ASSESSMENT OF RURAL RESIDENTS' HEALTH-RELATED QUALITY OF LIFEAND HEALTH INEQUALITY IN LIANGCHENG COUNTY, CHINA

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A Thesis Submitted in Partial Fulfillment of the Requirements
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บทคัดย่อและแฟ้มข้อมูลฉบับเต็มของวิทยานิพนธ์ตั้งแต่ปีการศึกษา 2554 ที่ให้บริการในคลังปัญญาจุฬาฯ (CUIR)
เป็นแฟ้มข้อมูลของนิสิตเจ้าของวิทยานิพนธ์ที่ส่งผ่านทางบัณฑิตวิทยาลัย

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การประเมินคุณภาพชีวิตด้านสุขภาพและความไม่เท่าเทียมด้านสุขภาพของผู้มีถิ่นอาศัยในเทศมณฑลเลียงเฉิงประเทศจีน

นายฉางเล่อลี

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

สาขาวิชาเศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ

คณะเศรษฐศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

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Field of Study	Health Economics and Health Care Management
Thesis Advisor	Associate Professor SiripenSupakankunti, Ph.D.

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นายฉางเล่อลี: การประเมินคุณภาพชีวิตด้านสุขภาพและความไม่เท่าเทียมด้านสุขภาพของผู้มีถิ่นอาศัยในเทศมณฑลเลียงเฉิงประเทศจีน. (ASSESSMENT OF RURAL RESIDENTS' HEALTH-RELATED QUALITY OF LIFE AND HEALTH INEQUALITY IN LIANGCHENG COUNTY, CHINA)อ .ที่ปรึกษาวิทยานิพนธ์หลัก: รศ .ดร .ศิริเพ็ญศุภกาญจนกันติ, 129 หน้า.

โครงการวิจัยนี้เป็นการศึกษาเชิงพรรณนา ณ จุดเวลาใดเวลาหนึ่งแบบตัดขวางที่ดำเนินการในเทศมณฑลเลียงเฉิง ประเทศจีนมีเป้าหมายประเมินคุณภาพชีวิตด้านสุขภาพ (health-related quality of life) และความไม่เท่าเทียมทางสุขภาพ (health inequality)ของชาวบ้านในชนบทโดยดำเนินการสัมภาษณ์แบบตัวต่อตัวทั้งหมด 948 ครัวเรือน

ผลการวิจัยหลักจากโครงการนี้พบว่ากลุ่มสตรี กลุ่มผู้สูงอายุ กลุ่มที่มีการศึกษาน้อย มีปัญหาเป็นสัดส่วนที่มากกว่าในทุกด้านของแบบสอบถาม EQ-5D โดยระดับการศึกษา รายได้ของครัวเรือนต่อปี ขนาดพื้นที่อยู่อาศัย สถานภาพการทำงาน โรคเรื้อรัง โรคที่มีระยะเวลา 2 สัปดาห์ อายุ การดื่มสุรา การเข้าถึงการรักษา มีความสัมพันธ์อย่างมี นัยสำคัญ กับคุณภาพชีวิตด้านสุขภาพ (health-related quality of life) จากผลของการศึกษานี้ ระดับการศึกษา รายได้ของครัวเรือนต่อปี ขนาดพื้นที่อยู่อาศัย สถานภาพการทำงาน การดื่มสุรามีความสัมพันธ์ต่อคุณภาพชีวิตด้านสุขภาพในเชิงบวก โดยมีระดับนัยสำคัญทางสถิติ 5% ในขณะที่คุณภาพชีวิตด้านสุขภาพมีความสัมพันธ์ เชิงลบ กับ โรคเรื้อรัง โรคที่มีระยะเวลา 2 สัปดาห์ อายุ และการเข้าถึงการรักษา โดยมีระดับนัยสำคัญทางสถิติ 5% การศึกษานี้ยังพบว่ารายได้ของครัวเรือนต่อปีนั้น มีความสัมพันธ์เชิงบวกต่อคุณภาพด้านสุขภาพ นอกจากนี้ค่าของดัชนีการกระจุกตัว (concentration index)มีค่าเท่ากับ 0.1250 เมื่อตัวแปรด้านสุขภาพ คืออัตราความชุก ของโรคเรื้อรัง (prevalence rate) ผลการวิเคราะห์บ่งชี้ว่า ในกลุ่มประชากรที่ยากจน จะมีอัตราความชุกของโรคเรื้อรังสูง และใน เทศมณฑลเลียงเฉิงมีความไม่เท่าเทียมทางสุขภาพในระดับหนึ่ง

สาขาวิชาเศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ ลายมือชื่อนิสิต .....

ปีการศึกษา 2554 ลายมือชื่อ อที่ปรึกษาวิทยานิพนธ์หลัก . .....

5485589129: MAJOR HEALTH ECONOMICS AND HEALTH CARE MANAGEMENT
KEYWORDS: HEALTH-RELATED QUALITY OF LIFE / HEALTH INEQUALITY / ASSESSMENT / RURAL RESIDENT /LIANGCHENG COUNTY/CHINA

CHANGLE LI: ASSESSMENT OF RURAL RESIDENTS' HEALTH-RELATED QUALITY OF LIFE AND HEALTH INEQUALITY IN LIANGCHENG COUNTY, CHINA. ADVISOR:ASSOC. PROF. SIRIPEN SUPAKANKUNTI, Ph.D., 129 pp.

This is a cross sectional descriptive study conducted in Liangcheng County, China. This study aims to assess rural residents' health-related quality of life and health inequality. It is a face-to-face interview, and altogether 948 households were collected.

The main findings of this study are that female group, elderly group, low educational level group and low income level group have the higher proportion of problems on each EQ-5D dimension. Educational level, annual household income, housing space, employment status, chronic disease, two-week disease, age, alcoholconsumption and accessibility of health service have significant relationship with health-related quality of life. According to the results of study, health-related quality of life has a positive relationship with educational level, annual household income, housing space, employment status and alcoholconsumption at 5% significant level, while health-related quality of life has a negative relationship with chronic disease, two-week disease, age and accessibility of health service at 5% significant level. This study also finds that annual household income has a positive relationship with health-related quality of life. In addition, the concentration index is -0.1250 when health variable is prevalence rate of chronic disease. This result indicates that prevalence rate of chronic disease takes higher rates among poorer people and Liangcheng County has a certain degree inequality.

Field of Study: Health Economics and Health Care Management Student's Signature .....

Academic Year: 2011 Advisor's Signature .....

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CONTENTS

Page

Page

Page

Page

Page

LIST OF TABLES

Page

Page

Page

LIST OF FIGURES

Page

Page

LIST OF ABBREVIATIONS

IMARSB	Inner Mongolia autonomous region statistic bureau
IMHD	Inner Mongolia health department
LCG	Liangcheng county government
MOH	Ministry of health
NBSC	National Bureau of Statistics of China
NDRC	National Development and Reform Commission
UNDP	United Nations Development Program
WHO	World Health Organization

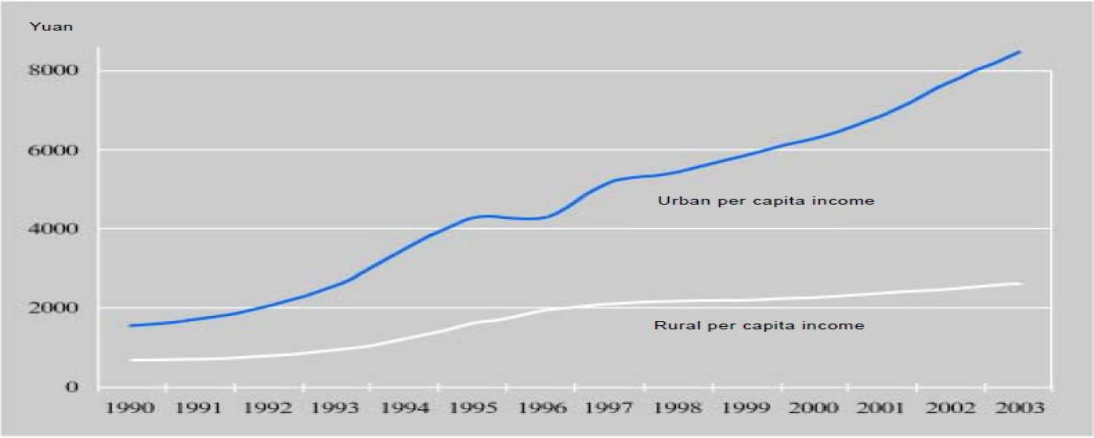
CHAPTER I

INTRODUCTION

1.1 Rationale

China has been going through a period of dramatic economic growth with social and political transitions since its reform and opening up policy were launched in the late 1970s. During the past over 30 years, China's GDP has grown from 406260 million yuan in 1979 to 34050690 million yuan in 2009 (NBSC, 2010). Rapid economic growth led to a substantial increase in personal income and makes great improvement in education. However, dramatic economic growth is accompanying with inequalities in income and education (see Figure 1 and Table 1).

Figure 1 Trend in Per Capita Income Changes of Urban and Rural Residents 1990-2003



Source: UNDP, 2005. China human development report 2005. p25.

Table 1 Proportions of City, Town and City Populations Aged 15-64 Years by Education Level and Years of Schooling, 2000

	Never attended school or any literacy class	Primary school	Junior high School	Senior high School	Junior college or more	Including: college or more	Average years of Schooling
Cities	2.5	14.3	40.0	29.2	14.0	5.5	10.2
County towns	4.2	21.4	44.3	23.8	6.3	1.3	9.1
Villages	8.7	38.9	43.9	7.8	0.7	0.1	7.3

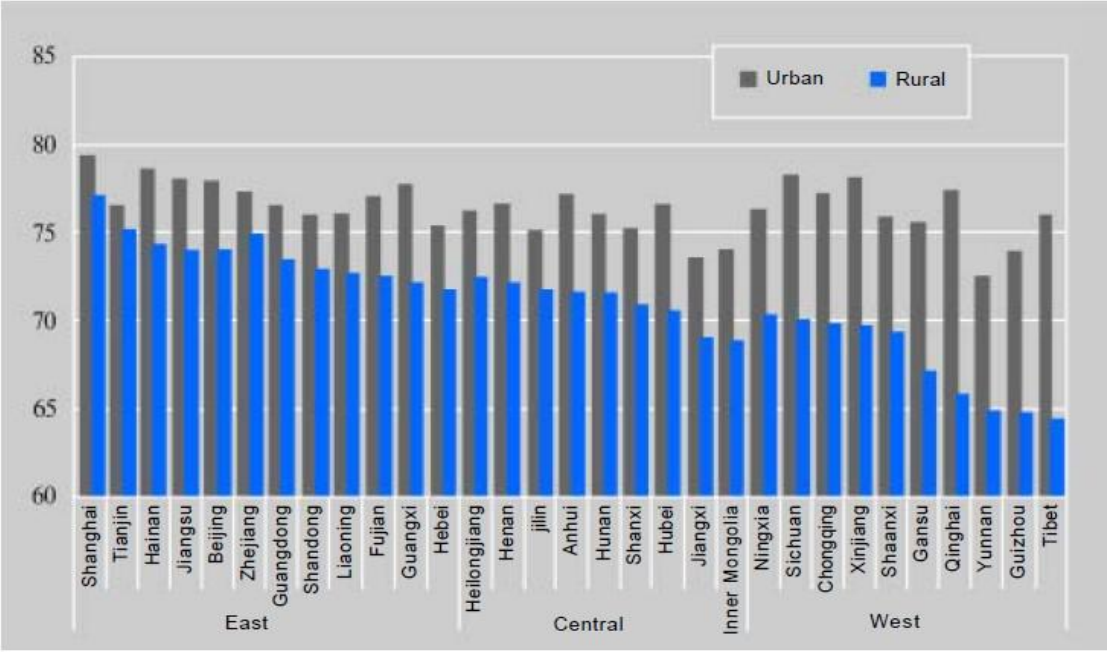
Source: UNDP, 2005. China human development report 2005. p48.

The dramatic socio-economic transitions during the past three decades have had major impacts on overall health, the Chinese live longer and are healthier, average life expectancy increased from 66.7 years in 1979 to 73.1 years in 2009 (WHO, 2010). Much progress reflects improved children and maternal health. From 1991 to 2009, under-five mortality fell from 61‰ to 17.2‰, infant mortality from 50.2‰ to 13.8‰, and maternal mortality from 0.8‰ to 0.319‰ (MOH, 2010). Although a big improvement has been made, it has occurred faster in urban areas than rural areas. Health inequalities between urban residents and rural residents are increasing.

According to China statistics data, first of all, life expectancy in rural areas was

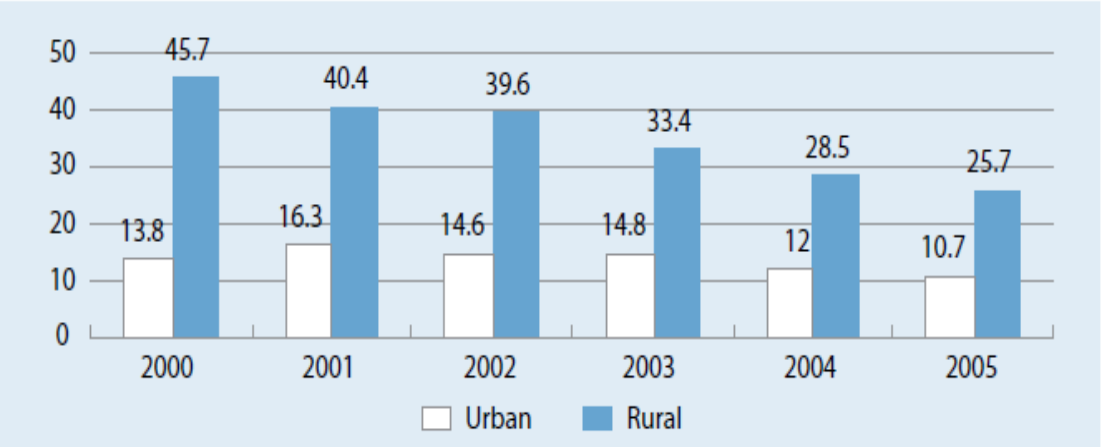
significantly lower than that in urban areas (see Figure 2). Secondly, from 2000 to 2005 under- five mortality rates and maternal mortality rates in urban and rural areas, the rural areas was always much higher than urban areas (see Figure 3 and 4). Finally, in term of the inequalities in medical service, the number of rural hospital beds was 0.81 per 1000 people in 2006, while in the urban the number was 2.54 per 1000 people in 2006. Number of rural and urban medical personnel per 1000 people was the same circumstances, and they were 1.16 per 1000 people and 3.59 per 1000 people in 2006, respectively (see Figure 5). Those health inequalities are considered an extremely serious problem and may influence heavily China's future development.

Figure 2 Urban and Rural Life Expectancy by Province in 2000



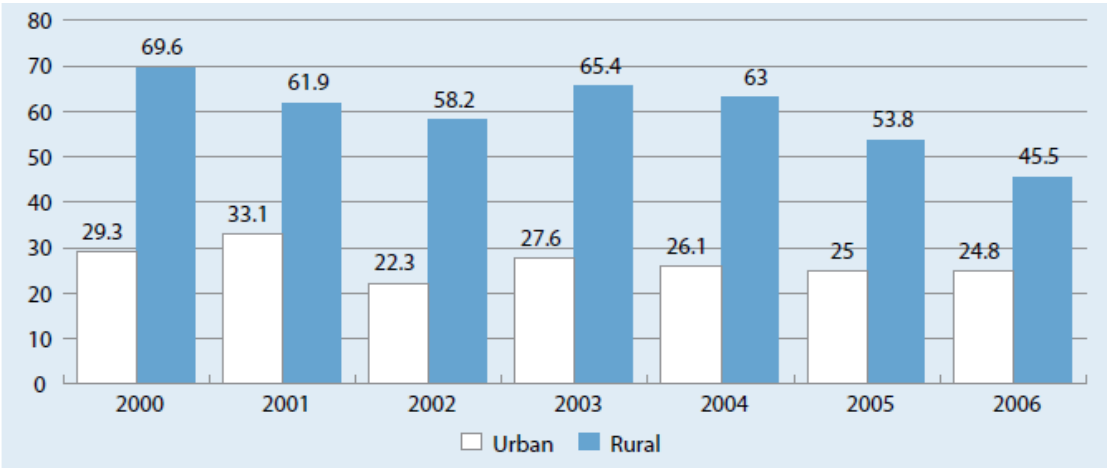
Source: UNDP, 2005. China human development report 2005. p9.

