged that the market oriented healthcare system was the "wrong concept"(Centre for Health Statistics and Information, 2008). In the meantime, a series of health initiatives was announced.

In 2006, the central government announced that a total of RMB83.2 billion (US$13.31 billion) were to be allocated to support the healthcare sector, and this money was subjected to an annual increase of 20% (Blomqvist and Qian, 2008). A more extended network of SHI was established. In 2003, the NCMS was launched to respond directly to the lack of insurance coverage in rural areas. In 2007, the government introduced an urban insurance scheme to cover urban residents without employment in the formal sector. These insurance schemes were designed to improve access and to provide assistance to poor households when facing unusually large health bills or catastrophic health payments.

At the provider's side, the Supreme People's Court explicitly stipulated that accepting drug commissions and medical instrument commissions was considered as a violation of the law in 2008 (China Daily, 2008). A set of new regulations were introduced to regulate provider behaviours and to correct the problems of over-prescription. In order to spin-off the commercial drug interests, the government launched a new round of reforms to combat "improper" behaviour in the healthcare sector and to build a corruption-proof system. Drug profits were set below 15% whereas before they were 30% more. Another important initiative was to de-couple hospital revenue from the sale of drugs to patients, meaning that the proportion of drug revenue had to be below a certain percentage of hospital general revenues (Yang, 2009). Other strategies included capitation or salary payments for outpatient services. Some SHI schemes, such as the NCMS, started to use alternative methods to regulate provider incentives, such as using case-based compensation methods to incentivise better performance of the providers (Yip and Hsiao, 2009a, Yip and Hsiao, 2008a, Yip *et al*., 2010, Yip *et al*., 2012).

The Chinese government seemed quite ambitious about changing the current healthcare delivery system and providing a more equitable and efficient healthcare system backed by more budgetary resources. However, it seemed unrealistic to expect immediate effects of these reforms. The successful implementation of the reforms depended on many other factors in China's health care system. In order to appreciate the need for the healthcare initiatives of the 2000s or to offer critical assessment, it is important to have a good understanding of China's healthcare system, such as the health of the population, organisation and health service delivery

as well as issues relating to health financing, which will be presented in the following section.

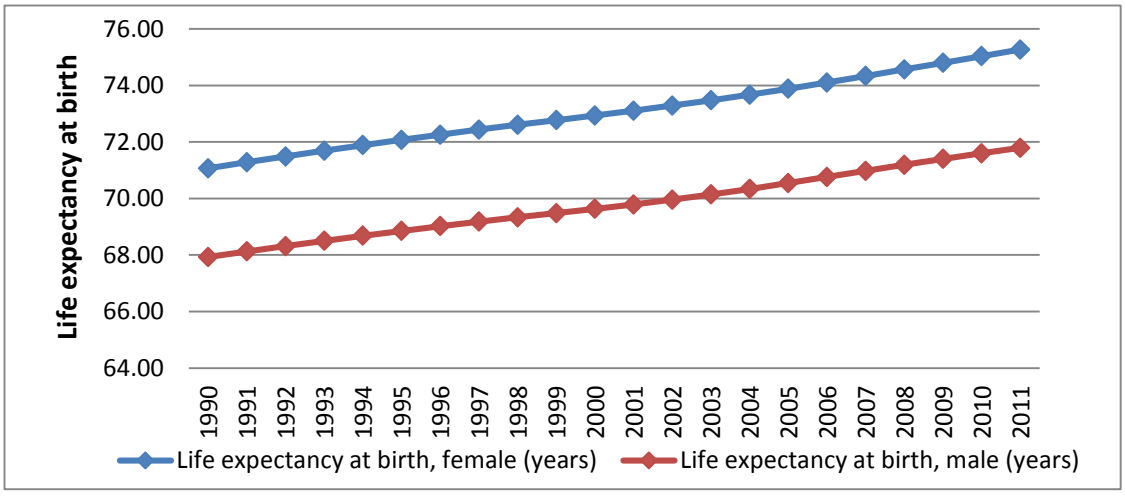
2.2 Organisation and service delivery in healthcare: a brief summary

The previous section offers a detailed discussion of the history of China's health system. This section provides basic information of China's healthcare. It discusses trends in health outcomes, service delivery, provider payment mechanisms, with a focus on inequity and inefficiency in the system.

2.2.1 Trends in health outcome indicators

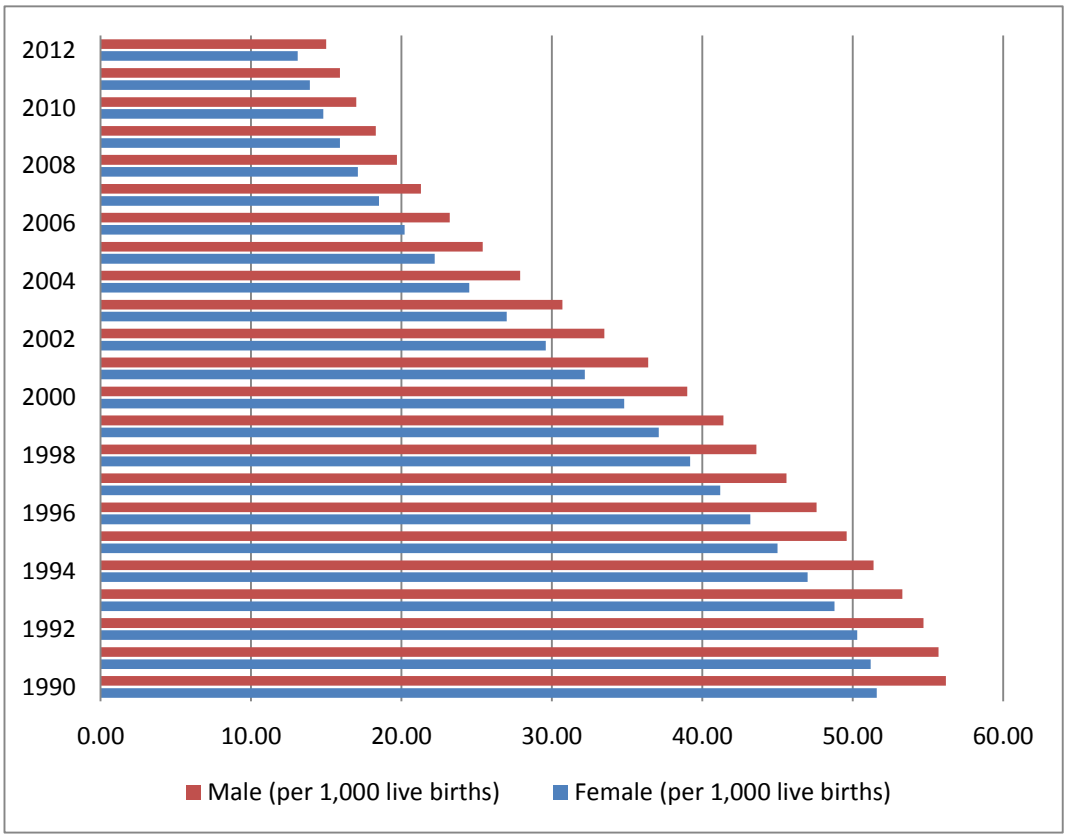
One of the main functions of a health system is to improve population health. Trends in health outcomes may offer some useful information on the performance of the health system. For the past few decades, China has made significant progress in improving population health. Figure 2.1 shows that life expectancy increased by an average of four years from 1990 to 2011. In 1970, China's under-five mortality rate for female was around 108.8 to 113.2 per 1,000 live births. By 2012, this had been reduced to just 51.6 to 56.2 per l,000 live births, which is a remarkable achievement. During the 1980s to the 1990s, under-five mortality continued to decrease. By 2012, the ratio was 13.1 to 15.0 per 1,000 live births (Figure 2.2), which is similar to many Middle East and Latin American countries (The World Bank, 2012b).

Figure 2.1 Life expectancy at birth by sex in China, 1990 - 2011



Source: Derived from the World Bank data at http://data.worldbank.org/.

Figure 2.2 Under-five mortality rate by sex in China, 1990 - 2012



Source: Derived from the World Bank data at http://data.worldbank.org/.

Patterns of disease in China have followed those typically found in rapidly developing countries, with a decline in morbidity related to infectious diseases, and a steep rise in chronic diseases such as heart diseases, hypertension, cerebrovascular disease, and cancer (Table 2.1) (Anson and Shifang, 2005). According to the Centre of Health and Information, chronic disease, such as malignant tumour, heart and cerebrovascular disease, are the major common diseases and have surpassed infectious diseases as the major causes of death (Centre for Health Statistics and Information, 2008). It is noted that urban people have higher two-week morbidity rates in terms of chronic diseases, whereas trauma and toxicities and digestive disease are more pervasive in rural areas (Table 2.1).

Table 2.1 Two-week morbidity rate (‰), 1998, 2003 and 2008

	1998		2003		2008	
	Urban	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**
Infectious disease	3.2	3.7	1.8	2.7	1.7	2.7
Malignant tumour	1.0	0.4	1.3	0.8	2.2	0.8
Internal system, nutrition, metabolite and immunity disease	5.4	1.0	7.7	1.6	17.8	1.6
Mental disease	1.0	0.7	0.9	0.8	1.7	0.8
Neuropathy	3.1	3.2	3.4	3.5	3.1	3.5
Heart diseases	14.1	3.7	14.6	4.6	20.4	4.6
Hypertension	15.6	3.6	21.9	8.4	60.8	8.4
Cerebrovascular disease	5.9	1.7	6.4	2.7	7.7	2.7
Digestive disease	25.8	21.5	17.7	22.3	20.6	22.3
Urinary disease	4.7	4.0	4.4	5.5	5.7	5.5
Trauma and toxicities	4.5	4.6	4.0	6.3	4.4	6.3

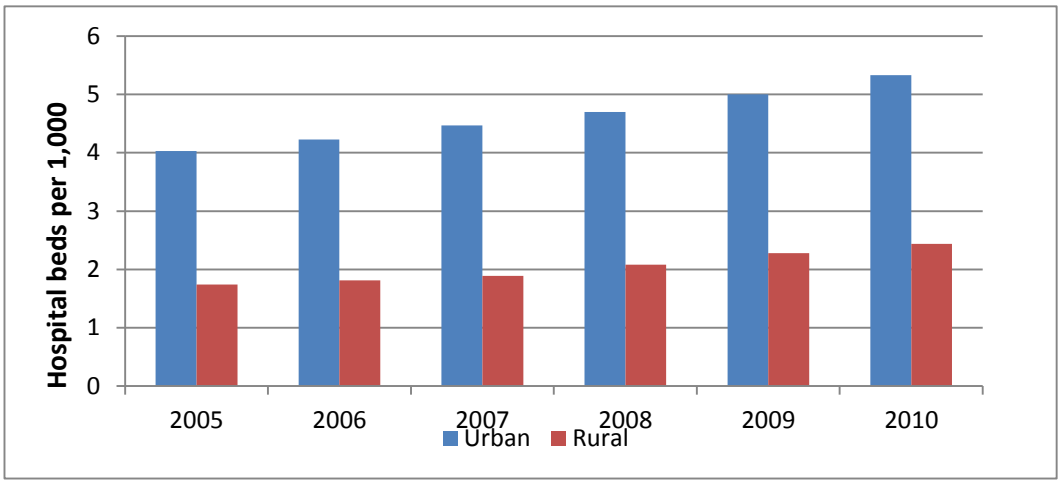
Source: Centre for health statistics and information, China (2008)

2.2.2 Service delivery and provider payment mechanism

China has an extensive network of public health facilities. In 2010, China had 937,000 public health facilities (including public hospitals, township health centres, village health clinics) staffed by 8.2 million health professionals, of which nearly 2 million were doctors. The country had more than 4.78 million hospital beds, or an average of 3.56 beds per 1,000 people; a ratio higher than most Asian countries and similar to many OECD countries (National Bureau of Statistics of China, 2011, The World Bank, 2012a).

Figure 2.3 shows that the percentage of hospitals beds per 1,000 people is considerably higher in urban areas compared with rural areas. This indicates the trend that health resources are more concentrated among urban and more developed areas.

Figure 2.3 Hospital beds per 1, 000 people, 2005-2010



Source: China Statistical Yearbook (2012)

Virtually all of the hospitals in China are owned by the state, and they adopt a three-tiered healthcare delivery system. They are categorised by size, but the levels are often perceived as *de facto* rankings of quality, with larger being better. A hospital's ranking determines government subsidies, staff salaries, and other allowances (such as funding for research projects and medical equipment) (Latker, 1998).

At the bottom of the healthcare hierarchy are the village and township health centres, which are effectively clinics offering basic inpatient and outpatient care. In 2006, the government initiated a community-based health system, which required that a community with a population between 30,000 to 100,000 people have a health centre established following national standards (Li and Yu, 2011). This community-based health system is an extension to the existing network of village and township health centres. Most revenue generated at village, township and community health centres come from drug sales, but their pharmacies are usually small and only offer a basic selection of drugs.

Although the village, township and community health centres act somewhat like primary care providers, China does not have a national system for primary care or general practice. The majority of Chinese people think they have a right to use the provider of their choice; they also hold a strong belief that specialists are more skilled than general practitioners, even for treating minor ailments (Li *et al*., 2005) .

It is noted that the government introduces a few strategies to improve efficient use of medical resources and to avoid patients seeking unnecessary care at tertiary hospitals, for instance, by offering patients higher reimbursement rates from their social health insurance schemes if care is sought at the village and township level health facilities (Babiarz *et al*., 2012, Babiarz *et al*., 2010). However, these strategies were barely effective, and acceptance of care provided at village, township and community health centres remains low (Li *et al*., 2005).

The second level of the healthcare hierarchy is district/county hospitals, which are middle tertiary-level hospitals offering a wider range of inpatient and outpatient services. Although most services offered at these hospitals are competing with provincial/city hospitals (one level above district/county hospitals), these hospitals do not have the latest diagnostic and therapeutic medical equipment, such as Magnetic Resonance Imaging (MRI), neither are they able to perform sophisticated treatment, such as organ transplantation.

Provincial and city hospitals are the largest and most sophisticated tertiary healthcare facilities in China. They are well-equipped with the latest medical equipment, and are able to offer a full range of outpatient, inpatient and specialist care (Suo, 2010, Jia, 2009). Both district and provincial hospitals have large pharmacies and drug sales constitute a major part of hospital revenues (Yang, 2009, Economic Intelligence Unit, 1998).

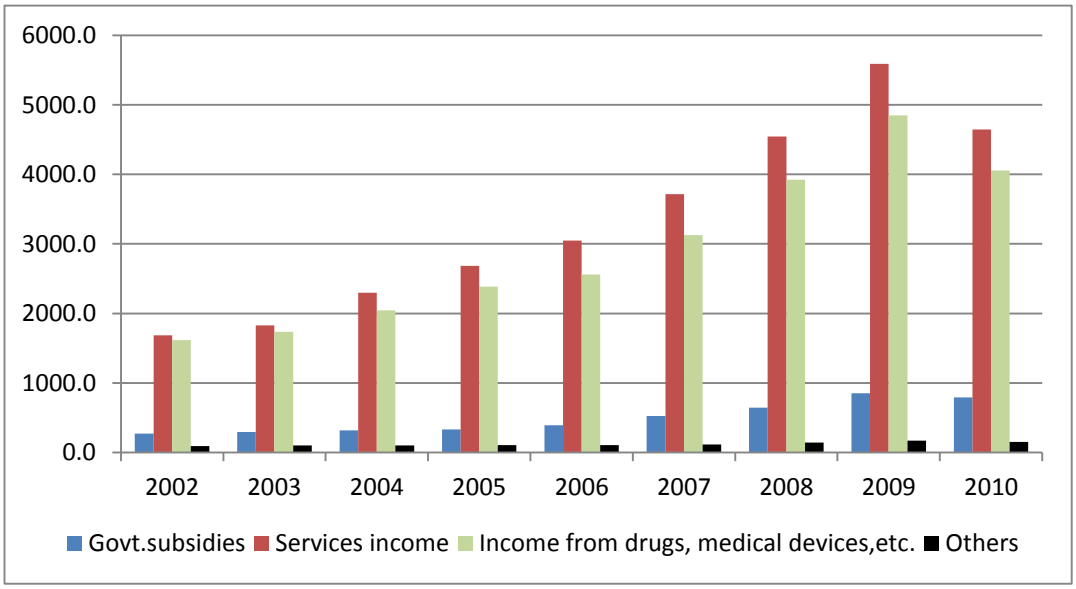
In terms of the provider payment mechanism, China's healthcare providers are mainly financed through service fees, and there is no provider and purchaser split. Health providers receive their incomes from three sources—government subsidies, insurance claims and co-payments. Government subsidies are only able to cover operational costs, but health professionals charge user-fees to generate their own salaries (Economic Intelligence Unit, 1998). From the early 1980s, the government started to withdraw subsidies to state-owned hospitals. Hospitals are encouraged to make profits by providing medical services and selling drugs, and deregulating price control over some high-technology services not covered by the government insurance healthcare schemes. Pharmacies owned and run by the hospitals and healthcare centres are allowed to have a non-taxable income in selling drugs and

medical devices at a mark-up of 15% of the purchase prices (Yang, 2009). Hospitals also survive by billing the SHI system for expensive pharmaceuticals and medical procedures using high-technology equipment, even where cheaper options are available (Yang, 2009).

Moreover, most hospitals establish complex systems of incentives to encourage the sales of drugs and use of services. Doctors' salaries are tightly linked to the performance of their individual medical departments. The more revenue the department generates, the larger the bonuses received by doctors (Yang, 2009). It is also common to see pharmaceutical and medical equipment companies offer medical doctors commission on each prescription to motivate prescription sales. These companies have seen those cash-starved hospitals and poorly-paid doctors as lucrative clients (Eggleston and Yip, 2004, Yang, 2009).

Figure 2.4 shows revenue sources of general hospitals in China from 2002 to 2010. Although government subsidies had increased over the years, fees from services, drugs, and medical devices still constituted a significant share of hospital revenues. These revenues continued to climb through the years, and became the major source of hospitals revenues.

Figure 2.4 Revenue sources of general hospitals in China, 2002-2010 (10,000 RBM)

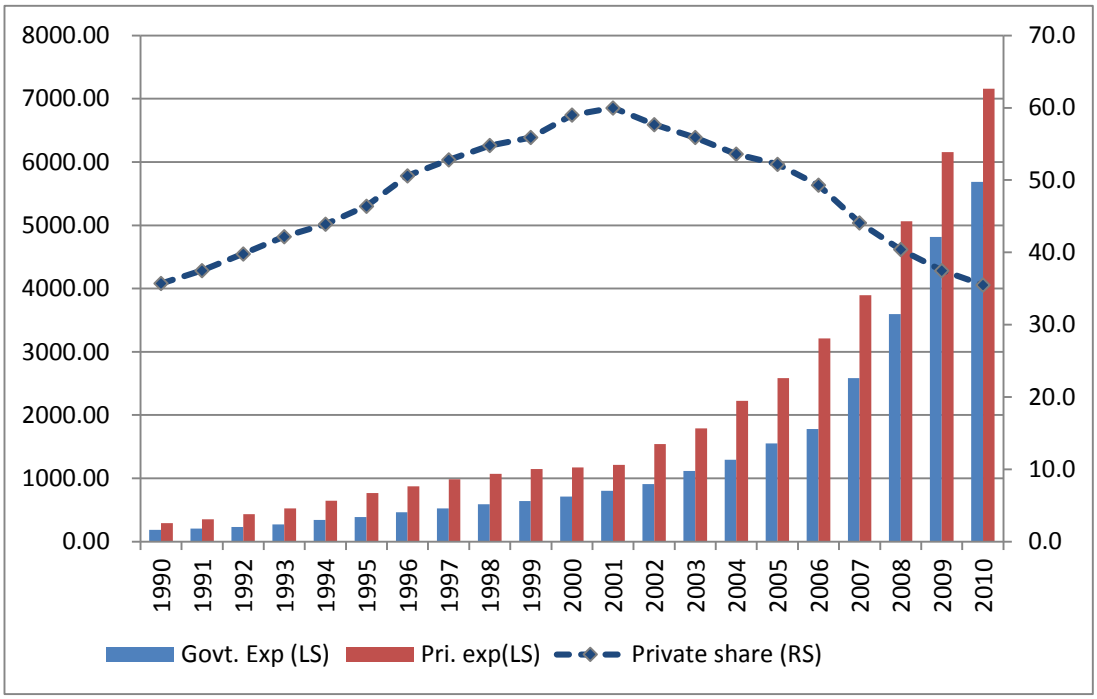


Source: China statistical yearbook (National Bureau of Statistics of China, 2011).

2.2.3 The importance of OOP payments—a barrier to access

In terms of health expenditure, China's total healthcare expenditure comprises three parts: government health expenditure, social health expenditure, and personal health expenditure (Ministry of Health China, 2012). In 1980, government expenditure accounted for 36.2% of total health expenditures, the percentage decreased to 25.1% in 1990, and 15.7% in 2002. In the meantime, personal health expenditure increased from 21.2% in 1980, to 35.7% in 1990, and reached to 60.0% in 2001 (Figure 2.5). Starting from 2002, with the launch of a few health initiatives and a massive injection of government subsidies, a steady increase on government subsidies was observed. The share of private health expenditure also decreased from 52.2% in 2005 to 37.5% in 2012.

Figure 2.5 Government and private health expenditure in China (RMB billion), 1990 - 2010



Source: China statistical yearbook (2011).

Note: LA indicates left-hand axis. RA indicates right-hand axis.

It has to be noted that even though the share of private expenditure has decreased over the years, the absolute health costs are still considered high for the majority of the Chinese. In the National Health Services Survey of 2008, 37.3% of the urban respondents and 37.8% of the rural respondents did not seek care when

recommended. Among these respondents, 24.4% reported financial difficulty or high medical costs as the main reasons for forgoing care (Centre for health and information, 2008). Some inpatient care data can be used as good examples to understand the situation. On average, an inpatient per episode involved OOP payments was around RMB3,463 (US$498.62) in 2008, which was equivalent to 52.69% of annual per capita household expenditure (Centre for health and information, 2008). High OOP payments not only created a barrier to access, but also became a source of financial hardship, especially for the poor. Although China claims to achieve universal health insurance coverage, by 2008, 39.8% of the urban poor and 9.0% of the rural poor had not been covered by any SHI (Centre for Health Statistics and Information, 2008). From 2003 to 2008, per episode inpatient costs for the urban poor and the rural poor increased 34.1% and 16.8% respectively. OOP payments accounted for an average of 65% of a single inpatient per episode visit. The fraction of the population experiencing catastrophic health payments in China was higher than elsewhere in Asia (O'Donnell *et al*., 2008a, O'Donnell *et al*., 2007).

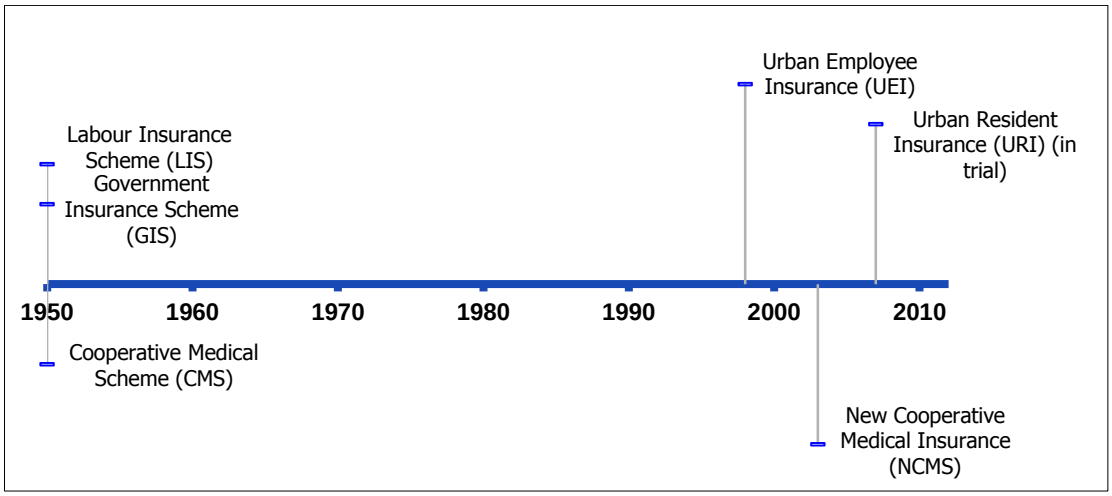
Access to affordable healthcare is one of the biggest challenges that the policy makers faced in the 2000s. The government was determined to tackle this issue. In the 2000s, two new SHI schemes, the NCMS and the URI, were launched to improve access to healthcare and to provide financial protection for the urban unemployed and the rural population. As this thesis offers impact evaluations of the NCMS on access and finance in healthcare, it is important to have a good understanding of China's SHI system, how much population it covers, what kind of benefit it offers, and how it is financed. The following section discusses SHI system in China, with a focus on the NCMS.

2.3 Financing healthcare services: social health insurance for urban and rural populations

Just like in many other developing countries, SHI in China is the countrywide public-subsidised insurance system that serves as the primary third-party payer and the backbone for health financing. The current basic social health insurance consists of three schemes, i.e., the Urban Employ Insurance (UEI) for urban residents with formal employment initiated in 1998, the NCMS for rural residents imitated in 2003,

and the Urban Resident Insurance (URI) for urban residents mainly covering the elderly, students and children, the urban unemployed, of which has still been under trial (Figure 2.6).

Figure 2.6 Development and evolution of China's Social Health Insurance System



Source: Author's own

2.3.1 Health financing in rural China

Before the economic reforms in 1978, healthcare for the majority of rural residents in China was covered by the Cooperative Medical Scheme (CMS), under which rural residents paid a small sum annually to help finance basic services from Barefoot Doctors, most of whom worked for little or no pay in the service at that time. The scheme played an important role in ensuring access to basic health services and essential medicine for rural residents at a relatively low cost, and was a critical piece in China's healthcare system which was heralded as a successful model in the developing world (Zhang *et al*., 2010b, Ma *et al*., 2012). However, following the disbanding of the People's Collective Communes, which was tied to the rural health system, during the late 1970s and early 1980s, China's rural health system, in particular the CMS, could no longer be sustained (Ma *et al*., 2012, Yan *et al*., 2011). In the 1970s, 90 % of rural farmers had access to basic health services and some financial protection against catastrophic illness (Ooi, 2005), but within a decade the proportion had shrunk to 5%. The rural residents were left almost completely on their own in terms of paying for health services.

Although the Chinese government tried to revive the CMS during the 1980s and the 1990s, these efforts were futile as the situation continued to deteriorate. The reforms towards the marketisation of health facilities have been carried out in full stream since the 1990s. The number of village health personnel decreased by 18% to as much as 23%, and the number of health facilities in towns and villages likewise decreased significantly. More importantly, due to the lack of government support in financing and support for healthcare, a FFS payment arrangement was introduced in the rural healthcare system (Yip and Eggleston, 2004). As a result, the average per episode inpatient cost in rural areas, payable out of pocket, increased from 613RMB (US$76.43) in 1993 to 2,649RMB (US$320) in 2003, while the proportion of rural residents who did not seek care when recommended reached 75.4% (Chen *et al*., 2011, You and Kobayashi, 2009). Due to the fact that the majority of the country's population resided in rural areas, it became clear that a lack of access to healthcare, if left unaddressed, could seriously undermine the political legitimacy of the Chinese Communist Party.

The NCMS was launched in 2003 in response to a dire need for people to access affordable healthcare among the rural population. Although bearing its name from the past, the NCMS differs from the old CMS in several key dimensions. First of all, the scheme is largely subsidised by the government, and an individual's contribution to the premium is kept relatively low. It is a government-subsidised and voluntary scheme, which makes it attractive to low-risk households. In many regions, the participants are expected to contribute only about 10RMB (US$1.21) per person per month, while the rest is paid for by central and local governments. Second, participation in the NCMS provides rural residents access to a range of health facilities, from village clinics to municipal hospitals, although the reimbursement rates for health services received differ from one facility to another. Third, the NCMS is administered at a county level, while it offers the benefits of pooling across participants compared to the old CMS, there are significant disparities across different counties. For example, in the more affluent eastern and coastal regions, local governments are able to upsize the government subsidies to offer more comprehensive coverage to their residents.

As a voluntary insurance scheme, the take-up rate for NCMS was quite low during the initial period after its inception. With low level government subsidies, NCMS initially was primarily an insurance scheme covering catastrophic illness with high levels of deduction, providing little incentives for rural residents with low risks (World Health Organization, 2004b). The scheme, however, has become more comprehensive over time with a massive injection of government subsidies: the government contribution to insurance premiums increased from 10RMB (US$1.21) in 2003 to 240RMB (US$ 38.01) in 2012. Since 2007, the coverage of the scheme has expanded from mainly catastrophic illnesses to outpatient and preventive care (Xinhua, 2012b). In addition, the coverage of the NCMS has become a key performance indicator for key government officials, and administrative means have been employed to expand the coverage. The progress since then has been quite remarkable. According to official statistics published by the Chinese government, the coverage of NCMS reached 97.5% of China's 857 million rural Chinese (Table 2.2). Key features of the NCMS and the old CMS are summarised in Table 2.3.

Table 2.2 Recent changes in NCMS insurance coverage

Year	Counties participating	Enrolment (100 million)	Enrolment as % of total population	Average government subsidy per participant (RMB)
2005	678	1.79	75.66	42.10
2006	1451	4.1	80.66	52.10
2007	2451	7.26	86.20	58.90
2008	2729	8.15	91.53	96.30
2009	2716	8.33	94.19	113.36
2010	2678	8.36	96.00	156.57
2011	2637	8.32	97.5	246.2

Source: China Statistical Yearbook (National Bureau of Statistics of China, 2011)

Table 2.3 Features of the old CMS and the NCMS

	NCMS	Old CMS
Date started	2003 (Pilot scheme was initiated in four provinces).	From 1950s onwards.
Enrollment	Voluntary at household level.	Mandatory at individual level (You and Kobayashi, 2009).
Coverage	94.3 % in 2009.	Less than 10 % in the 1990s (Sun *et al*., 2010).
Guideline	General guidelines are issued by the central government, local	No guidelines from central government.

	governments retain considerable discretion over the details.	
Administration	County government sets the reimbursement rate, ceilings, medical saving account, etc.	Village levels (People's Collective Communes).
Risk pooling	County level.	Township or village level.
Target population	Rural residents (840 million)	Rural residents.
Financing mechanism	In western and central China, the central government assisted the local government in providing finance for the scheme. In the more affluent eastern and coastal regions, financing the premium was mainly through local government.	Supported entirely by state funding. Care was provided by barefoot doctors, including basic outpatient services, emergency first aid, immunizations, public health surveillance (Babiarz *et al*., 2010).
Designated health facilities	All levels of health facilities.	Barefoot doctors affiliated with the People's Collective Communes.
Covered services	Inpatient series, catastrophic outpatient services, some prevention care services.	Focus on preventive care and outpatient care (You and Kobayashi, 2009).

Source: (Barber and Yao, 2011), (National Bureau of Statistics of China, 2011), (Sun *et al*., 2010), various reports from the website of the Ministry of Health, China.

The launch of the NCMS in 2003 responded directly to the lack of insurance coverage in rural China. In order to understand how the scheme was working, the Chinese Ministry of Health and the World Bank collaborated on a study of the early adopters of the NCMS in 2005. The study surveyed officials in more than 200 NCMS counties. The facility level data indicated that the NCMS had some positive effects on inpatient utilisation at the township health centres. However, the study also showed that the scheme did not affect the unit costs at township health centres or county hospitals; neither did it affect outpatient OOP payments per visit or per inpatient episode. It seemed that the scheme had benefited its participants by reducing the proportion of people forgoing care when needed, but the effects on overall OOP payments was negligible.

The report suggests that several features of the NCMS may limit its success. First, the NCMS over-emphasised inpatient care over outpatient care. This may inadvertently give providers powerful incentives to shift away from "basic" cost-effective outpatient interventions towards less cost-effective inpatient interventions. As the current healthcare system in China is financed through a FFS basis, emphasis on covering inpatient over outpatient care may encourage and induce the oversupply

of expensive inpatient treatment. Second, there is an equity issue in terms of how the scheme is financed. Counties paid similar contributions regardless of their capacity to pay. The NCMS households paid the same contribution irrespective of their income. Although offering financial protection is the goal of the NCMS, the scheme does not subsidise the poor, even though demand for them is usually price sensitive. Moreover, the reimbursement system is complicated. Patients have to pay the costs of care upfront and then wait for reimbursement, while the net co-payment is usually based on complex formulas for deductibles, ceiling and different reimbursement rates, and these issues are often more confusing for outpatient services. Farmers feel perplexed about how much they should pay for the care they received.