Figure 3 Under- Five Mortality Rates in Urban and Rural Areas, 2000-2005 (per 1,000 live births)



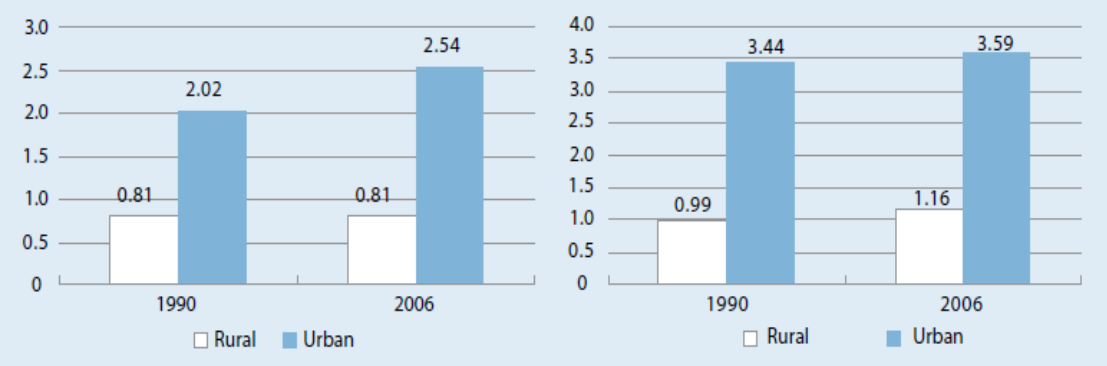
Source: UNDP, 2008. China Human Development Report 2007-2008. p21.

Figure 4 Maternal Mortality Rates in Urban and Rural Areas, 2000-2005 (per 100,000 live births)



Source: UNDP, 2008. China Human Development Report 2007-2008. p21.

Figure 5 Number of Rural and Urban Hospital Beds and Medical Personnel Per 1000 People

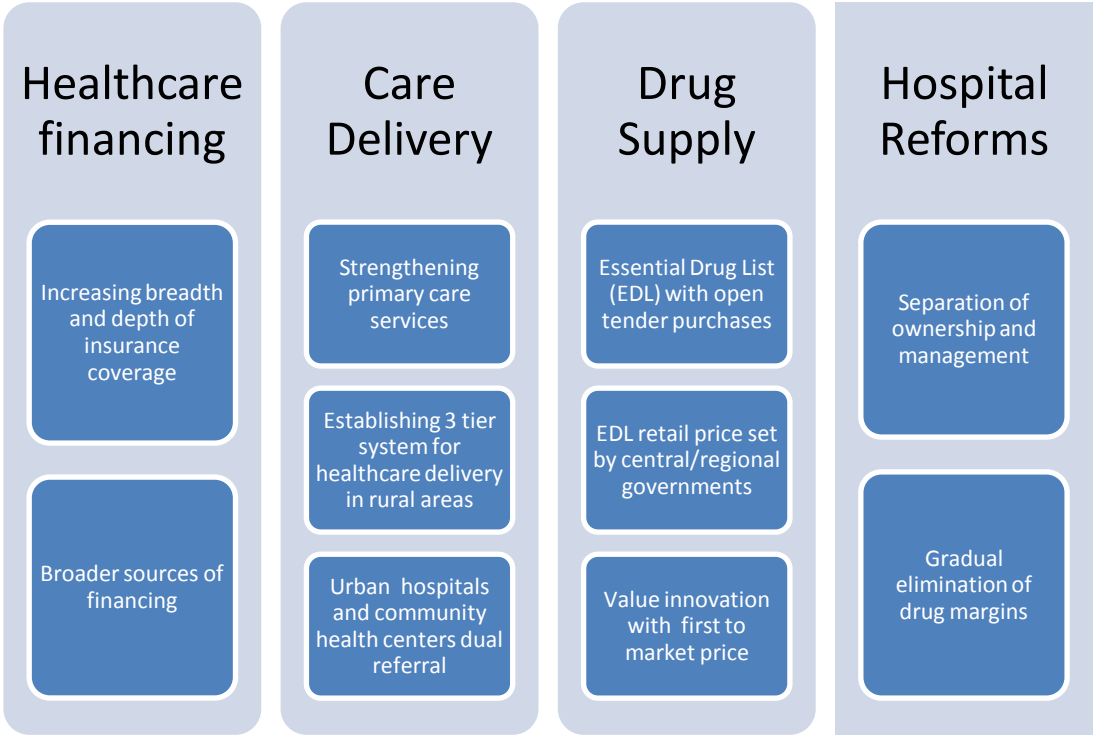


Source: UNDP, 2008. China Human Development Report 2007-2008. p76.

To solve health inequality, the central government of China started medical and health system reform in term of "Opinions on Deepening Pharmaceutical and Healthcare System Reform" since 2009. Chinese healthcare reform focuses on four areas: healthcare financing, care delivery, drug supply and hospital reforms (see Figure 6). The target of health care reform is "By 2020, the basic health care system covering urban and rural residents shall have been fundamentally established. We shall have set up, across the country, a fairly complete public health service system and health care service system, a comparatively sound medical security system, a secured and relatively well regulated pharmaceutical supply system, a comparatively sound health care institution management and operational system, a multi-sponsored medical configuration shall be formed, everyone shall have access to the basic health

care services, the multi-layer demands of the people for health care services shall be met preliminarily, and the health level of the people shall be further enhanced (NDRC,2009).”

Figure 6 Key Pillars of the Healthcare Reform



Source: IMS health, 2009.Healthcare Reform in China.p2.

In addition, Population health studies have mostly used “hard data” in China, such as mortality and life expectancy as health indicators. However, mortality and life expectancy may not enough reflect health, because with the rapid development of economy, the change of lifestyle of Chinese people has caused significant changes of Chinese disease pattern which is from communicable diseases to chronic

non-communicable diseases (Zhao and Chen, 2001), and the percentage of population living with ill-health are increasing. Mortality and life expectancy indicators do not take health status into account, for example, when population mortality decreases, some people living with bad health status may increase at the same time.

Consequently, by analyzing EQ-5D score and its affecting factors of rural residents, it is easy to investigate health status of different populations' rural residents, this study will show which population has major problems and we can target. And using EQ-5D and the concentration index, it is easy to know the situation of health inequality in Liangcheng County. This valuable information will provide some suggestions for China medical and health system reform. Moreover, EQ-5D is a standardized instrument used as a measure of health outcome; it is good to reflect people's health status. Policy maker use EQ-5D scores as health outcome, it is beneficial for making policy.

1.2 Research Questions:

- What is the current situation of health-related quality of life of rural residents in Liangcheng County, China?
- What factors influence rural residents' health-related quality of life in Liangcheng County, China?
- What is the relationship between health-related quality of life and annual

household income?

- What is the effect of varying EQ-5D value set[1] to health-related quality of life?
- What is the level health inequality among rural residents in Liangcheng County, China?

1.3 Research Objectives

1.3.1 General objective

To describe current situation of health-related quality of life in Liangcheng County, China, analyze the different factors affecting health-related quality of life and evaluate rural residents' health inequality.

1.3.2 Specific objectives

- To describe the health-related quality of life in different subgroup, such as age group and sex and socio-economic status.
- To analyze the potential influence factors of health-related quality of life, such as socio-economic, demographic characteristics and clinical characteristics especially.

[1] EQ-5D value set is a formula which can convert EQ-5D' five dimensions into a single summary index.

- To examine the relationship between health-related quality of life and annual household income.
- To convert EQ-5D index score using different EQ-5D value set and compare and analyze the result of multiple regression equations.
- To evaluate health inequality of rural residents.

1.4 Scope of the Study

This study is about the health-related quality of life in Liangcheng County which is a county in central-south Inner Mongolia, People's Republic of China. It is under the administration of Ulaan Chab city. The fieldwork was conducted from August 4, 2009 to August 10, 2009 and included 948 households.

1.5 Expected Benefits

This study is the first study regarding assessment of rural residents' health-related quality of life and health inequality in Inner Mongolia, China. This study involves the following three aspects: first of all, this study shows health-related quality of life score through the EQ-5D and health inequality score computing using the concentration index, in other words, it reveals the part of whole picture of rural residents' health status and the situation of health inequality. Secondly, the result of this study informs policy maker about the factors affecting rural residents'

health-related quality of life. The factors include socioeconomic status, demographic characteristic and clinical characteristics and so on. Thirdly, this study can indicate the relationship between health-related quality of life and annual household income.

The information of this study are useful for:

- Health policy makers can use this information in order to improve health and reduce inequalities in health by their relevant policy and program intervention.
- Health policy makers can use this information as a tool to measure whether it is a successful or a failure policy when it is implemented. These indicators are much better in measuring health status than mortality and life expectancy.
- This information is useful for other sectors such as Inner Mongolia economic department, education department and civil affairs department. For example, policy makers in civil affairs department can use this information to develop the rural minimum livelihood guarantee system in Inner Mongolia.

CHAPTER II

BACKGROUND

2.1 General Overview of Liangcheng County, Inner Mongolia, China

People's Republic of China also called China. China is the most populous nation in the world, with about 1.33474 billion citizens (NBSC, 2010). Located in East Asia, the country covers approximately 9.6 million square kilometers. It is the world's second-largest country by land area. It exercises jurisdiction 23 provinces, 5 autonomous regions, 4 directly controlled municipalities (Beijing, Tianjin, Shanghai, and Chongqing), and 2 special administrative regions (Hong Kong and Macau). Its capital city is Beijing.

Inner Mongolia is an autonomous region of the People's Republic of China, located in the northern region of the country (see Figure 7). It is the third-largest subdivision of China spanning about 1,200,000 km^2 or 12% of China's total land area. It had a population of about 2422 thousand and the birth rate and death rate were 9.57‰ and 5.61‰, respectively in 2009 (NBSC, 2010). The majority of the population in the region is Han Chinese, with a substantial Mongol minority. Inner Mongolia is divided into 12 prefecture-level divisions. It includes 9 prefecture-level cities and 3 leagues. The twelve prefecture-level divisions of Inner Mongolia are subdivided into 101 county-level divisions, including twenty-one districts, eleven county-level cities,

seventeen counties, forty-nine banners, and three autonomous banners. Those are in turn divided into 1425 township-level divisions, including 532 towns, 407 townships, 277 sumu, eighteen ethnic townships, one ethnic sumu, and 190 subdistricts. The Gross Regional Product of Inner Mongolia in 2009 was 974025 million yuan (NBSC, 2010). In 2010, the urban per capita disposable income and rural per capita net income were 17698.2 yuan and 5530 yuan, respectively (IMARSB, 2010).

Figure 7 Map of Inner Mongolia, China

Source: China Knowledge. The Map of Inner Mongolia.

Liangcheng County is a county of central-south Inner Mongolia, People's Republic of China, bounded by Shanxi province to the south. It is under the administration of Ulaan Chab city, and borders Fengzhen City to the east, Zhuozi County to the north, and the regional capital, Hohhot to the west. Liangcheng County covers 3,458 square kilometers. It exercises jurisdiction 5 towns (Daihai, MaiHutu, LiuSumu, Yongxing, and Manhan), 2 townships (Tiancheng and CaonianManzu) and one regional office. The total population of Liangcheng County was 248 thousand. In detail, the ratio of male to female was 117:100 and rural population and urban population were 172 thousand and 38 thousand, respectively. According to 2009 government statistics, the per capita disposable income of urban residents was 7028 yuan, but the per capita cash income of rural residents was 2923 yuan (LCG, 2009).

2.2 China's Healthcare System

2.2.1 Basic Healthcare Insurance System

There are mainly three types of basic medical insurance in China. They are New Rural Cooperative Medical Scheme (NRCMS), Basic Medical Insurance for Urban Employees (BMIUE) and Basic Medical Insurance for Urban Residents (BMIUR).

2.2.1.1 New Rural Cooperative Medical Scheme

The NRCMS is a kind of voluntary medical insurance and started in 2003. Because of China's vast regional, economic and social differences, NRCMS is implemented in term of central government determined framework which grants local government the autonomy to make adjustments given their own regional characteristics (Chen et al., 2011). It is for rural population and it receives funding from central government, local government and individuals. In order to reduce adverse selection, the NRCMS requires full household participation rather than an individual. The NRCMS coverage rapidly increased from 0.179 billion in 2005 to 0.833 billion in 2009. In 2009, 94.19% rural residents were covered under the NRCMS, and the amount of per capita financing averaged 113.36 yuan (MOH, 2010). For NRCMS's reimbursement, central government requires that catastrophic and inpatient expenditures must be covered (Chen et al., 2011).

In Inner Mongolia, the NRCMS covered 12.018 million rural residents, and 96.39% rural residents were covered under the NRCMS in 2009. The amount of per capita financing averaged 107.36 yuan and the number of reimbursement was 5.763 million (MOH, 2010).

According to Liangcheng County government public information, NRCMS finances from three aspects: central government finance 60 yuan, local government finance 60 yuan and individuals finance 30 yuan. The amount of per capital financing averaged is

150 yuan. About NRCMS reimbursement in Liangcheng County, outpatient service reimbursement apply for the ceiling line (highest paying is family size who have NRCMS multiply by 40), and inpatient service reimbursement carries out the ceiling line (60000 yuan per year), the lower pay line. In addition, inpatient service reimbursement adopts different reimbursement proportion in term of different tiers government hospitals and inpatient expenses (see Table 2).

Table 2 NRCMS reimbursement proportion in term of different tiers government hospitals and inpatient expenses

Hospital Level	Inpatient Expenses	Reimbursement Proportion
Primary hospital	≤5000 yuan	65%
	5001-10000 yuan	75%
	≥10000 yuan	85%
Secondary hospital	≤5000 yuan	55%
	5001-10000 yuan	75%
	≥10000 yuan	85%
Tertiary hospital	≤5000 yuan	45%
	5001-10000 yuan	65%
	≥10000 yuan	75%

Source: LCG, 2007. Liangcheng County Healthcare Basic Situation.

2.2.1.2 Basic Medical Insurance for Urban Employees

The BMIUE is for urban workers and was established by the Chinese State Council by the end of 1998. BMIUE covers all employers and employees in urban areas,

including employees and retirees of all government agencies, public institutions, enterprises, mass organizations and private non-enterprise units. The BMIUE consists of a pooled fund for inpatient stays and outpatient visits. It is financed by payroll taxes paid by employers (6%) and employees (2%). The individuals' premiums and 30% of the premiums paid by the employers go to the personal accounts, and the remaining 70% of the premiums paid by the employers goes to the social pool program funds. For BMIUE's reimbursement, outpatient expenses are mainly paid from the personal account, while inpatient expenses are paid mainly from the social pool program funds. In 2009, about 219.61 million people were covered by BMIUE (MOH, 2010).

In Inner Mongolia, the BMIUE covered 3.74 million urban workers in 2009 (MOH, 2010). It is financed by payroll taxes paid by employers (6%) and employees (2%). In regard to reimbursement, personal account is used in outpatient service reimbursement, and inpatient service reimbursement carries out the ceiling line and the lower pay line. The reimbursement proportion was about 75% in 2010.

In Liangcheng County, BMIUE is financed by payroll taxes paid by employers (6%) and employees (2%). About BMIUE reimbursement in Liangcheng County, outpatient expenses are mainly paid from the personal account. Inpatient service reimbursement carries out the ceiling line (80000 yuan per year), the lower pay line (300 yuan). In addition, inpatient service reimbursement adopts different reimbursement proportion

in term of different inpatient expenses (see Table 3).

Table 3 BMIUE reimbursement proportion in term of different inpatient expenses

Inpatient expenses	Reimbursement proportion
300-500 yuan	80%
5001-10000 yuan	82%
10001-20000 yuan	86%
20001-30000 yuan	88%
30001-80000 yuan	50%

Source: LCG, 2007. Liangcheng County Healthcare Basic Situation.

2.2.1.3 Basic Medical Insurance for Urban Residents

The BMIUR started in 2007. It is provided for urban residents who are not covered by the Basic Medical Insurance for Urban Employees and on a voluntary basis at the household level. It also receives funding from central government, local government and individuals. According to State Council policy, BMIUR premium should generally be higher than those of the NRCMS, but lower than those of the BMIUE. In 2009, about 181 million people were covered by BMIUR (MOH, 2010). it is the same with NRCMS. Local governments should follow the central government's general guidelines, but they have autonomy in developing and implementing BMIUR in term of their own regional characteristics (Lin, Liu and Chen).

In Inner Mongolia, total 2.39 million urban residents covered BMIUR in 2009. The central and local government finance no less than 80 yuan. BMIUR is financed by urban residents in light of local economic conditions. For reimbursement, inpatient service reimbursement carries out the ceiling line and the lower pay line. The reimbursement proportion was about 60% in 2010.

In Liangcheng County, BMIUR is financed by urban residents who pay 100 yuan per year. About BMIUR reimbursement in Liangcheng County, inpatient service reimbursement carries out the ceiling line (60000 yuan per year), the lower pay line (300 yuan). In addition, inpatient service reimbursement adopts different reimbursement proportion in term of different tiers government hospitals and inpatient expenses (see Table 3).

Table 4 BMIUR reimbursement proportion in term of different tiers government hospitals and inpatient expenses

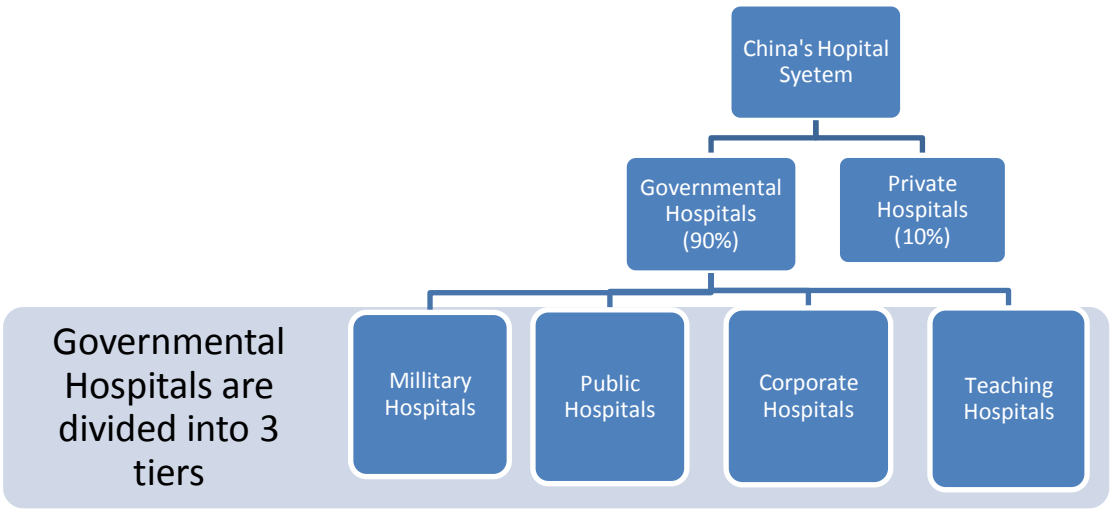
Inpatient expenses	Tertiary hospital	Secondary hospital
300-10000 yuan	60%	55%
10001-30000 yuan	70%	65%
30001-60000 yuan	60%	55%

Source: LCG, 2007. Liangcheng County Healthcare Basic Situation.

2.2.2 China's Hospital System

In China, healthcare services are mainly provided by governmental hospitals. Currently in China 90% of total hospitals are public hospitals which are under the Ministry of Health, provincial health department (or municipal health department), while the rest 10% are private hospitals (Frost and Sullivan, 2011). Popularly, governmental hospitals include public hospitals, military hospitals, teaching hospitals, and corporate hospitals (see Figure 8). In addition, Ministry of Health divides the governmental hospitals into 3 different tiers. The tier 1 means the lowest tier and the tier 3 means the top tier. The standard criteria of classifying are in term of facility, medical technology, hospital administration and hospital quality.

Figure 8 China's Hospital System



Source: Author.

According to 2010 Inner Mongolia Health Development Statistic Presentation, Inner Mongolia had 467 hospitals, 1030 community health service centers, 1336 health clinics in towns and townships, 4597 rural clinics and 117 maternal and child care service centers.

Specific to Liangcheng County, it has 2 hospitals, 19 health clinics in towns and townships, 303 rural clinics and 1 maternal and child care service center (LCG, 2007).

2.2.3 China's Essential Drug System

In August, 2009 a national essential drug list was published by Ministry of Health, which marked the beginning of establishing the National Essential Drug System (NEDS). NEDS aims to lower the price by reducing the middleman, and setting ceiling price for drugs. According to the NEDS, the provincial government is responsible for holding public bidding, purchasing, and delivering the drugs to hospitals directly (Frost and Sullivan, 2011).

Inner Mongolia starts to implement since 2009. Moreover, Liangcheng County also initiates NEDS in 2009.

2.3 Health Situation of Rural Residents in China

According to the 2008 National Health Service Survey, it finds that two-week morbidity rate was 188.6‰ in China. More specifically, the rate in urban area was 222‰, and the rate in rural area was 176.7‰ (MOH, 2008). The study ranks the major disease in rural area in term of two-week morbidity rate in China (see Table 5) and three of the top diseases in rural area are Respiratory System Disease, Circulation System Disease and Digestive System Disease.

Table 5 Two-Week Morbidity Rate by Major Disease in China Rural Area

Ranking	Disease System	Morbidity Rate (per 1000)
1	Respiratory System Disease	50.4
2	Circulation System Disease	35.6
3	Digestive System Disease	28.5
4	Musculoskeletal System Disease	26.4
5	Urologic and Genital Disease	6.9
6	Injury and Poising	6.0
7	Endocrine, Nutrition and Metabolism	3.7
8	Nervous System Disease	3.5
9	Skin Disease	3.1
10	Infectious Disease	2.2

Source: MOH, 2008. 2008 National Health Service Survey.

According to the Inner Mongolia 2008 National Health Service Survey, it showed that two-week morbidity rate was 215‰ in Inner Mongolia. More specifically, the rate in urban area was 217.2‰, and the rate in rural area was 213‰. The study ranks the major disease in rural area in term of two-week morbidity rate in Inner Mongolia (see

Table 6) and three of the top diseases in rural area is Circulation System Disease, Musculoskeletal System Disease and Respiratory System Disease.

Table 6 Two-Week Morbidity Rate by Major Disease in Inner Mongolia Rural Area

Ranking	Disease System	Morbidity Rate (per 1000)
1	Circulation System Disease	33.5
2	Musculoskeletal System Disease	19.4
3	Respiratory System Disease	14.5
4	Digestive System Disease	13.1
5	Urologic and Genital Disease	3.4
6	Endocrine, Nutrition and Metabolism	3.2
7	Injury and Poising	2.7
8	Nervous System Disease	2.5
9	Infectious Disease	2.4
10	Mental Disease	1.2

Source: IMHD, 2008. 2008 Inner Mongolia National Health Service Survey.

CHAPTER III

LITERATURE REVIEW

3.1 Quality of Life and Health-Related Quality of Life

3.1.1 Quality of Life

Use of the term “quality of life” has become widespread in recent year, but unfortunately there is no universally accepted definition (Aaronson, 1992). However, it is generally agreed that quality of life is a multidimensional concept (Siegrist and Junge, 1989).

There is a definition of quality of life in term of taxonomy. They are global definitions, component definitions, focused definitions and combination definitions (Farquhar, 1995).

First of all, global definitions are the most common definition, and they describe quality of life in term of the degree of satisfaction with life. For example, quality of life defined as a combination of both life conditions and satisfaction. (Borthwick-Duffy, 1992).

Secondly, component definitions mean that quality of life is decomposed into different dimensions. For example, quality of life has been conceived in four different ways: as satisfaction with life; as satisfaction of defined needs; as happiness; and as self-realization and growth (Maeland, 1989).

Thirdly, focused definitions refer to one or a small number of dimensions of quality of life. For example, quality of life encompasses the concept of health-related quality of life (HRQOL) and other domains such as environment, family, and work. HRQOL is the extent to which one's usual or expected physical, emotional, and social well-being are affected by a medical condition or its treatment (Ware and Dewey, 2000).

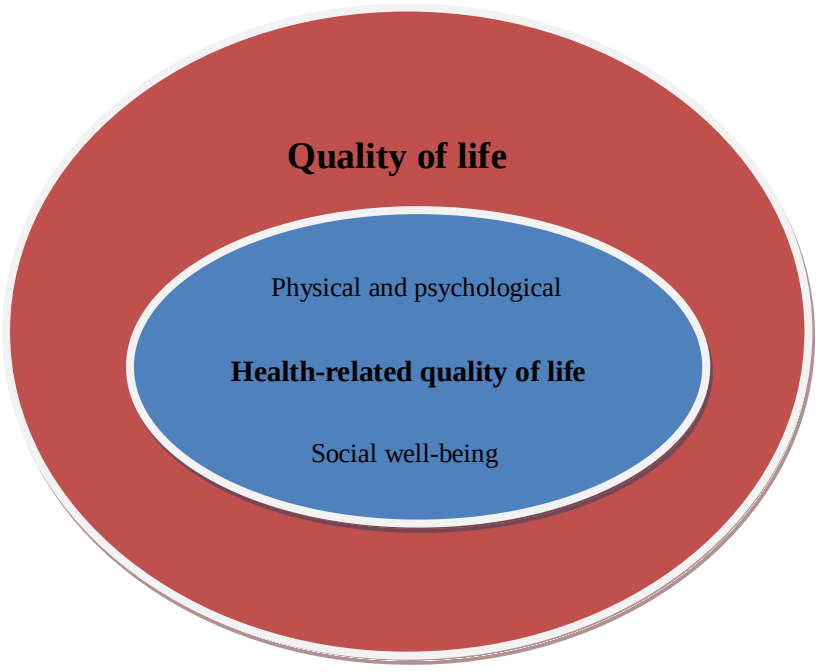
Finally, combination definitions include global definitions and component definitions. For example, quality of life is defined as a combination of life conditions and satisfaction and it should take personal values, aspirations, and expectations account into. (Felce and Perry, 1995).

3.1.2 Health-Related Quality of Life

Health-related quality of life is also lack of a hard and fast definition. But after years of study, conceptualization of health-related quality of life has made progress since the last two decades.

Health-related quality of life is some aspects of quality of life and is related to health or health care (see Figure 9). It represents those elements of quality of life (QoL) directly affect an individual's health, there aspects are physical, psychological, social, spiritual and role functioning, as well as general well-being(Spilker and Revicki, 1996).

Figure 9 Quality of Life and Health-Related Quality of Life



Source: Author.

As we know, health refers to a “state of complete physical, mental and social

well-being and not merely the absence of disease (WHO, 1947).” The concept of health-related quality of life (HRQL) is a multi-factorial construct that describes individuals' perceptions of their physical, psychological and social functioning (Schipper, Clinch and Olweny, 1996). Similarly, HRQoL should include physical, social and role function. The other essential dimensions are mental health and general health perception. Vitality, pain and cognitive function are also important domains of HRQOL (Wilson and Cleary, 1995).

3.2 Health-Related Quality of Life Measurement Tools

3.2.1 General Overview Health-Related Quality of Life Measurement Tools

HRQoL become widely accepted as a measurable health outcome. HRQoL focus on individuals' perceptions of physical and mental health and function and have become an important component of health surveillance and are generally considered as valid indicators of service needs and intervention outcomes. Self-report health status has proved a more powerful health outcome than many objective measures of health (Idler and Benyamini, 1997).

Nowadays, there are two instruments to measure health-related quality of life. They are generic instruments and disease specific instruments. Generic instruments provide

a summary of HRQL; and specific instruments focus on problems associated with single disease states, patient groups, or areas of function (Guyatt, Feeny and Patrick, 1993).

3.2.1.1 Generic Instruments

The common used generic instruments include the 36-item Short Form of the Medical Outcomes Study Questionnaire (SF-36) (Ware and Sherbourne,1992), the Quality of Well-Being Scale (QWB) (Kaplan, Anderson and Ganiats, 1993), the Nottingham Health Profile (NHP) (Hunt et al., 1981), Health Utilities Indexes (HUI) (Furlong et al., 2001), and the European Quality of Life (EQ-5D) (Roset, Badia and Nancy, 1999).(see Table 7)

Table 7 The Commonly Used Generic Instruments

Instrument	Domains	No. items	Score	Completion	Time
European Quality of Life Questionnaire (EQ-5D)	EQ-5D Mobility, Self-care, Usual activities, Pain/discomfort, Anxiety/depression. EQ-VAS Global health	6	EQ-5D five dimensions can be defined as a 5 digit number and can be converted into a utility index. EQ-5D VAS (0-100)	Interview or self report	10 min

Instrument	Domains	No. items	Score	Completion	Time
The 36-item Short Form of the Medical Outcomes Study Questionnaire (SF-36)	Bodily pain, General health, Mental health, Physical functioning, Role limitation-emotional, Role limitation-physical, Social functioning, Vitality.	36	Algorithm Domain profile(0-100, 0 death 100 best health) Summary: Physical (PCS), Mental (MCS)	Interview or self report	20 Min
The Nottingham Health Profile (NHP)	Part 1: Bodily pain, Emotional reactions, Energy, Physical mobility, Sleep, Social isolation. Part 2: life areas affected	45	Algorithm Domain profile 0-100, 100 is maximum limitation.	Interview or self report	20 Min
The Quality of Well-Being Scale (QWB)	Mobility and confinement, Physical activity, Social activity, Symptoms and medical problems.	30	Algorithm Index 0-1, the ranging from 0 (for dead) to 1.0 for asymptomatic full function	Interview or telephone interview	20 Min
Health Utilities Indexes (HUI)	Vision, Hearing, Speech, Ambulation, Dexterity, Emotion, Cognition, Pain.	8	Global utility index and single attribute utility scores for the eight separate dimensions. The scale defined such that being dead has a utility of 0.00 and perfect health has a utility of 1.00.	Interview or self report	3 Min

Source: Author.

3.2.1.2 Disease Specific Instruments

Disease specific instruments are used to assess treatment progress for a specific disease. Disease-specific scales often take the form of questionnaires with items assessing various aspects of symptoms and functioning marking various degrees of disease severity and impact that people may experience. Scores are usually computed by summing categorical responses across items (Fryback, 2010).

According to the disease diagnosis, they can be listed which are the disease specific instruments measure cancer, back pain, arthritis, chronic lung disease, diabetes, digestive diseases and neurologic (Donald and Richard, 1989) (see Table 8).