2.3.2 Health financing in urban China

When China's urban social medical scheme was first established in the 1950s, it mainly consisted of two programmes: Government Insurance Scheme (GIS) and Labour Insurance Scheme (LIS). These two schemes were targeted at urban residents. GIS, which was financed by the central and local governments, was mainly targeted at civil servants. Those who were covered by GIS needed to visit designated hospitals to obtain prescription medicine. Outpatient and inpatient services were provided free of charge. LIS, which was founded in 1951, was targeted at urban employees. This scheme was financed by employers, and it reimbursed part of the health expenses of a participant's family. In urban areas, universal coverage was achieved under these two schemes (Dong, 2009).

In 1994, the State Council carried out a pilot health insurance scheme targeting urban employees in Jiangsu province and Jiangxi province. This scheme transferred China's social insurance system to a payroll related SHI in the later years. After a four-year trial, this scheme—the URI—replaced the GIS and LIS, and the scheme was launched throughout the country in 1998. Participation for all urban employers and employees was mandatory, and both of the employees and the employers were to share the responsibility of paying the premium contributions. A total of 8% of employees' monthly payroll contributed to the scheme, with the employee paying 2% and the employer paying the remaining 6%. The UEI has played an important role in healthcare financing for urban employees. The participation increased from 5% of the total urban population in 1998 to 64.6% in 2007(Xu *et al*., 2007b).

Although this scheme has covered a large number of urban residents, more than 420 million urban residents without formal employment have been left uninsured since the abolition of free urban medical services in the early 1990s. In 2007, a new social health insurance scheme—the URI—was piloted in 79 cities. The implementation of this scheme was a crucial step in closing the insurance coverage gap. This scheme targeted primary and secondary school students, young children and unemployed urban residents. Enrolment in this scheme is on a voluntary basis at the household level. The financing mechanism of this scheme is complicated and varies across the country. In general, an annul premium provided by the government should be no less than 40RMB (US$4.48) per participant per year. Insured urban residents who live in affluent provinces are likely to receive better benefit packages compared with those who live in less affluent provinces. By the end of 2007, the URI covered 42.91 million people. In 2008, another 229 cities participated in the scheme (Dong, 2009).

This chapter offers a contextual background to China's healthcare system and recent reform efforts, which sets the scene for the empirical chapters of this thesis. The following chapters comprise of four empirical chapters and a concluding chapter. Chapter 3 provides an analysis of income-related health inequalities between urban and rural areas in China. It is important to have a good understanding of the distribution of health across income groups in urban and rural areas, and to know who the people are that generally have the worst health and why. The study results are expected to feed back into the policy process for future reform options to then improve population health and to efficiently identify target populations in both urban and rural areas.

3 Age and gender standardised inequity in health outcome

Income-related health inequalities in urban and rural China[4]

Abstract

In China, the poor usually have less access to healthcare than the better-off, despite having higher levels of need. Since the proportion of the Chinese population living in urban areas increased tremendously with the urbanization movements, attention has been paid to the association between urban/rural residence and population health. It is important to understand the variation in health across income groups, and in particular to take into account the effects of urban/rural residence on the degree of income-related health inequalities. This paper empirically assesses the magnitude of rural/urban disparities in income-related adult health status, i.e., self-assessed health (SAH) and physical activity limitation, using Concentration Indices. It then uses decomposition methods to examine the factors associated with inequalities and their variations across urban and rural populations. Data from the China Health and Nutrition Survey (CHNS) 2006 are used. The study finds that the poor is less likely to report their health status as "excellent or good" and are more likely to have physical activity limitation. Such inequality is more pronounced for the urban population than for the rural population. Results from the decomposition analysis suggest that, for the urban population, 76.47% to 79.07% of inequalities are associated with social economic factors, among which income, job status and educational level are the most important. For the rural population, 48.19% to 77.78% of inequalities are socioeconomic related factors. Income and educational attainment appear to have a prominent influence on inequality. The findings suggest that policy targeting the poor, especially the urban poor, is needed in order to reduce health inequality.

[4] This chapter is based upon a published co-authored paper (with Panos Kanavos) at *BMC Public Health* (Yang and Kanavos, 2012).

3.1 Introduction

Health inequality has been recognized as a problem all over the world. A large and growing body of research has examined the hypothesis that the individual's health is shaped not just by the absolute level of resources available to them, but also by the level of resources available to them relative to others in their cohort or community(Wagstaff, 2005c, Wagstaff *et al*., 1993, Liu *et al*., 1999, Costa-Font *et al*., 2010). Inequality in income has grown at a startling pace in the last 25 years in China and scholars generally agree that disparities in income are considered to be one important factor leading to inequality in health (Chen, 2010, Zhao, 2006, Zhang and Eriksson, Zhang and Eriksson, 2010). In China, studies show that the poor usually have less access to healthcare than the better-off, despite having higher levels of need. Notwithstanding their lower levels of utilization, the poor often spend more on healthcare as a share of their income than the better-off (O'Donnell *et al*., 2008b, Fang *et al*., 2010, Li and Zhu, 2006).

As the proportion of the Chinese population living in urban areas has grown tremendously with the urbanization movements in China, some attention has been paid to the association between urban/rural residence and the health of the population. Earlier studies found that, in general, health outcomes were better in urban China. For instance, the prevalence of child stunting was much lower in urban than in rural China (Chen *et al*., 2007). The rural elderly were more likely to experience functional limitation than the urban elderly, and were less likely to survive a two-year follow-up period (Zimmer *et al*., 2010). However, findings were not always consistent. Chen *et al*. (2007) examined the issue of regional disparity in child malnutrition in China, and found that rural children were more likely to be stunting than their urban counterparts. Although the studies mentioned above began to show some interesting findings on urban/rural disparities in health, these studies mainly focused on comparisons between average health of urban and rural populations, and most were descriptive. Reports on income-related differences in health between urban and rural populations are relatively rare (O'Donnell *et al*., 2008b, Fang *et al*., 2010, Li and Zhu, 2006). Only two studies to date have examined income-related inequalities in health between the rural and urban populations in China. Van de Poel *et al*. (2007, 2009) explored some aspects of the relationship between the distribution of diseases and urbanization in China. One of his studies found that urban residents

were more likely to suffer from non-communicable diseases, and that urbanization had been proven to impose a penalty on perceived health in China (2009). In another of his studies examining child health in 47 developing countries, Van de Poel *et al*. (2007) found that the urban poor had higher rates of stunting and mortality than their rural counterparts. The findings implied that there was a need for programs that target the urban poor, and this was becoming more necessary as the size of the urban population grew. However, since both studies used earlier versions of the CHNS, more updated analyses are needed in order to understand income-related inequalities in health in urban and rural areas in China.

This paper seeks to understand the differing degrees of income-related health inequality in rural and in urban populations and the major factors contributing to that inequality. The study of health inequality in China is timely and important. To our knowledge, it is the first to measure and decompose the income-related differences in adult health in urban and rural Chinese populations. The chapter follows Erreygers, Wagstaff, van Doorslaer and O'Donnell in using Concentration Indices and decomposition analysis as a measure of income-related health inequality (Erreygers, 2009, Wagstaff, 2005c, Wagstaff, 2009a, Wagstaff, 2005a, van Doorslaer *et al*., 2000, O'Donnell *et al*., 2008b). It estimates two major health outcome measures: (1) a subjective model assessing self-assessed health (SAH); and (2) a functional model assessing physical activity limitation. Income-related inequalities in health outcomes are calculated by Concentration Indices and presented as Concentration Curves. The contribution of socioeconomic determinants to health inequality is decomposed and quantified. Data from CHNS 2006 are used. Subsequent sections discuss the policy implications that can be drawn from this study.

3.2 Methods

3.2.1. Data source and variable specifications

CHNS is used, and please refer to Chapter 1 Section 1.5.1 for a detailed description of the dataset. Although data for 2009 were available at the time of this study, health status data for that year had not yet been released at the point of writing. Hence, this

study uses data from 2006. Table 3.1 provides a summary statistics of the sample. The population was 50.21% male and 49.79% female, 29.36% urban and 70.64% rural in 2006. The total number of individuals surveyed was 10,182.

Table 3.1 Descriptive statistics for urban and rural populations (mean/standard deviation)

Variable	Definition	Rural (*N*=7193)		Urban(*N*=2989)	
		Mean	SD	Mean	SD
Health variables					
SAH	Dummy variable: 1, excellent and good health; 0 otherwise	0.593	0.491	0.594	0.491
Physical Limitation	Dummy variable: 1, having limitation coded as 1. 0 otherwise	0.072	0.259	0.081	0.272
Demographic variables					
Female 18-24	Dummy variable: 1, female aged between 18-24; 0 otherwise.	0.026	0.160	0.020	0.141
Female 25-34	Dummy variable: 1, female aged between 25-34; 0 otherwise.	0.076	0.265	0.065	0.246
Female 35-44	Dummy variable: 1 female aged between 35-44; 0 otherwise.	0.136	0.342	0.127	0.333
Female 45-54	Dummy variable: 1 female aged between 45-54; 0 otherwise.	0.130	0.336	0.123	0.329
Female 55-64	Dummy variable: 1 female aged between 55-64; 0 otherwise.	0.101	0.301	0.093	0.290
Female 65+	Dummy variable: 1 female aged above 65; 0 otherwise.	0.076	0.264	0.136	0.342
Male 18-24*	Dummy variable: 1 male aged between 18-24; 0 otherwise.	0.031	0.174	0.028	0.164
Male 25-34	Dummy variable: 1 male aged between 25-34; 0 otherwise.	0.079	0.269	0.052	0.222
Male 35-44	Dummy variable: 1 male aged between 35-44; 0 otherwise.	0.136	0.343	0.120	0.325
Male 45-54	Dummy variable: 1 male aged between 45-54; 0 otherwise.	0.127	0.333	0.123	0.328
Male 55-64	Dummy variable: 1 male aged between 55-64; 0 otherwise.	0.108	0.310	0.093	0.290
Male 65+	Dummy variable: 1 male aged 65 and above; 0 otherwise.	0.067	0.249	0.108	0.310
Socioeconomic variables					
Marital status	Dummy variable: 1 married, 0 otherwise	0.856	0.351	0.808	0.394
Job status	Dummy variable: 1 having a job, 0 otherwise	0.687	0.464	0.465	0.499
Income	Gross annual household per capita income inflated to 2009	31,115	44,736	32,089	39,130
No education	Dummy variable: 1 no education; 0 otherwise	0.273	0.446	0.157	0.364
Pri and Sec education	Dummy variable: 1 primary and secondary education; 0 otherwise	0.554	0.497	0.371	0.483
High school education	Dummy variable: 1 high school and technical school education; 0 otherwise	0.151	0.358	0.342	0.474
University education and above*	Dummy variable: 1 university education and above; 0 otherwise	0.022	0.145	0.130	0.336
Province Liaoning	Dummy variable: 1 Liaoning, 0 otherwise	0.113	0.316	0.091	0.288

Province Heilongjiang	Dummy variable: 1 Heilongjiang, 0 otherwise	0.099	0.299	0.107	0.310
Province Jiangsu	Dummy variable: 1 Jiangsu, 0 otherwise	0.118	0.323	0.117	0.321
Province Shandong	Dummy variable: 1 Shandong, 0 otherwise	0.106	0.308	0.112	0.316
Province Henan	Dummy variable: 1 Henan, 0 otherwise	0.116	0.320	0.114	0.318
Province Hubei	Dummy variable: 1 Hubei, 0 otherwise	0.095	0.293	0.106	0.308
Province Hunan	Dummy variable: 1 Hunan, 0 otherwise	0.107	0.309	0.132	0.339
Province Guangxi	Dummy variable: 1 Guangxi, 0 otherwise	0.132	0.338	0.107	0.310
Province	Dummy variable: 1 Guizhou, 0 otherwise	0.115	0.319	0.112	0.316

Note: *reference groups. Gross household income is inflated to year 2009 using consumer price index.

Dependent variables: health variables

This paper uses self-assessed health (SAH) as the dependent variable. Although SAH is a subjective measure of individual health, previous studies show that SAH is highly correlated with subsequent mortality, even when controlling for more objective health measurements (Li and Zhu, 2006, van Doorslaer *et al*., 2000, Idler and Kasl, 1995). In order to measure an individual's self-assessed health status, individuals are asked: "Right now, how would you describe your health compared to that of other people of your age: excellent, good, fair, or poor?" Following a standard method, a new variable is constructed with two categories, collapsing the two lowest categories (fair and poor) (Hernandez Quevedo and Jimenez Rubio, 2009, Li and Zhu, 2006). The new SAH variable has a value of 1 if SAH is excellent or good, and otherwise of 0.

This paper also uses a functional measurement, that of physical activity limitation, as another indicator. As with SAH, this is defined as a binary variable that equals 1 if the respondent has been physically restricted and unable to perform daily activities for the past three months, and otherwise equals 0. Respondents are asked: "During the past three months have you been unable to carry out normal activities and work or studies due to illness?"

Independent variables

Age and gender interaction are allowed in this study as demographic variables. I categorized 12 groups: females aged 18-25, 25-34, 35-44, 55-64, and 65 and above; males aged 18-24, 25-34, 35-44, 45-54, 55-64, and 65 and above. 18-24year-old males are the reference group.

Socioeconomic variables used in this paper are as follows. Per capita income data are used as the measurement of living standard (based on household income inflated to 2009 using consumer price index). Although using household expenditure as a measurement of living standard are suggested in a number of studies on health equity in developing countries (Wagstaff *et al*., 2003, Wagstaff, 2009b). Scholars argue that household expenditure may not be a reliable indicator for living standard measurement in the context of China (Sun *et al*., 2010). China has the highest saving rate in the world; expenditure data are distorted by the propensity to save for emergencies and thus may not be a good proxy as living standard indicators (Qian, 1988, Kraay, 2000, Wu, 2001). Therefore, this study uses an income variable instead of expenditure variable as an indicator for living standard measurements. Household income data are measured as gross annual household income aggregated from all sources including: gardening, farming, livestock/poultry, fishing, handicraft and small commercial household business inflated to 2009 (the last wave of the survey). As this paper examines individual level of healthcare use, it is important to adjust household estimates of aggregate income to reflect household size and composition. This is done by using Equivalence Scale, which is constructed as some function of the household size and demographic composition provided estimates are available for household economies of scale and the cost of children: $AE = (A + \alpha K)^{\theta}$ (Citro *et al*., 1995). A represents the number of adults in the household, K represents the number of children, α is the "costs of children", and θ is the degree of economies of scale. The value of θ should be high when most goods are private and low when most of the household expenditure is on shared goods. A value of 0.75 to 1.0 is suggested when food expenditures account for a large proportion of total household income, which means that the economies of scale are limited (O'Donnell *et al*., 2008b). In this paper, α is set as 0.3, and θ is set as 0.75.

Education is categorized by four groups: no education, primary and secondary education, high school and technical school education, and university education and above. University education and above is used as the reference group. Job status, marital status, insurance status, urban and rural residence, and province of residence are also included among the socioeconomic variables. For the province variable, the province of Guizhou is set as the reference group. Whether the respondent is treated

as an urban resident or a rural respondent depends on his/her registration status as on his/her ID booklet (Hukou[5]). Table 3.1 shows the descriptive statistics for these variables.

3.2.2 Statistical analysis

Income-related inequality in health is estimated using well established methods based on Concentration Curves and Concentration Indices. The method involves five basic steps: (1) estimate a model of the determinants of health outcomes, using a set of demographic and socioeconomic variables; (2) predict (indirectly) age- and sex-standardized health for each health variable, and for urban and rural respectively; (3) calculate the Concentration Indices for the actual health variables and for the standardized health variable for urban and rural populations; (4) calculate the non-demographic/socioeconomic-related inequality of health, and compare the non-demographic inequality in the rural population with that in the urban population; (5) decompose the socioeconomic factors from total health inequalities for urban and rural population respectively.

The multivariate regressions models for steps (1) and (2) above are central to the methods. The health variables, i.e. SAH health and physical limitation, are binary variables. The nature of the dependent variables formally calls for a non-linear estimation. However, the disadvantage of this procedure is that certain components of the equity analysis, such as decomposition analysis, are difficult to implement and interpret when using non-linear models. Further, studies have shown that equity measurements calculated by OLS regression do not differ importantly from the non-linear estimation (Hernandez Quevedo and Jimenez Rubio, 2009, Allin and Hurley, 2009). Therefore, this paper will use OLS regression instead of non-linear regression to standardize the health variables and to decompose the Concentration Indices. Results from the Probit model are nonetheless presented in Appendix 1 in order to enable a comparison. Further, instead of using the Concentration Indices, the Erreygers Concentration Index, which has recently been developed and has proved a

[5] Hukou is a common name used in mainland China for the household registration system. It is issued on household basis. Every household have a Hukou booklet that records information on the family members, including name, birth date, relationship with each other, marriage status (and with whom if married), address, etc.

better estimation of binary variables, will be used (Erreygers, 2009, Wagstaff, 2009a, Costa-Font and Gil, 2008, Van de Poel *et al*., 2007).

The following sections will discuss the statistical analysis used for each step.

Standardization of health variables

Standardization of the health variables was the first step, so as to enable a reasonable estimation of health inequality. It is noted that variations in health are associated with a number of factors. In the literature, these factors are usually categorized as demographic inequalities, e.g. age and sex factors, and non-demographic inequalities arising from circumstances beyond the individual's control, e.g. economic resources and access to healthcare. Policy may be less concerned with inequalities arising from demographic factors, e.g. demographic variation, because these are usually reasonable and acceptable. Therefore, a measurement of socioeconomic-related health inequality, to control for demographic differences or identify only non-demographic differences, would be desirable for policy formation. In order to measure socioeconomic-related health inequalities that reflect only non-demographic health differences, indirect standardization of health variables is used. The aim of indirect standardization is to subtract the variation in health which is driven by demographic factors or demographic variation, and capture only the health inequality driven by non-demographic factors(O'Donnell *et al*., 2008b).

As suggested by O'Donnell *et al*.(2008b), standardized health variables ($\hat{y}_i^X$) is obtained by a regression of actual health variables ($\hat{y}_i$) as follows,

(1) $y_i = \alpha + \sum_j \beta_j x_{ji} + \sum_k \gamma_k z_{zi} + \varepsilon_i$

Where x_j are the demographic variables, i.e., age and sex; z_k are non-demographic variables, i.e., (the logarithm of) income, education, job status, province of residence, urban/rural residence, marital status; $\alpha, \beta,$ and γ are the parameter vectors, and ε is the error term.

The coefficients from OLS estimations are obtained from actual values of the x_j variables, i.e. age and sex, which are to be standardized for, and from the sample

mean for z_k variables, which are not to be standardized, but to be controlled for. The predicted values of health indicator $\hat{y}_i^x$ are then obtained.

(2) $\hat{y}_i^X = \hat{\alpha} + \sum_j \hat{\beta}_j x_{ji} + \sum_k \hat{\gamma}_k \bar{z}_{zi}$

Assuming a linear model, estimates of indirectly standardized health $\hat{y}_i^{IS}$ can be obtained by calculating the difference between actual health (y_i) and standardized health ($\hat{y}_i^X$), plus the sample mean ($\bar{y}$)

(3) $\hat{y}_i^{IS} = y_i - \hat{y}_i^X + \bar{y}$

Rearranging the equation (3),

(4) $\hat{y}_i^{IS} = y_i - \sum_j \hat{\beta}_j (x_{ji} - \bar{x}_j)$

Equation (4) shows that standardization will subtract the variation in health driven by demographic factors from actual health. Therefore, the distribution of $\hat{y}^{IS}$ across income can be interpreted as the health status we expect to observe in an individual, irrespective of differences in the distribution of demographic characteristics.

Measuring income-related health inequality using Concentration Curves

The Concentration Index has been used in many studies to quantify the degree of socioeconomic-related inequality in health variables (Wagstaff *et al*., 1993, Kakwani *et al*., 1997, O'Donnell *et al*., 2008b). It quantifies the degree of socioeconomic-related inequality in a health variable. There are many ways to express the Concentration Index. The most convenient for the purpose of this research is (O'Donnell *et al*., 2008b):

(5) $CI = 1 - 2\int_0^1 L_n(p)dp = \frac{2}{\mu}\mathrm{cov}(h_{it}, R_i^t)$

Where i represents the individual, h_i is the health variable, R is the individual's living standard ranking, μ is the mean of the health variable in the population, and t is the year. If there is no socioeconomic-related inequality, the index is zero. A positive value indicates a pro-rich inequality, and a negative value indicates a pro-poor inequality.

However, recent studies have suggested that there are some limitations on the Concentration Index. Wagstaff (2005a) has found that if the health variable of interest is binary, taking the value of 0 or the value of 1, then the bounds of the Concentration Index depend on the mean of the health variable. Therefore, this paper uses the recently introduced Erreygers's Concentration Index, which is more suitable for the binary nature of the variables and the purpose of this study (Erreygers, 2009). Erreygers proposed a revised calculation of the Concentration Index for health.

$$E(h) = \frac{4\mu}{(b_n - a_n)} C(h) \quad (6)$$

Where b_n and a_n represent the max and min of the health variable (h), μ is the mean of the health variable in the population, and $C(h)$ represents the Concentration Index specified in (5).

The range of the Erreygers's Concentration Index is from -1 to 1. A positive value indicates a pro-rich inequality, meaning that ill/good health is more concentrated among the better-off. A negative value indicates a pro-poor inequality, meaning that ill/good health is more concentrated among the poor. The magnitude of the concentration index reflects the strength of the relationship between income and health variable. For example, an index of -0.7 indicates that the health variable is concentrated among the poor, and the health variable demonstrates a pro-poor inequality. Compared with an index of -0.1, an index of -0.7 indicates a more pronounced pro-poor inequality for the health variable.

Regression-based decomposition analysis helps to capture the contribution of each individual factor to income-related health inequality (O'Donnell *et al*., 2008b:159, Wagstaff *et al*., 2003). The Erreygers's Concentration Index can be decomposed by transforming the health variable $h_i = (h_i - a_h)/(b_h - a_h)$. Therefore, the Erreygers's Concentration Index differs from the decomposition of C by the multiplication by 4 and μ_h. The equation is as follows.

$$E = 4\left[\beta\mu_y C_y + \sum_j \gamma_j \mu_{zj} C_{zj} + \sum_k \delta_k \mu_{xk} C_{xk}\right] \quad (7)$$

Where μ is the mean, j represents a vector of a set of variables z_j, k represents a vector of variables x_k, γ represents the coefficient of the variable z, δ represents the coefficient of the variable x, C is the Concentration Index for x.

Another critical problem arises from calculation of the Concentration Index is the ranking indicator of the livings standard measurements. Studies have found that repetitive values of the ranking variables, i.e. two of more observations have the same values of the living standard variables, may bring instability for the calculation (Chen and Roy, 2009, Van Ourti, 2004). With random sorting, when a number of observations have a same value of the living standard variable, they are assigned different values of living standard-related fractional rank. Using this approach for a dataset with multiple repetitive values of the living standard variable may lead to a fictitious ranking of individuals, hence affecting the results of the Concentration Index. Specifically, Chen and Roy (2009) have found that sorting observations with ascending order in the health outcome produces the upper boundary of the Concentration Index; and sorting the observations with a descending order in the health outcome produces the lower boundary of the Concentration Index. In this paper, we have sorted the data both in ascending and descending order to test the accuracy of the Erreygers's Index, and to obtain the boundaries of Erreygers's Index. The results suggest that no change is observed in terms of the value of the indices. A possible explanation of the results may be that individuals whose health outcomes do not deviate substantially from those with same values of the living standard variable. Hence, the estimations of Erreygers's Indices in this paper are close or same to the true value of the Erreygers's Index.

3.3 Empirical Results

3.3.1 Descriptive analysis by urban and rural populations

Table 3.1 presents descriptive results for the urban and rural populations in the total sample. Urban respondents have similar self-assessed health, but more physical limitations compared with rural respondents. In terms of the demographic structure of the sample, the urban population has a much higher proportion of respondents who are above 65 years old, while the rural population has a higher proportion of

respondents in other age groups. Moreover, urban respondents are more likely to have received high school and university education and are wealthier compared with the rural population. In terms of other factors, the average rates of those reporting themselves as "married" and "employed" are higher for rural than for urban respondents.

Figure 3.1 and Figure 3.2 show the reporting rates for SAH and physical activity limitation (standardized by age and gender) by income deciles for urban and rural populations respectively. The rich are more likely to report their health status as excellent/good, and are less likely to report physical activity limitation. Such inequality is more pronounced for the urban population compared with the rural population.

Figure 3.1 Standardized SAH (excellent and good health = 1, fair and poor health = 0) for the urban population and the rural population by income deciles in 2006 (Standardized by Linear Probability Model)

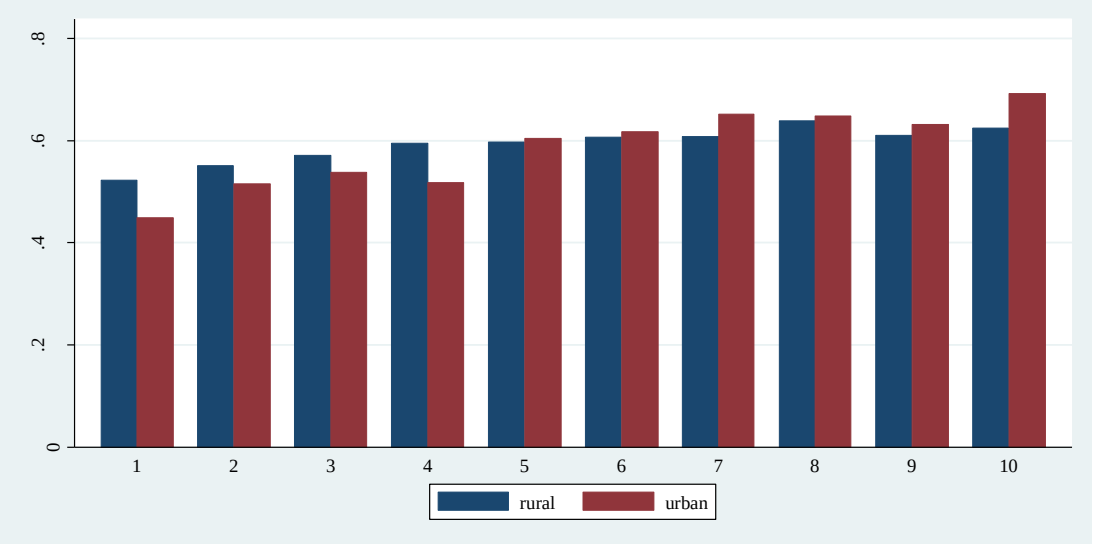
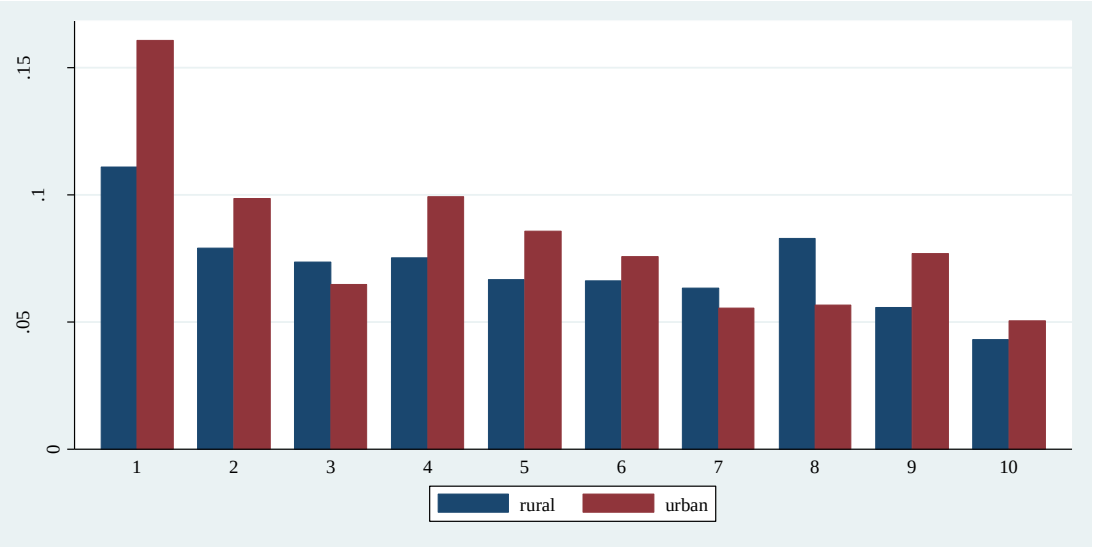


Figure 3.2 Standardized physical activity limitation (having physical limitation = 1, otherwise = 0) for the urban population and the rural population by income deciles in 2006 (Standardized by Linear Probability Model)



3.3.2 Determinants of health outcomes

Table 3.2 presents the OLS coefficients of the linear probability model. These estimates are used to calculate and decompose the Concentration Indices of the SAH and of physical activity limitation. The F test confirms the joint significance of the coefficients of all independent variables. Regarding the supposed association between income, education, and occupation types, a very low degree of correlation is found. Computation of the variance inflation factors (VIF) indicates that multicollinearity is not a problem (VIF = 2.01). A Ramsy RESET test is performed, indicating that the models showed no specification problems. As mentioned in the previous section, the nature of the variables calls formally for a non-linear estimation. Previous studies have shown that equity measurements calculated by OLS regression do not differ significantly from the non-linear estimation, and the results from this study have also confirmed this (Hernandez Quevedo and Jimenez Rubio, 2009, Allin and Hurley, 2009). To be succinct, only OLS coefficients are calculated and presented in the paper, while results from Probit models are presented in Appendix 1 in order to enable a comparison.

Table 3.2 shows that an increase in age is associated with a decrease in SAH. In particular, the rural population aged 65 and above has a lower probability of reporting excellent/good health compared with their urban counterparts. The impact of income on SAH is higher for the urban population than for the rural population. Having a job also increases the likelihood of reporting excellent/good health. Interestingly, the rural residents of the provinces of Liaoning, Heilongjiang, Jiangsu, Shandong and Hunan showed an increased likelihood of reporting excellent/good health compared with rural residents of other provinces.

Age is positively associated with reporting physical activity limitation. The impact of educational attainment on health is also significant. Those with no education are more likely to be physically restricted; such an impact is higher for the urban population than for the rural population. Further, those who have a job are less likely to report physical activity limitation.

Table 3.2 OLS results for SAH and physical activity limitation

	SAH (1=excellent or good, 0=fair or poor)		Physical Limitation(having limitation = 1, no limitation = 0)	
	Rural	Urban	Rural	Urban
Age and gender (ref = m18-24)				
f18-24	0.1825***	0.2293***	0.0013	-0.0384
f25-34	0.1174***	0.1714***	-0.0067	-0.0238
f35-44	0.1174***	0.1259***	-0.0022	-0.0171
f45-54	0.0305	0.0135	-0.0084	-0.0097
f55-64	-0.0753***	-0.0968**	0.0093	0.0301
f65+	-0.2258***	-0.1685***	0.0326**	0.08***
m25-34	0.1598***	0.0652	-0.0196	-0.0216
m35-44	0.0391	0.0661*	-0.0122	-0.0212
m45-54	-0.0393	-0.0513	-0.002	-0.0394*
m55-64	-0.2***	-0.1497***	0.0184	0.0184
m65+	-0.255***	-0.1968***	0.0583***	0.0538**
Income(lg)	0.014**	0.0376***	-0.0077**	-0.0048
Marital Status (1 = married)	-0.0165	0.0019	0.0067	-0.0187
Job status (1 = having a job)	0.038***	0.0418*	-0.0374***	-0.0306**
Education level (ref = uni edu and above)				
No edu	-0.132***	-0.0301	0.0471**	0.0902***
Pri and sec edu	-0.0633	-0.0313	0.0202	0.0224
High school	-0.0131	-0.0042	0.003	0.0088

Regions (ref= Province Guizhou)				
Province Liaoning	0.0555**	0.0049	0.0042	0.0279
Province Heilongjiang	0.0869***	0.002	-0.0032	0.0569***
Province Jiangsu	0.0524**	0.1146***	0.0058	0.0082
Province Shandong	0.0974***	0.0904**	-0.0222*	-0.0032
Province Henan	-0.006	0.0072	-0.011	0.0004
Province Hubei	0.0064	0.0152	0.0325**	0.0073
Province Hunan	0.006	0.0406	0.0128	0.038*
Province Guangxi	-0.1207***	-0.1098***	0.0303**	0.0316
Constant	0.511***	0.2233**	0.1342***	0.1073*
Number of obs	7062	2923	7062	2923
F(25, 7036)	42.36	15.04	8.47	7.96
Prob > F	0	0	0	0
R-squared	0.1308	0.1149	0.0292	0.0643
Adj R-squared	0.1277	0.1073	0.0258	0.0562

*p<0.01***, p<0.05**, p<0.1**

3.3.3 Income-related inequality in health outcomes

Figure 3.3 and Figure 3.4 show the concentration curves for the standardized health variables, which illustrate the share of health by cumulative proportions of individuals in the population ranked from the poorest to the richest. The two key health variables are standardized by the interaction of age and gender using the indirect standardization method specified in earlier sections. Table 3.3 shows the Erreygers's Concentration Index (EI), non-demographic inequality, and the percentage of non-demographic inequality contributing to the total EI for urban and rural populations respectively.