Table 8 Disease Specific Instruments

Diagnosis/Condition	Disease specific instrument
Arthritis	Mc-Master-Toronto Arthritis Patient Reference Disability Questionnaire (MACTAR) Health Assessment Questionnaire (HAQ) Functional Capacity Questionnaire American Rheumatism Association Classification Arthritis Rheumatism Association Classification
Back pain	Waddell Disability Index Disability Questionnaire Oswestny Low Back Pain Disability Questionnaire

Diagnosis/Condition	Disease specific instrument
Cancer	Quality of Life Index (QLI) Karnofsky Performance Status Measure (KPS) Functional Living Index: Cancer
Chronic lung disease	Dyspnea Index Chronic Respiratory Disease Questionnaire
Diabetes	DCCT Questionnaire
Digestive diseases	Rating Form of IBD Patient Concerns (RFIPC) Inflammatory Bowel Disease Questionnaire (IBDQ)
Heart	Specific Activity Scale (SAS) Rose Chest Pain Questionnaire New York Heart Association Functional Classification (NYHA) Karolinska-Erasmus Classification
Neurologic	Modified Sickness Impact Profile Expanded Disability Status Scale (EDSS) Minimal Record of Disability

Source: Donald and Richard, 1989.

3.2.2 The European Quality of Life (EQ-5D)

EQ-5D is a standardized health-related quality of life questionnaire developed by the EuroQol Group in order to provide a simple, generic measure of health for clinical and economic appraisal (EuroQol Group, 1990). The EQ-5D includes two parts: the first part is called the 'descriptive system'. Descriptive system is consisting of five

dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) each of which can take one of three responses. The responses record three levels of severity (no problems/some or moderate problems/extreme problems) within a particular EQ-5D dimension. It defines a total of 243 health states. The second part is EQ-5D visual analogue scale (EQ-5D VAS), which is a standard vertical 20 cm visual analogue scale (similar to a thermometer), with endpoints of 100 "best imaginable health state" and 0 labeled "worst imaginable health state", respectively (Roset, Badia and Nancy, 1999).

3.2.2.1 EQ-5D value set

EQ-5D's five health states can be converted into a utility index (the EQ-5D index score) by applying the scores from value sets elicited from general population. Value sets have been derived for EQ-5D in several countries using the EQ-5D visual analogue scale (EQ-5D VAS) valuation technique or the time trade-off (TTO) valuation technique (see Table 9).

EQ-5D VAS valuation technique

The Visual Analogue Scale (VAS) also calls the Rating Scale or the Category Scaling. Using VAS technique, the subjects are asked to the best health state and the worst

state, which may or may not be death. Then the subjects are asked to locate the other states on the rating scale. The range of rating scale is 0 to 1. Preference score can be got, if death is judged to be the worst state and death placed at 0 on the rating scale; the preference value for other states is simply replaced by the scale value. If death is not judged to be the worst state but death is placed at some middle point of the scale (the point says d), the preference values for other stated are given by the formula (x-d)/ (1-d), where x is the scale placement of the health state (Drummond et al., 2007).

EQ-5D TTO valuation technique

The TTO method is originally developed as a simple instrument that gave comparable scores to the standard gamble (Torrance, 1976). TTO technique is used on a double-sided time board, with one side for ill health states (i) regarded as better than death, and the other side for states regarded as perfect healthy. The subjects are offered two alternatives. One is ill health states (i) for time t followed by death, the other is perfectly healthy for time x < t followed by death. Time x is varied until the subject is not different between two alternatives, so preference score can be obtained which is for ill health state (i) which is $h_i = \frac{x}{t}$ (Drummond et al., 2007).

Table 9 List of Available EQ-5D Value Sets

Country	N	Valuation
Belgium	722	EQ-5D VAS
Denmark	1686	EQ-5D VAS
Denmark	1332	TTO
Europe	8709	EQ-5D VAS
Finland	1634	EQ-5D VAS
Germany	339	EQ-5D VAS
Germany	339	TTO
Japan	621	TTO
Netherlands	309	TTO
New Zealand	1360	EQ-5D VAS
Slovenia	733	EQ-5D VAS
Spain	300	EQ-5D VAS
Spain	1000	TTO
UK	3395	EQ-5D VAS
UK	3395	TTO
US	4048	TTO
Zimbabwe	2440	TTO

Source: Cheung et al., 2009.User Guide Basic Information How to Use EQ-5D. p11.

The best known preference weights for utility measures were derived from samples of the UK general population in early 1990. The UK-based preference weights are applied to other populations when country specific weights are not available (Huang et al., 2007).

3.2.2.2 EQ-5D VAS score and EQ-5D index score

Due to the EQ-5D includes two parts: the first part is called the 'descriptive system'

and the second part is EQ-5D visual analogue scale, we can get two scores to measure health-related quality of life. They are EQ-5D VAS score and EQ-5D index score, respectively.

- **EQ-5D VAS score**

EQ-5D VAS score can be obtained from EQ-5D visual analogue scale (see Appendix A). Interviewers would ask the respondents how good or bad a health state is, and give the respondents a scale (rather like a thermometer) which display the best state you can imagine is marked 100 and the worst state you can imagine is marked 0. For example, if a respondent mark the point which is 85 on the scale, and the EQ-5D VAS score is 85.

- **EQ-5D index score**

EQ-5D five dimensions can be converted to EQ-5D index score through EQ-5D value set. For example, a respondent report EQ-5D five dimensions “22131” which indicate no problems with usual activities and anxiety/depression, moderate problem with mobility and self-care and extreme problem with pain/discomfort. Then use UK EQ-5D value set (see Appendix B). The table 10 shows the computation process of this example. As we can know, EQ-5D five dimensions “22131” can be converted to EQ-5D index score 0.295.

Table 10 The computation process of EQ-5D index score

EQ-5D value set		EQ-5D five dimensions (22131)	EQ-5D index score
Full health	1	★	1
At least one 2 or 3	-0.155	★	-0.155
At least one 3	-0.215	★	-0.215
Mobility 2	-0.071	★	-0.071
Mobility 3	-0.182		
Self-care 2	-0.093	★	-0.093
Self-care 3	-0.145		
Usual activities 2	-0.031		
Usual activities 3	-0.081		
Pain/discomfort 2	-0.084		
Pain/discomfort 3	-0.171	★	-0.171
Anxiety/depression 2	-0.063		
Anxiety/depression 3	-0.124		
			0.295

Source: Author.

3.2.2.3 The validity and reliability of EQ-5D in Chinese population

The EQ-5D instrument has been used for measuring population health status in many countries. An EQ-5D study in Beijing was performed among 2,994 individuals whose age are 12 year and older, which is from the 2000 Beijing Household Health Survey. The results show EVGFP[2] measure and EQ-5D has a strong relationship. When respondents self-report health status reduce from Excellent to Poor, the proportion of problems on any EQ-5D dimension goes up and the mean of VAS decreases.

[2] A 5-Point Categorical Rating Scale: Excellent. Very good, Good, Fair, and Poor (EVGFP)

Moreover, the results indicate EQ-5D has the expected association with demographic factors, socioeconomic factors and other health related indicators. In short, the EQ-5D is valid for measuring health related quality of life among the Chinese population (Wang, Kindig and Mullahy, 2005).

In addition, a study evaluated the reliability and validity of the EQ-5D in a general population sample in urban China, which chose 2800 respondents in HangZhou. The results indicate that there is a stronger relationship between EQ-5D and SF-36 which is in comparable dimensions. Moreover, test-retest reliability is carried out in this study, and the results show Kappa value were form 0.35-1.0. In summary, "the Chinese version of the EQ-5D demonstrated acceptable construct validity and fair to moderate levels of test-retest reliability in an urban general population in China (Wang et al., 2012)."

3.3 Health Inequality and Its Measurement Tools

3.3.2 Health Inequality

There is not general agreement on the definition of health inequality. Some researchers give definition as follows：

Health inequality is the generic term used to designate differences, variations, and disparities in the health achievements of individuals and groups. Moreover, health inequality is a descriptive term that need not imply moral judgment (Kawachi, Subramanian, and Almeida-Filho, 2002).

Health inequalities refer to composite measures of the variation in health status across individuals in a population (Murray, Gakidou and Frenk,1999).

Health inequalities can be defined as differences in health status or in the distribution of health determinants between different population groups. For example, differences in mobility between elderly people and younger populations or differences in mortality rates between people from different social classes (WHO Glossary).

In a word, health inequality means that people have different socio-economic status and demographic characteristics, so it leads to different people's behaviors and choices. Due to these differences, disparities in the health outcome are among different population groups.

The distinction between health inequality and health inequity is that health inequality does not include moral judgment in term of its definition. However, health inequity refers to those inequalities in health that are considered as be unfair or stemming from

some form of injustice. Therefore, the key of the distinction between equality and equity is that the identification of health inequities needs normative judgment (Kawachi, Subramanian and Almeida-Filho, 2002).

3.3.3 Health Inequality Measurement Tools

There are lots of methods to measure health inequalities. Such as the range, the Gini coefficient (and the associated Lorenz curve), a pseudo-Gini coefficient (and an associated pseudo-Lorenz curve), the index of dissimilarity, the slope index of inequality (and the associated relative index of inequality) and the concentration index (and the associated concentration curve) (Wagstaff, Paci and Doorslaer, 1991).

3.3.3.2 The Comparison of Different Measurement Tools

According to Carr-Hill and Chalmers-Dixon (2005) who summarize the approaches to measure health inequality, they divide them into two categories which are simple inequality measures and more complicated measures. Simple inequality measures include range and comparing groups of equal size. More complicated measures include the Gini coefficient, the index of dissimilarity, relative index of inequality and the concentration index.

Table 11 The Comparison of Different Measurement Tools

Methods	Measure	Advantages	Disadvantages
Range	The comparison of the experiences of the top and bottom socio-economic groups, which is presented as the ration of one extreme value to the other.	It focuses on the specific groups.	It overlooks what happened in the intermediate groups. It does not consider about the sizes of the groups being compared.
Comparing groups of equal size	The comparison of the bottom 10% with the top 10% at different points in time. The top 10% and bottom 10% are defined in term of some socio-economic status.	It focuses on the specific groups. It takes into account the sizes of the groups being compared.	It overlooks what happened in the intermediate groups.
The Lorenz curve and the Gini coefficient	The Gini coefficient is based on the Lorenz curve, which corresponds to twice the area between the Lorenz curve and the line of equality. The Gini coefficient ranges from 0 to 1 (0 representing perfect equality and 1 total inequality)	It reflects the experience of the whole population. It does not involve stratifying the population by social class, so it allows changing class sizes.	It does not take into account any dimension of socio-economic .
The pseudo Lorenz curve and the index of dissimilarity	The pseudo Lorenz curve based on grouped data, where the groups are occupational classes or socio-economic criterion. The index of dissimilarity is developed from this curve, which is based on under complete equality and everyone's share of health would be equal to their population share.	It reflects the experience of the whole population.	It is insensitive to the socio-economic dimension to inequalities in health.

Methods	Measure	Advantages	Disadvantages
The slopes and relative index of inequality	The slope index of inequality is defined as the slop of the regression line showing the relationship between a class or group's health status and its rank in socio-economic terms.	It reflects the experience of the whole population. It is sensitive to the distribution of the population across socio-economic groups. It ranks socio-economic groups by socioeconomic status, so it ensures that the socioeconomic dimension to inequalities in health is considered. It is sensitive to change in the mean level of health	
The concentration index	The concentration index is based on the concentration curve, which is defined as twice the area between the concentration curve and the line of equality	It reflects the experience of the whole population. It is sensitive to the distribution of the population across socio-economic groups. It ranks individuals by socioeconomic status, so it ensures that the socioeconomic dimension to inequalities in health is considered.	It is insensitive to change in the mean level of health.

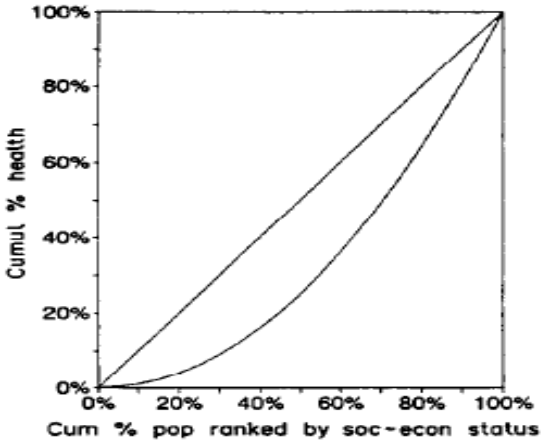
Source: Author.

3.3.3.3 The concentration index

- **Definition**

The concentration index is defined in term of the concentration curve. The concentration index is defined as twice the area between the concentration curve and the line of equality (the 45-degree line). People rank their health and their socioeconomic status which beginning with the most disadvantaged (see Figure 10), so in the case in which health is equally distributed across socioeconomic groups, the concentration curve will coincide with the line of equality (the concentration index is zero). Supposing that poor health is concentrated in the lower socioeconomic groups, the concentration curve lies below the line of equality (the concentration index is positive value) (Wagstaff, Paci and Doorslaer, 1991).

Figure 10 The Concentration Curve



Source: Wagstaff, Paci and Doorslaer, 1991

- **Computing the concentration index**

For how to compute the concentration index, it should consider the grouped-data and micro-data. Moreover, the concentration index can be decomposed to identify the impact of various factors.

Computing the concentration index through grouped-data：

The concentration index for t=1,….,T groups is easily computed in a spreadsheet program using the fowling formula:

$$C = (p_1 L_2 - p_2 L_1) + (p_2 L_3 - p_3 L_2) + \cdots + (p_{T-1} L_T - p_T L_{T-1})$$

Where p_t is the cumulative percentage of the sample ranked by economic status in group t and L_t is the corresponding concentration curve ordinate (Fuller and Lury, 1997).

Computing the concentration index through micro-data：

The concentration index can be computed by “convenient covariance” result.

$$C = 2\mathrm{cov}(y_i R_i)/\mu$$

Where y is the health variable whose inequality is being measured, μ is its mean, R_i is the ith individual’s fractional rank in the socioeconomic distribution and cov(.,.) is the covariance (Fuller and Lury, 1997).

Decomposition of the concentration index：

The concentration index can be decomposed to identify the impact of various factors, such as socioeconomic status, in order to determine how much each factor contributes to inequalities (Wagstaff and Doorslaer, 2002). They use the model as follows:

$$y = \alpha + \sum_k \beta_k x_k + \varepsilon$$

The concentration index for y, C can be written as follows:

$$C = \sum_k (\beta_k \bar{\chi}_k / \mu) C_k + GC_\varepsilon / \mu$$

where μ is the mean of y, $\bar{\chi}_k$ is the mean of χ_k, C_k is the concentration index for χ_k (defined analogously to C), and GC_ε is the generalized concentration index for the error term (ε). Moreover，this decomposition model can be computed easily in State.