As shown in Table 4, the EI indicated that the rich were more likely to report excellent/good health and less likely to report physical activity limitation. Some interesting findings come from the inequality levels between urban and rural populations. Although one might assume that the urban population would have a more equal distribution of health across wealth than the rural, given some evidence demonstrated by the existing literature, the empirical results show different findings. Table 4 reports the estimates of income-related inequality indices using the Erreygers's method (EI) for the urban and rural populations respectively. The EIs for

the rural population and the urban population for SAH were 0.135 and 0.182 respectively. The indices suggest that the urban poor have a higher risk of suffering from poor health than the rural poor, as reported by their own perceptions of their health status. The EI for physical activity limitation is -0.043 for the rural population and -0.060 for the urban population, which indicates that the degree to which poverty equates with physical activity limitation is higher for the urban population compared with the rural population. Indices calculated using Probit Modelling were presented in Appendix 2.

Table 3.3 Erreygers's Concentration Indices of SAH and physical activity limitation (OLS)

	Good Health		Physical Limitation	
	Rural	Urban	Rural	Urban
EI	0.135	0.182	-0.043	-0.060
SE (EI)	0.017	0.024	0.008	0.013
Socioeconomic related inequality	0.065	0.139	-0.034	-0.047
Percentage of Socioeconomic related inequality	48.19%	76.47%	77.78%	79.07%

Note: all indices are significant at 0.01 significance level.

The indices are verified by the presentation of Concentration Curves in Figure 3.3 and Figure 3.4. The blue curves represent the rural population and the red curves the urban population. If the curves coincide with the 45-degree line of equality, all respondents, irrespective of their economic status, have the same health outcomes. If, as is more likely in this case, the curves lie above/below the 45-degree line, inequalities in health variables favour the poor/rich; such inequalities are pro-poor/pro-rich. The further the curve lies from the 45-degree line, the greater the degree of inequality in the health variable across quintiles of economic status. In Figure 3.3, the urban curve lies below the line of equality and below the rural curve, indicating that the urban population has a higher level of inequality favouring the rich than the rural population. In Figure 3.4, the urban curve lies above the line of equality and above the rural curve, indicating a more pronounced inequality in favour of the poor for the urban population compared with the rural population.

Figure 3.3 The Concentration Curves for SAH for the urban and rural population in 2006 (Standardized by Linear Probability Model)

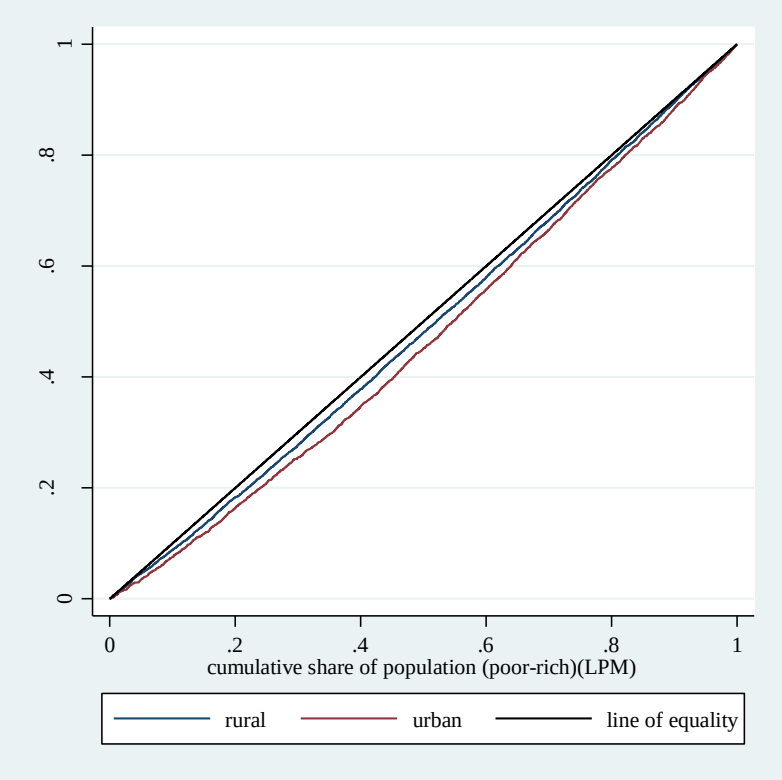


Figure 3.4 The Concentration Curves for physical activity limitation for the urban and rural population in 2006 (Standardized by Linear Probability Model)

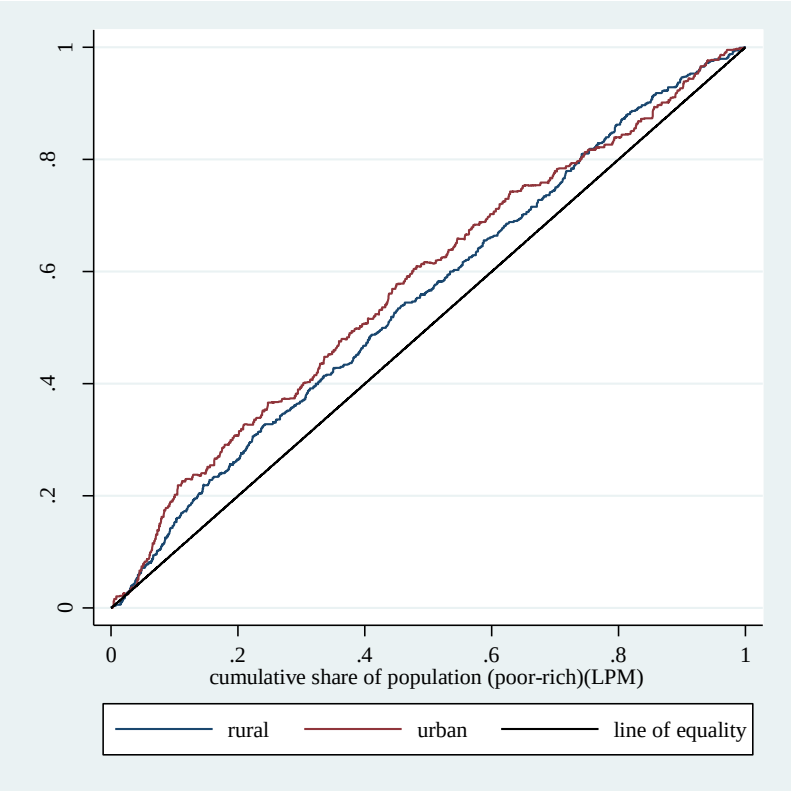


Table 3.3 also reports for the estimates of inequality indices that are driven mainly by non-demographic/socioeconomic factors. Results show that, for the urban population 76.47% of the inequality for SAH and 79.07% of the inequality for physical activity limitation is socioeconomic-related inequality. This suggests that, for the urban population, age and gender accounted for a relatively low share of income-related inequality. For the rural population, 48.19% of income-related inequality in SAH and 77.78% of inequality in physical activity limitation are driven by socioeconomic-related factors such as economic resources and education levels. These results indicate that a large percentage of existing income-related inequalities in SAH and physical activity limitation are potentially driven by non-demographic/socioeconomic-related factors.

3.3.4 Explaining health inequalities

The concentration indices results suggest that the level of inequality in terms of health status is higher for the urban population compared with the rural population. In order to investigate this issue further, decomposition analysis is used to estimate the contribution of individual factors to total inequality. Table 3.4 presents the results of the decomposition analysis based on OLS regressions, indicating the contribution of individual factors to total income-related inequalities (EI). Figure 3.5 and Figure 3.6 present the individual factors. A decomposition analysis based on the Probit model is presented in Appendix 3.

The first and second columns in Table 3.4 show the Concentration Indices for the distribution of the independent variables, e.g. income, age and sex, marital status, etc., across income for rural and urban respondents respectively. The other columns show the contribution and percentage contribution of the individual factors to the total inequality indices for each variable and separately for the urban and the rural populations. For the rural population, the elderly, i.e. respondents above 55 years old, and those with no education are more likely to be in the low-income group. For the urban population, those with no education or with primary and secondary education only are more likely to be among the low-income groups. The better-off are more likely to have high school education and above.

The decomposition analysis, which explains the contribution of individual factors to income-related inequality, reveals some interesting findings in the comparison between rural and urban. Income, demographic features and education are the major factors contributing to inequalities. For the rural population, in terms of SAH, demographic factors contribute 50.06% to total inequality, while income contributes 22.77%, and education contributes 17.58%. This indicates that approximately half of income-related health inequalities for the rural population are driven by demographic factors, i.e., age and gender. Further, the contribution of age and gender effects to total inequality is higher for the rural population compared to the urban population.

The physical activity limitation variable indicates similar results. Demographic factors contribute 22.45% to total inequality for the rural population and 21.01% for the urban population. This suggests that, for the rural population, a high degree of inequality is driven by demographic factors, while such factors only account for a small share of inequality for the urban population.

It is interesting to discuss the contribution of socioeconomic-related inequalities. Figure 3.5 and Figure 3.6 show the decomposition results for SAH and physical activity limitation. Unlike the developed countries, where the percentage contribution of income to total inequalities is relatively smaller compared to other factors, a large proportion of inequalities in China are still driven by income (Costa-Font and Gil, 2008). The results suggest that higher-income earners are both more likely to have higher levels of education and are more likely to report excellent/good health. Further, the influence of educational attainment on pro-rich inequality is higher for the rural population compared with the urban population.

The physical activity limitation variable also reveals some interesting findings. The most important factors relating to inequality are demographic factors, income, job status and educational attainment. Results suggest that high-income earners are both well-educated and less likely to have physical activity limitation. It is worth pointing out that, for the urban population, education is the most salient contributor to inequality, at approximately 40%. Job status and income are the other two important factors contributing to the urban inequality indices.

Figure 3.5 Decomposition of SAH (Linear Probability Model)

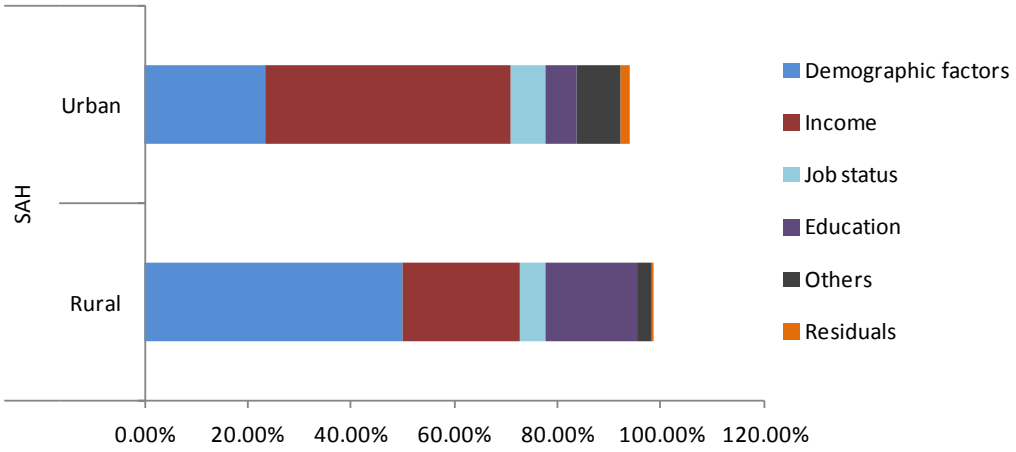


Figure 3.6 Decomposition of physical activity limitation (Linear Probability Model)

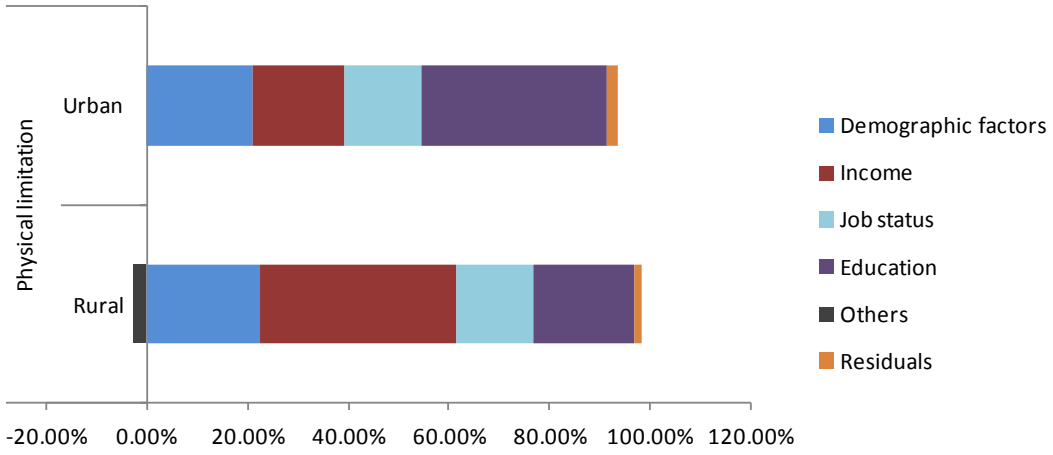


Table 3.4 Decomposition results (OLS)

	CI		SAH (1=excellent or good, 0=fair or poor)				Physical Activity Limitation			
			Rural		Urban		Rural		Urban	
	Rural	Urban	Contribution	%Contribution	Contribution	%Contribution	Contribution	%Contribution	Contribution	%Contribution
EI			0.135		0.182		-0.043		-0.060	
Residual			0.001	0.40%	0.004	1.98%	-0.001	1.46%	-0.001	2.22%
Age and gender (ref = m18-24)										
f18-24	0.198	-0.045	0.005	3.34%	-0.001	-0.61%	0.000	-0.07%	0.000	-0.33%
f25-34	0.153	0.155	0.005	3.49%	0.005	2.59%	0.000	0.70%	-0.001	1.17%
f35-44	0.099	0.114	0.006	4.38%	0.006	3.36%	0.000	0.23%	-0.001	1.33%
f45-54	0.035	0.021	0.001	0.37%	0.000	0.06%	0.000	0.23%	0.000	0.17%
f55-64	-0.053	-0.019	0.001	1.04%	0.001	0.28%	0.000	0.46%	0.000	0.33%
f65+	-0.286	-0.072	0.015	11.42%	0.005	2.70%	-0.002	5.10%	-0.002	3.84%
m25-34	0.109	0.120	0.005	3.41%	0.002	0.99%	-0.001	1.39%	-0.001	1.00%
m35-44	0.076	0.064	0.002	1.11%	0.002	1.10%	-0.001	1.16%	-0.001	1.00%
m45-54	0.020	0.070	0.000	-0.22%	-0.002	-0.83%	0.000	0.05%	-0.001	1.83%
m55-64	-0.114	-0.087	0.007	5.49%	0.004	2.09%	-0.001	1.62%	-0.001	0.83%
m65+	-0.309	-0.221	0.022	16.24%	0.021	11.78%	-0.005	11.58%	-0.006	9.84%
ln(income)	0.056	0.058	0.031	22.77%	0.086	47.27%	-0.017	38.92%	-0.011	18.35%
Marital Status	0.013	0.044	-0.001	-0.59%	0.000	0.17%	0.000	-0.70%	-0.003	4.50%
Job status	0.064	0.161	0.007	4.97%	0.013	6.88%	-0.007	15.29%	-0.009	15.18%
Education level (ref = uni edu and above)										
No edu	-0.181	-0.356	0.026	19.36%	0.007	3.69%	-0.009	21.55%	-0.020	33.36%
Pri and sec edu	0.004	-0.113	-0.001	-0.44%	0.005	2.92%	0.000	-0.46%	-0.004	6.34%
High school	0.229	0.141	-0.002	-1.33%	-0.001	-0.44%	0.000	-0.93%	0.002	-2.84%
Regions (ref= Province Guizhou)										
Province Liaoning	0.043	0.180	0.001	0.82%	0.000	0.17%	0.000	-0.23%	0.002	-3.17%

Province Heilongjiang	-0.073	0.133	-0.003	-1.85%	0.000	0.06%	0.000	-0.23%	0.003	-5.34%
Province Jiangsu	0.232	0.240	0.006	4.30%	0.013	7.04%	0.001	-1.39%	0.001	-1.50%
Province Shandong	-0.009	-0.120	0.000	-0.30%	-0.005	-2.70%	0.000	-0.23%	0.000	-0.33%
Province Henan	-0.071	-0.071	0.000	0.15%	0.000	-0.11%	0.000	-0.93%	0.000	0.00%
Province Hubei	-0.030	-0.189	0.000	-0.07%	-0.001	-0.66%	0.000	0.93%	-0.001	1.00%
Province Hunan	0.018	-0.023	0.000	0.00%	-0.001	-0.28%	0.000	-0.23%	-0.001	0.83%
Province Guangxi	-0.011	-0.186	0.001	0.52%	0.008	4.57%	0.000	0.46%	-0.002	4.00%

3.4 Conclusion and discussion

A by-product of China's rapid development is the growing differentiation of the social and economic life in urban and rural areas. The link between social inequality and health disparity provides a particularly useful line of inquiry into the issue of urban/rural disparity. It is critically important to understand the variation in health across income groups, and in particular to take into account the effects of urban/rural residence on the degree of income-related health inequalities. This paper first compares the average health status of rural and urban populations. It then measures and compares the degree of income-related health inequalities of urban and rural populations. Factors associated with inequalities are quantified in order to illuminate the dynamic of individuals' health and socioeconomic status for urban and rural populations respectively.

Specifically, this paper reveals some compelling new findings. The study shows that urban respondents have similar self-assessed health, but more physical limitations compared with rural respondents. Income-related health inequalities are more pronounced for urban populations as compared with rural populations. These results contradict some earlier studies, but are consistent with others. A number of the earlier studies found that living in a rural area increased the possibility of reporting poor health and that the urban population were healthier compared with the rural population (Chen *et al*., 2010, Anson and Sun, 2004). There are a few studies demonstrated different findings. For instance, Van de Poel *et al*. (2012a) found that urban residents were more likely to have a higher incidence of chronic diseases and that obesity and hypertension rates were more prevalent in urban China than in rural China. A possible explanation suggested by the authors was that the rapid environmental, economic and social changes that followed urbanization increased the prevalence of major risk factors for chronic disease. The increasing urbanization and development may change the geographical distribution of non-communicable diseases. Further, urban areas in low- and middle-income countries, such as China, were moving through a rapid nutritional transition towards western-style diets dominated by more processed foods and a higher fat content. Increasing urbanization also led to equally rapid shifts towards more sedentary occupations through the acquisition of new technology and transitions away from an agricultural economy,

which may also cause health problems (Van de Poel *et al*., 2007, Van de Poel *et al*., 2009, Van de Poel *et al*., 2012a).

The total differential decomposition allows us to examine the factors associated with inequality. Possible policy implications can be drawn from these results. The empirical results suggest that, for the rural population, the young, the better-off, and the educated are less likely to suffer from ill health. Similarly, for the urban population, income contributes strongly to inequality. Apart from income, educational attainment and job status also make a positive contribution to total inequalities. The study also finds that, for the urban population, 76.47% to 79.07% of inequalities are driven by socioeconomic-related factors. Income, job status and educational attainment each appear to have a prominent influence on inequality. For the rural population, 48.19% to 77.78% of inequality can be explained by socioeconomic-related factors, among which income and educational level are the most important factors. These findings are consistent with some of the previous studies. The role of income is notable. Wagstaff *et al*.(2005c) found that income played an important role in child malnutrition in the 1990s in Vietnam. They suggested that, although rising incomes reduced malnutrition and hence reduced average malnutrition, rising incomes also directly increased relative inequality in malnutrition, magnifying the inequality in malnutrition attributable to income inequality. As also indicated by the 2008 National Health Service Survey (Centre for Health Statistics and Information, 2008), income level was a major determinant of health outcomes. Being poor and lacking healthcare coverage often prevented people from seeking care (Zhao, 2006). Hence, promoting health equality and providing support for the poor and for those with special health needs are important strategies for maintaining sustainable development and alleviating poverty. As the present study has indicated an urban disadvantage with respect to health inequalities, there is certainly a need, if equality in health is to be realized, for better facilities in urban areas and to provide the urban poor with support.

The contribution of education is also important. Previous studies found that educational level made an important contribution to total inequality, and that its effect was even more important in some cases than the "pure income effect". Anson and Sun (2004) suggested that the association between education and income in

China resembled the patterns documented in industrial societies. Level of education, higher income and occupational status were all significantly related to health. Similar results were reported by Costa-i-Font *et al*.(2008), who examined socioeconomic inequalities in obesity and found that education was an important determinant in explaining obesity. The possible explanation given by Costa-i-font *et al*. was that education helped to convey unobserved effects such as knowledge transfer, which enabled people to be more health-conscious. Meanwhile, the translation of income into better living environment and healthy food may be as efficient as other effects such as knowledge transfer, presumably identified by the education treatment variable(Costa-Font and Gil, 2008). Hence, they suggested that government should coordinate a number of policies including promoting or subsidizing knowledge communication on healthy life styles. These implications are relevant and applicable in the Chinese context. Since physical exercise, healthy diet and sleeping habits may have an influence on the behaviour of certain low-income groups that are more oriented to unhealthy lifestyles, the prevention of certain unhealthy habits through knowledge-related activities directed especially at low-income individuals is likely to have desirable effects in reducing income-related inequalities in health (Costa-Font and Gil, 2008, Zhou *et al*., 2011).

It is worth pointing out that the healthcare systems in rural and urban areas may also affect the inequalities in health outcomes. The gap in distribution of health resources between urban and rural areas has been narrowed in the past a few decades, and substantial progress has been made in rural areas (World Bank, 1997). For the past decade, the Chinese government has been making concerted efforts to build new primary and secondary health facilities in rural areas in order to improve access to basic medical care (Eggleston *et al*., 2008). The New Operative Medical Insurance Scheme was initiated in 2003 to protect the rural population from disease and ill health (Wagstaff *et al*., 2009b). While in the urban areas, the majority of the urban unemployed were not covered by any SHI before 2007. The urban health system, despite absorbing a disproportionately large share of total health subsidies, has been criticized as plagued by inefficiency and low quality, by an overly concentrated use of services on tertiary care and by over-prescribing and over-use of health service, all of which may lead to health inequality and other health problems (World Bank, 1997, Gu, 2008, Eggleston and Yip, 2004, Yip and Hsiao, 2008a, Yip and Hanson, 2009).

These problems may give rise to access and affordability issues, thus influencing the population's health, particularly that of low-income groups. The Chinese government has apparently noticed these issues and is in the process of improving its healthcare sector in order to tackle inequalities. More primary healthcare facilities have been built. New health insurance schemes, such as the New Cooperative Medical Insurance Scheme and the Urban Residents Medical Insurance Scheme, have been introduced in order to target the rural population and the urban poor (Eggleston *et al*., 2008, Gu, 2008, Yip and Hsiao, 2008a, Yip and Mahal, 2008). The government is moving in the right direction to combat inequality, but how well these policies have been implemented and how effective they will be is yet to be shown.

This study has its own limitations, although it is among the first to provide evidence from China on urban/rural disparity in income-related adult health. The first concerns the dataset. The dataset used is probably by far the most comprehensive ever used in studying health inequality in the Chinese context; however, only nine provinces were included. Most of these provinces are situated in the eastern and coastal part of China, where the levels of economic development are high. Hence, any further generalization should be made with caution. Another limitation is the variables of interest. Self-assessed health variables can be biased because of problems in reporting. If reporting differences have influenced the population equally, this will not be a problem. However, it is possible that population groups may report the variable in a systematically different way. For instance, under-reporting may be greater in rural than in urban areas. Old people are likely to underestimate their health status compared with young people. If this were the case, the results shown here might represent an underestimation of inequality in certain population groups (Allin *et al*., 2010). Furthermore, the decomposition analysis of health inequality calls for further investigation. Income had a greater contribution in self -reported health in urban areas but not in rural areas, and the opposite applied for health limitations. Health and income can be recursively determined, and instrumental variable can be used to solve the problem. This would require finding a good instrument, which has proved to be difficult for the CHNS dataset.

4 Horizontal inequity in health service use

China's New Cooperative Medical Scheme and equity in access to healthcare[6]

Abstract

The NCMS was brought to life in 2003 in response to the deterioration in access to health services in rural areas. Despite its fast expansion, the scheme's impacts on access to healthcare raises growing concern, in particular regarding whether and to what extent the scheme is able to reduce inequity in access to healthcare in rural China. This study examines the magnitude and direction of income-related inequity in access to healthcare from 2004 (before the national rollout of NCMS) to 2009 (after the expansion of NCMS across the rural China) by estimating Concentration Indices over both formal healthcare (outpatient care, prevention care) and informal healthcare use (folk doctor[7] care). Data are drawn from a longitudinal household survey dataset – the CHNS. The study suggests that the level of inequity remains the same for outpatient care, and a widening gap favouring the poor between the poor and the rich in terms of folk doctor use is observed. In terms of preventive care, a pro-rich inequity was observed both in 2004 and 2009, and the level of inequity remained the same throughout the study period. The NCMS demonstrates positive effects on reducing income-related health inequity in folk doctor care and preventive care, but the contribution is rather small. The study concludes that without a more comprehensive insurance package that effectively targets the rural poor, the intended equity goals of the scheme will be difficult to realise.

[6] This chapter is based upon a published paper at *International Journal for Equity in Health* (Yang, 2013)

[7] Folk doctor in the survey refers to health practitioner who has no valid health practitioner license. The Chinese version of the term is "Min Jian Yi Sheng".

4.1 Introduction

Countries across the world are looking to health insurance as a means of ensuring access to healthcare and protecting patients from financial risks. Health insurance has the potential to lower financial barriers of access to healthcare, since the financial risk of healthcare is shared among insurance participants and health cost will be reduced at the point of healthcare use (Yip and Berman, 2001). One common way to organise insurance is to target its funds to either a group of the population, such as the vulnerable/disadvantaged socioeconomic population, or specific services that are most cost-effective and/or preferentially benefit the target population, such as primary care or outpatient care (Yip and Berman, 2001).

In China, a focus on healthcare for the rural population is gaining increased governmental attention in recent years. The government targets its public funds for health insurance by focusing on the rural population through the NCMS. Since "equitable access" has been officially declared by the State Council to be the principal aim of the rural health insurance reform (You and Kobayashi, 2009), the main objective of the NCMS is to provide universal coverage and to improve equity and access to healthcare to the rural population regardless of individual characteristics such as job status, education, pre-existing condition, and level of wealth. For the past few decades, the state and enterprise funded health insurance only covered well-off urban employees, leaving the majority of the rural residents unprotected from health risks (Liu *et al*., 2012c), the launch of the NCMS is considered as a crucial step in closing the insurance gap and reducing inequity in access to healthcare for the rural population.

However, the real world experience actually tells us little about how far public health insurance can improve access to healthcare. One major concern is whether the insurance is able to reach vulnerable/disadvantaged socioeconomic groups (Liu *et al*., 2012c, Watanabe and Hashimoto, 2012, Jehu-Appiah *et al*., 2011). Evidence from the developing countries suggest that public voluntary insurance programmes, especially the ones that require substantial premiums and patient cost-sharing, may have little effects in improving use of public financed health services of the poor. In Iran, despite of the decent development of a few government health insurance schemes targeting the poor and catastrophic inpatient care in the last decades, co-

payments still count for 58% of the health expenditures, and the proportion of people facing catastrophic health payment remained high even after the insurance reform (Kavosi *et al*., 2012). In India, the newly developed insurance—Rashtriya Swasthya Beema Yojna (RSBY) which aims to target the poor only allowed a limited rate of reimbursement for inpatient care. Studies found that expenditures on drugs claims which constituted around 75% of OOP payments and 80% of the spending on outpatient visits were not covered, and the impacts of the RSBY on protecting the poor against health payment-induced impoverishment were limited (Shahrawat and Rao, 2012).

The launch of the New Rural Cooperative Medical Scheme (NCMS) in 2003 represents a major step of the Chinese government to move towards a more equitable and efficient rural health financing system, but it is not clear that the participation in the NCMS is sufficient enough to deliver equitable access in different types of healthcare. One major concern is that, under the NCMS, healthcare is provided in public health facilities through a FFS system, and the reimbursement rates vary by different types of care and at different health facilities. Although the NCMS has extended its coverage to outpatient care since 2007, its emphasis is mainly on "catastrophic outpatient cost", and reimbursement is made either through participants' Medical Saving Account or pooled funds which requires substantial cost-sharing (Barber and Yao, 2011). Further, the scheme only reimburses drugs listed on the National Essential Drug Reimbursement List, services covered by the insurance package, and care sought at state-owned public health facilities. Most imported and new drugs and high-technology diagnoses procedures are not eligible for reimbursement. The claimed reimbursement rates are the highest for care delivered at village/township health centres and the lowest at city/provincial hospitals, while care sought at the high level health facilities is usually associated with severe illness and high medical expenditures (Babiarz *et al*., 2012, Babiarz *et al*., 2010). Consequently, as argued by many scholars, despite the broad coverage, co-payments for the NCMS participants in general remained high even after the insurance claims were made, and this may impede a subpopulation of the rural poor from seeking care (Liu *et al*., 2012a, Wang *et al*., 2012b, Wang *et al*., 2012c, Zhou *et al*., 2011). In terms of outpatient care, scholars argued that the NCMS increased the use of outpatient care among the poor at village clinics, whereas the increased use in

inpatient care overall and at the higher level health facilities was concentrated disproportionately among the rich (Wang *et al*., 2012a). Liu *et al*.(2012c) and Yu *et al*.(2010) also found that the NCMS only increased the use of inpatient care for the better-off, whereas it had no significant impact on outpatient use.

While this previous work is important, the investigation on how the NCMS impacts the inequity in health use is subjected to very little updated empirical research, which is the setting for this paper. Previous studies either limit their investigations to a given point in time (Mou *et al*., 2009, Wang *et al*., 2012c, Wang *et al*., 2012a), or a specific health service (Zhou *et al*., 2011). Little information is available on how the NCMS impacts the use of preventive care and folk doctor care in different socioeconomic groups, although the impact of the NCMS on inpatient use has discussed in a number of studies(Babiarz *et al*., 2012). Further, the NCMS was implemented one decade ago, but it is still not clear whether the scheme has any impact on utilisation. If it were, as the reimbursement rates of the NCMS are set at different levels for different services, it is worth investigating how it affects the patterns of utilisation for different socioeconomic groups, and whether differential pattern in use for different socioeconomic groups is a generalised phenomenon, or is only for some services.

I hypothesize that the expansion of the NCMS does not necessarily lead to equitable access to care. The launch of the NCMS is a means of improving the equitable access to formal care and discouraging the use of informal care/folk doctor care. Folk doctor care is not covered by the insurance scheme, whereas outpatient and inpatient care are included in the insurance package. Since the reimbursement rate set for formal care is relatively low, co-payments is likely to become one of the barriers to impede access to formal care among the poor. The NCMS may have positive impacts on reducing the use of informal care; however, these impacts may be limited since unmet health need may still lead to use of informal care, which is less costly and widely accessible compared with formal care. Second, the NCMS may also exert some positive influences on use of preventive care, which historically requires more cost-sharing and is now partially covered by the NCMS (e.g. general physical examination, blood pressure screening, and prenatal examination). As the

co-payments are still high, preventive care use may still appear to be concentrated among the rich, but the level of inequity may become less pronounced.

This paper measures the extent to which the NCMS affects healthcare utilisation on the rural population in China, considering two types of formal healthcare (outpatient care and prevention care), and one type of informal healthcare (folk doctor care). This paper first compares the magnitude of inequities in health use in 2004 (before the national rollout of NCMS) and 2009 (after the expansion of NCMS across the rural China). The Concentration Indices for utilisation, which compares the cumulative distribution of health use with the cumulative distribution of the population ranked by individual wealth, is used (O'Donnell *et al*., 2008b, Kakwani *et al*., 1997). It then investigates the determinants of patterns of healthcare use and the characteristics of the users for different services, taking into account the contribution of the NCMS to equity in health use. Data are drawn from China Health and Nutrition Survey 2004 and 2009.

The subsequent sections discuss methods, study results, policy implications and conclusions.

4.2 Methods

4.2.1 Data source and variable specifications

This chapter uses the CHNS. Please refer to Chapter 1 Section 1.5.1 for a detailed description of the dataset. The waves used in this study are 2004 and 2009. CHNS is a representative sample for population dwelling in the surveyed provinces. The rural sample totals 5,361 observations in 2004 and 5,232 observations in 2009. The analysis included 4,351 observations in 2004 and 3,919 observations in 2009 after dropping observations under 18 and with missing data.

Dependent variables

Formal (outpatient care, prevention care) and informal healthcare use (folk doctor care) are analysed for the likelihood of a visit (no visits versus one or more visits). Specific questions are as follows: for outpatient care variable, respondents were asked: “Have you sought outpatient care during the past 4 weeks? 0 No, 1 Yes, and 9

Unknown". For the prevention care variable, respondents were asked: "During the past 4 weeks, did you receive any preventive health service, such as health examination, eye examination, blood test, blood pressure screening, tumour screening? 0 No, 1 Yes, and 9 Unknown". For the folk doctor care variable, respondents were asked: "Did you visit a folk doctor last year? 0 No, 1 Yes, and 9 Unknown". In terms of missing variables for health variables, there is no missing value for outpatient use and preventive care use (binary variable). There were 33 missing values in 2004 and 1 missing value in 2009 with regard to the question of folk doctor use. This missingness is a tiny fraction (0.0046%) of the total sample (N = 8720), which can be considered as in the error term.

Independent variables

Per capita income data are used as the measurement of living standard. Please refer to Section 3.2 for how per capita income is calculated. Need variables are age, split into four categories (18 to 29, 30 to 44, 45 to 64, and 65 and above), gender, and morbidity types split into two categories (major illness, minor illness and others) (Hernandez Quevedo and Jimenez Rubio, 2009, Gravelle *et al*., 2006). Need variables are also measured by asking whether the respondent has been ill or injured during the past 4 weeks.

Non-need/socioeconomic variables included are education, occupations, marital status, insurance types, urban/rural residency, and provinces of residency. Education is categorized into four groups: no education, primary and secondary education, high school and technical school education, and university education and above. University education and above is used as the reference group. Occupations are categorized into four groups: white collars/professionals, unskilled workers/agricultures, unemployed, and other. For the province variable, province Guizhou is set as the reference group. Whether the respondent is classed as urban or rural is based on his/her registration status (*Hukou*). Finally, insurance coverage is included as a non-need/socioeconomic variable.

The CHNS did not distinguish between old CMS and the current NCMS before wave 2009, although the NCMS was initiated in 2003. It initially creates difficulties for the analysis because it is difficult to know whether the person is enrolled in the new

scheme (the NCMS) or the old one (the CMS). Luckily, confidential data from the community level from the CHNS is available. In the community level questionnaire, government officials from each community was asked whether the CMS had been implemented in their community, and if so, starting date was asked. Knowing that NCMS was first implemented in 2003, it was clear that the communities joined the rural cooperative scheme after 2003 were actually covered by the NCMS. After distinguishing between the old CMS and the current NCMS at the community level, it is easy to make the same distinction at the individual level. If an individual reports participating in the CMS and is at the same time living in a community that has participated in the NCMS, we define this individual as having participated in the NCMS. Similarly, if an individual reports participating in the CMS and is at the same time living in a community that has participated in the CMS, we define this individual as having participated in the old CMS. The same strategy for identifying the NCMS participants from the CHNS data was adopted by Lei and Lin (Lei and Lin, 2009).

A summary of dependent and independent variables are listed in Table 4.1.

Table 4.1 Descriptive statistics for the study population (mean/standard deviation)

Variable	Definition	2004 (N = 4351) Mean	S.D.	2009 (N = 3919) Mean	S.D.
Health use variables					
Outpatient use	Dummy variable: 1, outpatient use ; 0 otherwise	0.111	0.314	0.116	0.320
Folk doctor use	Dummy variable: 1, folk doctor use ; 0 otherwise	0.033	0.179	0.050	0.218
Preventive care use	Dummy variable: 1, Preventive care use ; 0 otherwise	0.030	0.170	0.035	0.184
Health needs variables					
18-29 (Ref)	Dummy variable: 1, aged between 18-29; 0 otherwise.	0.122	0.328	0.098	0.297
30-44	Dummy variable: 1, aged between 30-44; 0 otherwise.	0.333	0.471	0.310	0.462
45-64	Dummy variable: 1, aged between 45-64; 0 otherwise.	0.447	0.497	0.469	0.499
65 and above	Dummy variable: 1, aged between 65 and above; 0 otherwise.	0.097	0.296	0.124	0.329
Gender (Ref = male)	Dummy variable: 1, male; 0 female	0.499	0.500	0.506	0.500

No symptoms	Dummy variable: 1, no symtons ; 0 otherwise	0.784	0.412	0.801	0.400
Minor Illness	Dummy variable: 1, minor illness ; 0 otherwise	0.152	0.359	0.137	0.344
Major illness (Ref)	Dummy variable: 1, major illness ; 0 otherwise	0.064	0.245	0.062	0.242
4 week illness	Dummy variable: 1, having been illness for the past 4 weeks ; 0 otherwise	0.153	0.360	0.148	0.355
Socioeconomic variables					
Per capita income	Per capita household income inflated to 2009	4787.057	5004.990	9996.772	11817.190
No insurance (Ref)	Dummy variable: 1, no insurance ; 0 otherwise	0.888	0.315	0.067	0.250
NCMS	Dummy variable: 1, NCMS ; 0 otherwise	0.041	0.197	0.875	0.331
Marital Status	Dummy variable: 1 married, 0 otherwise	0.874	0.332	0.883	0.321
White collar/skilled (Ref)	Dummy variable: 1 white collar or skilled worker, 0 otherwise	0.065	0.246	0.072	0.258
Unskilled/farmer	Dummy variable: 1 unskilled worker or farmer, 0 otherwise	0.617	0.486	0.691	0.462
Other job	Dummy variable: 1 other jobs, 0 otherwise	0.021	0.143	0.029	0.169
Unemployed	Dummy variable: 1 Unemployed, 0 otherwise	0.225	0.418	0.207	0.405
No edu	Dummy variable: 1 no education; 0 otherwise	0.216	0.412	0.240	0.427
Pri and sec edu	Dummy variable: 1 primary and secondary education; 0 otherwise	0.628	0.483	0.604	0.489
High school	Dummy variable: 1 high school and technical school education; 0 otherwise	0.139	0.346	0.128	0.334
Uni and above (Ref)	Dummy variable: 1 university education and above; 0 otherwise	0.017	0.129	0.028	0.164
Province Liaoning	Dummy variable: 1 Liaoning, 0 otherwise	0.123	0.329	0.119	0.323
Province Heilongjiang	Dummy variable: 1 Heilongjiang, 0 otherwise	0.099	0.299	0.110	0.312
Province Jiangsu	Dummy variable: 1 Jiangsu, 0 otherwise	0.126	0.332	0.121	0.326
Province Shandong	Dummy variable: 1 Shandong, 0 otherwise	0.108	0.310	0.111	0.315
Province Henan	Dummy variable: 1 Henan, 0 otherwise	0.099	0.298	0.100	0.300
Province Hubei	Dummy variable: 1 Hubei, 0 otherwise	0.103	0.304	0.107	0.310
Province Hunan	Dummy variable: 1 Hunan, 0 otherwise	0.085	0.279	0.090	0.286
Province Guangxi	Dummy variable: 1 Guangxi, 0 otherwise	0.124	0.330	0.133	0.339
Province Guizhou (Ref)	Dummy variable: 1 Guizhou, 0 otherwise	0.132	0.339	0.110	0.312

Note: Ref = reference groups. Per capita household income is inflated to year 2009 using consumer price index.

4.3.2 Statistical analysis

Income-related inequity in health is estimated by pooled Probit Model and well-established methods based on the Concentration Indices (Hernandez Quevedo and Jimenez Rubio, 2009, O'Donnell *et al*., 2008b). The methods used in this chapter are similar with the ones used in the previous chapter. The methods involve three basic steps: (1) estimate pooled Probit Models on the determinants of health use, and predict need (indirectly) standardized health for each health variable, and for each year separately; the computation of variance inflation factors (VIF) indicates that multicollinearity is not a problem. Ramsy RESET tests are performed, and results show the models have no specification problems; (2) calculate the Concentration Indices for actual use EI (the inequity driven by the actual healthcare utilisation), the horizontal equity indices HI (the inequity driven by socioeconomic factors); (3) decompose the socioeconomic factors that contribute to the inequities for the each year to see whether contributions have changed over time.

Again, the nature of the health use variables (binary variables) formally calls for a non-linear estimation, but for the purpose of convenience and consistency, this study uses Linear Probability Model (LPM) to calculate the Concentration Indices and Decomposition Analysis (please refer to Section 3.2 for the detailed explanation of why LPM is chosen instead of using Probit Modelling for the analysis). Erreygers's Concentration Index will be used to calculate the inequity in health use (Erreygers, 2009, Wagstaff, 2009a, Costa-Font and Gil, 2008, Van de Poel *et al*., 2007).

Need standardisation, Concentration Indices, and Decomposition Analysis

Equitable distribution of health is a principle used in many legislation or official policy documents in many countries. Attention has been given to the horizontal equity principle, which is defined as "equal treatment for equal medical needs, irrespective of other characteristics such as income, race, place of residence, etc" (O'Donnell *et al*., 2008b). In practice, in order to examine the extent to which the horizontal equity principle is violated, we need to observe differential utilization patterns across individual with different states of need. This can be done in much the same way as the standardization methods used in Paper 1, Section 3.2.2. Specifically, if we are interested in establishing whether there is differential utilization by income after standardizing for health need in relation to income, we can use expected

utilization, given characteristics such as age, gender, and measures of health status, as a proxy for health need. Using equation (1) in Section 3.2.2,

(1) $y_i = \alpha + \sum_j \beta_j x_{ji} + \sum_k \gamma_k z_{zi} + \varepsilon_i$

we assume that x_j are the health need variables, i.e., age, sex and other health status variables, z_k are non-need/socioeconomic variables, i.e., (the logarithm of) income, education, job status, provinces of residence, urban/rural, ,marital status, $\alpha, \beta,$ and γ are the parameter vectors, and ε is the error term.

The coefficients from OLS estimations are obtained from actual values of the x_j variables, which are to be standardized for, and from the sample mean for z_k variables, which are not to be standardized, but to be controlled for. The predicted values of health indicator $\hat{y}_i^x$ are then obtained.

(2) $\hat{y}_i^X = \hat{\alpha} + \sum_j \hat{\beta}_j x_{ji} + \sum_k \hat{\gamma}_k \bar{z}_{zi}$

Assuming a linear model, estimates of indirectly standardized health $\hat{y}_i^{IS}$ can be obtained by calculating the difference between actual health (y_i) and standardized health ($\hat{y}_i^X$), plus the sample mean ($\bar{y}$)

(3) $\hat{y}_i^{IS} = y_i - \hat{y}_i^X + \bar{y}$

Rearranging the equation (3),

(4) $\hat{y}_i^{IS} = y_i - \sum_j \hat{\beta}_j (x_{ji} - \bar{x}_j)$

The results generated by Equation (4) shows the standardization that subtracts the variation of health use driven by health need factors from actual health use. Therefore, the distribution of health use across income can be interpreted as the health use that an individual would expect to be observed, irrespective of differences in the distribution of the characteristics associated with health needs. Erregyers's

Concentration Indices and Decomposition Analysis are carried out following the standardization.

4.3 Empirical results

4.3.1 Descriptive statistics

Some differences in healthcare use are observed across years. Table 4.1 compares the share of healthcare use by years. Results show that the use of outpatient care remained the same between 2004 and 2009, while the use of folk doctor care had increased and the use of preventive care had decreased from 2004 to 2009.

A significant increase in insurance coverage is observed. In 2004, 88.8% of the rural Chinese were not covered by any insurance; the percentage decreased to 6.7% in 2009. In the meantime, a significant increase in terms of the coverage of NCMS was observed from 2004 to 2009. In 2004, only 4.0% of the rural Chinese were covered by NCMS, the percentage increased to 87.5% in 2009.

4.3.2 Determinats of individual healthcare use

Table 4.2 presents the the estimations of the determinants: the maximum-liklihood marginal effects of Probit Model.

Results of the Probit regiression (Table 4.2) suggest that, *ceteris paribus*, the use of outpatient care is found to be associated with need factors and place of residence. Female, those who are with major illness or have been ill or injuried for the past 4 weeks are more likely to use outpatient care. Folk doctor care is associated with people aged 30 and above, as well as people with major illness. It is also worth pointing out that those who are covered by the NCMS and other insurance are less likely to use folk doctor care compared with the unsured.

In terms of preventive care, income is significantly associated with the use of preventive care. Unskilled and agricultural workers are less likely to use preventive care compared with white collars and skill workers. People with no education, primary and secondary education, and high school education are less likely to use

preventive care compared with people with university education or above. No siginificant assocation is observed in terms of the NCMS and preventive care use.

Table 4.2 Determinants of health service use (Random effect probit and pooled probit models)

	Outpatient care		Folk doctor care		Preventive care	
	Random effect Probit	Pooled probit	Random effect Probit	Pooled probit	Random effect Probit	Pooled probit
30-44	0.014	0.011	0.371***	0.36***	-0.124	-0.124
45-64	0.068	0.064	0.332***	0.323***	-0.239**	-0.239**
65 and above	0.138	0.129	0.422***	0.409***	-0.179	-0.179
Gender (1 = male)	-0.151**	-0.14**	-0.018	-0.016	-0.134**	-0.134*
No symptoms	-2.538***	-2.409***	-0.493***	-0.479***	-0.565***	-0.565***
Minor Illness	0.005	-0.002	-0.118	-0.116	-0.3**	-0.3**
4 week illness	0.76***	0.719***	0.213**	0.207*	0.276**	0.276**
Per capita income (lg)	0.048	0.045	-0.004	-0.005	0.073	0.073*
NCMS	-0.003	0.004	-0.228*	-0.22**	0.134	0.134
Marital Status (1 = married)	0.012	0.015	0.09	0.087	0.129	0.129
Unskilled and agriculture	-0.157	-0.145	0.108	0.106	-0.258*	-0.258**
Other job	-0.129	-0.112	-0.085	-0.082	-0.192	-0.192
Unemployed	-0.217	-0.201	0.209	0.205	-0.044	-0.044
No edu	-0.145	-0.14	0.248	0.242	-0.428	-0.428
Pri and sec edu	-0.104	-0.101	0.157	0.153	-0.348	-0.348
High school	-0.319	-0.303	0.165	0.163	-0.334	-0.334
Province Liaoning	-0.268*	-0.252*	-0.449***	-0.436***	0.027	0.027
Province Heilongjiang	-0.222	-0.212	-0.937***	-0.908***	-0.332	-0.332
Province Jiangsu	0.072	0.069	-0.471***	-0.455***	0.705***	0.705***
Province Shandong	0.115	0.107	-0.056	-0.054	0.5***	0.5***
Province Henan	0.343**	0.326***	0.079	0.077	0.157	0.157
Province Hubei	0.092	0.086	-0.521***	-0.504***	0.51***	0.51***
Province Hunan	-0.134	-0.13	-0.145	-0.14	0.017	0.017
Province Guangxi	0.255**	0.243**	0.135	0.131	0.279*	0.279*
2009	0.161	0.147	0.413***	0.4***	-0.033	-0.033
Constant	-0.684	-0.639	-2.027***	-1.962***	-1.946***	-1.947***
N	8270	8270	8270	8270	8270	8270
Wald Chi2	155.93	1596.86	141.48	216.84	154.27	191.75
Prob > chi2	0	0	0	0	0	
Pseudo R2		0.5929		0.0987		0.101

Note: Reference groups are indicated in Table 4.2. Per capita household income is inflated to year 2009 using consumer price index.

4.4.3 Equity in healthcare use

Table 4.3 provides need-adjusted and unadjusted health use by income quintiles. Table 4.4 shows the results of the Erreygers's Concentration Index (EI). For each healthcare type, the table provides an index of socioeconomic inequity in use (EI), indicating the level of inequity of actual health use, and horizontal inequity (HI), indicating the level of inequity driven only by individual's socioeconomic status. Confidence intervals are calculated using bootstrapping methods.

Table 4.3 shows the prevalence of healthcare use by income quintiles with adjusted and unadjusted needs by years. Outpatient care is equally distributed among all income groups in 2004 and 2009. However, the use of folk doctor is more concentrated among the low income groups, and the use of preventive care is more concentrated among the high income groups, even after controlling for needs.

Table 4.3 Health service use by income quintiles (Linear Probability Model)

			Poorest	2nd poorest	Middle	2nd richest	Richest
Outpatient use	2004	**Unadjusted**	11.85%	10.58%	9.62%	10.78%	12.09%
		Need-adjusted	11.33%	10.98%	10.10%	11.74%	12.05%
	2009	**Unadjusted**	12.42%	10.73%	10.98%	10.63%	12.46%
		Need-adjusted	11.24%	11.14%	11.61%	10.81%	10.81%
Folk doctor use	2004	**Unadjusted**	3.96%	4.16%	4.19%	2.78%	1.93%
		Need-adjusted	3.59%	3.91%	3.95%	2.62%	1.70%
	2009	**Unadjusted**	5.86%	7.43%	3.87%	4.51%	3.77%
		Need-adjusted	5.32%	7.12%	3.65%	4.38%	3.31%
Preventive care use	2004	**Unadjusted**	1.50%	2.21%	2.30%	3.22%	5.72%
		Need-adjusted	1.48%	2.39%	2.51%	3.36%	5.69%
	2009	**Unadjusted**	1.99%	2.69%	3.69%	3.79%	5.29%
		Need-adjusted	2.03%	2.88%	3.90%	4.11%	5.25%

In terms of the inequity indices, a favouring-poor inequity is observed for outpatient care; however, both indices are not significant at 0.05 significant level. This means that there is not any inequity in term of outpatient use across income groups because the indices are not different from 0.

However, favouring-poor inequities are seen across income groups for folk doctor use. Both the EI and HI indices show that the level of inequities has increased from 2004 to 2009. All indices are significant at 0.05 significant level. This means that the poor are more likely to visit folk doctor compared with the better-off, and the inequity effects have increased.

In terms of preventive care, a favouring-rich inequity is observed for both 2004 and 2009. However, it is worth pointing out that EI for preventive care was 0.032 in 2004 and 0.025 in 2009; HI were 0.032 in 2004 and 0.025 in 2009. However, the indices for HI are similar to EI, meaning that most of the inequities were driven by socioeconomic factors. However, by looking at the confidence interval, there is almost no significant difference between the index of 2004 and that of 2009. Hence, it should be concluded that the inequity level of preventive care use remain the same across the reform period.

Table 4.4 Socioeconomic Concentration Indices by Linear Probability Model (Erreygers's Concentration Index)

		2004	**2009**
Outpatient care	EI	0.001	-0.001
	Confidence Interval	(-0.022, 0.024)	(-0.025, 0.023)
	HI	0.006	-0.004
	Confidence Interval	(-0.011, 0.022)	(-0.02, 0.012)
Folk doctor care	EI	-0.018	-0.024
	Confidence Interval	(-0.031, -0.006)	(-0.041, -0.006)
	HI	-0.017	-0.022
	Confidence Interval	(-0.029, -0.004)	(-0.04, -0.005)
Preventive care	EI	0.032	0.025
	Confidence Interval	(0.019, 0.044)	(0.013, 0.038)
	HI	0.032	0.025
	Confidence Interval	(0.019, 0.044)	(0.013, 0.038)

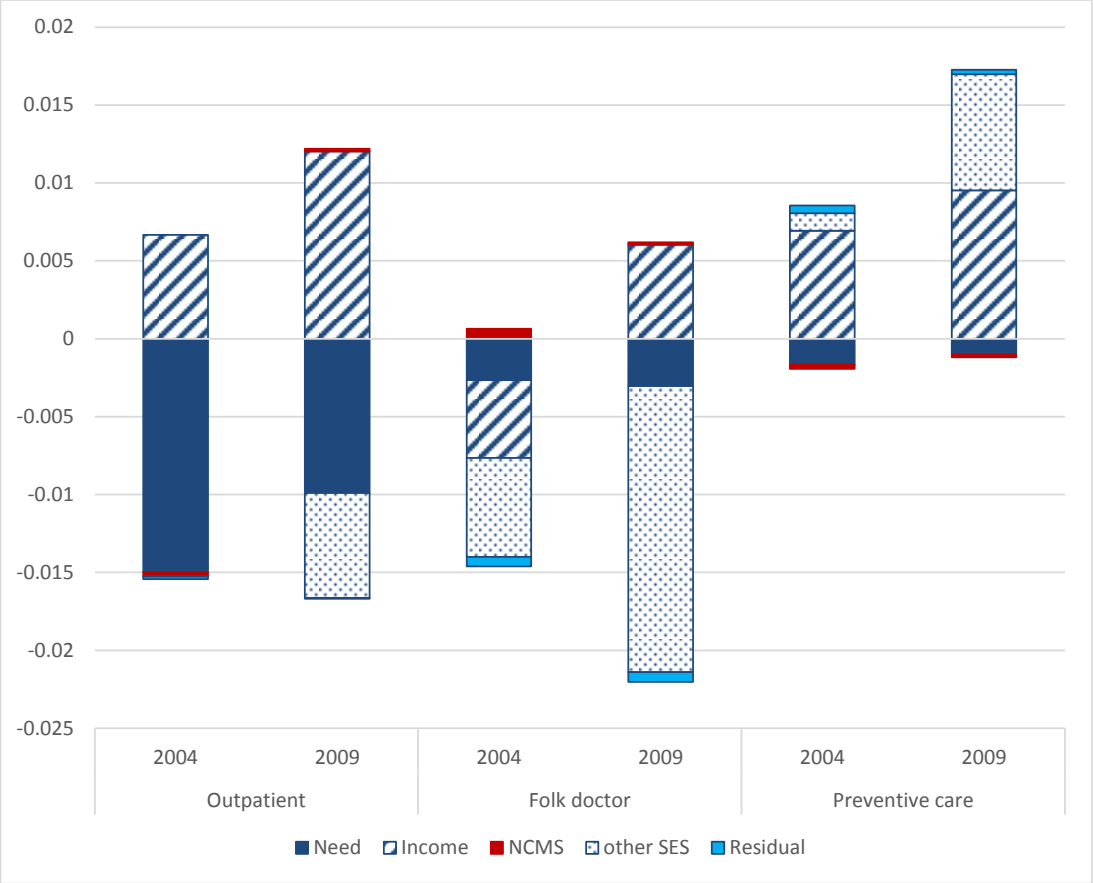
Note: EI represents Inequity Indices for actual use, HI represents Horizontal Inequity. Confidence interval is set at 0.05 significance level.

4.4.4 Decomposition analysis

Figure 4.1 presents the results of the decomposition analysis, depicting the contribution of income-related health inequity from both need and socioeconomic factors.

Results from decomposition analysis confirm with the previous findings. In general, inequities in health use, i.e. folk doctor care and preventive care, were mostly driven by non-need or socioeconomic factors. For folk doctor care, those with lower socioeconomic status were more likely to seek folk doctor care compared with the rich. For preventive care, those with higher socioeconomic status were more likely to seek folk doctor care compared with the rich. The contribution of NCMS to reduce the inequities in health care use was limited.

Figure 4.1 Components of Erreygers's Concentration Indices in the probability of health service use (Linear Probability Model)



Note: LPM is used as the regression model in the decomposition analysis. Results from Probit modelling does not differ much from LPM.

4.4 Discussion and conclusion

The study reveals a mixed picture in terms of the variation of healthcare utilisation and how the NCMS has influenced the level of inequity. Although the data used in this study represent only two points in time, it covers the whole period of the expansion of the NCMS from 2004 (before the national rollout of NCMS) and 2009 (after the expansion of NCMS across the rural China). The study finds that the level of inequity remains the same for outpatient care. In terms of preventive care, a pro-rich inequity was observed both in 2004 and 2009, and the level of inequity had remained the same throughout the study period. However, a widening gap between the poor and the rich in terms of folk doctor use is observed, with the poor being more likely to use these services.

Decomposition analysis shows that the NCMS reduces income-related health inequity in folk doctor care and preventive care, but the contribution is rather limited. Other socioeconomic factors including income have contributed positively to inequity in health use.

The findings are consistent with some of the previous research. Zhou *et al*.(2011) suggested that inpatient care use was concentrated among the better-off, but the inequity indices decreased from 0.224 in 2003 to 0.115 in 2008. In terms of outpatient care use for mid-aged and elderly people, Wang *et al*. (2012c) found that in more affluent provinces like Zhejiang, outpatient use was concentrated among the better-off, while in provinces with low economic development, such as Gansu, use of healthcare was equally distributed across income groups. The study also suggested that this may be because of the difference in terms of healthcare provision and coverage of insurance between these two provinces. In terms of folk doctor care, the growing inequity between the rich and the poor is troubling, and such a problem is particularly severe for low income groups. Similar findings were demonstrated in studies conducted in other developing countries. These studies suggested that demand of lower social classes for care was highly price-elastic and usually exceeded that of the rich (James *et al*., 2006, Pokhrel *et al*., 2005, Sauerborn *et al*., 1994). Hence, the poor were more likely to use more informal and less qualified providers, or resorted to self-treatment when they were ill (Okeke and Okeibunor, 2010).

To compare the level of inequity in health use of China with other countries, Van de Poel *et al*.(2012b) showed that the Erregyers' Concentration Indices of all healthcare use was 0.1 in India, 0.018 in Malaysia and 0.018 in Bangladesh, which seemed comparable with the indices from China. This suggested that, in a comparative sense, China was in a similar level of equity in health utilisation as other low- and middle-income countries.

The study has a few policy implications. The extension of the NCMS coverage reduces inequitable access in formal care, but does not eliminate them. One important constraint of the NCMS is the low reimbursement rate and the high co-payment at visit. Reported average reimbursement rate for outpatient care under the NCMS was only approximately 10% (Barber and Yao, 2011); it is argued that even though OOP payments for outpatient care may be easy to cope with in a short term, a large amount of outpatient costs in aggregate may still be excessively high from a social standpoint and may have substantial effects on household (Shahrawat and Rao, 2012). Similarly, the use of preventive care is unequally distributed and related to the unequal distribution of income level. A more comprehensive coverage in terms of outpatient care and preventive care is needed because outpatient care is the most commonly used for effective and efficient treatment for many health problems, especially chronic diseases, and preventive care is equally important in terms of allowing for early detection of diseases.

The NCMS aimed to achieve equity in the contribution through co-payments regardless of income levels of the participants; however, among the NCMS participants, there existed a wide gap in financial status. Low income participants are already burdened with a premium, while substantial co-payments due to the limited coverage further aggravate HI in healthcare access (Zhang *et al*., 2010a). A possible solution is to implement well-designed and regulated health insurance with comprehensive coverage to provide the low income participants with better financial protection. Successful examples include Universal Coverage Scheme of Thailand and *Seguro Popular* of Mexico for the poor and uninsured (Somkotra and Lagrada, 2008, Li *et al*., 2011, Knaul and Frenk, 2005).

The study has a few limitations. The first concern is the dataset. As mentioned in Chapter 3, only nine provinces are included; hence, any further generalization should be made with caution. As all the survey information is self-reported, this can be biased because of problems in reporting (e.g. inaccurate recall, misreporting). Second, the difference between what is officially called informal care and what happens in practice needs further refinement in future studies. In this dataset, all informal care providers are evaluated at the same standard, and are specified as "folk doctor care"; however, it is possible that folk doctor use may relate to the use of traditional Chinese medicines and healer, which are widely accepted and even recommended in some medical settings (Harmsworth and Lewith, 2001, Howes and Houghton, 2003, Xu *et al*., 2006). Therefore, the dataset needs further refinement in the definition of folk doctor care in order to make inference on equity of use.

5 Catastrophic health payments and health payment-induced poverty

Catastrophic outpatient health payments and health payment-induced poverty under China's New Rural Cooperative Medical Scheme[8]

Abstract

The Chinese government initiated a government-subsidised voluntary insurance programme for its rural population in 2003—the NCMS. The main objective of the programme is to provide the rural Chinese population with financial protection against health risks and to improve equity and access to healthcare in rural China. The NCMS started to partly reimburse catastrophic outpatient care in 2007 but rural Chinese households still incur substantial OOP payments. These payments are likely to disrupt the material living standards of the household, and in extreme cases, lead to health payment-induced poverty. This paper seeks to examine the impacts of the NCMS on catastrophic health payment and health payment-induced poverty in outpatient care by comparing the differences of health payments before and after the NCMS reimbursement. Using an individual level dataset of 1,846 rural Chinese households—China Health and Nutrition Survey of 2009, this paper measures OOP payments by using two threshold approaches, one requiring that payments do not exceed a pre-specified proportion of income, the other requiring that payments do not drive households into poverty. Concentration Indices are adapted to measure the extent to which health payments are distributed across income groups. The study finds that the NCMS has limited effects on reducing the likelihood of catastrophic payments or health payment-induced poverty. The economic burden of OOP payments for healthcare is concentrated disproportionately among the less wealthy households. The study concludes that a heavy burden of OOP payment has become a poverty trap for poor households; hence calling for a more comprehensive and effective insurance package.

[8] This chapter is based upon a paper that is under review by *Applied Economic Perspectives & Policy*.

5.1 Introduction

In most low- and middle-income countries with relatively limited healthcare cost prepayment mechanisms, e.g. health insurance, healthcare financing still largely relies on direct payments, often known as OOP payments. OOP payments have a few main economic consequences. They may impede people from receiving the care they need or encourage them to postpone the use of care; when the payments increase to a particular level, they may become a source of financial hardship that forces individuals or households to cut back their daily expenses and consumption, sell assets, or, worst of all, trap them in long-term debt (Kavosi *et al*., 2012, Van Doorslaer *et al*., 2007). Such direct costs are defined as "catastrophic" if they "exceed some fraction of household income or total expenditure in a given period" (O'Donnell *et al*., 2008b, Wagstaff and Lindelow, 2008, Kavosi *et al*., 2012, Pradhan and Prescott, 2002, Xu *et al*., 2007a, Van Doorslaer *et al*., 2007).

Catastrophic payment is a global problem—150 million people face financial catastrophe each year because of OOP payments, among whom approximately 90% live in low-income countries (Xu *et al*., 2007a, Shahrawat and Rao, 2012). China, just like its Southeast Asian counterparts—India and Vietnam, has a high burden of OOP payments. OOP payments for healthcare increased from 21.65% in 1982 to 39.81% in 1992, and to 57.72% in 2002. In a 2008 National Health Survey, average per episode cost for an inpatient visit involved OOP payments equivalent to approximately 52.69% of annual per capita household expenditure (Centre for health and information, 2008). Consequently, an increasing number of the Chinese population cannot afford healthcare services. In 1993, around 5.2% of the Chinese people reported that they could not afford outpatient care when they were sick. This percentage increased to 13.8% in 1998 and to 18.7% in 2008 (Gu, 2008).

As argued by many health economists, OOP payments are the most inequitable source of health financing. One concept of fairness in health financing is that households should be protected from economic burdens of illness, and the risks of such burdens should be shared by the society (Wagstaff, 2007b, Somkotra and Lagrada, 2008). Several developing countries, such as Thailand, Iran and India, have

introduced government-subsidised social health insurance programmes to ensure equitable healthcare financing. While in some countries, insurance yields compelling results (Somkotra and Lagrada, 2008, Tangcharoensathien *et al*., 2007), in others, the effectiveness of these programmes in achieving equitable financing is unclear (Shahrawat and Rao, 2012).