3.4 Health-Related Quality of Life Models

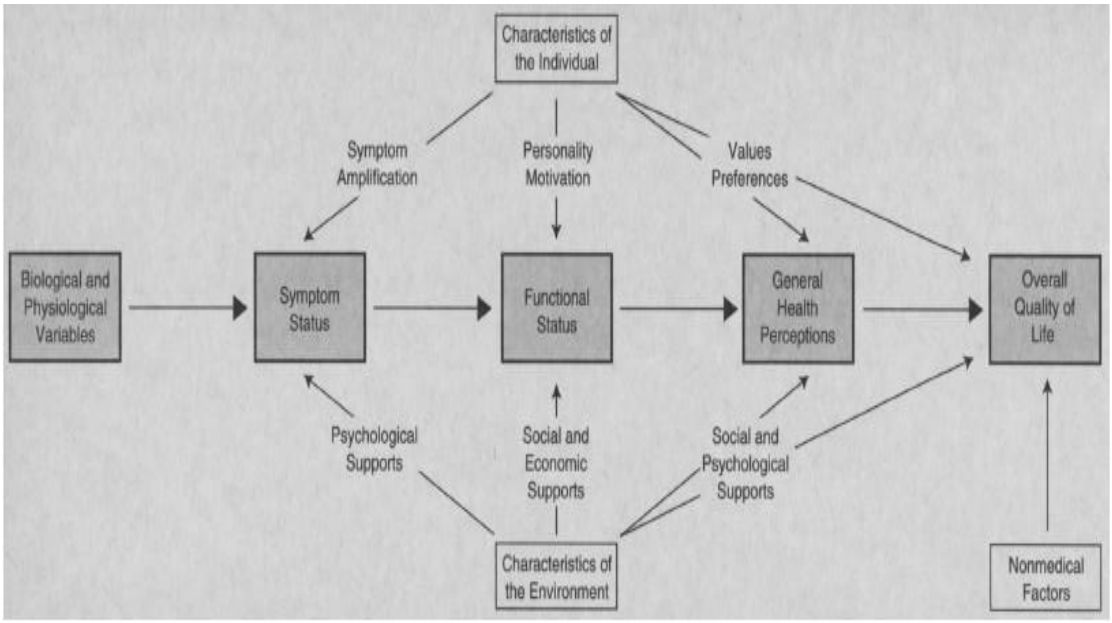
3.4.1 Wilson and Cleary's Health-Related Quality of Life Conceptual Model

Wilson and Cleary (1995) present a health-related quality of life conceptual model. This model integrates two different paradigms of health, and they are clinical paradigm and social science paradigm, respectively. Specifically, the clinical paradigm focuses on etiologic agents, pathological processes, and biological, physiological and clinical outcomes. The social science paradigm focuses on

dimensions of functioning and overall well-being, and complex behaviors and feelings.

Wilson and Cleary's health-related quality of life conceptual model has 5 levels, which are biological and physiological factors, symptoms, functioning, general health perceptions and overall quality of life (see Figure 11). Wilson and Cleary describe this model as a linear progression. As one moves from left to right in the model, one moves outward from the cell to the individual to the interaction of the individual as a member of society.

Figure 11 Relationships among Measures of Patient Outcome in a Health-Related Quality of Life Conceptual Model

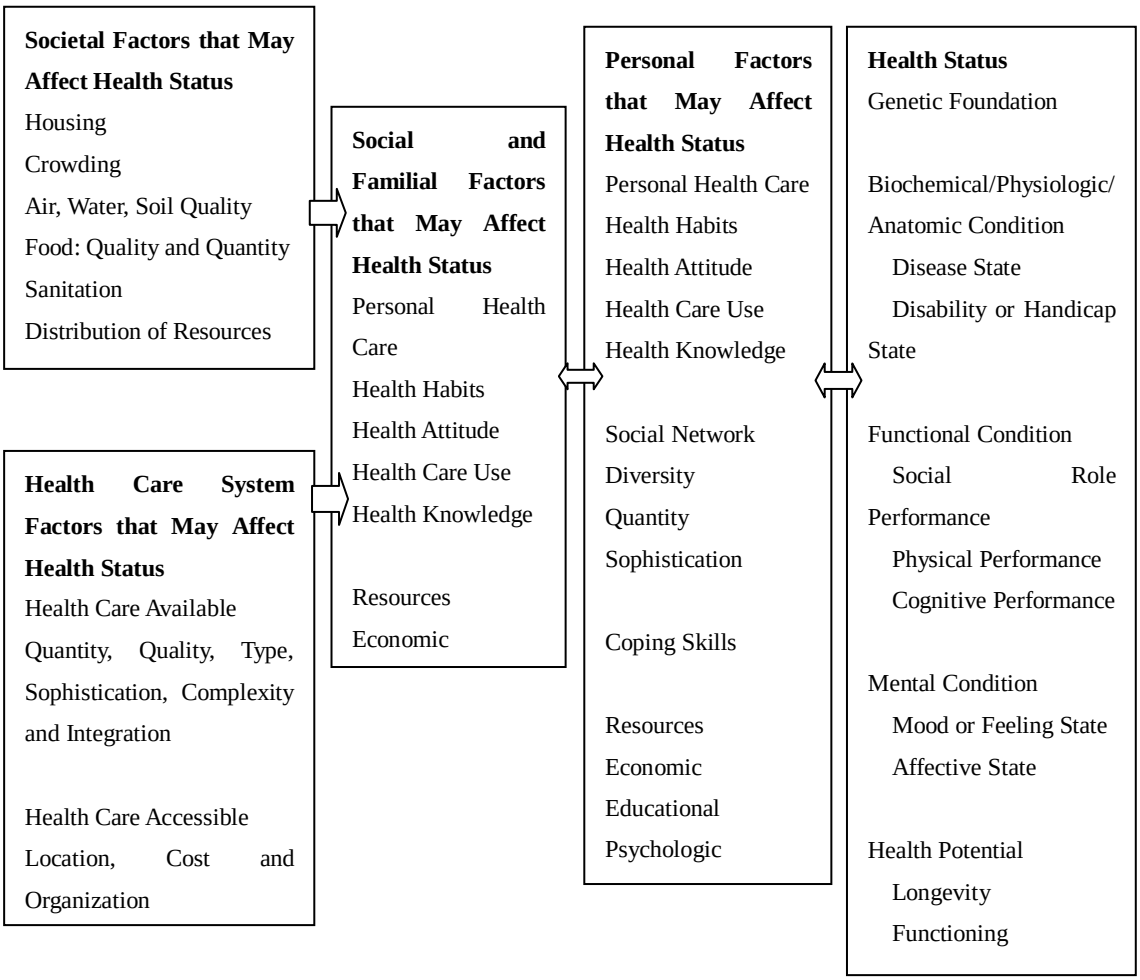


Source: Wilson and Cleary, 1995

3.4.2 Bergner's Health Status Model

Bergner (1985) proposes a model of health status. This model includes four groups of factors which may affect health status. They are societal factors, health care system factors, social and familial factor and personal factors (see Figure 12).

Figure 12 The Dimensions of Health Status and the Factors that Affect Them



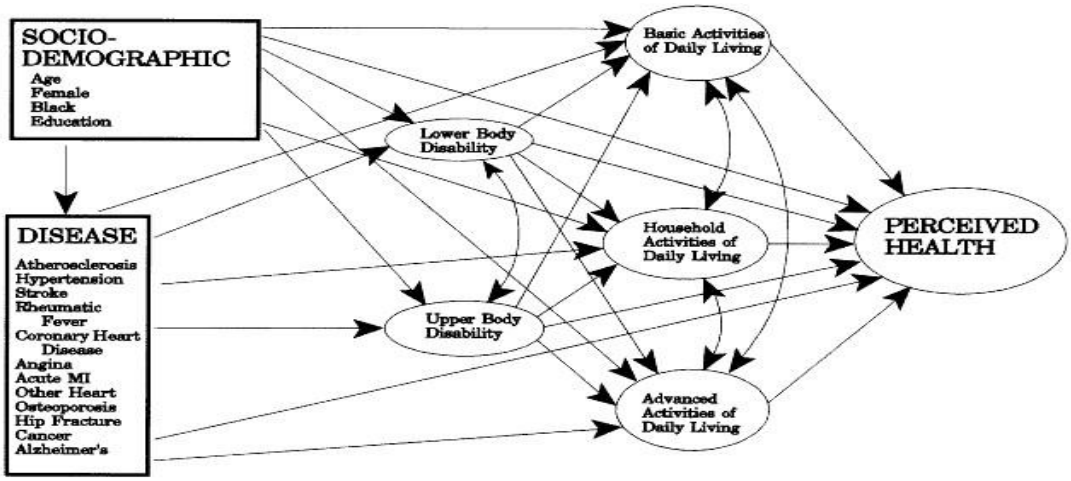
Source: Bergner, 1985

More specifically speaking, societal factors include environmental quality, housing, crowding, and sanitation. Health care system factors include availability and accessibility. Social and familial factor include the personal health attitudes and behavior, the physical condition and the resources. Personal factors include personal health care, coping skills, social network and resources.

3.4.3 Johnson and Wolinsky Causal Model

Johnson and Wolinsky (1993) build a model of health status. The model includes 4 aspects, which are disease, disability, functional limitation and socio-demographic factors (i.e. age, race, gender and education) (see Figure 13).

Figure 13 Specified Conceptual Model of Disease, Disability, Functional Limitation, and Perceived Health

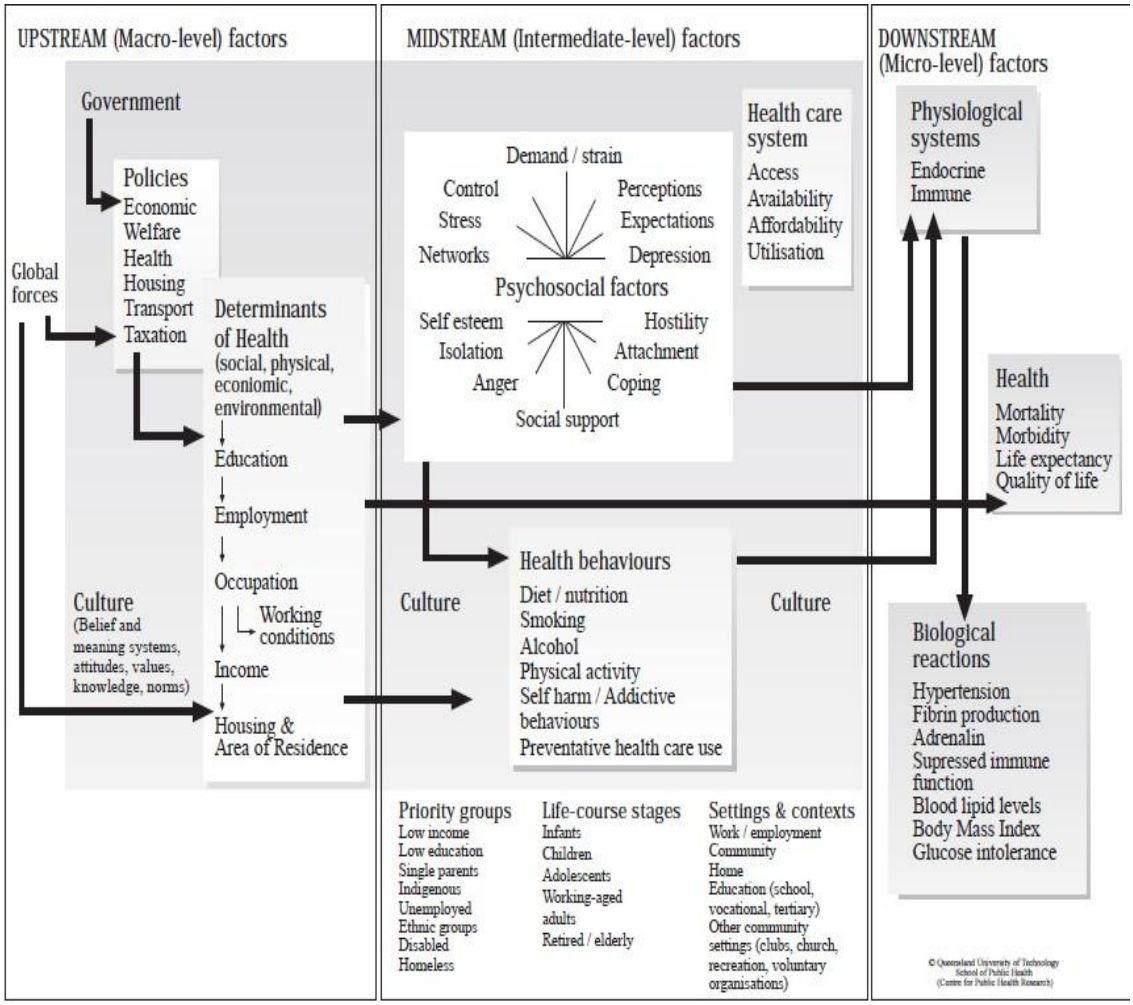


Source: Johnson and Wolinsky, 1993

3.4.4 The Model of Socio-economic Determinants of Health and Disease

Turrell et al., (1999) provide a model of the socio-economic determinants of health and disease. The model consists of three levels which are upstream, midstream and downstream levels (see Figure 14).

Figure 14 The Model of Socio-Economic Determinants of Health and Disease



Source: Turrell et al., 1999

Upstream level factors: this level includes a range of interrelated factors such as education, employment, occupation and working conditions, income, housing and area of residence. In addition, the level also includes government policies and factors associated with globalization.

Midstream level factors: this level includes psychosocial processes, health behaviors and the health care system.

Downstream level factors: this level includes physiological and biological functioning.

3.5 Previous Researches about Health-Related Quality of Life Determinants

Most researches have performed a multivariate analysis in health-related quality of life (HRQoL), for example, U.S., Vietnam, Sweden, China, Spain, South Africa and Japan. Table 12 shows the factors associated with health-related quality of life, which include how to measure HRQoL, what are significant variables, the size of sample, method analysis and source.

Table 12 The Factors Associated with Health-Related Quality of Life

Measure	Significant Variables	Sample	Method of Analysis	Authors
HRQoL is measured using SF-36	Age, Gender, Education and Economic status	400 community residents of Tehran aged 65 years old and over	Multiple logistic regression	Tajvar, Arab and Montazeri, (2008)
HRQoL is measured using EQ-5D	Socioeconomic factors	2873 people aged 60+ living rural Vietnam	Multilevel-multivariate linear regression	Hoi, Chuc and Lindholm, (2010)
HRQoL is measured using SF-36	Age, employment status, chronic medical conditions, hospitalization, emotional abuse, sexual abuse, mental health problems, physical abuse, the use of sedatives, the use of cocaine, the number of days of cocaine use, sedative use and multiple substance use	145 opiate users at enrollment into low-threshold methadone maintenance programs	ANOVA, Correlational analyses and Stepwise regression	Millson et al., (2006)
HRQoL is measured using EQ-5D	Socio-demographic (age, sex, race/ethnicity, income and education) factors and clinical conditions	13,646 adults in U.S.	OLS regression	Lubetkin et al., (2005)
HRQoL is measured using EQ-5D	socioeconomic status	1159 residents of a socially and ethnically diverse suburb of Cape Town, South Africa	Multiple linear regression	Jelsma and Ferguson, (2004)

Measure	Significant Variables	Sample	Method of Analysis	Authors
HRQoL is measured using EQ-5D	Socio-economic status	2994 respondents whose age are 12 years and older in Beijing	Multiple linear regression	Wang, Kindig and Mullahy, (2005)
HRQoL is measured using EQ-5D	Socio-economic status and disease group	495 respondents whose age 20-88 year in Stockholm County, Sweden	Multiple regression	Burstrom, Johannesson and Diderichsen, (2001)
HRQoL is measured using EQ-5D	Socio-economic status and clinical characteristics	120,703 people in China	Multiple regression	Sun et al., (2011)
HRQoL is measured using SF-36	Education level	9984 persons whose age 15 years or older residing Spain	OLS regression	Regidor et al., (1999)
HROoL is measured using The European KIDSCREEN	Education level and the number of material goods in the family (material resources)	754 students from seven European countries	Multivariate logistic regression	Rueden et al., (2006)
HRQoL is measured using EQ-5D	Age, unemployed or retired, feel severe stress and chronic conditions	915 adults from Takamatsu, Japan	Multivariate regression	Fujikawa et al., (2010)
HRQoL is measured using EQ-5D	Height in adult life	14 416 adults (aged > 18 years) in England	OLS regression	Christensen et al.,(2007)
HRQoL is measured using SF-8	Demographic characteristics, living conditions, and violent and traumatic events	1228 adults in town of Juba, Southern Sudan	Multivariate regression	Roberts et al., (2010)
HRQoL is measured using HUI	Income and education	13682 adults (aged>20) in Canada	Growth curve analysis	Ross et al., (2010)

Source: Author.

In summary, variables significantly associated with HRQoL score are socioeconomic factors, demographic characteristics, health behavior factor medical utilization and clinical characteristics and so on. Specifically, socioeconomic factors include income level, education level, living conditions and family size. Demographic characteristics include gender, age, employment status and race. Health behavior factors include smoking, alcohol consumption and drug abuse. Medical utilization include hospitalization and visiting doctor. Clinical characteristics include chronic disease and two-week disease.