In China in 2003, the New Rural Cooperative Medical Scheme (NCMS) was launched in response to the dismantling of the old Cooperative Medical Scheme (CMS) in the 1980s and the dire health needs of the rural population. The launch of the programme represents a major step of the Chinese government to move towards a more equitable and efficient rural health financing system. The NCMS is a voluntary health insurance program subsidised by the central government and administered by county-level governments. The main objective of NCMS is to provide financial protection and to improve equity and access to healthcare to the rural population regardless of individual characteristics such as gender, job status, education, pre-existing conditions, and level of wealth. According to the 2012 Report on the work of the Chinese Government, the scheme had covered 832 million rural residents, or 97.5% of Chinese farmers by 2012; government contributions to insurance premiums increased from 10RMB (US$1.21) in 2003 to 240RMB(US$30.02) in 2012; and insurance packages expanded from covering mainly catastrophic illness to outpatient and preventive care (Xinhua, 2012b).

Despite its rapid expansion, studies thus far have yielded mixed reviews of the performance of the NCMS around a number of key criteria. Scholars have argued that the NCMS was not able to provide adequate financial protections for rural households, and thus called for a more generous package . A 2004 WHO report suggested that the NCMS overly emphasized medical catastrophe at the expense of the health needs of the majority of the rural population because the number of farmers falling into poverty due to medical expenses was likely to be small (World Health Organization, 2004b). The NCMS may also inflate medical costs at lower levels of health services hierarchy that tend to over-prescribe for patients covered by NCMS (Sun *et al*., 2009a, Sun *et al*., 2009b).

However, findings are not always consistent; other scholars praised the achievements of the scheme. Wagstaff *et al*. (2009a) reported a decrease in medical expenditure after the introduction of the NCMS for those covered by the NCMS. Tan and Zhong (2010) and Babiarz *et al*.(2012) found that the NCMS successfully lowered OOP payment levels and protected households against financial risks by reducing the spending by patients with catastrophic illness. Zhang *et al*.(2010a) also suggested that in terms of inpatient care, the NCMS helped relieve the financial burden on the household, especially those who were in low income groups.

Although previous work has started to build a picture of the effectiveness of the NCMS in reducing OOP payments, current understanding of the true effects of NCMS on the costs of healthcare in rural areas remains limited. For instance, the NCMS was originally designed to cover catastrophic inpatient care, but by 2007, most counties had expanded the benefit package beyond inpatient care to outpatient services (Babiarz *et al*., 2010). However, almost none of the existing studies have empirically assessed the impacts of NCMS on outpatient care, which is considered the most frequently used and accessible healthcare source in rural China. Second, although under the current rural health system, patients are able to seek care in any health facility, many counties encourage local spending by lowering minimum spending levels or by offering higher reimbursement rates at local facilities, such as village clinics and township health centres (Babiarz *et al*., 2012, Brown and Theoharides, 2009). Previous studies tend not to perform analysis on aggregated costs at different levels of health facilities, even though reimbursement rates are set differently at different health facilities, and this may lead to inaccurate estimations (Sun *et al*., 2009a, Ma *et al*., 2012).

In terms of methodology, existing studies mainly focus their investigations on absolute reduction of OOP payments, whereas the investigation of payments-to-income ratio is largely limited (Babiarz *et al*., 2012, Babiarz *et al*., 2010, Lei and Lin, 2009). Consider two households with the same level of OOP payments. If one household has a high household income, whereas the other is below the poverty line, the impact of OOP payments on these two households cannot be sufficiently reflected in the actual amount of OOP payments, which is the same for the both households. Paying for healthcare has for too long been taken as synonymous with

willingness and ATP, but little is known on how much the OOP payments for healthcare have placed a burden on less wealthy households, and how well the NCMS is able to protect severely economically constrained households. The investigation of the effectiveness of insurance in reducing health payment-induced poverty should have a more prominent place in policy evaluations. OOP payments for healthcare may drive households into poverty, or deepen the poverty gap for those who are already poor (Whitehead *et al*., 2001, Kavosi *et al*., 2012, Shahrawat and Rao, 2012, Werner, 2009). Such an investigation is of significant importance in the context of China where ill health has already become one of the leading causes of household impoverishment (Whitehead *et al*., 2001).

This study seeks to answer a few salient research questions related to the effectiveness of the NCMS on reducing catastrophic outpatient costs. Using an individual level dataset – China Health and Nutrition Survey 2009, this paper measures outpatient payments by using two threshold approaches, one requiring that the payments do not exceed a pre-specified proportion of income, the other requiring that the payments do not drive households into poverty. Specifically, this paper compares the differences in the incidence and severity of catastrophic health payments and health payment-induced poverty in outpatient care before and after the introduction of NCMS reimbursements. Concentration Indices are used to measure the distribution sensitivity of catastrophic payments (O'Donnell *et al*., 2008b). This study assesses households having at least one member with a chronic condition, and care being sought at village and township level heath facilities.

The empirical results derived from this study are expected to provide valuable insights for policy makers. In particular, I am concerned that the actual outcomes of the NCMS may be contrary to the stated objectives of the insurance scheme. Although the NCMS has extended its package to outpatient care, its benefit package is far from comprehensive. The NCMS still requires substantial contributions through private financing from individuals, via OOP payments. Given that outpatient care has proven to be expensive, with low reimbursement rates, such costs may pose obvious threats to households. The empirical results show that the incidence and severity of catastrophic health payments and health payment-induced poverty remain almost constant after the insurance reimbursements were made. Second, while there

exists a wide gap in health needs as well as financial status among the NCMS participants, the scheme requires the same premium to be paid, and offers the same benefit package to all participants. The effects of the NCMS on reducing inequity in catastrophic payments and health payment-induced poverty will therefore be limited. Empirical results confirm that OOP payments are concentrated disproportionately among the poor and those with greater health needs because their abilities to secure health services are weaker compared with the rich, and they are not entitled to additional insurance benefits.

In the subsequent sections, a background of the NCMS and outpatient care is provided, followed by methods, results, and a discussion of the results and policy implications.

5.2 NCMS and catastrophic outpatient service

With a low level of government subsidization, the NCMS initially was primarily a high-deductible insurance plan that covered catastrophic illness; rural residents with low risks had little incentive to subscribe (World Health Organization, 2004b). The program has since become more comprehensive: since 2007 coverage has expanded from mainly catastrophic illnesses to outpatient care (Xinhua, 2012b). Two main categories of catastrophic outpatient care are eligible for reimbursement. These include general chronic conditions and severe chronic conditions that require specialist care (Table 5.1). Although the reimbursement rate varies in different provinces, the central government set 30% as the minimum threshold that should be reimbursed by the NCMS for chronic outpatient care. Further, from 2007 onwards, many provinces have started to reimburse general outpatient care (Hao and Yuan, 2009, Hu *et al*., 2008). Table 5.1 shows a list of diseases that are eligible for outpatient reimbursement, general reimbursement procedures, and average reimbursement rate.

Table 5.1 Catastrophic outpatient care under the NCMS after 2007

	Outpatient care for chronic disease conditions	**General outpatient care**
Types of disease covered	Common chronic diseases: Hypertension (phrase I and II), heart disease complicated by heart failure, coronary heart disease	All the drugs and services in National Drug Reimbursement List.

	(myocardial infarction), cerebral haemorrhage and cerebral infarction convalescence, etc. Severe chronic diseases: Aplastic anaemia, leukaemia, haemophilia, severe mental illness, cancer chemotherapy, chronic renal insufficiency, dialysis, organ transplant anti-row treatment for valvular heart surgery, vascular stent implantation, etc.	Imported drugs and some high-technology diagnosis procedures are not covered.
Reimbursement procedure	Patients will first need to obtain diagnoses from a county/district level hospital to be eligible for chronic disease outpatient reimbursement. They also need to renew their diagnoses on an annual basis. Only outpatient costs incurred in designated secondary/tertiary hospitals can be reimbursed.	Patients can receive immediate outpatient care at any state-owned public hospitals. They will need to pay the costs upfront, and those costs can be partially reimbursed through the NCMS fund.
Reimbursement rate	Average reimbursement rate as claimed by the government is around 70% at village clinics and township health centres, and 40% at township hospitals and above. However, actual reimbursement rates are much lower than claimed rates.	Average outpatient care reimbursement rate is around 40% according to the government, but actual rates are much lower.

Source: (Hao and Yuan, 2009), (Hu et al., 2008), (Ministry of Health of Shandong Province, 2008), (Ministry of Health of Guangxi Province, 2007), (Ministry of Health of Hei Long Jiang Province, 2009), and various sources from local government websites.

5.3 Methods

5.3.1 Data source and variable specifications

This paper uses the 2009 CHNS, which is the most recent available survey wave. The objective of the paper is to estimate the impact of the NCMS on OOP payments for healthcare. We include a total of 1,846 households in the study after dropping observations in urban areas and those are not insured the NCMS. This dataset is ideal for the purpose of this paper because all the surveyed provinces had included catastrophic healthcare and general outpatient services in the NCMS benefit package by 2008 (Ministry of Health of Hei Long Jiang Province, 2009, People's Daily, 2009, Ministry of Health of Guangxi Province, 2007, Ministry of Health of Shandong Province, 2008, Hao and Yuan, 2009, Hu *et al*., 2008).

Dependent and independent variables

Table 5.2 shows the variable specification. Health payment is for a 4-week window in the CHNS. Individuals are asked to report their health payments, the percentage of these health payments that can be reimbursed by the NCMS. I exclude the outliers on

health costs distribution: the top and bottom one per cent of cases are dropped from the analysis (Wagstaff and Lindelow, 2008).

The impacts of the NCMS on catastrophic health payments are measured separately for the total sample and households that have at least one member with a chronic disease. Chronic disease conditions include any of the following: hypertension, diabetes, myocardial infarction and apoplexy. Care sought at village clinics and township health centres are measured separately, conditional on at least one visit in the past 4 weeks. Per capita income data are used as a measurement of living standards. Please refer to Section 3.2 for how per capita income is calculated.

Table 5.2 Descriptive statistics for the study population (mean/standard deviation)

		Total sample (N = 1,846)	Chronic conditions (N=351)
Variable	Definition	Mean	Mean
Household monthly health expenditures	Health expenditure during the past month (before the NCMS reimbursement)	41.697 (228.908)	69.073 (314.433)
Per episode reimbursement rate for the NCMS participants	Per episode reimbursement rate for household that have health expenditures during the past month	13.012 (26.163)	11.300 (26.202)
Household monthly OOP health expenditures	OOP health expenditure during the past month (after the NCMS reimbursement)	35.936 (207.609)	59.641 (292.586)
Chronic conditions member in household	Dummy variable: 1, the household has at least a member with chronic conditions; 0 otherwise	0.171 (0.376)	--
Village clinics and township health centres	Dummy variable: 1, the household has sought care at village clinics or township health centres in the past 4 weeks; 0 otherwise	0.065 (0.247)	0.092 (0.290)
County and city hospitals	Dummy variable: 1, the household has sought care at county or city hospitals in the past 4 weeks; 0 otherwise	0.016 (0.124)	0.035 (0.184)
Private clinics and others	Dummy variable: 1, the household has sought care at private clinics and other facilities in the past 4 weeks; 0 otherwise	0.018 (0.134)	0.035 (0.184)
Per capita household income	Per capita household income inflated to 2009 (adjusted to household size using Equivalence Scale)	24775.810 (38044.530)	23415.970 (26941.940)
Household size	Number of people live in the household	2.045 (0.901)	2.190 (0.918)

Definition of catastrophic payments

Using household income as the denominator, catastrophic payments are defined as occurring when health payments exceed a given fraction of household per capita income (Xu *et al*., 2003, Wagstaff and van Doorslaer, 2003). There are two approaches in the literature. The first is ATP, defined as the household's per capita expenditure/disposable income net of spending on basic necessities; and this is used as the denominator to define catastrophic thresholds. The difficulty of adopting the first approach lies in the definition of basic necessities. The most common strategy is to use household expenditure/income net of food expenditure as a denominator; however, not all food expenditures are nondiscretionary, and it is possible that richer families may spend substantially more on food consumption than their poorer counterparts. Another approach to define catastrophic payments thresholds is to consider given thresholds. Since the CHNS data lack relevant information on food consumption, and therefore spending on basic necessities cannot be accurately calculated, this paper uses the second approach which considers catastrophic thresholds levels at 5%, 10%, 15%, 20%, and 25% (Wagstaff and Lindelow, 2008, O'Donnell *et al*., 2008b, Xu *et al*., 2003, Xu *et al*., 2007a).

Measuring the impact of the NCMS on catastrophic headcounts and catastrophic payment gaps

This study uses the methods introduced by Wagstaff and van Doorslaer (2003) to measure catastrophic payment. Specifically, this study looks at the incidence and severity of catastrophic payments before and after the deduction of the NCMS. Incidence of catastrophic payments is measured by the number of people who fall below the catastrophic thresholds (headcount); and the intensity of the payment is measured by the average amount exceeding the catastrophic threshold (gap).

Catastrophic payment headcount estimates the proportion of households with catastrophic health payments in the sample. Catastrophic headcounts are calculated before and after the NCMS reimbursement by Equations (8) and (9), respectively. The impact of the NCMS on the absolute difference in headcount is estimated by Equation (10). Let T^{before} be health payments before the NCMS reimbursement, T^{after} be health payments after the NCMS reimbursement, and x be total household income. A household is considered as falling below the catastrophic threshold z if T^{before}/x or

T^{after}/x exceeds a specific threshold. Let CH be the indicator, CH^{before} equals 1 if $T^{before}/x > z$, and CH^{after} equals 1 if $T^{after}/x > z$, and zero otherwise. N is the total number of households.

Catastrophic payment before the NCMS reimbursement H^{before} is,

$$(8)\ H^{before} = \frac{1}{N}\sum_{i=1}^{N} CH_i^{before}$$

Catastrophic payment after the NCMS reimbursement H^{after} is,

$$(9)\ H^{after} = \frac{1}{N}\sum_{i=1}^{N} CH_i^{after}$$

Absolute difference in the headcount, DH, before and after the NCMS reimbursement is,

$$(10)\ DH = H^{before} - H^{after}$$

The severity of the catastrophic payments is measured by the average sum of the amount by which the health payment exceeds the threshold from all households experiencing catastrophic payments. The difference of the severity can be calculated before and after the NCMS reimbursement by Equations (11) and (12), respectively. The impact of the NCMS on the absolute difference on gap was estimated by Equation (13).

Catastrophic gap before the NCMS reimbursement CG^{before} is,

$$(11)\ CG_{before} = \frac{\sum_{i=1}^{N} CH_i^{before}\left(\frac{T_i^{before}}{x_i} - z\right)}{N}$$

Catastrophic gap after the NCMS reimbursement CG^{after} is,

$$(12)\ CG_{after} = \frac{\sum_{i=1}^{N} CH_i^{after}\left(\frac{T_i^{after}}{x_i} - z\right)}{N}$$

Absolute difference in the catastrophic gap before and after the NCMS reimbursement is,

$$(13)\ DCG = CG^{before} - CG^{after}$$

Measuring the distribution sensitivity of catastrophic payments

The study also takes into account of the distribution sensitivity of the measures of catastrophic headcount and gap, the study uses the well-established methods of the Inequity Indices introduced by O'Donnell *et al*. (2008b) and Erreygers (2009) to measure the distribution. For catastrophic headcount measures, Erregyers's Concentration Indices will be used since the binary nature of the variable calls formally a non-linear measure. The distribution of catastrophic gaps – a continuous variable – will be measured by Concentration Indices introduced by O'Donnell *et al*. (2008b).The study calculates the Concentration Indices for the distribution of the catastrophic headcount (C_h) and gap (C_g) relative to the household income. A positive index indicates that richer households are more likely to incur catastrophic payments, and a negative index indicates that poorer households are more likely to incur catastrophic payments.

As suggested by O' Donnell, van Doorsaler and others (O'Donnell *et al*., 2008b, van Doorslaer *et al*., 2006, Wagstaff and van Doorslaer, 2003, Somkotra and Lagrada, 2008), it is important to give some weight to poorer households when assessing the incidence and severity of catastrophic payments. The justification behind this approach is that, if the catastrophic headcount and gap are not adjusted, then households exceeding the thresholds, and all spending exceeding the thresholds will count equally. This is usually not the case since the opportunity costs of such expenditure by the poor households are usually greater than the rich households if we assume a decreasing marginal utility of income. Therefore, measures on weighted catastrophic headcount and gap are proposed in Equations (14) and (15), respectively (O'Donnell *et al*., 2008b):

(14) $H_w = H(1 - C_h)$

(15) $G_w = G(1 - C_g)$

Where H_w represents the weighted headcount, and C_h represents the Erregyers's Concentration Index for the catastrophic headcount, G_w represents the weighted gap, and C_g represents the Concentration Index for weighted gap. This statistic is equivalent to a weighted sum of a catastrophic payment indicator variable, in this case, either *H* or *G*, by multiplying weights declining linearly from 2 to 0 as the household ranks from the poorest to the richest. The weights produced by Equations

(14) and (15) impose the assumption that that poor household receive more weight, while the rich households receive less—if those who exceed the catastrophic threshold tend to be poor, the indices C_h and C_g tend to be negative, which will then make H_w greater than H.

Definition of health payment-induced poverty

Standard poverty measures do not take into account health payments. It is highly likely that a household at a time of illness will be forced to divert some of its usual spending on daily necessities to healthcare, and this may lead households to fall below the poverty line. For households already below the poverty line, the spending from borrowing or selling assets may further increase the poverty gap, and consequently push them into deeper poverty. It is estimated that, in Asia, 78 million people may fall into extreme poverty (US$1 per day) if their health spending were taken out of their per capita household expenditures (O'Donnell *et al*., 2008b).

Health payment-induced poverty measures the difference between poverty before and after health spending is subtracted from household income (Sun *et al*., 2010, O'Donnell *et al*., 2008b). As introduced by Wagstaff and van Doorslaer (2003), incidence and severity of health payment-induced poverty are compared before and after the deduction of the NCMS. Incidence is measured by the number of people who fall below the poverty line because of health payments (headcount); and the intensity is measured by the amount by which the household falls below the poverty line because of health payments (gap).

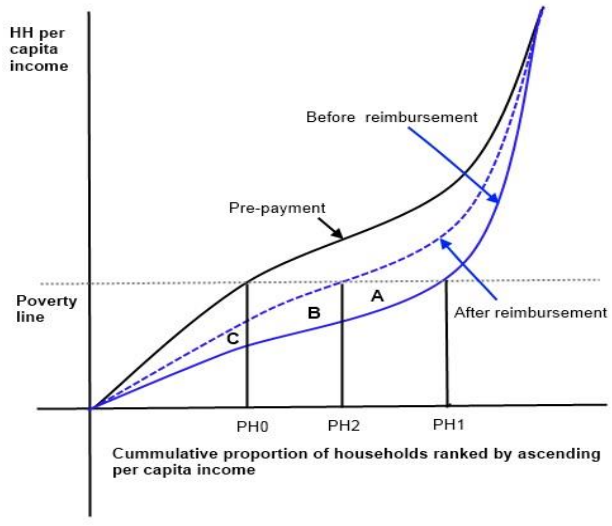
This paper uses three poverty thresholds. They are the international poverty line of US$1.08 per person per day, US$2.15 per person per day, and the Chinese National Poverty Line (NPL), which is a net per capita income of RMB1,196 per year (US$175.08 per year) in 2009. If a poverty line allows health costs, then the line should be adjusted downwards. However, in this study, none of these poverty lines are adjusted when assessing health payment-induced poverty. The US$1.08 per day poverty line is not adjusted because it is used in the Millennium Development Goal as the extreme poverty line. The Chinese National Poverty Line is lower than the extreme poverty line; it is not defined as to cover expected health expenditures so it not adjusted. The US$2.15 per day line is not adjusted in order to make a comparison

(O'Donnell *et al*., 2008b, Wagstaff *et al*., 2001a). The exchange rate use for US dollars to RMB was US$1 equals RMB6.83 in 2009.

Measuring the impact of the NCMS on the reduction of health payment-induced poverty

Estimating of health payment-induced poverty headcount and gap is similar to what has been presented for estimating catastrophic payments. Figure 5.1 illustrates the impact of the NCMS on health payment-induced poverty using a stylized version of the Jan Pen's Parade (Cowell, 2011, O'Donnell *et al*., 2008b). The *x*-axis shows the cumulative proportion of households ranked by income, and *y*-axis shows the household per capita income. The solid black curve represents household per capita income gross of health payment; the solid blue curve and the dotted blue curve represent household per capita income net of the health payment before and after the NCMS reimbursement respectively. The points from the starts of the curves to the intersections with the poverty line (*PL*) represent the numbers of people living in poverty (PH_0, PH_2, and PH_1) under three conditions. The impact of the NCMS on health payment-induced poverty headcount can be calculated by the difference between PH_1 and PH_2. The areas (A, B and C) between the two blue curves capture the poverty gaps reduced by the NCMS.

Figure 5.1 Stylise Pen's Parade for household per capita income gross and net of outpatient costs under the NCMS



(Note: PH0 is the poverty headcount gross of health payments; PH1 and PH2 are the poverty headcounts net of health payments before and after the NCMS reimbursement).

Specifically, the standard poverty headcount, health payment-induced headcount can be calculated by Equation (16). Let T^{before} be health payments before the NCMS reimbursement, T^{after} be health payments after the NCMS reimbursement, and y_i be per capita household income in household *i*. A household is considered as falling below the poverty thresholds *PL* if $y_i < PL$. The poverty head count ratio gross of health payment can be obtained as follows (O'Donnell *et al*., 2008b),

$$(16)\ PH_0 = \frac{\sum_{i=1}^{N} p_i^{gross}}{N}$$

Where $p_i^{gross} = 1$ if $y_i < PL$, and 0 otherwise, N is the total number of households in the sample.

In terms of measuring the poverty gap, defining the poverty gap gross of health payments, the individual-level poverty gap can be obtained by Equation (17),

$$(17)\ PG^{gross} = \frac{\sum_{i=1}^{N} g_i^{gross}}{N}$$

Where $g_i^{gross} = p_i^{gross}(PL - y_i)$.

The severity of poverty for each household is measured by the mean poverty gap,

$$(18)\ MPG^{gross} = \frac{PG^{gross}}{PH_0}$$

Similarly, to estimate the health payment-induced poverty before the NCMS reimbursement, this paper defines y_i as the per capita household income estimated by subtracting the health payment from total household income. Replacing health payments before the NCMS reimbursement with those after the reimbursement gives the analogous post-reimbursement measures.

Following other studies, the effect of OOP payments on poverty which is often termed as “Poverty Impact”, can be obtained by the absolute difference between pre-reimbursement and post-reimbursement measures.

5.4 Empirical results

Table 5.3 shows that for the total sample, average monthly health expenditures before insurance reimbursement are 41.70RMB, while for households with members with chronic conditions, the expenditures are 69.07RMB. However, the per episode reimbursement rate for people with chronic conditions is 11.3%, which is lower than the total sample. Average OOP payments for households with chronic disease members are 59.64RMB, which are 23.70RMB higher compared with the payments for the total sample.

Table 5.3 illustrates health payment for healthcare as a share of household income before and after the NCMS reimbursement. The results show that health payments account for 3.45% of the household income as a share of household income before the reimbursement, and 3.13% after the reimbursement for the total sample. The difference is only 0.33% ($p < 0.01$). For households with chronic disease members, health payments share is10.43% before the reimbursement, but there is no significant change after the reimbursement.

Table 5.3 Health payments for healthcare as a share of household income before and after the NCMS reimbursement

	Total sample (N = 1,846)	**Chronic conditions (N = 351)**
Before reimbursement (a)	3.45%***	10.43%*
	(0.010)	(0.058)
After reimbursement (b)	3.13%***	9.92%*
	(0.010)	(0.058)
Difference (a) – (b)	0.33%***	0.51%

(Notes: Standard errors are in brackets. * indicates $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$)

5.4.1 Catastrophic payments under the NCMS

Table 5.4 presents measures of the incidence and distribution of catastrophic payments before and after the NCMS reimbursement in 2009. The total household income is used as the proxy to define catastrophic payment thresholds for healthcare, and the catastrophic thresholds are presented at the 5%, 10%, 15%, 20%, and 25% level.

The estimate of the catastrophic headcount is 6.61% ($p < 0.01$) for the total sample and 8.57% ($p < 0.01$) for households with chronic disease members at the 5% threshold level. Health payments are more likely to become catastrophic for households with chronic disease members compared to the total sample at all threshold levels.

For households that have at least one outpatient visit to health facilities in the past 4 weeks, 41.67% ($p < 0.01$) of the households fall below the 5% threshold level. Table 5.4 also presents the rank-weighted headcount. The rank-weighted catastrophic headcount is 64.14% for care sought at village and township health facilities at the 5% level. The difference between the rank-weighted and the un-weighted headcount is 22.47%; this is not surprising given the relatively high concentration of catastrophic payment among the poor households.

The impacts of the NCMS in reducing catastrophic head are reported under absolute difference in Table 5.4. The Concentration Index of catastrophic headcount for households with chronic disease members is -0.095 ($p < 0.01$) at the 5% threshold level, whereas the index is -0.075 ($p < 0.01$) for the total sample. This also implies that catastrophe is more likely to be concentrated among the poor and for households with chronic disease members. The results show that for households with chronic members and care sought at village and township health facilities, the NCMS has no significant effects on reducing the incidence or the favouring-poor distribution of catastrophe. The NCMS has some effects in reducing the favouring-poor distribution of catastrophe at the 15%, 20% and 25% threshold levels for the total sample, but no effects are observed in terms of reduction of headcount and rank-weighted headcount.

Table 5.4 Incidence of catastrophic payment at threshold levels 5%, 10%, 15%, 20% and 25%

		OOP payments as share of total household income														
		Total sample (N=1,846)					**Chronic conditions (N = 351)**					**Village clinics and township health centres (N = 120)**				
		Threshold level					Threshold level					Threshold level				
		5%	10%	15%	20%	25%	5%	10%	15%	20%	25%	5%	10%	15%	20%	25%
Pre-insurance	Headcount (H^{before})	**6.61%**	**4.82%**	**3.79%**	**2.76%**	**2.38%**	**8.57%**	**6.67%**	**5.08%**	**3.49%**	**2.86%**	**41.67%**	**29.17%**	**20.83%**	**14.17%**	**12.50%**
	Concentration Indices (C_h^{before})	**-0.075**	**-0.066**	**-0.060**	**-0.048**	**-0.047**	**-0.095**	**-0.091**	**-0.085**	**-0.066**	**-0.072**	**-0.539**	**-0.424**	**-0.420**	**-0.314**	**-0.279**
	Rank-weighted headcount (H_w^{before})	**7.10%**	**5.14%**	**4.02%**	**2.90%**	**2.50%**	**9.38%**	**7.27%**	**5.51%**	**3.72%**	**3.06%**	**64.14%**	**41.54%**	**29.58%**	**18.62%**	**15.98%**
Post-insurance	Headcount (H^{after})	**5.85%**	**4.17%**	**3.14%**	**2.33%**	**2.06%**	**7.62%**	**5.71%**	**4.44%**	**3.17%**	**2.86%**	**35.83%**	**24.17%**	**16.67%**	**10.00%**	**9.17%**
	Concentration Indices (C_h^{after})	**-0.065**	**-0.055**	**-0.049**	**-0.039**	**-0.037**	**-0.092**	**-0.083**	**-0.072**	**-0.063**	**-0.072**	**-0.439**	**-0.350**	**-0.319**	**-0.192**	**-0.167**
	Rank-weighted headcount (H_w^{after})	**6.23%**	**4.40%**	**3.30%**	**2.42%**	**2.13%**	**8.32%**	**6.19%**	**4.76%**	**3.38%**	**3.06%**	**51.57%**	**32.63%**	**21.99%**	**11.92%**	**10.70%**
Absolute difference	Headcount (H^{after} - H^{before})	-0.76%	-0.65%	-0.65%	-0.43%	-0.33%	-0.95%	-0.95%	-0.63%	-0.32%	0.00%	-5.83%	-5.00%	-4.17%	-4.17%	-3.33%
	Concentration Indices (C_h^{after} - C_h^{before})	0.010	0.010	0.011*	0.009**	0.011**	0.002	0.008	0.013	0.003	0.000	0.100	0.074	0.100	0.123	0.112
	Rank-weighted headcount (H_w^{after} - H_w^{before})	-0.87%	-0.73%	-0.72%	-0.48%	-0.36%	-1.06%	-1.08%	-0.75%	-0.35%	0.00%	-12.57%	-8.91%	-7.59%	-6.70%	-5.29%

(Note: * indicates $p < 0.1$, ** $p < 0.05$, **bold** indicates $p < 0.01$)

Table 5.5 shows measures for the severity of catastrophic payments before and after the NCMS reimbursement. The catastrophic gap is 3.0% ($p < 0.01$), and 7.30% ($p < 0.01$) for the total sample and households that sought care at village and township health facilities, respectively. The catastrophic gap is 9.77% ($p < 0.01$) for households with chronic diseases. The results also show a modest decline in terms of catastrophic gap after the NCMS reimbursement for the total sample and sample that includes households that sought care at village and township health facilities. However, the NCMS has no significant impacts on the severity of catastrophe for households with chronic disease members.

In terms of the distribution of catastrophic gaps, most of the Concentration Indices (C_g) are negative, indicating that the catastrophic gaps are more concentrated among the poor households. It is noted that the indices for catastrophic gap are -0.851($p < 0.01$) for households with chronic disease members, -0.666 ($p < 0.01$) for the total sample, and -0.510 ($p < 0.01$) for households that sought care at village and township health facilities. The indices indicate a favouring-poor concentration of catastrophic gap among the population. The level of inequity is more pronounced for households with chronic disease members.

Table 5.5 Severity of catastrophic payment at threshold levels 5%, 10%, 15%, 20% and 25%

		OOP payments as share of total household income														
		Total sample (N=1,846)					**Chronic conditions (N = 351)**					**Village clinics and township health centres (N = 120)**				
		Threshold level					Threshold level					Threshold level				
		5%	10%	15%	20%	25%	5%	10%	15%	20%	25%	5%	10%	15%	20%	25%
Pre-insurance	Gap (CG^{before})	3.00%	2.72%	2.51%	2.34%	2.21%	9.77%	9.41%	9.10%	8.89%	8.72%	7.30%	5.55%	4.30%	3.45%	2.77%
	Concentration Indices (C_g^{before})	-0.666	-0.707	-0.730	-0.752	-0.769	-0.851	-0.872	-0.889	-0.899	-0.908	-0.510**	-0.519**	-0.530	-0.511	-0.470
	Rank-weighted gap(G_w^{before})	5.00%	4.65%	4.34%	4.10%	3.91%	18.08%	17.61%	17.19%	16.88%	16.63%	11.03%	8.44%	6.59%	5.21%	4.08%
Post-insurance	Gap(CG^{after})	2.70%	2.46%	2.28%	2.14%	2.03%	9.30%	8.99%	8.73%	8.54%	8.38%	5.82%	4.33%	3.33%	2.68%	2.21%
	Concentration Indices (C_g^{after})	-0.695	-0.734	-0.762	-0.784	-0.804	-0.872	-0.891	-0.906	-0.916	-0.924	-0.607**	-0.582**	-0.572**	-0.539	-0.486
	Rank-weighted gap(G_w^{after})	4.58%	4.26%	4.02%	3.83%	3.67%	17.41%	17.00%	16.63%	16.36%	16.12%	9.35%	6.85%	5.24%	4.13%	3.28%
Absolute difference	Gap (CG^{after}- CG^{before})	-0.30%	-0.26%	-0.23%	-0.20%	-0.18%**	-0.47%	-0.42%	-0.37%	-0.35%	-0.34%	-1.48%	-1.22%	-0.97%**	-0.76%**	-0.57%**
	Concentration Indices (C_g^{before}- C_g^{after})	-0.03	-0.03	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02	-0.10	-0.06	-0.04	-0.03	-0.02
	Rank-weighted gap(G_w^{after} -G_w^{before})	-0.42%	-0.38%	-0.32%	-0.28%	-0.24%**	-0.67%	-0.61%	-0.55%	-0.52%	-0.51%	-1.67%	-1.58%	-1.35%**	-1.08%**	-0.80%*

(Note: * indicates p < 0.1, ** p < 0.05, bold p < 0.01)

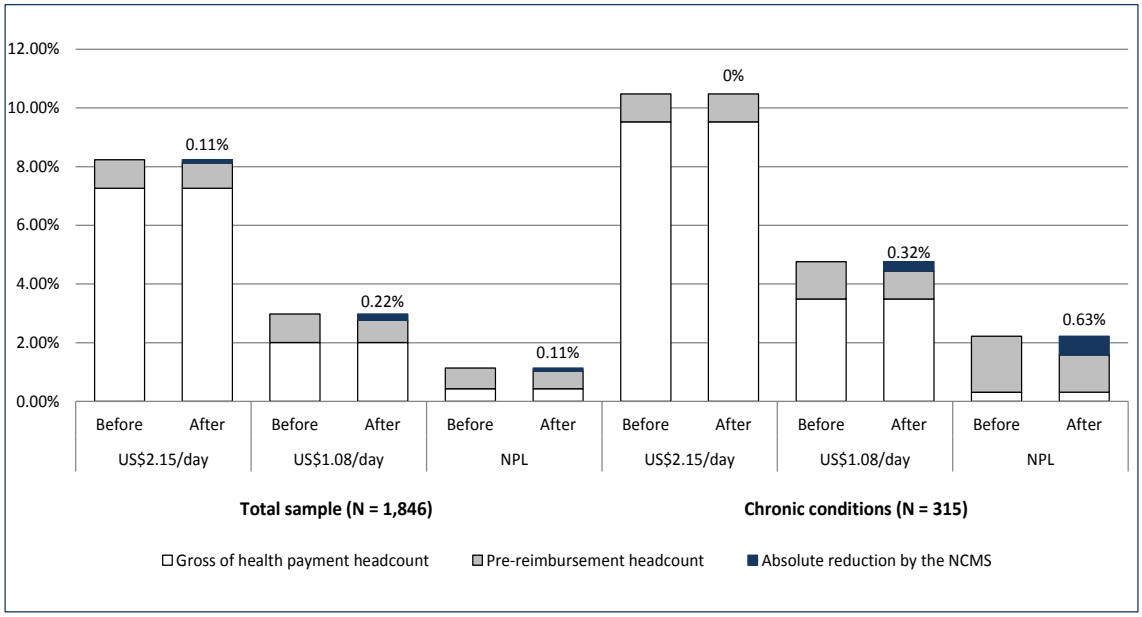
5.4.2 The NCMS and the poverty impact

Figure 5.2 shows health payment-induced poverty headcount before and after the NCMS reimbursement. Before the health payment, 134 households, or 7.26% of the sample, fell below the US$2.15 poverty line. A total of 18 households were pushed below the poverty line because of the health payments. No significant reduction in terms of poverty headcount was observed.

Using US$1.08 per day as the poverty threshold, poverty headcount gross of health payments was 37 (2%). The number increased to 55 (2.98%) before the NCMS reimbursement, and decreased to 51 (2.76%) after the NCMS reimbursement.

At the Chinese NPL, fewer households were classified as poor before taking into account of health payment. The difference before and after the NCMS reimbursement on poverty headcount reduction were not statistically significant at any poverty thresholds.

Figure 5.2 OOP share before and after the NCMS



(Note: Before: before the NCMS reimbursement; After: after the NCMS reimbursement. Chinese NPL = Chinese National Poverty Line)

Table 5.6 shows the health payment-induced poverty gap before and after the NCMS reimbursement. For households falling below the US$2.15 per day poverty line, the estimate of poverty gap gross of health payment is11.60RMB. The mean positive

poverty gap is 159.79RMB. However, if OOP payment for healthcare is netted out of the household income, the average poverty gap increases to 19.48RMB, and the mean positive gap increases to 236.60RMB. After the NCMS reimbursement, the average poverty gap reduces by 7.88RMB (p<0.1). No significant reduction is observed in terms of mean positive gap.

If we take a look at the households with chronic disease members, the poverty gap and mean positive poverty gap are larger for all poverty lines compared with the total sample. However, the NCMS has no significant impact in reducing either the average gap or the mean positive poverty gap for households with chronic disease members.

Table 5.6 OOP payments and the poverty gap before and after the NCMS reimbursement

	Total sample (N=1,846)			**Chronic conditions (N = 351)**		
	US$2.15/day	**US$1.08/day**	**NPL**	**US$2.15/day**	**US$1.08/day**	**NPL**
Poverty gap (RMB)						
Gross of health payment gap (PH_0)	11.60	1.61	0.14	15.87	2.17	0.02
Pre-reimbursement gap (PH_{before})	19.48	7.35	4.96	36.85	20.03	16.21
Post-reimbursement gap (PH_{after})	18.37	6.65	4.48	34.16	17.94	14.50
Health payment -induced gap before reimbursement (PH_{before} - PH_0)	7.88	5.74	4.83	20.98	17.86	16.19
Absolute reduction by the NCMS (PH_{before} - PH_{after})	1.11*	0.70	0.48	2.69	2.10	1.71
Mean positive gap (RMB)						
Gross of health payment mean positive gap (MPG^{gross})	159.79	80.48	31.58	166.64	62.17	7.83
Pre-reimbursement mean positive gap(MPG^{before})	236.60	246.78**	436.34**	351.77	420.68	851.13
Post-reimbursement mean positive gap(MPG^{after})	226.09	240.76**	435.39**	326.11	403.55	913.59
Health payment -induced mean positive gap before reimbursement (MPG^{before}- MPG^{gross})	76.81	166.29	404.75	185.13	358.51	843.30
Absolute reduction by the NCMS (MPG^{before}- MPG^{after})	10.51	6.01	0.95	25.66	17.13	-62.46

(Note: * indicates $p < 0.1$, ** $p < 0.05$, $p < 0.01$)

5.5 Discussion and conclusion

Using data from CHNS 2009, this study provides new evidence of the impacts of the NCMS on the magnitude, distribution and economic consequences of OOP payments for outpatient care in rural China. The study suggests that outpatient care is not a low cost event, and indeed can be catastrophic. The NCMS has limited impacts on

reducing incidence or severity of catastrophic payments, or reducing favouring-poor inequity in catastrophic payments. It has no significant effects on reducing health payment-induced poverty. For care sought at village and township health facilities, outpatient care is likely to become catastrophic, and the NCMS has no significant impact on this. For households with chronic disease members, a large catastrophic payments gap is observed, and the gaps are disproportionately concentrated among the poor. However, the NCMS has no impact on the reduction of gaps or inequities.

The findings are consistent with previous studies. Specifically, this study suggests that, using the catastrophic payment threshold at 5%, 6.61% of rural households in 2009 fell into a catastrophe due to OOP payments. Similar results are demonstrated by Sun *et al*.(2009a). That study investigated the impact of the NCMS in Linyi County in Shandong, adopting 50% ATP, and showed that the incidence of catastrophic payments was 8.98% before the NCMS reimbursement and 8.25% afterwards. The incidence from our study appeared to be larger relative to an earlier study conducted by Wagstaff and Lindelow (2008). Using the earlier waves of the CHNS data (1993, 1997 and 2000), Wagstaff and Lindelow suggested that catastrophic headcount increased from 2.0% in 1993 to 3.4% in 2000 at a threshold level of 5%. The differences may be due to the use of the early waves of the CHNS data and the inclusion of the urban sample in the analysis; in the same study, using data from Gansu Survey of Children and Family (GSCF) in 2003, the reported incidence of catastrophic payments was 6.5%, which was closer to our findings. Despite the differences, one common feature as suggested by this study as well as others is the positive correlation among catastrophic payment variables, and their negative correlation with level of wealth of the household in the rural China– the less wealthy rural Chinese households are more likely to experience catastrophic payments.

The impacts of the NCMS on the severity of catastrophic payments in rural households are reported by the average catastrophic gap. Using a 5% threshold level, the average catastrophic gap is reduced by just 0.30 point per cent by the NCMS. The severity of the payments could still be disastrous for most rural Chinese residents. Similar findings were demonstrated by Sun *et al*.(2009a). The study also

suggested that the effects of the NCMS on reducing the catastrophic gap were limited.

This study quantifies the level of inequity in health financing and finds that the NCMS reduces the level of inequity of the incidence of catastrophic payments for the total sample; however, it has no significant impacts for households with members suffering chronic disease, or for households seeking care at village and township health facilities. This study also finds that the catastrophic payment gap is disproportionately concentrated among the poor for households with chronic disease members even after the NCMS reimbursement. However, this may seem less surprising if we take a close look at the insurance design. In practice, the reimbursement rate does not differ between the rich, the poor, or households with potentially greater health needs. If the goal of the NCMS is to have as few poor households crossing catastrophic thresholds as possible, the insurance should provide the poor and those with high health risks with more generous package. Low reimbursement rates and excessively high co-payments are directly responsible for catastrophic outpatient payments, and with the poor bearing the brunt of the consequences. Furthermore, at the moment, the NCMS emphasises inpatient care and catastrophic outpatient care. This study and previous studies have proven that outpatient care could also be quite expensive given the income level of the overall Chinese rural population (Zhang *et al*., 2010a), and the share of outpatient costs in the aggregate may have a substantial impoverishing effect on households (Shahrawat and Rao, 2012). Households with greater health needs or those already in the lower income quintiles may find it difficult to cope with outpatient care or any types of care; consequently, they may more easily fall below catastrophic thresholds when they seek care.

We may find that the situation of China is even bleaker than that found in other countries. It is noted that OOP payments, as perceived as the most regressive instrument of health financing (Whitehead *et al*., 2001), are generally regressive or are proportional to ATP in most high-income countries. Even in most of the low-/middle-income Asian countries, OOP payments still absorb a larger share of economic resources of the rich households. However, both our study and existing studies showed that China, unlike that of many other Asian countries, demonstrated

a favouring-poor concentration of OOP payments (Van Doorslaer *et al*., 2007). The proportion of population that experienced "catastrophe" (as defined as 40% of non-food consumption) in China was the highest among the rest of Asia except Nepal and Sir Lanka, and higher still among the less wealthy (Van Doorslaer *et al*., 2007, Wagstaff *et al*., 2009c).

The study also measures health payment-induced poverty for healthcare by quantifying the extent to which such payments may push households into poverty. As demonstrated by the results, the effects of the NCMS on preventing households from becoming impoverished are limited—the majority of health payment-impoverished households remained below the poverty lines after the NCMS reimbursement, and the severity of their situations is not improved. This again is consistent with previous research (Sun *et al*., 2010, van Doorslaer *et al*., 2006).

Two possible policy solutions have been discussed to improve the design of the insurance. One solution is to reduce OOP payments by providing higher reimbursements through more generous government subsidises and through an increased level of risk-pooling (Yip and Hsiao, 2009b, Zhang *et al*., 2010b). A less costly solution is to provide extra benefits for the less wealthy households or those with high risks of incurring catastrophic illness costs, and this was adopted by a few low- and middle-income Asian countries, such as Thailand and Vietnam (Somkotra and Lagrada, 2008). However, it is not clear whether these solutions are applicable to the Chinese situation. First, a more generous insurance package may not always lead to a reduction of health costs since ample studies in the field of health economics have suggested the opposite (Dusansky and Koc, 2010, Feldman and Dowd, 1991, Arrow, 2001, Manning *et al*., 1987). Stensland *et al*. (2010) found that hospitals under more financial pressure –with less market share and less ability to charge higher private rates – were likely to generate profits on Medicare patients. In the case of China, the current health provision system is still functioning on the basis of a FFS system. Healthcare providers, who are largely relying on revenue from drugs and services, are also likely to charge more from those who are covered by insurance. Anecdotal evidence showed that health providers in China may supply high margin high-technology care and expensive medicines to the NCMS patients wherever possible, and the insured patients had paid more than was warranted (Hu *et*

al., 2009, Yip and Hsiao, 2009b). Examples also included the initiative of merging China's Government Insurance Health Scheme (GIS) and Labour Insurance Health Scheme (LIS) into one single insurance with a larger risk pool and more generous reimbursement rates in the 1990s. This reform increased the health payments in Zhejiang Province among the insured patients, especially the wealthy patients (Liu and Zhao, 2006). A more recent case was the launch of the urban employee insurance—UEI in 1998. With a relatively generous package, this insurance had been proven to be responsible for over-prescribing of drugs and unnecessary use of health services (Hu *et al*., 2009).

The proposal of increasing the level of risk pooling at individual level, at first glance, seems feasible—a more comprehensive risk pooling could increase the NCMS funds and improve the insurance package for the participants. However, for poor households, who already have difficulty in coping with daily living, increasing the premium may increase dropout rates and consequently high costs of care. Furthermore, if we take a close look at the structure of the NCMS funds, we notice that the current NCMS funds have huge surpluses. Mao (2005) found that in the affluent East regions, the surplus accounted for 27.58% of the total NCMS funds, while in the less affluent Central and West regions, the surplus accounted for 32.51% and 55.98% of the total funds respectively. Since risk pooling is currently administrated at the county level, keeping a large surplus of funds might be a safe way to prepare for a wide disease outbreak. A more efficient use of the insurance funds could include a larger pool, in other words, to increase the risk pooling level from one county to a few counties or even to provincial level. But this may also increase the administrative costs and other related costs.

The second policy solution is to develop a specific sub-insurance to target the poor and those with greater health needs. However, establishing a well-functioning insurance for fee-waiver or fee reduction for a specific population may be very difficult in practice (Whitehead *et al*., 2001). In countries like China where poverty is rife, it is extremely difficult to identify the target population—the poor—sufficiently and accurately. Further, as suggested above, the current Chinese health system is based on a FFS system. Healthcare providers may take advantage of the patients who are entitled to extra insurance benefits. Providing fee waiver or

reduction to the poor may motivate the health providers to prescribe more. Such problems may become more accentuated since the current Chinese health system also allows the revenue from fees to be directly linked to incomes and bonuses for the health staff (Economic Intelligence Unit, 1998).

In interpreting the results we must also bear the limitations in mind. First of all, the recall period of the health cost variable is relatively short (4 weeks). It is problematic because most surveys use 12 months as the recall period. Outpatient costs used in this study are self-reported. Such data can be problematic because self-reporting may lead to inaccuracy and bias. Second, the threshold approaches adopted in the study to investigate the impacts of insurance on costs may have some limitations. When measuring catastrophic payments, it is not possible to identify the households that are recommended for treatment, but cannot meet these costs and so forgo treatment. Subsequent deterioration of health may lead to indirect costs such as welfare loss, and these losses cannot be captured by the measurement of catastrophe (Pradhan and Prescott, 2002). Further, the justification of measuring health payment-induced poverty is that health costs as responses to basic needs are not adequately reflected in the poverty line. Adjusting higher poverty lines downwards is suggested when measuring health payment-induced poverty because these lines may make some implicit allowance for expected healthcare needs. However, the stochastic nature of healthcare needs makes it difficult to capture in a fixed poverty line (O'Donnell *et al.*, 2008b).

6 Health insurance and cost escalation

Cost escalation under China's New Cooperative Medical Scheme[9]

Abstract

The NCMS, a government subsidized health insurance program, was launched in 2003 in response to the deterioration in access to health services in rural areas. Although the scheme was initially designed to cover inpatient care, it has started to expand its benefit package to cover outpatient care since 2007. However, the program's impacts on outpatient care costs have raised growing concern since the new initiative was launched, in particular regarding whether it has in fact reduced OOP payments for health services among rural participants. This paper examines the impacts of the NCMS on outpatient costs by analysing data from an individual level longitudinal survey—the CHNS of 2004 and 2009. This study adopted various health econometrics strategies, such as Two-Part Model (2PM), Heckman Selection Model (HSM) and Propensity Score Matching (PSM) with Differences-in-differences (DID) model to estimate the impacts of the NCMS on per episode outpatient cost of 2004 and 2009. We find that NCMS has little impact on reducing the NCMS patients' OOP payments for outpatient services and may also have contributed to an observed increase in the total per episode of outpatient costs billed to the insured patients. This increase is more pronounced among village clinics and township health centres—the backbone of the health system for rural residents—than at county and municipal hospitals.

[9] This chapter is based upon a co-authored paper (with Xun Wu) that is published by *Health Policy and Planning*.

6.1 Introduction

The dismantling of collective farms during the 1980s led to the demise of the Cooperative Medical Scheme (CMS), which had provided 90% of rural population with access to basic healthcare (Liu and Yi, 2004). By the early 2000s, around 95% of the rural population lacked any form of coverage for health services (Babiarz *et al*., 2010, Yip and Hsiao, 2009b). According to a national survey on health services, three-fourths of rural residents did not seek care when recommended; meanwhile the average per episode inpatient cost in rural areas increased from 613 RMB in 1993 to 2,649 RMB in 2003 (Chen *et al*., 2011, You and Kobayashi, 2009).

China's New Cooperative Medical Scheme (NCMS) was launched in 2003 in response to the deterioration in access to health services in rural areas. The NCMS is a voluntary health insurance program heavily subsidized by the government and administered by county-level government agencies. Its main goal is to improve the rural population's access to health services by alleviating the financial burdens of paying for healthcare. Its expansion since inception has been truly remarkable: by 2012, the NCMS covered 97.5% of rural population in China, some 832 million people, making it arguably the largest health insurance program in the world (China Daily, 2012).

Despite its rapid expansion, the effectiveness of the NCMS in reducing rural residents' financial burdens in paying for healthcare should not be taken for granted. Some studies have reported that medical expenditures and OOP payments, especially for catastrophic illnesses, have indeed decreased since the program was inaugurated (Wagstaff *et al*., 2009a, Wagstaff *et al*., 2009d, Tan and Zhong, 2010, Babiarz *et al*., 2012), but other researchers found that OOP payment for health services remains a severe financial burden for subscribing rural households and that the financial protection provided to participants was in fact rather limited (Sun *et al*., 2010, Zhang *et al*., 2010a). More important, the NCMS may have inflated medical costs at village clinics and township health centers, which tended to overprescribe for the NCMS covered patients (Sun *et al*., 2009a, Sun *et al*., 2009b).

From 2007 onwards, the NCMS has started to include outpatient care in the benefit package in order to improve utilization of outpatient care—the most frequently used and widely accessible care for the rural farmers. Specifically, the NCMS reimburses two types of outpatient care: catastrophic outpatient care (chronic diseases and severe chronic conditions), and general outpatient care. While previous studies of the NCMS focuses mainly on inpatient care, little is known about the impacts of this new initiative on outpatient care use in rural areas. As it is evident that social health insurance in China may induce unnecessary use of healthcare (Yip *et al*., 2010, Wagstaff *et al*., 2009c, Tang *et al*., 2012), whether the expanded benefit package may lead to supply induced-demand of outpatient use is an important issue to discuss. Further, there is a critical need to trace the patterns of health costs incurred at village clinics and township health centers—the backbone of the health system for rural residents—thus far no rigorous evaluations of these costs has been undertaken.

To shed light on these issues, we trace the effects of the NCMS on the costs of outpatient care in data from an ongoing longitudinal household survey, the CHNS. Data from the survey are ideal for the study for two reasons: the survey covers important questions relating to utilization and costs of healthcare; and most recent surveys, conducted in 2004 and 2009, cover virtually the entire period from the inception of the NCMS in 2003 through its first rapid growth and into the years immediately following an important extension in the benefit package to include outpatient care in 2007. Three modeling approaches are adopted for our analysis. The first approach takes advantage of the panel structure of the dataset, comparing average per episode outpatient costs for a sample group of individuals over the interval from 2004 (when none participated in the NCMS) through 2009 (when all participated in the NCMS). The second approach is to subject pooled data from the most recent two rounds (2004 and 2009) of the CHNS to an econometric analysis, using a Two-Part Model (2PM) and Heckman Selection Model (HSM) (Gravelle *et al*., 2006, Jones, 2007, O'Donnell *et al*., 2008b) to estimate the impacts of the NCMS on use of outpatient care, outpatient costs before the NCMS reimbursement, and OOP payments for outpatient care (after the costs are reimbursed by the NCMS). The third approach used Propensity Score Matching (PSM) with Difference-in-differences (DID) model to estimate the effect of the NCMS on outpatient costs from 2004 to 2009.

Our empirical findings from the three approaches are mutually consistent: during the interval studied, the NCMS has little impact on reducing participants' OOP payments for health services; it may have contributed to an observed increase in per episode outpatient costs billed to participants. This increase appears to have been more pronounced among village clinics and township health centers than in county and municipal hospitals.

Our findings have several important policy implications in the context of healthcare reforms in China and other developing countries. First, although the deterioration of access to health services in the 1990s was in part driven by the general escalation of healthcare costs, the government's response—the NCMS—may have inadvertently induced pressures for new waves of cost escalation, as had happened with China's urban employee-based insurance scheme —the UEI (Wagstaff and Lindelow, 2008). Second, the program's lack of success in reducing its participants' OOP payments for health services, despite massive government subsidization, suggests that increased health costs created by implementing the program may have outweighed the benefits provided to its participants. Third, despite intense political pressure to increase government subsidies to the NCMS in order to offer a more generous insurance package to rural residents (Ma *et al*., 2012), our findings suggest that unless effective policy measures can be taken to alleviate the pressures of cost escalation upon health service providers, any such increases in subsidization may have limited impacts on improving access to health services among the rural population. That is, increases in government financing may not forestall the need for more difficult reforms directed at modifying the behavior of health service providers. From this perspective, funding increases might be better deployed in developing incentives for urgent reforms in health cost management in facilities that serve the rural population.

6.2 Literature review on supplier-induced demand under insurance

Although the most basic argument for insurance is that it reduces health costs and provides financial protections to the households (Wagstaff and Lindelow, 2008), it is yet not obvious in the real world health insurance always reduces health expenses or how far health insurance helps to reduce health expenses. Heath economists argued

that when patients were aware of the types and the extent of health services they would receive with the coverage of insurance, they may derive utility from health status and financial wealth, and additional medicines and interventions that may possibly increase the chance of a recovery. In this case, a generous insurance may induce the individual's demand for health services because the price is reduced through insurance. As for the providers, health insurance may cause the providers to provide more services; OOP payments would increase because of having insurance. (Chen, 2006, Latker, 1998, Eggleston *et al*., 2008, Zhan *et al*., 1998).

In terms of the NCMS, despite this impressive performance, serious questions remain regarding the impacts of the NCMS on the rise of healthcare expenditures and in particular on whether the program has actually led to a reduction in patients' out-of- pocket payments. Participants may in fact have seen a reduction in OOP payments for health services used and may have increased their usage of the health system as a result; but the availability of reimbursement for costs through insurance claims may have induced healthcare facilities and doctors to prescribe more expensive drugs or order unnecessary treatments, thus actually increasing overall healthcare expenditures. If the first of these two effects dominates, participants may see a decline in OOP payments for health services. If the second effect dominates, participants could be subjected to an overall increase in their out-of- pocket payments, as the increase in healthcare expenditures outweighs the amount of reimbursements claimed from their insurance plan.

Although some studies showed that NCMS has reduced OOP payments and protected households against financial risks by reducing the costs of catastrophic illness, especially among low-income patients (Babiarz *et al*., 2012, Zhang *et al*., 2010a, Wagstaff *et al*., 2009a), other evidence pointed to the contrary. Scholars found that OOP payments post-enrolment remained a severe financial burden for rural households and that financial protection through the NCMS was rather limited(Sun *et al*., 2010). It was also pointed out by Zhang *et al*. (2010b) that although the NCMS reached most rural areas, it still failed to cover large medical expenses, as deductibles and co-payments were quite high, and OOP payment did not appear to be reduced by the NCMS. Some studies even found that the NCMS resulted in people getting more unnecessarily expensive care. Such an increase in

OOP payments was more pronounced for the disadvantaged groups (Long *et al*., 2010).

Moreover, it has been well documented that the current Chinese healthcare system encourages providers to supply sophisticated care wherever possible. Scholars argued that current provider payment mechanism based on a FFS system gave perverse incentives to providers and were not conductive to cost containment (Li *et al*., 2011). Since most healthcare facilities relied heavily on drug revenue and the provision of health services to survive (Latker, 1998, Yip and Hanson, 2009, Yip and Hsiao, 2008a), insurance such as the NCMS may further exacerbate the situation. For instance, an alarming increase in Cesarean delivery rates and costs occurred in rural areas after the NCMS was launched (Bogg *et al*., 2010). Studies likewise found that over-prescription of antibiotics in village clinics was common for patients covered by the NCMS (Sun *et al*., 2009b, Bogg *et al*., 2010). Village clinics and township health centres in counties covered by the NCMS tended to generate more revenues than similar facilities in counties not participating in the program (Babiarz *et al*., 2012), and the care delivered at participating facilities was also found to be more costly and more sophisticated than medically necessary (Wagstaff and Lindelow, 2008).

Although studies to date have enabled a better understanding of the impact of the NCMS on medical costs, several critical gaps remain in information that would guide policy decisions on the issues. First, since the expansion of the NCMS in 2007 to include coverage of expenses for outpatient care, no study has yet focused on the program's impact on the costs of outpatient care. Second, although cost escalation at village clinics and township centres has been studied (Babiarz *et al*., 2012, Brown and Theoharides, 2009), no systematic comparison has been conducted of costs incurred at different types of health facilities. Third, the attempt to establish a causal relationship between the insurance and health costs is not as strong as it could be. Even though numerous studies has contributed to the rich array of provider payment incentives, very few has indicated what more rigorous evaluation might reveal; thus findings are by far still anecdotal. More rigorous methods are need, such as modelling on multivariate regression analysis of individual-level data, to isolate or control other factors which might influence health costs, or to pinpoint how much

health costs or inappropriate use is driven by supplier-induced demand because of the existence of insurance. Our study aims at addressing these gaps by focusing on three research questions:

1) What effects has the NCMS had on the overall costs of outpatients care?
2) Does the NCMS help to reduce OOP payments for outpatient participants?
3) How do patterns of costs for outpatient care differ among different types of healthcare facilities?

6.3 Methods

6.3.1 Data source

The survey data are ideal for our purposes because the survey (from 2004 to 2009) covered virtually the entire period from the inception of the NCMS in 2003 through the early years after its expansion in outpatient coverage in 2007. Table 6.1 shows the rapid expansion of the NCMS from 2004 to 2009: fewer than 5% the rural residents surveyed were covered by the NCMS in 2004, but by 2009 more than 90% subscribed. Among the nine provinces surveyed by the NCMS, four provinces (Henan, Hubei, Liaoning, and Guangxi) started to reimburse catastrophic outpatient care since 2007. By 2008, all the surveyed provinces included catastrophic healthcare in the NCMS benefit package, and general outpatient services in the NCMS benefit package (Ministry of Health of Hei Long Jiang Province, 2009, People's Daily, 2009, Ministry of Health of Guangxi Province, 2007, Ministry of Health of Shandong Province, 2008, Hao and Yuan, 2009, Hu *et al*., 2008)

Table 6.1 Sample NCMS participants/non-participants covered by CHNS Survey years

Year	Uninsured (%)	Insured (%)	Total
2004	4,139 (95.79)	182 (4.22)	4,321
2009	280(6.86)	3,804 (93.14)	4,084

We identify two potential limitations for deriving policy implications from an analysis based on the CHNS survey. First, as mentioned in previous papers, only nine provinces are included in the survey, most of these situated in the eastern and

coastal part of China; hence, generalizations from the CHNS data to national conditions should be made with caution. Second, outpatient costs are influenced by supply as well as demand. Because the CHNS survey does not include specific data on some potentially important factors influencing the supply side, such as number of doctors in a health facility, ownership structure of health facilities, and number of health facilities in specific localities, the effects of these factors on the costs of outpatient care could not be assessed in our analysis. Third, the recall period of healthcare use is only 4 weeks. This is problematic because the stochastic nature of healthcare needs means that they cannot be sufficiently captured by a 4 weeks window. Most surveys would allow for 12 months for recall period.

6.3.2 Variable specifications

The dependent variables are the occurrence of outpatient costs, and the pre-insurance and post-insurance outpatient costs. Health payment is for a 4-week window in the CHNS. Individuals are asked to report their health payment, the percentage that can be reimbursed by the NCMS. We use these two variables to construct pre- and post-reimbursement health payments. Because the inflation rate is quite high in China, costs were adjusted according to the Consumer Price Index (CPI) for health services. According to *China Statistical Yearbook* 2005 and 2010, using 2009 as the base year CPIs for 2004 is 0.927 (National Bureau of Statistics of China, 2005, National Bureau of Statistics of China, 2011, National Bureau of Statistics of China, 2007) .

Knowing that NCMS was first implemented in 2003, it is clear that the communities joined the rural cooperative scheme after 2003 are actually covered by the NCMS (Lei and Lin, 2009). Aside from participation in the NCMS, the model also considers a set of potential determinants of the use of outpatient care and of costs of outpatient care. This includes health need and non-need variables of the sample population, as commonly suggested and used in the literatures (Hernandez Quevedo and Jimenez Rubio, 2009, Gravelle *et al*., 2006, Jones, 2007). For health need variables, the model controls for age, gender, and morbidity type. Morbidity is categorized into four types: Type 1 for fever, sore throat, cough, diarrhoea, stomach ache, headache, and dizziness; Type 2 for joint pain, muscle pain, rash, dermatitis, and eye/ear disease; Type 3 for infectious diseases; and Type 4 for non-communicable diseases. For non-need factors, it controls for household per capita income, education, job

status, and province of residency, and season. Per capita income is constructed by using Equivalence Scales (Citro *et al*., 1995). Education is categorized into four groups: no education, primary and secondary education, high school and technical school education, and university education and above. University education and above are used as the reference group. Health facilities are categorized into five groups: village clinics, township hospitals, county and city hospitals, private clinics, and other health facilities. Village clinics are the reference category. For the province variable, province Guizhou is set as the reference group. Season is categorized into two groups, September to December, and January to March. January to March is the reference group. Table 6.2 provides descriptive statistics of the data set used in the analysis.

Table 6.2 Descriptive statistics for the study population (mean/standard deviation)

Variable	Definition	Mean	Std. Dev.
Need variables			
Age		46.481	14.571
Gender	Dummy variable: 1, Male; 0 Female	0.503	0.500
Morbidity type 1*	Dummy variable: 1, fever, sore throat, cough, diarrhea, stomachache, headache, and dizziness; 0 otherwise	0.821	0.384
Morbidity type 2	Dummy variable: 1, joint pain, muscle pain, rash, dermatitis, and eye/ear disease; 0 otherwise	0.088	0.284
Morbidity type 3	Dummy variable: 1, infectious disease; 0 otherwise	0.045	0.208
Morbidity type 4	Dummy variable: 1, non-communicable diseases; 0 otherwise	0.046	0.209
Non-need variables			
Per capita income	Per capita household income is inflated to year 2009	9.527	0.869
Job status	Dummy variable: 1, Employed; 0 otherwise	0.784	0.411
No edu	Dummy variable: 1, No education; 0 otherwise	0.222	0.415
Pri/sec edu	Dummy variable: 1, Primary and secondary education; 0 otherwise	0.620	0.485
High school/tech edu	Dummy variable: 1, High school and technical school education; 0 otherwise	0.129	0.336
Uni and above edu*	Dummy variable: 1, University and above education; 0 otherwise	0.021	0.144
Province Liaoning	Dummy variable: 1 Liaoning, 0 otherwise	0.118	0.323
Province Heilongjiang	Dummy variable: 1 Heilongjiang, 0 otherwise	0.102	0.302
Province Jiangsu	Dummy variable: 1 Jiangsu, 0 otherwise	0.118	0.323

Province Shandong	Dummy variable: 1 Shandong, 0 otherwise	0.109	0.312
Province Henan	Dummy variable: 1 Henan, 0 otherwise	0.098	0.297
Province Hubei	Dummy variable: 1 Hubei, 0 otherwise	0.108	0.310
Province Hunan	Dummy variable: 1 Hunan, 0 otherwise	0.086	0.280
Province Guangxi	Dummy variable: 1 Guangxi, 0 otherwise	0.136	0.342
Province Guizhou*	Dummy variable: 1 Guizhou, 0 otherwise	0.125	0.331
Season	Dummy variable: 1 Sep. to Dec., 0 Jan. to Mar.	0.546	0.498

Note: *reference groups.

6.3.3 Empirical strategies

Mean comparison using longitudinal features of the data

Three modelling approaches were used to estimate the impacts of NCMS on the cost of outpatient care. First, we use the panel structure of the CHNS survey to conduct a comparison of average per episode outpatient costs for a single group of individuals over time, between 2004 (when none participated in NCMS) and 2009 (when all participated in NCMS). A total of 96% of the respondents were not covered by NCMS in the 2004 CHNS survey, whereas 93% were covered in the 2009 survey. Using the whole sample for mean comparison may cause selection bias, because it studies aggregate data, and individuals are not compared with themselves. Traditionally, scholars may use matching methods, such as Propensity Score Matching (PSM) to match sample with similar characteristics to correct selection bias. However, methods such as PSM are only able to correct selection bias caused by observable factors. The difficulty lies in accounting for a set of unobservable individual characteristics that were consistent throughout the years and might influence the use of health services and costs of outpatient care.