CHAPTER IV

RESEARCH METHODOLOGY

4.1 Conceptual Framework

This study attempts to assess rural residents' health-related quality of life and health inequality in Liangcheng County, China. To achieve this objective, using which instrument to measure health-related quality of life should be considered. In this study, EQ-5D is an appropriate tool, because EQ-5D has several advantages.

First of all, it has been validated in different population, such as Europe and the USA, Canada and Zimbabwe. Moreover, population norms have been established by age, sex and socio-economic status. Norm data can be used to compare health status of specific groups with that of the general population (Sun et al., 2011). Secondly, it has been validated in different languages, and there are currently 36 official language versions of the EQ-5D. A Chinese version of EQ-5D is available. Thirdly, EQ-5D has 5 dimensions and each dimension has only one question with three levels of responses, so it is a very feasible instrument for a survey with multiple purposes and for a large, relatively low educated population. Last but not least, it is the simplest multi-dimensional measure compared to other instruments (see Table 13). EQ-5D is a pretty good instrument to measure health-related quality of life.

Table 13 The Comparison of Multi-Dimensional Instruments

Instrument	Instruments domains			
	Physical function	Symptoms	Global judgment	Phychol. Well-being
EQ-5D	√	√	√	√
HUI	√			√
NHP	√	√		√
QWB	√			
SF-36	√	√		√

Instrument	Instruments domains			
	Cognitive functioning	Role activities	Personal construct	Social well-being
EQ-5D		√		√
HUI	√			
NHP				√
QWB				√
SF-36	√	√		√

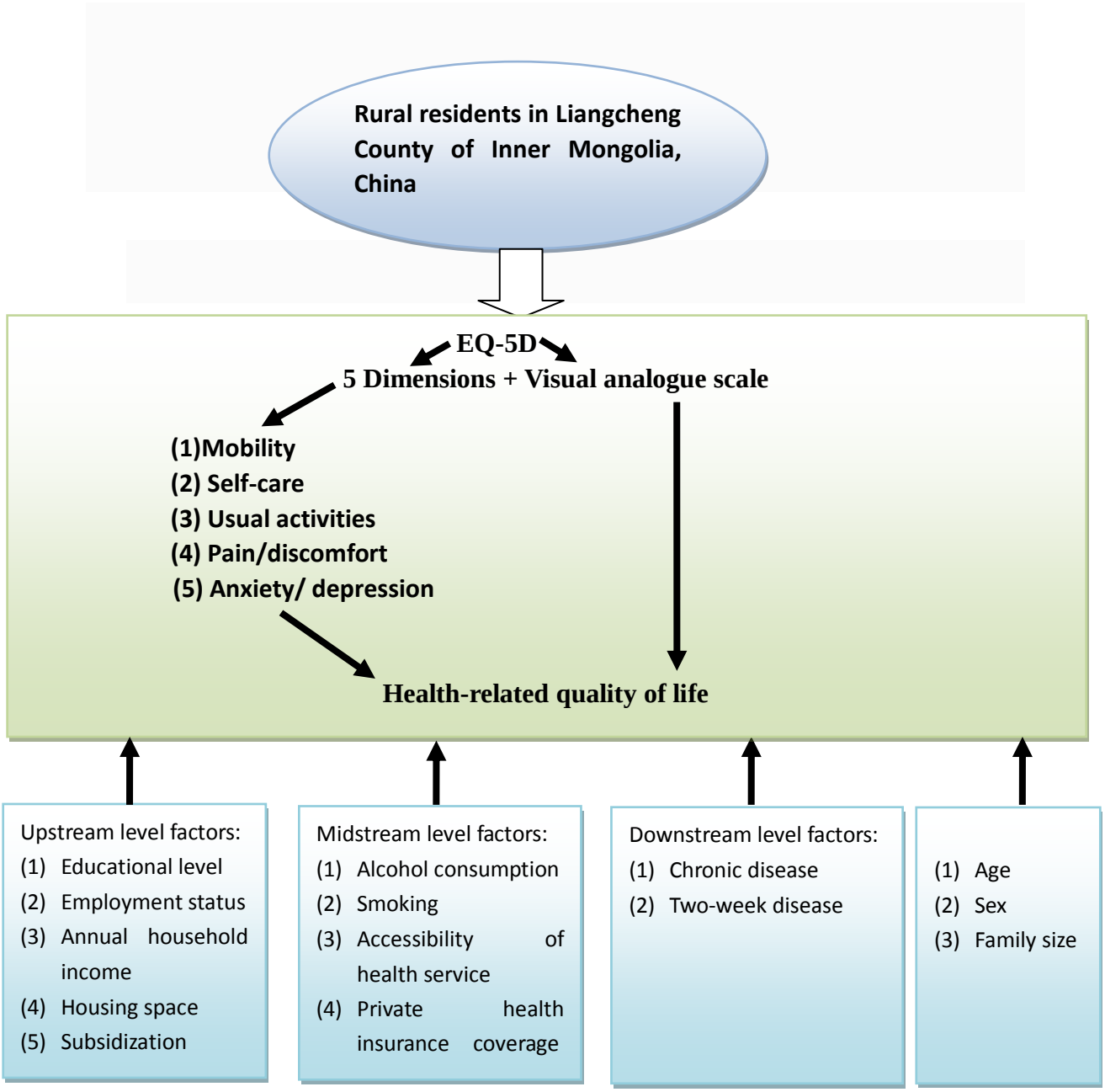
Source: Fitzpatrick et al., 1998

According to several models in literature review, the Model of Socio-economic Determinants of Health and Disease is a good choice, which is classified in three level factors: upstream level factors, midstream level factors and downstream level factors. The selection of this model is based on the availability of information on the database. Moreover, the Model of Socio-economic Determinants of Health and Disease has able to include the most important factors that determine health-related quality of life. According to the Model of Socio-economic Determinants of Health and Disease and

database, this study chooses educational level, employment status, annual household income, employment status, housing space, subsidization, alcohol consumption, smoking, accessibility of health service, private health insurance coverage, chronic disease and two-week disease as independent variables. In addition, this study adds age, sex and family size these three independent variables.

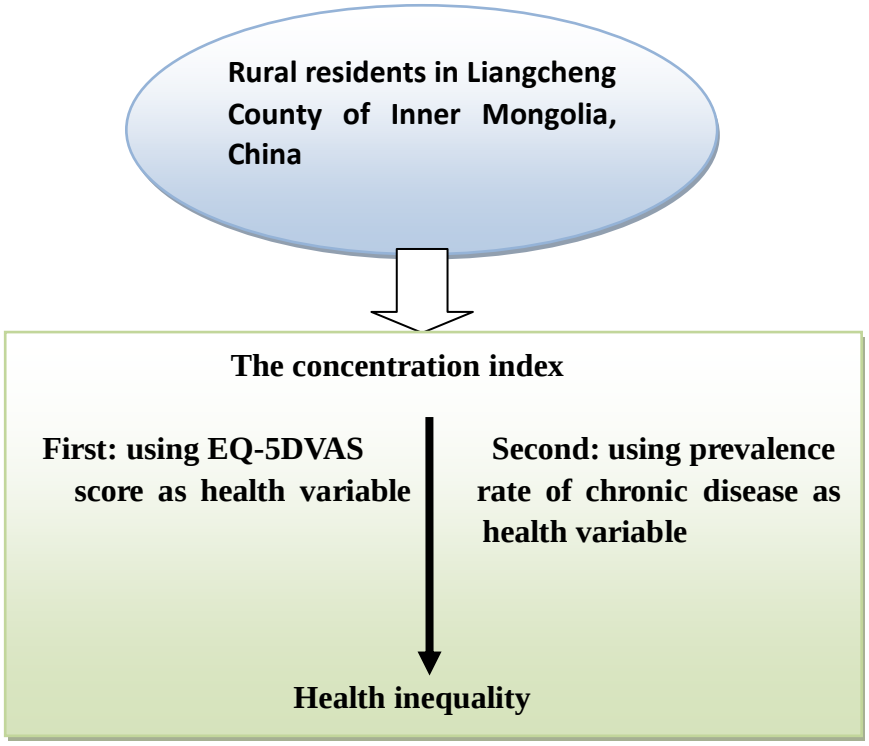
This study intends to use two different dependent variables which are EQ-5D index score and EQ-5D VAS score. EQ-5D index score is based on EQ-5D five dimensions which can generate 243 health states theoretically, so EQ-5D index score is dependent variable which can measure health-related quality life very well. However, there is no Chinese EQ-5D value set, so we cannot convert EQ-5D five dimensions to EQ-5D index score well. Under such conditions, this study also employs EQ-5D VAS score for dependent variable. Because EQ-5D VAS score does not need to convert and can be got from visual analogue scale directly. But EQ-5D VAS score is a simple score to measure health-related quality of life. From this, it can be seen that this study use two different dependent variables and the same independent variables to build two multiple regression equations which may help us understand more clearly that the relationship between health-related quality of life and its influencing factors.

Figure shows the conceptual framework to assess rural residents' health-related quality of life in Liangcheng County, China.



To assess rural residents' health inequality, this study considers how to measure health inequality. Based on the literature review, several methods can measure health inequality. By analysis and comparison in literature review, the concentration index is a used method in this study. This study calculates the

concentration index, and we must choose a health variable. In the past, most studies choose mortality or morbidity as health variable. Until 2004, Szende firstly use EQ-5D as health variable to analysis health inequality (Szende and Williams, 2004). In order to assess the health inequality in Liangcheng County, this study choose EQ-5D VAS score and prevalence rate of chronic disease, respectively to calculate the concentration index. Figure shows the conceptual framework to assess rural residents' health inequality in Liangcheng County, China.



4.2 Research Design

The study is a cross-sectional descriptive design. The study was carried out in 9 villages of Liangcheng County, China in 2009. Health-related quality of life is measured by EQ-5D.

4.3 Sources of Data

The secondary data are used in this study, which collected from Inner Mongolia Medical College. The data were collected during 04-08 August 2009. It is a face-to-face interview and was conducted by trained interviewers. This survey used the questionnaire. The questionnaire included more than 170 questions, on acute diseases and injuries, chronic and other diseases, hospitalization, health-related behavior, educational level, family income and employment status, social relations, safety and security, medical care fees, accessibility (distance and time) and satisfaction with health service, insurance coverage, and EQ-5D.

4.3.1 Target population

The target population is all rural residents in Liangcheng County of Inner Mongolia, China.

4.3.2 Sampled population

The study is conducted in nine villages of Liangcheng County of Inner Mongolia, China; altogether 948 households were collected.

4.3.3 Sample

Table 14 The Situation of Sample

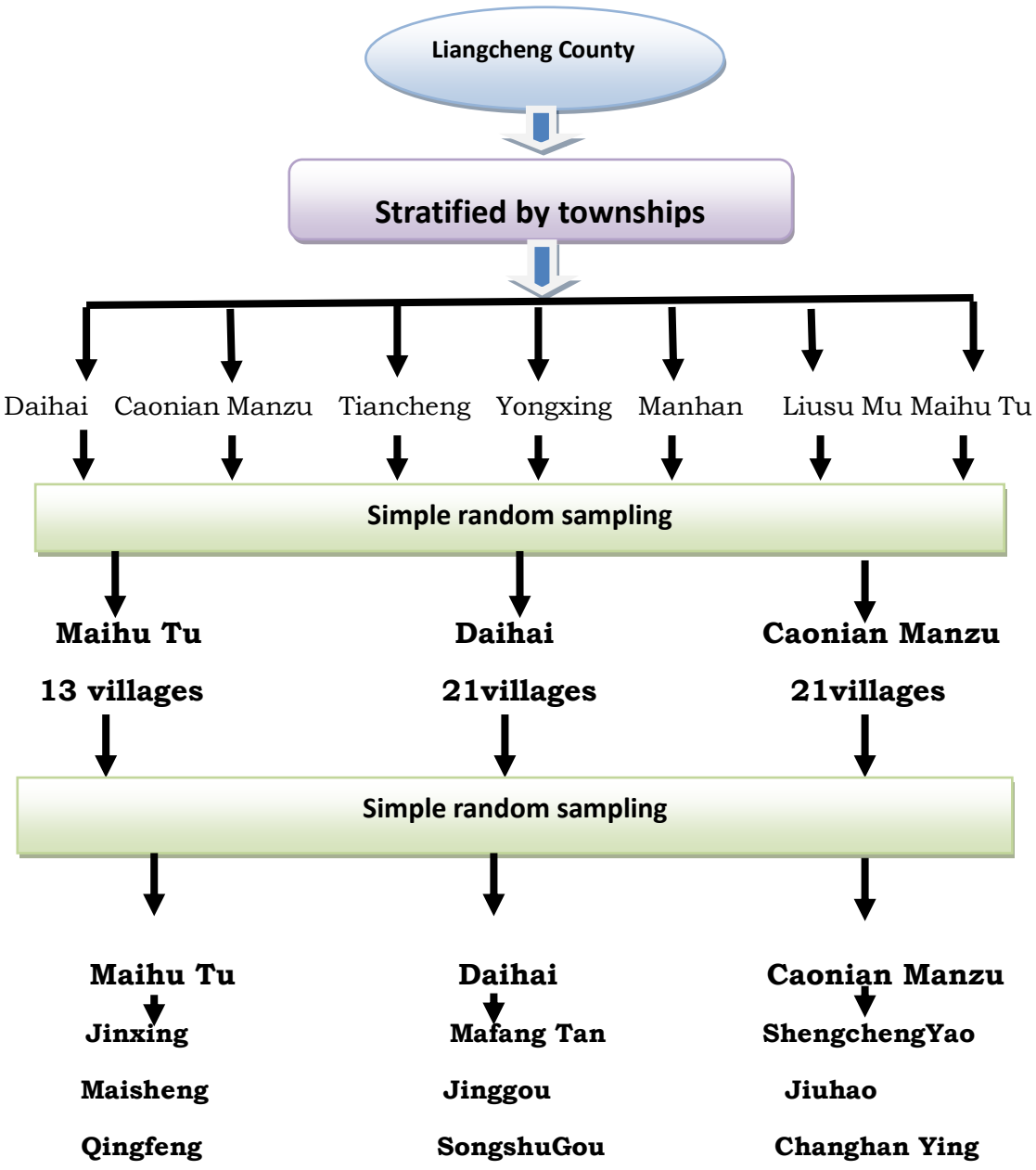
Townships	Villages	Number of households	Sampled households
Maihu Tu	Jinxing	753	223
	Maisheng	507	150
	Qingfeng	278	81
Daihai	Mafang Tan	459	137
	Jinggou	455	136
	Songshu Gou	126	42
Caonian Manzu	Shengcheng Yao	98	35
	Jiuhao	65	27
	Changhan Ying	381	117
Total		3122	948

Source: Author.

4.3.4 Sampling technique

948 households are sampled by using a two-stage stratified cluster random sampling. In the first sample stage, 7 townships are stratified based on population size to sample 3 townships. In the second stage, 55 villages in the 3 townships are stratified based on population size sample 9 villages. In 9 villages, 948 households are randomly selected, and all family members in a sampled household are interviewed individually. EQ-5D is asked among persons aged 15 years and over, and no upper-age limit is applied. Figure 15 shows this sampling procedure.

Figure 15 Sampling Procedure



Source: Author.

4.3.5 Study sites

The study is conducted in three townships (nine villages) of Liangcheng County of Inner Mongolia, China.