In this analysis, it was noted that a total of the 1,954 individuals surveyed in 2004, when none participated in NCMS, were re-interviewed in 2009, when all were covered by NCMS (Table 6.3). Among these individuals, 186 of them reported outpatient cost data in 2004 and 2009. We conduct a mean comparison based on the same individuals who had outpatient costs data in both survey periods, and who were uninsured in 2004 and insured in 2009. By using the methods, we are able to control for unobservable individual factors of the sample that are consistent through time.

Table 6.4 presents the descriptive analysis of the sample characteristics. Two samples are identical in most of the key variables.

Table 6.3 Sample distribution by NCMS participation for 2004 and 2009

		2009 (*N* = 4,084)		
		Insured with NCMS	Uninsured with NCMS	Not surveyed in 2009
2004 (*N* = 4,321)	Insured with NCMS	81	1	100
	Uninsured with NCMS	1,954	120	2,065
	Not surveyed in 2004	1,769	159	0

Table 6.4 Descriptive statistics for the study population for empirical strategy 1 (mean/standard deviation)

	2004 (N =182)		**2009 (N = 182)**	
Variables	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Age	49.555	11.547	55.141	11.575
Gender	1.548	0.499	1.566	0.497
Household expenditures	4346.565	5132.607	4828.061	7003.482
4 week illness	0.785	0.412	0.786	0.411
Village clinices	0.355	0.480	0.379	0.487
Township hospitals	0.231	0.423	0.225	0.419
County/city hospitals	0.188	0.392	0.198	0.399
Private clinics	0.177	0.383	0.154	0.362
Other health facilities	0.048	0.215	0.044	0.206
Job status	0.780	0.415	0.780	0.415
No edu	0.269	0.445	0.352	0.479
Pri and sec edu	0.608	0.490	0.604	0.490
High school	0.118	0.324	0.044	0.206
Uni and above	0.005	0.073	0.000	0.000
Province Liaoning	0.129	0.336	0.088	0.284
Province Heilongjiang	0.059	0.237	0.049	0.217
Province Jiangsu	0.005	0.073	0.000	0.000
Province Shandong	0.032	0.177	0.049	0.217
Province Henan	0.183	0.388	0.187	0.391
Province Hubei	0.220	0.416	0.104	0.307
Province Hunan	0.027	0.162	0.033	0.179
Province Guangxi	0.177	0.383	0.335	0.473
Province Guizhou	0.167	0.374	0.154	0.362
season	0.559	0.498	0.258	0.439

2PM and HSM

Secondly, to estimate the determinants of the use, total costs, and OOP payments for outpatient care, pooled data from two rounds of CHNS to date (2004 and 2009) are subjected to a regression analysis with a 2PM that has been used extensively in the health economics literature (Gravelle *et al*., 2006, Jones, 2007, O'Donnell *et al*., 2008b). The regression analysis draws data from CHNS 2004 and 2009 and includes all NCMS participants in our sample and all nonparticipants in any insurance coverage, excluding only individuals in the sample who are participants in other insurance programs.

The model comprises a Probit Model for the probability that an individual makes any expenditure on healthcare and an Ordinary Least Squares (OLS) model, applied only to the population with nonzero expenditures. Invariably the log of expenditure is modelled in the OLS because the distribution of medical expenditures is often right-skewed. Assume that the probability that outpatient cost (y_i) is positive is determined by observable (X_{1i}) and unobservable (ε_{1i}) factors. Let $\ln(y_i)$ be the log of positive outpatient costs, with a set of control variables X_{2i}, and unobservable factors ε_{2i}. The model can be written as follows (Jones, 2007):

(19) $E[\ln(y_i) \mid y_i > 0, X_{2i}\beta_2] = E[\ln(y_i) \mid X_{1i}\beta_i + \varepsilon_{1i} > 0, X_{2i}\beta_2] = X_{2i}\beta_2$

While the 2PM assumes that two independent decisions are behind medical expenditures, HSM allows the decision that seeking medical care and the actual expenditures can be influenced by distinct but correlated observable and unobservable factors (Gravelle *et al*., 2006, Jones, 2007, O'Donnell *et al*., 2008b). The model can be written in the latent variable form by the following:

(20) $y_{ji}^{*} = X_{ji}\beta_j + \varepsilon_{ji} \qquad j = 1,2$

(21) $y \begin{cases} y_{2i}^{*} & \text{if} \quad y_{1i}^{*} > 0 \\ 0 & \text{otherwise} \end{cases}$

Assuming the two error terms are jointly normally distributed, the model can be estimated either by the Heckman two-step procedure. The former involves first estimating a Probit Model for the probability of nonzero expenditures, and then uses

the results to estimate the Inverse Mills Ratio (IMR) to correct for selection bias. In the second part of the regression, the following is estimated (Gravelle *et al*., 2006, Jones, 2007, O'Donnell *et al*., 2008b):

(22) $y_i = X_{2i}\beta + \rho\sigma_2 \frac{\phi(X_{1i}\hat{\beta}_1)}{\Phi(X_{1i}\hat{\beta}_1)} + e_{2i}$

Where ϕ and Φ are the standard normal probability density and cumulative density functions, respectively, ρ is the correlation coefficient between the errors, and σ_2 is the standard deviation of ε_{2i} (σ_1 = 1). The performance of the HSM depends on the collinearity between the IMR and the explanatory variables in the regression equitation, and this can be tested using a t-ratio test.

PSM with DID estimation

DID is also used to measure the effect of the change of health costs induced by the NCMS. DID represents the difference between the pre-post, within-subject differences of the treatment group and control group (Stock and Watson, 2011). In order to identify treatment and control groups, we would need data on the same individual in both 2004 and 2009, or we would be able to identify the surrogate treatment group if we treat the dataset as repeated cross-sectional data. Given the difficulty in identifying surrogate treatment group, DID is conducted on the same individual who were both surveyed in 2004 and 2009. Treatment group is defined as those who were not covered by the NCMS in 2004, but were covered by the NCMS in 2009. Control group was defined as those who were not covered by any insurance in either 2004 or 2009. Let *t* = 0 represents 2004 and *t* =1 represent 2009. The model can be written as follows,

(23) $\ln(y_i) = \beta_0 + \beta_1 X_i + \beta_2 T_t + \beta_3 X_i * T_t + \varepsilon_{it}$

Where X_i is the dummy variable taking the value of 1 if the individual was in the treatment group and 0 if they were in the control group, and T_t was a dummy variable taking the value of 1 in 2009 and 0 in 2004.

The premise of using DID is that the treatment is randomly assigned in the population. PSM is frequently used in policy analysis to avoid selection bias and to ensure that observations are randomly selected for receiving a treatment (Rosenbaum

and Rubin, 1983). We use PSM to predict participating in the NCMS by constructing counterfactuals on an assumption that the participation is based on a set of observed characteristics. The method includes two steps: (i) predict a conditional probability of participating in the NCMS conditional on a set of observable variables; (ii) match each participant to one or more nonparticipants on the given propensity score using Kernel Function. Balancing properties of the matching was reported in Appendix 4. It shows that the estimated propensity score balance the observed characteristics well. One concern with regard to PSM is that it only takes into account the selection biases based on observed characteristics. Combing PSM with DID, we will be able to remove the selection bias resulting from unobserved characteristics are constant over time.

For all analyses, the computation of VIF was performed, and results indicated that multicollinearity was not a problem. Ramsy RESET tests were also performed, and results showed the models had no specification problems.

6.4 Empirical results

Results based on the first analytical method, the comparison of per episode outpatient costs for the same group of individuals in 2004 (pre-enrolment) and 2009 (as participants to NCMS), are presented in Table 6.5.

The average gross per episode outpatient costs (total billings per episode before insurance claims were filed) is 308.14 RMB in 2009, much higher than in 2004, when the individuals studied were not covered by NCMS, a statistically significant difference. After participants in 2009 filed claims, the average per episode outpatient cost for the insured is reduced to 253.81 RMB. A *t*-test showed that this is not significantly different than costs for the uninsured.

Table 6.5 per episode outpatient costs for the insured and uninsured

	Uninsured (2004) (n = 186)	Insured (2009) (n = 182)	Difference	*t*-stat
Gross billed	205.43	308.14	–102.71	–1.86*
Net after claim paid	205.43	253.81	–48.38	–0.93

Note: $p < 0.01$, ** $p < 0.05$, *, $p < 0.1$

Table 6.6 shows how per episode costs for outpatient care at different levels of health facilities differed for the insured and the uninsured. Gross per episode outpatient costs, before insurance claims were filed, are significantly higher for the insured patients if care is sought at village clinics, township health centres, and private clinics rather than larger facilities. For care sought at village clinics, gross per episode costs before insurance claims are filed is 116.68 RMB, which is 44.47 RMB higher than gross costs billed to the uninsured (t = –1.92). Similarly, gross per episode costs for the insured at village clinics is 349.39 RMB, which is 201.09 RMB higher than gross billings to the uninsured (t = –2.05). However, after claims are paid, no significant difference is observed in the net costs to the insured and the uninsured. For care sought at the higher-level health facilities (county and city hospitals), no significant difference is observed in costs to the insured and costs to the uninsured.

Table 6.6 Medical costs per treatment episode, for the insured and uninsured, at different levels of health facilities

	Uninsured (2004) (N = 186)	**Insured (2009)** (N = 182)	**Difference**	***t*-stat**
Village clinics	66	69		
Gross billed	72.21	116.68	–44.47	–1.92*
Net after claim	72.21	97.77	–25.56	–1.14
Township health centres	43	41		
Gross billed	139.30	349.39	–210.09	–2.05**
Net after claim	139.30	244.20	–104.90	–1.24
City/county hospitals	35	36		
Gross billed	618.12	683.89	–65.77	–0.34
Net after claim	618.12	569.72	48.40	0.26
Private clinics	33	28		
Gross billed	52.31	289.29	–236.98	–2.04**
Net after claim	52.31	289.29	–236.98	–2.04
Other	9	8		
Gross billed	454.91	123.13	331.78	1 .00
Net after claim	454.91	103.11	351.80	1.06

Note: $p < 0.01$, ** $p < 0.05$, *, $p < 0.1$

Table 6.7 shows the results for 2PM and HSM. The models estimates the impacts of NCMS on outpatient costs by comparing gross costs before insurance claims are filed with net costs after insurance claims are filed and reimbursement was paid. Occurrence of outpatient costs is analysed in relation to insurance, type of illness, job status, and place of residence, etc. Results from this second method are consistent with the regression results presented above. One salient finding is that the NCMS had no significant impacts on outpatient care utilization. Even more importantly, results of the regression show that, ceteris paribus, NCMS has no effect in reducing participants' OOP payments (indicated under the after reimbursement column in Table 6.7) for outpatient care, and meanwhile it significantly increases the pre-insurance costs of outpatient care (indicated under the before reimbursement column in Table 6.7). Both 2PM and Heckman Selection Model show that pre-insurance cost of outpatient care for rural residents covered by NCMS to be more than 40% higher than for those not covered. Further, it is also noted that comparing to minor illness (Morbidity type 1), people who are with major illness are more likely to seek outpatient care.

Table 6.7 Regression results for outpatient medical costs for 2004 and 2009

	2PM				**HSM**			
	Before reimbursement		**After reimbursement**		**Before reimbursement**		**After reimbursement**	
	Participation Probit	Continuous OLS	Participation Probit	Continuous OLS	Participation Probit	Continuous OLS	Participation Probit	Continuous OLS
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Insurance	0.065	0.343***	0.052	0.098	0.046	0.415***	0.052	0.098
Age	0.02	0.008	0.02	0.008	0.024*	0.017	0.02	0.008
Age2	0	0	0	0	0	0	0	0
Gender	-0.133**	0.085	-0.107*	0.117	-0.131**	-0.044	-0.107*	0.115
Morbidity type 2	2.558***	-0.534**	2.538***	-0.428*	2.534***	2.245***	2.538***	-0.377
Morbidity type 3	2.15***	0.106	2.17***	0.214	2.154***	2.503***	2.17***	0.259
Morbidity type 4	2.62***	0.957***	2.621***	1.039***	2.63***	3.77***	2.621***	1.091
Per capita income (lg)	0.031	-0.044	0.017	-0.023	0.037	-0.024	0.017	-0.022
Job status	0.083	0.006	0.091	-0.044	0.073	0.106	0.091	-0.042
No edu	-0.345	-0.75	-0.367	-0.756	-0.383	-1.017	-0.368	-0.762
Pri and sec edu	-0.261	-0.668	-0.297	-0.724	-0.291	-0.872	-0.297	-0.729
High school	-0.46	-0.616	-0.495	-0.597	-0.487	-0.996	-0.496	-0.605
Province Liaoning	-0.279**	0.944***	-0.285**	1.077***	-0.289**	0.709***	-0.285**	1.072***
Province Heilongjiang	-0.379**	0.619**	-0.375**	0.504	-0.386***	0.273	-0.375**	0.497
Province Jiangsu	0.184	0.483**	0.203	0.668***	0.154	0.675**	0.203	0.671**
Province Shandong	0.003	0.41	0.025	0.139	-0.023	0.464	0.025	0.14
Province Henan	0.37***	0.027	0.384***	0.181	0.371***	0.346	0.384***	0.187
Province Hubei	0.092	0.409*	0.017	0.447*	0.064	0.537**	0.017	0.448*
Province Hunan	-0.074	0.778***	-0.134	0.906***	-0.092	0.723**	-0.134	0.903***
Province Guangxi	0.459***	0.096	0.425***	0.266	0.424***	0.534**	0.425***	0.273
Season	-0.272***	0.114	-0.328***	0.046	-0.272***	-0.118	-0.328***	0.041
Constant	-3.063***	4.758***	-2.883***	4.488***	-3.159***	0.594	-2.882***	4.41*

	N = 7717 LR chi2(21) = 2547.26 Prob > chi2 = 0 Pseudo R2 = 0.5272	N = 730 F(21, 708) = 9.65 Prob > chi2 = 0 R2 = 0.2042	N = 7717 LR chi2(21) =2487.31 Prob > chi2 = 0 Pseudo R2 = 0.5242	N = 711 F(21, 689) = 7.5 Prob > chi2 = 0 R2 = 0.186	N = 7717 Rho = 0.7696349 LR test of Rho = 0: p = 0.0133 Wald chi2(21) = 175.23 Prob > chi2 = 0	N = 730	N = 7717 Rho = 0.0174707 LR test of Rho = 0: p = 0.9706 Wald chi2(21) = 161.65 Prob > chi2 = 0	N = 711

(Note: p < 0.01, ** p < 0.05, *, p < 0.1)

Table 6.8 shows the PSM with DID estimates for outpatient costs before the NCMS deduction and after the NCMS deduction. The results show a trend of an observed increase in the difference of pre-reimbursement outpatient costs between the treatment and control group (*p =0.1)*. The results also show that there is no significant difference for post-reimbursement outpatient costs between the control and treatment groups after the launch of the NCMS.

Table 6.8 DID results with PSM for outpatient costs before the NCMS deduction and after the NCMS deduction

	Before reimbursement (N = 351)						
	Control	Treated	Diff(2004)	Control	Treated	Diff(2009)	Diff-in-diff
Outpatient cost (lg)	5.108	4.146	-0.962	3.854	4.668	0.814	1.777*
S.E.	0.567	0.124	0.581	0.926	0.122	0.934	1.1
R^2							0.238
	After Reimbursement (N = 344)						
	Control	Treated	Diff(2004)	Control	Treated	Diff(2009)	Diff-in-diff
Outpatient cost (lg)	3.976	4.141	0.165	4.390	4.402	0.012	-0.153
S.E.	0.547	0.128	0.561	0.669	0.126	0.681	0.883
R^2							0.233

(Note: $p < 0.01$, ** $p < 0.05$, *, $p < 0.1$. DID model used include age, gender, morbidity types, *per capita* income, job status, province and season variables.)

Robustness test

We perform two main sets of robustness tests for the analysis. The first set uses both 2PM and HSM to estimate the probability of using outpatient care and the main factors that influence outpatient costs. These two models show similar results. The second set of robustness tests is performed on the continuous part of the regression model. The positive association between education and health is well established (Ross and Wu, 1995, Costa-Font and Gil, 2008, Costa-Font et al., 2010). In the main analysis, education is categorised into four groups. For the robustness checks, these groups are re-categorised into five groups: no education, primary education, secondary education, high school or technical school, university education and above—that is, primary and secondary education have treated separately, not in combination as before. The regression model is then re-estimated. Robustness tests confirm the results from the 2PM and HSM models that outpatient costs are higher for the NCMS insured group compared with the uninsured group before insurance

claims are filed. No significant difference is observed for these two groups in terms of costs after insurance claims are filed.

6.5 Discussion and conclusion

The study has yielded some compelling new findings regarding the impact of NCMS on the costs of outpatient care in rural China. Evidence as recent as 2009 indicates that outpatient treatments for the program's participants incurred significantly higher per episode costs than outpatient treatments for the uninsured after the new initiative was implemented. This pre-reimbursement inflation in costs of service is most noticeably observed at village clinics, township hospitals, and private clinics. Cost inflation for health insurance is not new and has been observed in countries other than China. In Chile, the availability of private health insurance led to increased use of high-technology obstetric practices and consequently to higher Cesarean delivery rates (Murray and Elston, 2005). Prescription drug insurance likewise had positive effects in encouraging the use of specialist care (Allin and Hurley, 2009). In China, cost escalation was observed in the urban health insurance scheme adopted in the late 1990s before NCMS was inaugurated for the rural population. All these programs created strong incentives for health providers to prescribe expensive drugs and high-tech diagnosis procedures, on which the profit margins were higher (Wagstaff and Lindelow, 2008).

Our analysis shows that during the interval covered by our study (2004 and 2009), one possible explanation for the observed increase in outpatient costs is that the availability of funds through patients' insurance claims from NCMS may similarly have induced participating health facilities and doctors to prescribe more expensive drugs or order unnecessary treatments—one phenomenon that has been recognised in the literature (Yip *et al*., 2010, Yip and Mahal, 2008, Wagstaff and Lindelow, 2008). Comparison of average per episode costs for outpatient care before and after rural residents subscribed to the NCMS yielded similar findings. From this evidence it appears that during the interval analysed, the NCMS is associated with an escalation in pre-reimbursement per episode outpatient health costs (gross billings, before claims are filed) for its participants, even if after claims were filed, OOP payments are reduced to a level similar to that for nonparticipants. The regression analysis and

DID analysis also reveal that pre-reimbursement costs for outpatient care for rural participants to NCMS are 40% higher than those for no subscribing, uninsured patients. Thus in terms of OOP payments for outpatient services, the NCMS has limited impacts on reducing outpatient costs, while costs billed to the NCMS for outpatient services may continue to rise.

One policy implication to be drawn from this scenario is that further infusions of government subsidies aimed at covering rising NCMS expenditures may simply induce further waves of cost escalation, unless the program can use its leverage as purchaser and third-party payer to introduce cost-saving measures in participating health services facilities.

More crucially, pressures for cost inflation appear to be stronger in village clinics and township health centres, where rural residents are most likely to seek outpatient care, than at larger facilities. Per episode costs for outpatient care at village clinics and township health centres are significantly higher for patients covered by the NCMS than for those not covered. Because it is widely believed that cost-effective care can best be delivered at low-level health facilities that are most accessible to rural residents, The NCMS create incentives for its participants to seek care in those venues; the claims reimbursement rates for care delivered in these, small local health facilities are the highest offered by the program. Yet during the interval studied, these same venues received less government subsidization through the NCMS than others did, usually larger health facilities. The resulting financial vulnerability, coupled with the local availability of at least some NCMS funding, may have led to higher charges for participants as local facilities struggled to make ends meet. Much of the government support intended to subsidize participants' payments for healthcare may instead have been absorbed by the insatiable quest for revenues and cost coverage at these smaller health facilities that are most frequently visited by rural residents.

Given these considerations, it is not surprising that the rapid expansion of NCMS through massive injection of government subsidies has so far had limited impacts on either improving access or reducing OOP payments for outpatient care at participating health facilities. In fact, our analyses indicate that rural residents

covered by NCMS are less likely to seek outpatient care than are uninsured residents who do not subscribe to the program. There is no evidence from our analysis that NCMS reduces OOP payment for outpatient care. Providers, seeking to offer improved care, ultimately increased total costs of outpatient care, such that financial benefits to patients in the form of claims reimbursements through NCMS are largely dissipated by the costs of this enhanced service, providing no overall cost savings to outpatient participants.

More research is needed to understand how and to what extent NCMS created and may continue to create this cost escalation at lower-level health providers, who are the front line of care for rural residents. Caught between a mandate for improved services to their rural clientele, and lagging funds to accomplish the job, these small facilities may be forced to drive up reimbursable costs to make ends meet. Participants to the program are then left no worse off than nonparticipants in terms of OOP payments per episode of service, but they are not seeing the hoped-for savings, against prior, uninsured levels of expense, that the program was intended to provide.

Without a careful examination of medical costs at different levels of health facilities, policy makers will not be able to identify the root causes of this problem. Without a clear understanding of the governance framework that support it, the intended benefits of the health insurance program for China's large rural population will be difficult to realize (Ramesh *et al*., 2012). New measures in improving NCMS should be directed not only at offsetting rising costs, but also at designing and implementing reforms in cost management in participating health service facilities, in an effort to make best use of the public financing in the long term. If costs can be reined in, rural participants stand a better chance at realizing actual cost savings in medical care under NCMS, one of the program's core goals.

7 Conclusion

The overarching objective of this thesis was to investigate issues of inequities and inefficiencies in healthcare in China. The research questions that this thesis followed are: Do health inequities and inefficiencies exist in China's healthcare system? To what extent does the rural insurance scheme address issues of inequities and inefficiencies in healthcare in rural China? This thesis examines the emergence of income-related health inequalities in rural and urban China, and the impacts of the NCMS on equity in access and finance in healthcare. Specifically, it looks into the distribution of health outcomes for urban and rural populations in order to understand which socioeconomic or income groups are affected by which health issues, and why. The bulk of the thesis focuses on the discussion of the rural health insurance reform and its impacts on inequity in health. This thesis argues that, the NCMS has met some of its principal goals of expanding coverage and increasing utilization of some services, but equity is still an issue with the NCMS. Outpatient care, which usually covers the "basic" cost-effective interventions, is not emphasized in the benefit package. It is evident that even for households covered by the NCMS, costs incurred from outpatient care might still considered catastrophic, and may even become a poverty trap for some households. This thesis pays particular attention to the issue of inefficiency in health provision by investigating the relationship between the NCMS and cost escalation. This thesis suggests that the NCMS may respond to a certain amount of cost escalation because doctors and hospitals may increase demand for those who are covered by health insurance.

This chapter starts by summarising results of the empirical chapters. It sets out some policy implications for addressing issues of inequities and inefficiencies in China's healthcare system, focusing on changes that build on recent government initiatives, notably the NCMS. Limitations and future research agenda are also presented in the concluding section.

7.1 Summary of the findings

The main research question of this thesis is whether inequity and inefficiency exist in China's healthcare system in the 2000s, how the NCMS responses to these issues. This thesis investigates health inequities by looking at specific health inequities, i.e., socioeconomic related inequities in health outcomes, horizontal inequities in health access, catastrophic health payment and health payment-induced poverty in health finance. By analysing the data from CHNS of 2004, 2006 and 2009, this thesis raises equity concerns about the affordability of health costs for the poor, the worry being that the poor, even covered by the NCMS, are more likely to use folk doctor care than the rich, and less likely to use preventive care. They may also have difficulty in meeting the costs of care that they need, or may have to pay a substantial share of income on healthcare. This thesis investigates the problem of inefficiency in China's healthcare system. The findings suggest that the NCMS may exacerbate the problem of inefficiency in healthcare provision because the scheme may lead to healthcare cost escalation. It argues that without removing the distortions in provider incentives inherited in China's healthcare system, the best intentions of the NCMS to provide financial protection to the rural Chinese will be difficult to realise. The following section summarises the findings of each paper:

- Chapter 3 (Paper 1) argues that urban respondents have similar self-assessed health, but more physical limitations compared with rural respondents. Income-related health inequalities are more pronounced for urban populations than for rural populations. The most striking result from this chapter is that for the urban population, more than two-thirds of inequalities are driven by socioeconomic related factors, among which income, job status and educational level are the most important. The contributions from socioeconomic related factors of the rural population are much less pronounced compared with the urban population.
- Chapter 4 (Paper 2) shows a mixed picture in terms of the variation of healthcare utilisation and how the NCMS has influenced the level of inequity. It investigates the whole period of the expansion of the NCMS from 2004 (before the expansion of the NCMS) and 2009 (after the expansion of NCMS across rural China). It finds that the level of inequity remains the same for outpatient care. In terms of preventive care, the pro-rich inequity has

decreased. A widening gap between the poor and rich in terms of folk doctor use is observed. The NCMS demonstrates positive effects on reducing income-related health inequity in folk doctor care and preventive care, but the contribution is rather small.

- Chapter 5 (Paper 3) provides evidence of the impacts of the NCMS on the magnitude, distribution and economic consequences of OOP payments for outpatient care in rural China. The NCMS has limited impact on reducing the incidence or severity of catastrophic payments, or reducing favouring-poor inequity in catastrophic payments. It has had no significant effects on reducing health payment-induced poverty. The costs are likely to become catastrophic when care is sought at village and township health facilities, and the NCMS has no significant impact on reducing the likelihood of this occurring. For households with chronic disease members, catastrophe is disproportionately concentrated among the poor.
- Chapter 6 (Paper 4) investigates the relationship between the NCMS and cost escalation. The study shows that during the interval covered by our study (2004 to 2009), the availability of funds through patients' insurance claims from the NCMS may have induced participating health facilities and doctors to prescribe more expensive drugs or induce unnecessary treatments. Outpatient treatments for the program's participants incurred significantly higher pre-reimbursement per episode costs than outpatient treatments for the uninsured. This pre-reimbursement inflation in costs of service is most noticeably observed at village clinics, township hospitals, and private clinics.

This thesis makes a contribution to the methodology in healthcare research. Although the health equity methods used in this thesis are built upon the Concentration Indices and Decomposition Analysis, this thesis transforms these methods into tools for policy evaluation in China's healthcare system. Specifically, this thesis assesses health inequities by looking at socioeconomic related inequities in health outcomes, horizontal inequities in health access, catastrophic health payments and health payment-induced poverty in health finance. This thesis also develops a set of analytical tools to investigate one potential type of inefficiency—cost escalation under the NCMS. It does so by using three empirical strategies to

investigate the relationship between insurance and cost escalation. The specific empirical strategies include conditional mean testing, Two-part Model and Heckman Selection Model and Propensity Score Matching with Difference-in-differences analysis. This study is also among the first to offer suggestive empirical evidence of supplier-inducement under the insurance. The findings of this thesis should be understood within their contexts, but these tools of measurement are transferrable for analysing health inequities in other countries with similar political structures and levels of socioeconomic development.

7.2 Policy implications

The thesis suggests that inequities and inefficiencies are urgent issues in China's healthcare sector. Drawing from the empirical results from the papers presented here, a number of policy recommendations are made. Policy recommendations for the rural healthcare system are drawn specifically from Papers 2, 3 and 4, policy recommendations for the urban healthcare system are drawn specifically form Paper 1, while the overarching recommendations are policy recommendations for the Chinese health system more generally.

7.2.1 Policy recommendations for the rural healthcare system (Papers 2, 3 and 4)

A major topic of this thesis is to discuss the rural health insurance reform, i.e. the NCMS. This thesis has shown that despite the impressive expansion of the health insurance system, there are growing concerns about the impacts of the insurance on health equity, and in particular on whether it has improved equitable access and led to the reduction in OOP payment for patients (see Paper 2, Paper 3 and Paper 4). A few specific policy recommendations on how to improve the design of the insurance to achieve its goal in improving equitable access, fairness in financing, and reducing health cost are presented as follows.

Improving the NCMS benefit package

- *Outpatient care*

Outpatient care is one of the most frequently used and widely accessible forms of care for rural Chinese farmers (Hu *et al*., 2011). However, it is not a cheap event, and costs can become catastrophic for poor households (Kavosi *et al*., 2012,

Szwarcwald *et al*., 2010, Wagstaff *et al*., 2005). Paper 3 suggested that the NCMS had little impact on reducing catastrophic outpatient payments, and the scheme still required substantial cost sharing for outpatient care. Although the NCMS claimed to reimburse catastrophic outpatient care associated with chronic conditions, Paper 3 found that patients with chronic disease conditions were more likely to suffer from catastrophic health payments, and such a trend was more pronounced among the poor. It is not surprising because the NCMS mainly reimburses two types catastrophic outpatient care: general chronic conditions and severe chronic conditions that require specialist care (see Table 5.1 in Paper 3). A list of 28 chronic conditions are eligible for catastrophic outpatient care reimbursement (Ministry of Health P.R.China *et al*., 2007). These chronic conditions are either associated with severe post-surgical conditions, such as conditions requiring chemotherapy and radiotherapy, etc., or other severe chronic conditions that are in need of long-term specialist care. Many common chronic conditions, such as conditions related to neurological dysfunction, are not eligible for catastrophic outpatient reimbursement. Patients who are diagnosed with these common chronic diseases would need to pay a large share of their medical bills out of pocket. More common chronic diseases should be included in the NCMS's outpatient reimbursement list in order to reduce access barriers and improve the affordability of care.

Aside from a limited reimbursement list, the reimbursement rate for outpatient care is low in general. The government claimed that between 40% to 79%of medical bills will be reimbursed by the NCMS, but the actual reimbursement rates, as evidenced in the literature, are between 10% and 20%, and a substantial fraction of costs has to be financed out of pocket (Barber and Yao, 2011). Even though outpatient care is generally believed to be cheap and affordable, it is not always true for the poor because demand for outpatient care for this group is usually price sensitive (Werner, 2009, Shahrawat and Rao, 2012, Chen and Meltzer, 2008), and OOP payments can lead to a substantial burden for poor patients, and may even induce poverty as evident from this thesis. Moreover, limiting the insurance benefit package may actually increase the risk that the poor may delay seeking care until their condition becomes sufficiently serious to require inpatient care. Delayed care may then lead to higher medical costs, which may again create affordability issues for patients.

- *Inpatient care*

Problems with inpatient care are similar to those with outpatient care. Two policy recommendations are given in order to address problems related to access to and finance of inpatient care. First, the NCMS needs a more comprehensive benefit package for inpatient care. Although coverage of treatments for catastrophic illness remains the primary objective of the NCMS, at the time of writing, the NCMS has only included eight severe diseases in its inpatient reimbursement list, which includes childhood leukaemia, congenital heart disease, end-stage renal disease, breast cancer, cervical cancer, etc. The scheme is running a pilot program to include 12 more severe diseases in the benefit package (Liu *et al*., 2012a, Wang *et al*., 2012b, Wang *et al*., 2012c, Zhou *et al*., 2011, Xinhua, 2012a), but the list is still far from comprehensive. Some common life-threatening diseases, such as lung cancer, are not included in the list, and co-payments for inpatient care of these remain high even after claims for reimbursable costs are paid (Liu *et al*., 2012a, Wang *et al*., 2012b, Wang *et al*., 2012c, Zhou *et al*., 2011).

Similar to outpatient care, reimbursement rates for inpatient care are low in general. As mentioned in the earlier papers in the thesis, the reimbursement rate depends on where the care is sought. The claimed reimbursement of inpatient care as suggested by the government is no less than 75% for village clinics/township health centres, 55% for county/district hospitals and 45% for city/province hospitals (Centre for Health Statistics and Information, 2008). The intention in giving higher reimbursement rates for care sought at village and township level health facilities is to improve efficient use of medical resources and to avoid patients seeking unnecessary care at secondary and tertiary hospitals; however, patients seeking care at county/district hospitals and city/province hospitals tend to incur higher costs because they may suffer from severe illness and would require complex treatment procedures. Low reimbursement rates at these health facilities may lead to higher co-payments, and this may in turn lead to affordability issues when the NCMS participants seek care at these health facilities.

Provide additional benefits to the poor

Papers 2 and 3 find that the NCMS has limited impacts on improving equitable access and fairness in finance among the poor. The poor are often less likely to use

preventive care, and have a higher risk of suffering from catastrophic health shocks than the rich. Nearly half of the outpatient care episode costs incurred at village clinics and township health centres are catastrophic; and the catastrophe is more concentrated among the poor. One policy implication drawn from the findings is to link co-payments to household income, and to offer better financial protection to the poor.