- Maihu Tu town: Jinxing village, Maisheng village and Qingfeng village
- Daihai town: Mafang Tan village, Jinggou village and Songshu Gou village
- Caonian Manzu town: Shengcheng Yao village, Jiuhao village and Changhan Ying village

4.4 Data Analysis

All descriptive analyses are performed stratified by sex, age, educational level and income level. First of all, age groups: 15–44 years, 45–64 years and 65+ are used for age categorization. Secondly, educational level: illiterate, primary education, middle school education, secondary education and university or postsecondary education were used for educational level categorization. Finally, income level: low level (0-3000yuan), low middle level (3001-11500), high middle level (11501-20000 yuan)

and high level (20001+ yuan) are used for income level categorization. Calculations of frequency of respondents reporting problems in each EQ-5D dimension, VAS score (mean). To test the statistical significance of the difference between groups in the frequency of reported problems, $\chi 2$ tests are used.

Multiple regression analyses are performed in Eviews 6.0. Multiple regression analyses are used to estimate how health-related quality of life varied with age, family size, and annual household income. Dummy variables are created for health risk behaviors, educational level, sex and clinical characteristics and so on. Moreover, in this study health-related quality of life and annual household income influence each other. In order to find the relationship between health-related quality of life and annual household income, this study uses Two-Stage Least Squares for a system of simultaneous equation model. A 5% significance level is used for all analyses.

This study employs sensitivity analysis, which aims to assess the impact of different countries EQ-5D value set for multiple regression equations. Because EQ-5D value sets have been derived for EQ-5D in several countries using the EQ-5D visual analogue scale (EQ-5D VAS) valuation technique or the time trade-off (TTO) valuation technique, they are called EQ-5D VAS value set and EQ-5D TTO value set, respectively. There is no simple answer to the question how to choose between VAS value set and TTO value set. We must consider about specific research (Devlin and

Parkin, 2007). In this study, we focus on the general population, so this study chooses Belgium, Denmark, Europe, Finland, Germany, Slovenia, Spain and UK EQ-5D VAS value set to convert EQ-5D into EQ-5D index score. If this study focuses on disease group, we will choose TTO value set.

This study intends to use the concentration index to measure inequalities. First of all, this study draws the concentration curve. Secondly, this study estimates the concentration index. Most importantly, this study chooses two health variables (prevalence rate of chronic disease and EQ-5D VAS score) to respectively describe the concentration curve and calculate the concentration index.

4.4.1 Definition of Dependent Variables

For Dependent variable health-related quality of life (HRQoL), scores for the five health states can be converted into a utility index (the EQ-5D index score) by applying the scores from UK EQ-5D value set. This variable is used in the multiple regression model and simultaneous equation model.

For Dependent variable health-related quality of life (HRQoL) can be measured by EQ-5D VAS score. This variable is used in the multiple regression model.

For Dependent variable annual household income, this variable is calculated using information about yearly net income of each member of the household. This is measured in yuan. This variable is used in simultaneous equation model.

4.4.2 Definition of Independent Variables

- **Educational level:** It is measured as four dummy variables. According to the last complete educational level achieved by the respondent, they are: complete primary education, complete middle school education, complete secondary education and complete university or postsecondary education, respectively.

- **Annual household income**：It is measured in Chinese yuan. It means using information about yearly net income of each member of the household.

- **Housing space:** It is measured in square meter. It means the building area of living housing.

- **Subsidization:** It is measured in Chinese yuan. It means that national government and regional government subsidy for rural resident in a year.

- **Alcohol consumption:** It is measured as a dummy variable, which people have

alcohol consumption equal 1 and people do not have alcohol consumption equal 0.

- **Smoking:** It is measured as a dummy variable, which people smoke equal 1 and people do not smoke equal 0.

- **Accessibility of health service:** It is measured in minutes. It means how long people use transport from home to the nearest health care facility.

- **Private health insurance coverage:** It is measured as a dummy variable, which people have private health insurance equal 1 and people do not have private health insurance equal 0.

- **Chronic disease:** It is measured as a dummy variable, which people suffer from chronic disease (after doctor diagnosis as chronic disease) equal 1 and people do not suffer from chronic disease equal 0.

- **Two-week disease:** It is measured as a dummy variable, which people reported suffer from disease in the last two weeks equal 1 and people reported do not suffer from disease in the last two weeks equal 0

.

- **Age:** It is measured in years, only individuals of 15 years and above at the time of the survey was included in the study.

- **Sex:** It is measured as a dummy variable, in which female was equal to 0 and male equal to 1.

- **Family size:** It is measured in number. It means the number of the household.

- **Employment status:** It is measured as three dummy variables. It has four statuses, which are employed, retired, students and unemployed.

More information about variables can be found in Table 15, which shows variables' abbreviation, how it is measured and its expected sign and source.

Table 15 Variables' Abbreviation, Measurement, Expected Sign and Source

Abbreviation	Variable	Measure as	Expected Sign	Source
HRQoL	Health-Related Quality of Life	EQ-5D index score		Secondary
HRQoL1	Health-Related Quality of Life	EQ-5D VAS score		Secondary
INC	Annual Household Income	Monetary terms in 10000 Chinese yuan	+	Secondary

Abbreviation	Variable	Measure as	Expected Sign	Source
EDU	Educational Level	Dummy EDU_1:1=Complete Primary Education 0=Otherwise EDU_2:1=Complete Middle School Education 0=Otherwise EDU_3:1=Complete Secondary Education 0=Otherwise EDU_4:1=Complete University or Postsecondary Education 0=Otherwise If all EDU_1, EDU_2, EDU_3, EDU_4=0 it means illiterate	+	Secondary
HS	Housing Space	Square measure in square meter	+	Secondary
S	Subsidization	Monetary terms in 10000 Chinese yuan	+	Secondary
AC	Alcohol Consumption	Dummy 1=Have alcohol consumption 0= Do not have alcohol consumption	__	Secondary
SK	Smoking	Dummy 1= Smoke 0=Do not smoke	__	Secondary
AHS	Accessibility of Health Service	Time unit in minutes	__	Secondary

Abbreviation	Variable	Measure as	Expected Sign	Source
PHI	Private Health Insurance Coverage	Dummy 1=Have private health insurance 0=Do not have private health insurance	+	Secondary
CD	Chronic Disease	Dummy 1= Suffer from diagnoses of chronic disease 0= Do not suffer from diagnoses of chronic disease	__	Secondary
TWD	Two-Week Disease	Dummy 1= Suffer from two-week disease 0= Do not suffer from two-week disease	__	Secondary
AGE	Age	Measure in years	__	Secondary
SEX	Sex	Dummy 1=Male 0=Female		Secondary
FS	Family Size	Measure in the number of the household Dummy	__	Secondary
ES	Employment status Level	ES_1:1=Employed 0=Otherwise ES_2:1=Retired 0=Otherwise ES_3:1=Students 0=Otherwise If all ES_1, ES_2, ES_3=0 it means unemployed	+/-	Secondary

Source: Author.

4.4.3 Model specification

4.3.3.1 Multiple regression analyses using Ordinary Least Squares

In this model, dependent variable is HRQoL or HRQoL 1. There are eleven independent variables as follow: EDU, INC, HS, S, AC, SK, AHS, PHI, CD, TWD, AGE, SEX, FS.

HRQoL=f (EDU1, EDU2, EDU3, EDU4, INC, HS, S, AC, SK, AHS, PHI, CD, TWD, AGE, SEX, FS, ES1, ES2, ES3)

HRQoL 1=f (EDU1, EDU2, EDU3, EDU4, INC, HS, S, AC, SK, AHS, PHI, CD, TWD, AGE, SEX, FS, ES1, ES2, ES3)

Estimation equation：

$$HRQoL = \beta_0 + \beta_1 EDU1 + \beta_2 EDU2 + \beta_3 EDU3 + \beta_4 EDU4 + \beta_5 INC + \beta_6 HS + \beta_7 S + \beta_8 AC + \beta_9 SK + \beta_{10} AHS + \beta_{11} PHI + \beta_{12} CD + \beta_{13} TWD + \beta_{14} AGE + \beta_{15} SEX + \beta_{16} FS + \beta_{17} ES1 + \beta_{18} ES2 + \beta_{19} ES3 + \varepsilon$$

$$HRQoL\ 1 = \beta_0 + \beta_1 EDU1 + \beta_2 EDU2 + \beta_3 EDU3 + \beta_4 EDU4 + \beta_5 INC + \beta_6 HS + \beta_7 S + \beta_8 AC + \beta_9 SK + \beta_{10} AHS + \beta_{11} PHI + \beta_{12} CD + \beta_{13} TWD + \beta_{14} AGE + \beta_{15} SEX + \beta_{16} FS + \beta_{17} ES1 + \beta_{18} ES2 + \beta_{19} ES3 + \varepsilon$$

4.3.3.2 A system of simultaneous equation model using Two-Stage Least Squares

In this model, endogenous variables are HRQoL and INC, and exogenous variables are EDU, HP, S, AC, SK, AHS, PHI, CD, TWD, AGE, SEX.

HRQoL=f (INC, EDU, HS, S, AC, SK, AHS, PHI, CD, TWD, AGE, SEX, FS) (1)

INC=f (HRQoL, EDU, S, AGE, SEX) (2)

Estimation equation：

$$HRQoL = \beta_0 + \beta_1 INC + \beta_2 EDU1 + \beta_3 EDU2 + \beta_4 EDU3 + \beta_5 EDU4 + \beta_6 HS + \beta_7 S + \beta_8 AC + \beta_9 SK + \beta_{10} AHS + \beta_{11} PHI + \beta_{12} CD + \beta_{13} TWD + \beta_{14} AGE + \beta_{15} SEX + \beta_{16} FS + \varepsilon$$

$$INC = \beta_0 + \beta_1 HRQoL + \beta_2 EDU1 + \beta_3 EDU2 + \beta_4 EDU3 + \beta_5 EDU4 + \beta_6 S + \beta_7 AGE + \beta_8 SEX + \varepsilon$$

4.5. Hypothesis

H_1： Educational level is expected to have positive relationship on health-related quality of life

H_2: Annual household income hopes to be positively associated with health-related quality of life

H_3: Age is hope to have negative association with health-related quality of life

H_4: Accessibility of health service has a negative impact on health-related quality of life

H_5: Rural residents have alcohol consumption hopes to be negatively associated with health-related quality of life

H_6: Rural residents who smoke are expected to have negative relationship on health-related quality of life

CHAPTER V

RESULTS AND DISCUSSION

According to the research methodology discussed in the previous chapter, this chapter illustrates results and discussion with the objectives of study set in the first chapter.

5.1 Descriptive Analysis

In order to get a better understanding of the results, it is important to know the main characteristics of the sample used in the research. It provides a brief description of the sample in term of different criteria as following. This study collected 948 households, 2058 individuals. Complete data for EQ-5D five dimensions are available for 1770 respondents (86%) who are over 15 years old. In addition, complete data for EQ-5D visual analogue scale (EQ-5D VAS) are 1755 respondents among 1770 individuals. Table 16 provides the profile of the 1770 individuals in term of different characteristics.

- Distribution of the sample according to sex: 50.9% (901) of the sample is male while 49.1% (869) is female.

- Distribution of the sample according to age: 31.4% (555) of the sample is between 15 to 44 years old, 52.2% (924) is between 45 to 64 years old and 16.4%

(291) is over 65 years old.

- Distribution of the sample according to educational level: 27% (478) of the sample is illiterate, 34% (602) is of primary education, 28.2% (500) middle school education, 10.1% (179) secondary education and 0.7% (11) university or postsecondary education.

- Distribution of the sample according to whether the individual has a private health insurance: 4.9% (87) of the sample has private health insurance while 95.1% (1683) do not have it.

- Distribution of the sample according to diagnoses of chronic disease: 41.4% (733) of the sample suffers from chronic disease while 58.6% (1037) does not suffer from chronic disease.

- Distribution of the sample according to two-week disease: 43.4% (769) of the sample self-reports two-week disease, while 56.6% (1001) does not self-report two-week disease.

- Distribution of the sample according to whether the individual is smoking: 37.2% (658) of the sample smokes while 62.8% (1112) does not smoke.

- Distribution of the sample according to whether the individual has alcohol consumption: 12.8% (227) of the sample has alcohol consumption while 87.2% (1543) does not have alcohol consumption.

- Distribution of the sample according to accessibility of health service: 59.2% (1048) of the sample accesses to health service no more than 10 minutes, 17.1% (303) between 11 to 20 minutes, 12.2% (216) between 21 to 30 minutes and 11.5% (203) over 31 minutes.

- Distribution of the sample according to governmental subsidization: 34.2% of the sample has governmental subsidization while 65.8% (1165) does not have governmental subsidization.

- Distribution of the sample according to employment status: 78.4% (1387) of the sample is employed, 0.8% (14) is retried, 6.4% (113) is student, and 14.4% (256) is unemployed.

- Distribution of the sample according to income level: 9.9% (175) of the sample is low level, 52.9% (936) is low middle level, 25.5% (452) is student, and 11.7% (208) is unemployed.

Table 16 The Distribution of 1770 Individuals

	Total(1170) Frequency	Percent
Sex		
Female	869	40.1%
Male	901	50.9%
Age		
15-44 years old	555	31.4%
45-64 years old	924	52.2%
More than 65 years old	291	16.4%
Education level		
Illiterate	478	27%
Primary Education	602	34%
Middle School Education	500	28.2%
Secondary Education	179	10.1%
University or Postsecondary Education	11	0.7%
Private Health Insurance		
Yes	87	4.9%
No	1683	95.1%
Chronic Disease		
Yes	733	41.4%
No	1038	58.6%
Two-Week Disease		
Yes	769	43.4%
No	1001	56.6%
Smoking		
Yes	658	37.2%
No	1112	62.8%
Alcohol Consumption		
Yes	227	12.8%
No	1543	87.2%
Accessibility of Health Service		
No more than 10 mins	1048	59.2%
Between 11 to 20 mins	303	17.1%
Between 21 to 30 mins	216	12.2%
More than 31 mins	203	11.5%

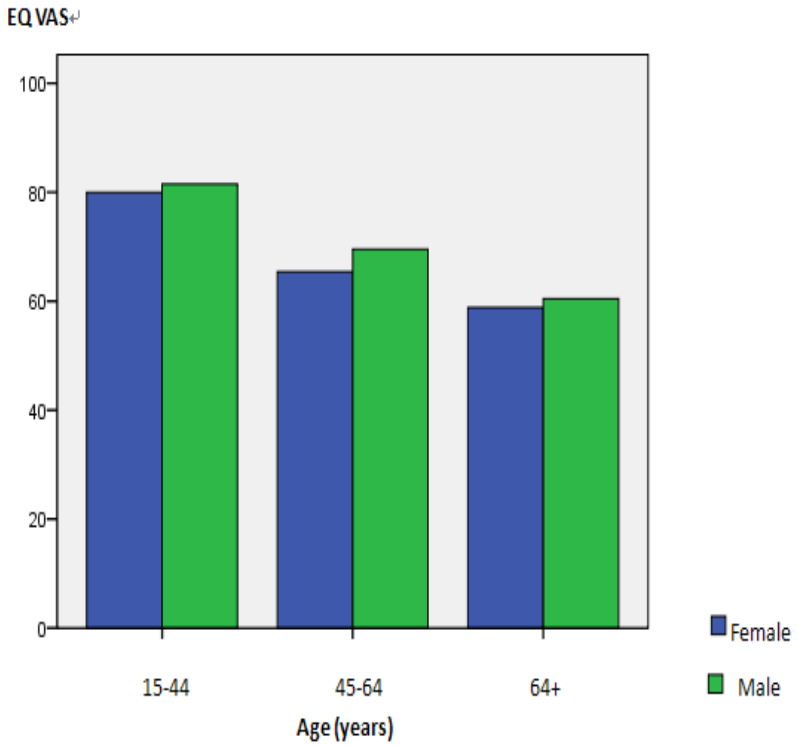
	Total(1170) Frequency	Percent
Governmental Subsidization		
Yes	605	34.2%
No	1165	65.8%
Employment status		
Employed	1387	78.4%
Retried	14	0.8%
Students	113	6.4%
Unemployed	256	14.4%
Income level		
Low level	175	9.9%
Low middle level	936	52.9%
High middle level	452	25.5%
High level	208	11.7%

Source: Author.