It is unfair to say that the Chinese government has done nothing to help the poor with medical expenses. In fact, a separate social security scheme, the Medical Assistance Safety Net (MASN), was initiated in 2003 to provide financial support with medical expenses and insurance contributions to the extremely poor and vulnerable groups, in rural and urban areas. However, studies showed that the impacts of the scheme were rather limited, and this was mainly because of the limited budget of the MASN (Wagstaff *et al*., 2009c). In 2006, the MASN budget was approximately RMB18 (US$2.26) per person. Even if all this budget had been used on paying healthcare, the program would have had been just enough to cover the contribution to the NCMS premium, which was RMB10 (US$1.25) per person. This would leave only RMB8 (US$ 1.003) for health payments, whereas the average payments for healthcare for the bottom quintile of the rural population were around RMB200 (US$ 25.08) (Wagstaff *et al*., 2009c). Moreover, the aim of the MASN is only to provide financial protection for the extremely poor, and this excludes a large share of the rural farmers who are not eligible MASN beneficiaries but might still be considered poor.

The current rural health system in China needs to pay more attention to the poor, either by designing a separate SHI programme or by offering additional benefits from existing insurance packages. One possible solution is to link insurance contributions to household income; this means that households would need to devote a fixed percentage of their income to insurance contributions. At the moment, the poor are paying the same flat-rate of insurance contributions and receiving the same benefit package as the rich. For most SHIs, insurance contributions can either be made through a payroll tax or through any government pension programme, and the contribution can be deducted before the individual receives the pension (Mossialos,

2002). However, in rural China, it is potentially difficult to gain access to income level data because farmers are usually self-employed or working in informal sectors, where national level data of declarations for income tax are often unavailable or unreliable (Wagstaff *et al*., 2009c). A number of alternative strategies for linking the NCMS contributions to living standards of individual households might be worth considering. Examples can be drawn from other low-and middle-income countries. For instance, Colombia has adopted a proxy-means testing instrument, which is known as the System for Selecting Beneficiaries of Social Spending (SISBEN) for targeting health spending since the mid-1990s (Castañeda, 2005). The approach was based on the evaluation of household living standard to determine targeting beneficiaries—the poor and the vulnerable. The objects of the SISBEN were to select target population for the program, and to provide these people with a determined health insurance package by contracting and paying their private health insurance agencies. This health insurance package usually includes primary and basic inpatient care, as well as a list of catastrophic illness. By 2002, 60% of the Colombian population (27 million people) were enrolled in the SISBEN, and about half of them (13 million) received benefits. The proxy-means testing instrument has also been extensively used to target subsidies for a variety of government programmes including health insurance and subsidies for the poor and the vulnerable by national and local governments (Castañeda, 2005, Escobar *et al*., 2010).

In theory, a similar strategy as the SISBEN can be applied to the Chinese context so that the NCMS contributions can be linked to household income. In practice, this approach will obviously be costly unless the data can be used for other purposes, as is the case for Colombia. Alternatively, China can use other available data sources, such as property tax data, to capture and identify the vulnerable population and to link insurance contributions to household income.

Enhancing effective purchasing for the NCMS

Although purchasing is still in its infancy in China, the SHI schemes need to consider it an important element, and change the ways schemes interact with providers. In China, the government agencies, as purchasers and third-party payers, undertake limited bargaining with health providers for low prices, and provide

limited oversight role over service quality and provider behaviour (Wagstaff *et al*., 2009c, Yip and Hsiao, 2009a, Li *et al*., 2011). In fact, most policy documents mentioning strategic purchasing usually lack information on how such policies would be formed and implemented. It is important that the NCMS should become a proactive purchaser of healthcare to lead health providers to provide effective and appropriate care.

Despite the fact that the NCMS thus far has shown limited capability in utilizing its purchasing power, some experimental efforts have brought promising results. In Shanghai, purchasing decisions can only be made based on the most cost-effective choices for each treatment plan. For example, a hospital is allowed to offer and use a maximum of two pharmaceutical products that share the same formula, selected according to their cost-effectiveness (Yang, 2009). Some western regions, taking into account evidence of provider performance as well as village-level ratings of services provided, have created "fund boards" (comprised of village representatives, government officials, township health centre directors, and auditors) to act as a single purchaser and to make purchasing decisions (Wang *et al*., 2009a). Clearly, insurers have started to exercise some influence over purchasing decisions in some areas, but it is too early to tell whether these mechanisms—cost-effective limits set on hospital purchases, or locally comprised purchasing boards—can be sustained in the long run, and, more importantly, whether they will prove to be applicable in a wide range of circumstances. It has to be noted that, to transform NCMS into a proactive purchaser of healthcare would require effective coordination of different levels of local health authorities and providers, a task that would demand significant changes to existing institutional arrangements.

7.2.2 Policy recommendations for the urban healthcare system (Paper 1)

China is undergoing a rapid transformation from a rural, agricultural based society into an urban one (Hussain, 2003). While the urban growth has doubtlessly resulted in a rise in the middle classes and in wealth, a large fraction of urban population is still poor, and the income gap between the rich and poor is also associated with inequalities in other socioeconomic areas, such as health (Chen and Meltzer, 2008).

Paper 1 discusses the issue of widening inequalities in urban China, and finds that a large percentage of inequalities in health outcomes are associated with socioeconomic related socioeconomic factors. The striking findings urge Chinese policy makers to pay attention to the health of those who belong to the lower socioeconomic groups, especially those who live in urban areas.

The discussion of inequities in health outcomes in Paper 1 underlines the nature and scope of the problems that the Chinese government faced in the mid-2000s. A number of health initiatives were launched to improve equitable access to healthcare for the urban poor and to enhance the capacity of health facilities in urban communities after 2006. In 2007, the Chinese government launched the URI, a new social health insurance scheme targeting the urban unemployed. Prior to 2007, there were two primary SHI programs in China: UEI for the urban employed and the NCMS for the rural population. Approximately 420 million urban residents without formal employment were completely left out of the SHI safety net (Lin *et al*., 2009). As unaffordable access to healthcare and impoverishment due to high health costs is one of the great difficulties confronting the urban unemployed, the launch of the URI in 2007 offered financial assistance for the urban poor to overcome their health dilemma.

This thesis does not include an analysis of existing SHIs in urban China. However, as the URI is the only available SHI for the urban vulnerable, it is important to discuss some potential problems of the URI. Like the NCMS, the URI focuses mainly on catastrophic illness, and its benefit package is limited. The URI participants are not entitled to any additional benefits even though they may have greater health needs than the urban employed (Lin *et al*., 2009). A more comprehensive disease list for outpatient and inpatient services, along with more generous reimbursement rates should be applied to the URI benefit package. Further, the government should also reduce or waive the insurance contribution from the URI participants, or allocate aggressive subsidies to help the urban poor pay for the premium in order to ensure equity of enrolment. Currently, the participation in the URI is on a voluntary basis, and a premium is required for enrolment. This may impede the urban poor because they are already struggling with meeting their living

expenses (Chen and Yan, 2012).

The second main policy initiative for improving access of care for the urban poor is the establishment of community-based health system in the urban areas. In 2006, the government allocated a total of 850 billion RMB (US$136 billion) to establish a community-based health system, which required communities with a population of between 30,000 and 100,000 to have a health centre (Li and Yu, 2011). The aim of the programme was to improve equity in access and to provide basic healthcare for the urban population generally and the urban poor specifically (Li and Yu, 2011). These health centres provide low costs basic services including primary medical care, preventive care, health management, rehabilitation, and family planning, and they offer short waiting times and a short travel distance, and the services are open for all residents living in cities, including migrant workers from rural areas (Li and Yu, 2011). The community-based health system acts as a complement to the URI by filling the gap for low-cost preventive and primary care which is not covered by the URI.

However, whether the centre is able to offer effective treatments at a low price largely depends on the financing capability of local governments (Li and Yu, 2011). Where per capita GDP in the most affluent province can be much higher than the least affluent one, the services that can be offered by community centres vary significantly among provinces and cities. It is common to see community health centres survive on medicine sales and revenues generated from clinic services since many local governments are not able to allocate sufficient funding for health centres. Drugs can account for about 75% of the total revenue in a community health centre, and profit margins were as high as 50% (Li and Yu, 2009). Such a financing mechanism creates strong incentives for health facilities to prescribe more expensive medicines and provide more costly health services than is necessary. This is problematic because if the goal of the community-based health centres is to improve access to basic care for the urban population, then care provided at these health centres should be based on the most cost-effective, rather than the most profitable options (Wang *et al*., 2005).

It might be useful to look into possible strategies to regulate provider behaviours and

to reform provider payment mechanisms for primary care providers. For primary care, the most commonly used alternative to a FFS mechanism is capitation, linking provider payment arrangement to number of patients the providers are expected to serve, or having a fixed salary payment for the physicians. As there might be a risk of under provision, it is suggested to use capitation and salary payment for reducing unnecessary use for primary care but also use FFS to create incentives for priority preventive services (Figueras *et al*., 2005). Further, the government should incorporate other methods to make the most efficient use of scarce resources, for instance, to include more cost-effective choices for care provided through community health centres.

7.2.3 Overarching policy recommendations

Reforming provider payment methods

The above discussion focuses on improving the existing benefit package of the NCMS, the URI and to improve the services provided at the community level. However, these policy recommendations may only be effective with a thorough reform of provider incentives. The Chinese healthcare providers, who are largely relying on revenue from drugs and services, are likely to charge more from those who are entitled to insurance benefits. Studies showed that hospitals in China may supply high margin high-technology care and drugs to the NCMS patients wherever possible, and insured patients usually need to pay more than was strictly necessary (Hu *et al*., 2009, Yip and Hsiao, 2009b).

Paper 4 provides a detailed evaluation on whether the NCMS is effective in providing equitable access and fairness in financing. Policy makers must not only focus on the design of the health interventions. It is equally important to look at structural problems of the Chinese healthcare system. The findings suggest that the effectiveness of NCMS may be undermined by the prevailing FFS payment mechanism for healthcare, which allows healthcare providers to earn a profit for services rendered and also to profit from related prescription drug sales (Wagstaff, 2007b, World Bank, 1997). Because most healthcare facilities rely heavily on direct health services and prescription drug revenues to survive (Latker, 1998, Yip and Hanson, 2009, Yip and Hsiao, 2008a), the availability of insurance funds such as

NCMS reimbursements for claims may create incentives for price hikes, which insured patients (and the uninsured as well) are helpless to combat.

A number of policies and regulations are available to alter the perverse incentive embedded in the FFS payment system. Prospective payment methods are suggested and have already been used to make providers bear the financial risk of overprescribing and to provide incentives for providers to reduce inefficient use of services. Evidence has begun to emerge, pointing to positive effects from using prospective payment methods to regulate provider behaviours in China (Luo, 2011, Jiao *et al*., 2013). Particular examples of prospective payment methods that might be suitable for application in China include diagnosis-related group (DRG) payment for hospitals, and capitation for primary care doctors (Yip and Hsiao, 2009a). However, the success of these initiatives will necessarily depend on the capacity of local government agencies in insured areas, and how effective they are in monitoring provider behaviours.

It has to be noted, for these prospective payments methods to be effective, China must change the FFS financing mechanism. Evidence from Thailand shows that the DRG, capitation, and other payment methods were effective in cost control under its Universal Coverage Healthcare Scheme (UC scheme), while the Civil Servant Medical Benefit Scheme (CSMBS) using FFS payments continued to experience cost escalation despite numerous efforts made to rein in the costs (Tangcharoensathien *et al*., 2007). Government agencies, as the insurers, must not limit their attention to establish appropriate service-specific standards with regard to the package of services to be delivered, but also closely monitor providers' performance and enforce those standards.

Reducing regional inequalities in health finance

There appears to be significant regional disparities in economic development in China. In the case of the NCMS and the URI, individual participants and local governments are required to contribute to the individual's insurance premium in addition to the contribution made by central government. Participants and localities in less wealthy areas are often unable to contribute as much to this total premium as are their counterparts in more affluent areas. In western and central China, where the

level of economic development remains low, local governments as well as rural residents have a limited capacity to finance the overall program adequately; in the more prosperous eastern and coastal regions, the insurance benefit package is usually much more comprehensive, as local governments and residents, even rural households, are better able to contribute resources to finance treatments that the basic package does not cover. It is important to establish a fiscal redistribution mechanism to reduce inequities arising from different regions of the country. Using the NCMS as an example, wealthy provinces should be encouraged to improve the NCMS benefit package using their own resources, but central government should ensure a minimum package for the NCMS in all provinces, and that should be financed entirely by central government from existing central government revenue streams, or by transferring through the fiscal transfer system, that is to require richer provinces to pay proportionally more. It is also suggested that rich provinces with high economic development and large income inequalities within the provinces should use surplus revenues from the richer counties to finance the poorer ones (Wagstaff *et al*., 2009c). This will also allow the central government to concentrate its limited economic resources on poor provinces that have low incomes, flatter income distributions, and limited scope for redistribution even with full pooling (Wagstaff *et al*., 2009c). The same strategy can apply to other SHI schemes in China.

7.3 Limitations

In thinking about the results and policy implications of this thesis, it is important to bear the limitations in mind. This section provides an outline of limitations common to all of the papers (topic specific descriptions are found within each empirical chapter/paper). Limitations fall under two broader categories: data source and measurement.

7.3.1 Data source

Weights

The first limitation concerns the data source used in this paper. The CHNS data are probably by far the most comprehensive ever amassed in studying health-related topics in a Chinese context; however, this survey only includes nine provinces, most of these are situated in the eastern and coastal part of China, where economic

development is high compared with other areas of the country. Thus the sample may limit the generalisation of the study results to other settings.

Many international datasets provide weights in order to allow researchers to make data representative of the general population. The CHNS used extant census data for a multi-level random sample. As suggested by CHNS research team, it was not possible to create cross-sectional sampling weights or longitudinal ones based on the sampling methods used. The data are considered as representative of the nine provinces surveyed, but any further generalisation of the study findings should be made with caution.

Newly-collected data

Longitudinal data sets are being used more and more in applied work, especially for policy analysis. At the point of writing, CHNS has finished collecting the data for 2011. In this thesis, Papers 2 and 4 take into account a time dimension, but analyses mainly capture the cross-sectional features of the data rather than longitudinal ones since only two periods of data are available for analysing the NCMS. At the time of writing, updating the longitudinal data was still underway. Therefore, findings should be interpreted as associations rather than causal as it was not possible to control for unobserved heterogeneity. Attempts have been made to include longitudinal analysis in the thesis, but short panel data (Two-Period Panel Data) tends not to be ideal for panel data analysis because for the estimators to work in practice, there must be sufficient within-individual variability in the model, or most ideally a long panel (Wooldridge, 2012, Stock and Watson, 2011, Jones, 2007).

In the beginning of 2013, the CHNS released the biomarker data for the 2009 survey wave. Owing to time and cost constraints, I am not able to re-estimate some of the results in this thesis using biomarker data which are considered as objective measures of health status. As a number of policy interventions were implemented after 2006, it would be ideal to re-analyse the results using data collected after 2006, especially for Paper 1.

Updating questionnaires with recent policy changes

Some survey questions need to be updated along with current policy changes. The CHNS does not distinguish between the old CMS and the current NCMS until the 2009 wave, even though the NCMS was initiated in 2003. This initially creates difficulties for the analysis because it is not clear whether the respondents are enrolled in the new scheme (the NCMS) or the old one (the CMS). Although I am able to distinguish between the CMS participant and the NCMS participant by linking the individual level data with the community level ones (see Paper 2 for detailed explanations), it would be preferable if the questionnaires had been consistent with policy changes. The same problem applies to other policy variables in this dataset, such as UEI and URI.

7.3.2 Measurements

The second category of limitations concerns measurements. First, there has not been a broad agreement on a working definition of 'need' in healthcare. Empirical work tends to measure need in terms of health status. Such a measurement is accepted mainly because of data availability and convenience of measurement. Self-assessed health (SAH) has been adopted in many studies as a measure of health status. This measurement is practical, inexpensive, quick, and easy to obtain, but there is also good evidence that individuals tend to underestimate or overestimate some of the information. The analyses represented in this thesis rely mainly on self-reported subjective measures. This is not a problem if reporting differences have influenced the population equally. However, in some case, it will cause bias in the analyses if population groups report the variable in a systematically different way. For instance, under-reporting may be greater in rural people and young people, whereas urban people and old people are likely to underestimate their health status (Allin *et al*., 2010, Masseria *et al*., 2010).

Despite of ample empirical evidence of using CI and Decomposition Analysis to estimate socioeconomic related inequity, some limitations with regard to the use of this method need to acknowledge. First of all, although decomposition analysis captures the association between the distribution of health and socioeconomic factors, the analysis only provides suggestive evidence on correlation rather than causal relationship. It is noted that the inequity in health and health care may

correlate with education, income and job status, etc. The nature of such correlation has been found as widely complex and controversial. Socioeconomic status may influence health through various ways, such as ensuring nutritious diet, healthy life style and improving access to care. Yet health may also influence socioeconomic status through the impact of health shocks on employment and earnings. Hence, a causal relationship between these two is difficult to disentangle. (Costa-Font and Hernandez-Quevedo, 2012). Secondly, as mentioned in empirical chapters, regarding the sensitivity of CI to living standard measures, differences have also been found when CIs are computed using income, expenditures or assets. For instance, using data from Mozambique, Lindelow (2006) found that the choice of welfare indicator can have a large and significant impact on measured inequality in utilization of health services. Different conclusions had been reached depending on how socioeconomic status were defined. Similar problems were discussed in Ljungvall and Gerdtham (2010). The study found that inequality in obesity based on short-run income differred substantially from inequality based on long-run income.

It would also be worth thinking how the results generated from the general application of CI can be transferred to policy makers. In a 2001 Lancet article, Almeida et al. (2010) suggested that in order to relate the method of measurement of health inequity to policy implication, the assessment of distributional difference in terms of health and health care should be related to identifiable subpopulation characteristics. This is considered as prerequisite for policy and intervention to target subpopulation at greatest risk because of underlying disadvantages. The thesis considers socio-economic factors. However, it is important to note that equity is not the absence of all disparities; it is the absence of systematic disparities between social groups that have greater and lesser degrees of underlying social advantage because of such factors as wealth, sex, race and ethnicity, or urban and rural residence. As mentioned earlier in this thesis, for countries like China, where poverty is rife, it is difficult to identify the target population—the poor—sufficiently and accurately. Further research is needed to link the method of Concentration Index to identify disparities in health across social groups, hence to informing policy makers.

Papers 2 and 3 examine health service utilization and financing under the NCMS. Inpatient care was not included in the analyses. One reason for not including inpatient care is because of the small sample size for inpatient care use. Those in hospital at the time of the interview are presumably excluded from the sample. Although family members might be able to provide information in the interview, it is likely that some of them may need to attend to the patients in a daily basis, and may not be available at the time of interview. Therefore, the CHNS is likely to capture only a part of household inpatient-related use and expenses, and these data may be subject to large variances. Therefore, this study does not investigate inpatient care use.

This thesis does not take into account the population of migrant workers (*min gong*) because the CHNS does not systematically sample migrants. According to National Statistical Office, China has 260 million migrant workers in 2012, which accounts for 19.69% of the total Chinese population (People's Daily, 2012). China has increased spending on healthcare reform, with last year's overall expenditure at RMB568.86 billion (US$ 90.12) (around 1.43% of GDP) (Ministry of Health China, 2012). Yet according to the Ministry of Human Resources and Social Security, only about 20% of migrant workers have health insurance (Li and Blanchard, 2013). These migrant workers cannot formally register in urban areas because of their household registration status *(Hukou)*. Neither are they eligible for enrolling in any urban social health insurance scheme or employee-based insurance. There is a clear need to investigate issues related to access to healthcare and health insurance coverage among migrant workers. Qualitative research methods such as interviews and focus groups can be adopted as it is difficult to systematically survey migrant worker population in practice.

7.4 Future research agenda

China will doubtless continue to explore its own way in its healthcare reforms. The implementation of the insurance reforms was a crucial step in closing the insurance coverage gap and moving the current health insurance system towards realization of universal insurance coverage. At the moment, the country still adopts an insurance system which separates the rural and urban population. This might have been

justifiable in the 1990s when migration into and between cities was strictly controlled (Wong *et al*., 1998), and access to care through place of residence or employment worked adequately and healthcare was broadly available (Jin, 2012). Starting from the mid-1990s, a large flow of rural migrants has come to urban areas to seek employment opportunities, whereas the social health insurance system, based on household registration and a large number of local pools from those migrants' place of residence, discriminates against migrants because of their mobility and not being able to transfer benefits between regions (Gu and Li, 2012). The NCMS offers financial protection to people with rural household registration status, but it is noted that reimbursement rates of medical bills are usually set low if a person seeks care outside his/her home province; furthermore, medical bills can only be claimed after the migrant workers returns to his/her hometown (Gu and Li, 2012). These restrictions may create barriers to access to healthcare and financial burdens to rural migrant workers. It is documented that only 72.9% of the migrant workers in Shanghai were covered by the NCMS, and approximately 16.7% were completely uninsured. The coverage rate was much lower than the nationwide coverage rate for the NCMS (Zhao *et al*., 2011).

One potential research agenda would be to investigate the impacts of the NCMS on access (outpatient, inpatient and preventive services) and finance (OOP payments and insurance claims) in healthcare among migrant workers in urban cities. Migrant workers are a highly mobile and growing population. As these workers are usually breadwinners in their households, their health status directly affects the income and living standard of their respective households. Qualitative methods such as interviews and focus group methods can be used to explore this topic in depth.

While the findings of this thesis are for specific policy contexts, the health equity method used here can be applied to other insurance schemes in China, for instance, the URI. It would be interesting to analyse the impacts of the URI on equity in access and fairness in finance. Inequalities can be compared between the population enrolled in the scheme and the population not enrolled in it. Like the NCMS, the URI also aims to improve service use for inpatient care. Analyses can then focus on inpatient care for different income groups. Concentration Indices and Decomposition Analysis can be applied accordingly.

Whether the availability of insurance may be associated with cost escalation is an interesting topic. This thesis offers tentative findings on supplier-inducement under the NCMS. However, it is noted that, by the end of 2009, almost 95% of the rural Chinese population were covered by the NCMS. This makes it technically difficult to identify a sufficient control group that remains uninsured throughout the time to capture the impacts of the NCMS on supplier-inducement. The URI provides a better context to investigate the association between insurance and supplier-inducement because the URI is still in its trial period, and a substantial fraction of urban unemployed remains uncovered by any SHI or private insurance. This population could form a control group for us to monitor their health costs. The CHNS only has data from 2009 for URI and comparison across time is therefore rather difficult. Other datasets, for instance, China Health and Retirement Longitudinal Survey (CHARLS) (Peking University, 2012), which has recently been made publicly available, would be a suitable choice for the purpose of such a study.

Finally, while this thesis used China as a case study, the experience of China can shed some light on other countries with similar health system and economic development. For instance, Vietnam also aims to achieve full coverage of health insurance in 2015 (Wagstaff, 2005c, Wagstaff, 2009b, Wagstaff, 2007a). It has a compulsory SHI system which covers mainly formal sector employees, civil servants, and some social protection groups. Along with its compulsory SHI, Vietnam has a voluntary SHI system covering specific occupational and age groups such as school children, farmers, and professional groups. Both countries have rural SHI designated for the rural population; and FFS is the most widely used provider payment mechanism in both countries (Wagstaff, 2007a, Liu *et al*., 2012c). Existing studies showed that China achieved high SHI coverage compared with Vietnam; however, in terms of equity in service utilisation, Vietnam is doing much better than China. The poor received more benefits from SHI when using inpatient services than the rich in Vietnam, but this relationship was reversed in China (Wagstaff, 2007a, Liu *et al*., 2012c).

Another example of SHI for the poor is the Seguro Popular in Mexico, which was implemented almost at the same time as the NCMS in China. The Mexican

experience is being used as a reference in international work on quality and in designing strategies of universal coverage for countries at all income levels. The reform encompasses three dimensions—risk, patient, and finance—embedded in the concept of social protection of health. In particular, public health interventions, institutions and dedicated financing are providing protection against health risks; system-wide initiatives that enhance patient safety, effectiveness, and responsiveness are protecting the quality of health care. Evidence indicates that Seguro Popular is improving access to health services and reducing the prevalence of catastrophic and impoverishing health expenditures, especially for the poor.

It would be interesting to apply the health equity framework (age and gender standardised inequities in health outcomes, horizontal inequities in access, and catastrophic health payments and health payment-induced poverty) used in this thesis to analyse and compare equity in access and finance in countries such as Vietnam, Mexico, etc. Mutual learning would help China, and perhaps other middle-income developing countries with similar healthcare systems to learn from each other, address challenges in their systems, promote equitable access and fairness in finance, and improve population health.

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Appendices

Appendix 1 Probit model results of SAH and physical activity limitation

	SAH (1=excellent or good, 0=fair or poor)		Physical Limitation(having limitation = 1, no limitation = 0)	
	Rural	Urban	Rural	Urban
Age and gender (ref = m18-24)				
f18-24	0.2091	0.255	-0.0000429	-0.0276
f25-34	0.1291	0.2044	-0.0104	-0.0298
f35-44	0.1273	0.1385	-0.0053	-0.0205
f45-54	0.0316	0.0161	-0.0107	-0.0111
f55-64	-0.0748	-0.0978**	0.0083	0.0252
f65+	-0.2282	-0.1668	0.024	0.0565**
m25-34	0.1726	0.0716	-0.023	-0.0254
m35-44	0.0413	0.0721*	-0.0134	-0.0225
m45-54	-0.0389	-0.0503	-0.0007	-0.0387**
m55-64	-0.2014	-0.1488	0.0156	0.013
m65+	-0.2633	-0.1971	0.0382**	0.0308
Income(lg)	0.0152**	0.0407	-0.0066**	-0.0048
Marital Status	-0.0178	0.0038	0.0053	-0.0138
Job status	0.0436	0.0478*	-0.0338	-0.0354
Education level (ref = uni edu and above)				
No edu	-0.154	-0.0305	0.065**	0.0748
Pri and sec edu	-0.0816*	-0.034	0.0328	0.0226
High school	-0.0244	-0.0075	0.0122	0.01
Regions (ref= Province Guizhou)				
Province Liaoning	0.0609**	0.0077	0.0035	0.0284
Province Heilongjiang	0.0968	0.0035	-0.0064	0.0588**
Province Jiangsu	0.0547**	0.1246	0.0036	0.0089
Province Shandong	0.1076	0.0967**	-0.024**	-0.0039
Province Henan	-0.0075	0.0069	-0.0133	-0.0028
Province Hubei	0.0079	0.0191	0.0302**	0.008
Province Hunan	0.007	0.045	0.0125	0.0363*
Province Guangxi	-0.1345	-0.1156	0.0264**	0.0293
Constant				
Number of obs	7062	2923	7062	2923
LR chi2(25)	963.18	354.01	191.24	174.58
Prob > chi2	0	0	0	0
Pseudo R2	0.1009	0.0898	0.0523	0.1077
Log likelihood	-4290.08	-1794.89	-1733.27	-723.05

Appendix 2 The Erreygers's Concentration Indices of SAH and physical activity limitation (Probit)

	Good Health		Physical Limitation	
	Rural	Urban	Rural	Urban
EI	0.135	0.182	-0.043	-0.060
SE (EI)	0.017	0.024	0.008	0.013
Socioeconomic related inequality	0.067	0.138	-0.035	-0.049
Percentage of socioeconomic related inequality	49.95%	75.84%	81.91%	82.51%

Appendix 3 Decomposition results (Probit)

	CI		SAH (1=excellent or good, 0=fair or poor)				Physical Activity Limitation			
			Rural		Urban		Rural		Urban	
	Rural	Urban	Contribution	%Contribution	Contribution	%Contribution	Contribution	%Contribution	Contribution	%Contribution
EI			0.135		0.182		-0.043		-0.060	
Residual			-0.002	-1.35%	0.001	0.33%	-0.002	4.23%	0.001	-1.01%
Age and gender (ref = m18-24)										
f18-24	0.198	-0.045	0.005	3.86%	-0.001	-0.72%	0.000	0.00%	0.000	-0.17%
f25-34	0.153	0.155	0.005	3.86%	0.006	3.14%	0.000	0.93%	-0.001	1.33%
f35-44	0.099	0.114	0.006	4.75%	0.007	3.69%	0.000	0.70%	-0.001	1.67%
f45-54	0.035	0.021	0.001	0.37%	0.000	0.06%	0.000	0.46%	0.000	0.17%
f55-64	-0.053	-0.019	0.001	1.04%	0.001	0.28%	0.000	0.46%	0.000	0.17%
f65+	-0.286	-0.072	0.016	11.57%	0.005	2.64%	-0.002	3.71%	-0.002	2.67%
m25-34	0.109	0.120	0.005	3.71%	0.002	1.10%	-0.001	1.62%	-0.001	1.17%
m35-44	0.076	0.064	0.002	1.11%	0.002	1.16%	-0.001	1.16%	-0.001	1.17%
m45-54	0.020	0.070	0.000	-0.22%	-0.002	-0.83%	0.000	0.00%	-0.001	1.83%
m55-64	-0.114	-0.087	0.008	5.56%	0.004	2.09%	-0.001	1.39%	0.000	0.50%
m65+	-0.309	-0.221	0.023	16.76%	0.022	11.83%	-0.003	7.65%	-0.003	5.50%
ln(income)	0.056	0.058	0.033	24.77%	0.093	51.18%	-0.014	33.36%	-0.011	18.18%
Marital Status	0.013	0.044	-0.001	-0.59%	0.001	0.28%	0.000	-0.46%	-0.002	3.34%
Job status	0.064	0.161	0.008	5.71%	0.014	7.87%	-0.006	13.90%	-0.011	17.68%
Education level (ref = uni edu and above)										
No edu	-0.181	-0.356	0.030	22.54%	0.007	3.74%	-0.013	29.65%	-0.017	27.69%
Pri and sec edu	0.004	-0.113	-0.001	-0.52%	0.006	3.14%	0.000	-0.70%	-0.004	6.34%
High school	0.229	0.141	-0.003	-2.52%	-0.001	-0.77%	0.002	-3.94%	0.002	-3.17%
Regions (ref= Province Guizhou)										
Province Liaoning	0.043	0.180	0.001	0.89%	0.001	0.28%	0.000	-0.23%	0.002	-3.17%
Province Heilongjiang	-0.073	0.133	-0.003	-2.08%	0.000	0.11%	0.000	-0.46%	0.003	-5.50%
Province Jiangsu	0.232	0.240	0.006	4.52%	0.014	7.65%	0.000	-0.93%	0.001	-1.67%
Province Shandong	-0.009	-0.120	0.000	-0.30%	-0.005	-2.86%	0.000	-0.23%	0.000	-0.33%
Province Henan	-0.071	-0.071	0.000	0.22%	0.000	-0.11%	0.000	-0.93%	0.000	-0.17%
Province Hubei	-0.030	-0.189	0.000	-0.07%	-0.002	-0.88%	0.000	0.70%	-0.001	1.17%
Province Hunan	0.018	-0.023	0.000	0.07%	-0.001	-0.28%	0.000	-0.23%	0.000	0.67%
Province Guangxi	-0.011	-0.186	0.001	0.52%	0.009	4.79%	0.000	0.23%	-0.002	3.67%

Appendix 4 Matching balancing properties between the NCMS participants and the control

	Control (mean)	Treated (mean)	Diff.	t	Pr(T>t)
lncost	5.108	4.146	-0.962	1.57	0.1194
age	52.65	49.54	-3.11	0.8	0.427
gender	0.5	0.449	-0.051	0.28	0.7796
Morbidity type 2	0.5	0.515	0.015	0.08	0.9346
Morbidity type 3	0.5	0.24	-0.26	1.66	0.0992*
Morbidity type 4	0	0.21	0.21	1.44	0.1506
Job status	0.75	0.808	0.058	0.4	0.6864
Per capita income(lg)	8.94	8.943	0.003	0.01	0.9917
Province Liaoning	0.25	0.144	-0.106	0.82	0.4132
Province Heilongjiang	0	0.06	0.06	0.71	0.4801
Province Jiangsu	0	0.006	0.006	0.22	0.828
Province Shandong	0	0.036	0.036	0.54	0.589
Province Henan	0	0.18	0.18	1.31	0.1912
Province Hubei	0.125	0.222	0.097	0.64	0.5216
Province Hunan	0	0.03	0.03	0.49	0.6229
Province Guangxi	0.625	0.174	-0.451	3.22	0.0015***
season	0.875	0.557	-0.318	1.78	0.0773*

(Note: *** $p < 0.01$, ** $p < 0.05$, *, $p < 0.1$)