The mean EQ-5D VAS score equals to 70.4. Female is 69.5 and male is 71.3. According to Analysis Report of National Health Services Survey in China, 2008, the mean EQ-5D VAS score is 80.1 in China (79.3 for urban residents, and 80.4 for rural residents) (MOH, 2009). Obviously, rural residents in Liangcheng County have significantly lower the mean EQ-5D VAS score than the national average ($p<0.0001$). When this study employs UK EQ-5D value set, the mean EQ-5D index score is 0.83. Female is 0.82 and male is 0.85. The Pearson correlation coefficient between EQ-5D VAS score and EQ-5D index score is 0.62 ($p<0.0001$).

Specifically, the mean EQ-5D VAS data from 1755 individuals are presented in Figure 16.

Figure 16 Mean Population EQ-5D VAS Ratings



Source: Author.

As can be seen, the mean EQ-5D VAS ratings decrease with increasing age. Moreover, men of three age groups report higher EQ-5D VAS ratings than women. This difference between men and women is the largest in 45-64 years old group.

Table 17, 18, 19 and 20 are made by the frequency and proportion of reported problems in each level for each dimension, which present as a health profile. These

tables are categorized in term of sex, age, educational level and income level.

Table 17 Frequency and Proportion of Reported Problems by Dimension and Sex

EQ-5D DIMENSION		SEX		TOTAL	Chi-Square Tests
		Male	Female		
MOBILITY	Level 1	739	688	1427	Value=4.327
		82.0%	79.2%	80.6%	
	Level 2	142	167	309	df=2
		15.8%	19.2%	17.5%	
	Level 3	20	14	34	P=0.115
		2.2%	1.6%	1.9%	
SELF-CARE	Level 1	841	785	1626	Value=5.497
		93.3%	90.3%	91.9%	
	Level 2	47	68	115	df=2
		5.2%	7.8%	6.5%	
	Level 3	13	16	29	P=0.064
		1.5%	1.9%	1.6%	
USUAL ACTIVITIES	Level 1	726	681	1407	Value=1.457
		80.6%	78.4%	79.5%	
	Level 2	135	142	277	df=2
		15.0%	16.3%	15.6%	
	Level 3	40	46	86	P=0.483
		4.4%	5.3%	4.9%	
PAIN/ DISCOMFORT	Level 1	625	528	1153	Value=15.759
		69.4%	60.8%	65.1%	
	Level 2	226	291	517	df=2
		25.1%	33.5%	29.2%	
	Level 3	50	50	100	P=0.000
		5.5%	5.7%	5.7%	
ANXIETY/ DEPRESSION	Level 1	762	708	1470	Value=3.035
		84.6%	81.5%	83.1%	
	Level 2	119	137	256	df=2
		13.2%	15.8%	14.5%	
	Level 3	20	24	44	P=0.219
		2.2%	2.7%	2.4%	

Source: Author.

First of all, the female group has a higher proportion of problems[3] on each EQ-5D dimension than male group.

The dimension pain/discomfort is reported the most problems in male group and female group, and the proportions are 30.6% (25.1%+5.5%) in male group and 39.2% (33.5%+5.7%). Inversely, the dimension self-care is reported the least problems in male group and female group, and the proportions are 6.7% (5.2%+1.5%) in male group and 9.7% (7.8%+1.9%) in female group.

Table 18 Frequency and Proportion of Reported Problems by Dimension and Age Group

EQ-5D DIMENSION		**AGE GROUPS**			**TOTAL**	**Chi-Square Tests**
		15-44	45-64	65+		
MOBILITY	Level 1	532	752	143	1427	Value=271.485
		95.9%	81.4%	49.1%	80.6%	
	Level 2	19	160	130	309	df=4
		3.4%	17.3%	44.8%	17.5%	
	Level 3	4	12	18	34	P=0.000
		0.7%	1.3%	6.1%	1.9%	
SELF-CARE	Level 1	542	852	232	1626	Value=83.618
		97.7%	92.2%	79.7%	91.9%	
	Level 2	8	59	48	115	df=4
		1.4%	6.4%	16.5%	6.5%	
	Level 3	5	13	11	29	P=0.000
		0.9%	1.4%	3.8%	1.6%	

[3] This study dichotomizes the EQ-5D level in to "no problems" (response level 1) and "problems" (response level 2 and 3).

USUAL ACTIVITIES	Level 1	524	730	153	1407	Value=236.721
		94.4%	79.0%	52.6%	79.5%	
	Level 2	21	166	90	277	df=4
		3.8%	18.0%	30.9%	15.6%	
	Level 3	10	28	48	86	P=0.000
		1.8%	3.0%	16.5%	4.9%	
PAIN/ DISCOMFORT	Level 1	465	569	119	1153	Value=168.230
		83.8%	61.6%	40.9%	65.1%	
	Level 2	77	291	149	517	df=4
		13.9%	31.5%	51.2%	29.2%	
	Level 3	13	64	23	100	P=0.000
		2.3%	6.9%	7.9%	5.6%	
ANXIETY/ DEPRESSION	Level 1	493	765	212	1470	Value=34.862
		88.8%	82.8%	72.9%	83.1%	
	Level 2	54	135	67	256	df=4
		9.7%	14.6%	23.0%	14.5%	
	Level 3	8	24	12	44	P=0.000
		1.4%	2.6%	4.1%	2.5%	

Source: Author.

Secondly, the proportion of problems reported in EQ-5D five dimensions increase with age. For example, the proportions of problems reported in the dimension mobility are 4.1% (3.4%+0.7%) in 15-44 year old group, 18.6% (17.3%+1.3%) in 45-64 years old group and 50.9% (44.8%+6.1%) in 65+ years old group.

The dimension pain/discomfort is reported the most problems in three age groups, and the proportions are 16.2% (13.9%+2.3%) in 15-44 year old group, 38.4% (31.5%+6.9%) in 45-64 years old group and 59.1% (51.2%+7.9%) in 65+ years old group. On the contrary, the dimension self-care is reported the least problems in three age groups, and the proportions are 2.3% (1.4%+0.9%) in 15-44 year old group, 7.8%

(6.4%+1.4%) in 45-64 years old group and 20.3% (16.5%+3.8%) in 65+ years old group.

Table 19 Frequency and Proportion of Reported Problems by Dimension and Educational Level

EQ-5D DIMENSION		EDUCATIONAL LEVEL[4]					TOTAL	Chi-Square Tests
		I	PE	MS	SE	UE		
MOBILITY	Level 1	308	491	446	172	10	1427	Value=134.976
		64.4%	81.6%	89.2%	96.1%	90.9%	80.6%	
	Level 2	152	102	48	6	1	309	df=12
		31.8%	16.9%	9.6%	3.4%	9.1%	17.5%	
	Level 3	18	9	6	1	0	34	P=0.000
		3.8%	1.5%	1.2%	0.5%	0%	1.9%	
SELF-CARE	Level 1	399	560	480	176	11	1626	Value=71.995
		83.5%	93.0%	96.0%	98.3%	100%	91.9%	
	Level 2	65	35	12	3	0	115	df=12
		13.6%	5.8%	2.4%	1.7%	0%	6.5%	
	Level 3	14	7	8	0	0	29	P=0.000
		2.9%	1.2%	1.6%	0%	0%	1.6%	
USUAL ACTIVITIES	Level 1	310	478	438	170	11	1407	Value=125.255
		64.9%	79.4%	87.6%	95.0%	100%	79.5%	
	Level 2	116	104	50	7	0	277	df=12
		24.3%	17.3%	10.0%	3.9%	0%	15.6%	
	Level 3	52	20	12	2	0	86	P=0.000
		10.9%	3.3%	2.4%	1.1%	%	4.9%	
PAIN/ DISCOMFORT	Level 1	238	370	385	149	11	1153	Value=123.124
		49.8%	61.5%	77.0%	83.2%	100%	65.1%	
	Level 2	203	194	98	22	0	517	df=12
		42.5%	32.2%	19.6%	12.3%	0%	29.2%	

[4] Educational Level: I: Illiterate, PE: Primary education, MS: Middle school, SE: Secondary education and UE: University education.

	Level 3	37	38	17	8	0	100	P=0.000
		7.7%	6.3%	3.4%	4.5%	0%	5.6%	
ANXIETY/ DEPRESSION	Level 1	360	497	447	155	11	1470	Value=42.574
		75.3%	82.6%	89.4%	86.8%	100%	83.1%	
	Level 2	101	87	44	24	0	256	df=12
		21.1%	14.5%	8.8%	13.4%	0%	14.5%	
	Level 3	17	18	9	0	0	44	P=0.000
		3.6%	3.0%	1.8%	0%	0%	2.5%	

Source: Author.

Thirdly, in general, the proportion of problems reported in most EQ-5D dimensions decrease with increasing educational level. But the proportion of problems reported in the dimension anxiety/depression does not follow increasing educational level. Secondary education group (13.4%) has a higher proportion of problems than middle school education group (10.6%).

The dimension pain/discomfort is reported the most problems in four educational level groups, and the proportions are 50.2% (42.5%+7.7%) in illiterate group, 38.5% (32.2%+6.3%) in primary education group, 23.0% (19.6%+3.4%) in middle school education group and 16.8% (12.3%+4.5%) in secondary education group. Moreover, the dimension mobility is reported the most problems in university or postsecondary education group, and the proportion is 9.1%. Inversely, the dimension self-care is reported the least problems in four educational level groups, and the proportions are 16.5% (13.6%+2.9%) in illiterate group, 7.0% (5.8%+1.2%) in primary education

group, 4.0% (2.4%+1.6%) in middle school education group and 1.7% (1.7%+0%) in secondary education group. In addition, the university or postsecondary education group response no problems in dimensions self-care, usual activities, pain/discomfort, anxiety/depression.

Table 20 Frequency and Proportion of Reported Problems by Dimension and Income Level

EQ-5D DIMENSION		INCOME LEVEL[5]					Chi-Suare Tests
		LL	LML	HMLl	HL	TOTAL	
MOBILITY	Level 1	93	735	406	193	1427	Value=135.787
		53.1%	78.6%	89.8%	92.8%	80.6%	
	Level 2	76	183	37	13	309	df=6
		43.4%	19.6%	8.2%	6.3%	17.5%	
	Level 3	6	17	9	2	34	P=0.000
		3.4%	1.8%	2.0%	1.0%	1.9%	
SELF-CARE	Level 1	138	855	432	201	1626	Value=59.831
		78.9%	91.4%	95.6%	96.6%	91.9%	
	Level 2	32	63	17	3	115	df=6
		18.3%	6.7%	3.8%	1.4%	6.5%	
	Level 3	5	17	3	4	29	P=0.000
		2.8%	1.9%	0.6%	2.0%	1.6%	
USUAL ACTIVITIES	Level 1	91	730	397	189	1407	Value=137.368
		52.0%	78.1%	87.8%	90.9%	79.5%	
	Level 2	54	167	43	13	277	df=6
		30.9%	17.9%	9.5%	6.3%	15.6%	
	Level 3	30	38	12	6	86	P=0.000
		17.1%	4.1%	2.7%	2.9%	4.9%	
PAIN/ DISCO	Level 1	85	573	341	154	1153	Value=58.610
		48.6%	61.3%	75.4%	74.0%	65.1%	

[5] Income level: LL: Low level, LML: Low middle level, HML: High middle level and HL: High level.

MFORT							
	Level 2	71	308	92	46	517	df=6
		40.6%	32.9%	20.4%	22.1%	29.2%	
	Level 3	19	54	19	8	100	P=0.000
		10.8%	5.8%	4.2%	3.9%	5.6%	
ANXIE	Level 1	122	775	387	186	1470	Value=37.310
TY/		69.7%	82.9%	85.6%	89.4%	83.1%	
DEPRE							
SSION							
	Level 2	41	142	56	17	256	df=6
		23.4%	15.2%	12.4%	8.2%	14.5%	
	Level 3	12	18	9	5	44	P=0.000
		6.9%	1.9%	2.0%	2.4%	2.5%	

Source: Author.

Finally, broadly speaking, the proportion of problems reported in most EQ-5D dimensions decrease with increasing income level. However, the proportion of problems reported in the dimension pain/discomfort does not follow increasing income level. High level income group (26.0%) has a higher proportion of problems than high middle income group (24.6%).

The dimension pain/discomfort is reported the most problems in four income level groups, and the proportions are 51.4% (40.6%+10.8%) in low level income group, 38.7% (32.9%+5.8%) in low middle level income group, 24.6% (20.4%+4.2%) in high middle level income group and 26.0% (22.1%+3.9%) in high level income group. On the contrary, the dimension self-care is reported the least problems in four income level groups, and the proportions are 21.1% (18.3%+2.8%) in low level income group,

8.6% (6.7%+1.9%) in low middle level income group, 4.4% (3.8%+0.6%) in high middle level income group and 3.4% (2.0%+1.4%) in high level income group.

As expected, health status decreased with age and women report much worse health status than men. In addition, socio-economic status (educational level and income level) is positive with health status. These results are in the line with EQ-5D population studies in other 15 countries (Szende and Williams, 2004) and previous EQ-5D population studies in China (Wang, Kindig and Mullahy, 2005 and Sun et al., 2011). This suggests that the EQ-5D instrument is a good tool to describe rural residents' health status.

It is notable that 933 respondents (52.7%) report good health status (report no problem on all EQ-5D five dimensions) and 841 respondents (47.9%) report more than 80 on EQ-5D visual analogue scale (100 represents perfect health). There are two possibilities: first, most rural residents are healthy. Second, rural residents do not really understand the instrument EQ-5D. For example, when interviewers use the EQ-5D visual analogue scale, they will ask rural residents: "we would like you to indicate on this scale how good or bad your own health is today, in your opinion." We know that most rural residents are less educated, so they cannot really understand definition of health. In their mind, health is the absence of significant illness. It could lead to overestimating their health status. When using EQ-5D five dimensions to

measure health status, there are some problems of sensitivity in this study. The simple reason is that the responses record three levels of severity (no problems/some or moderate problems/extreme problems) within a particular EQ-5D dimension. Moreover, this is a face-to-face interview conducted by trained interviewers, so interviewers might not clearly explain the EQ-5D to rural residents or rural residents are too optimistic when they answer interviewers' questions face to face.

5.2 Multiple Regression Analysis

In order to guide policy maker to make appropriate policies, this study considers the factors affecting health-related quality of life. Ordinary Least Square was used to estimate values of coefficients and other indicators. This study chooses two different dependent variables to represent health-related quality of life, and they are EQ-5D index score and EQ-5D VAS score, respectively.

The resulting output for the first model is shown in Table 21. The dependent variable in the model is EQ-5D index score. First of all, this equation has 10 significant coefficients. They are constant term, educational level 1, educational level 2, annual household income, housing space, chronic disease, two-week disease, age, employment status 1 and employment status 3. Next, value of R square is 0.361624 that means 36.1624% of dependent variable can be explained by independent

variables. The R square of this equation is slightly low, because the selected independent variables may be not the good independents variables for this dependent variable. Finally, value of F test is 52.17528 ($p<0.05$), it means that coefficients of the significant variable in regression equation are not equal to 0, simultaneously.

Table 21 Multiple Regression Results of Factors Affecting Health-Related Quality of Life (1)

Variable	Coefficient	Std.Error	t-Statistic	Prob.
C	0.797814	0.034299	23.26035	0.0000*
EDU1	0.032006	0.012215	2.620189	0.0089*
EDU2	0.045737	0.013941	3.280655	0.0011*
EDU3	0.034286	0.020082	1.707318	0.0879
EDU4	0.064108	0.058609	1.093828	0.2742
INC	0.019972	0.005820	3.431750	0.0006*
HS	0.000250	0.000115	2.184394	0.0291*
S	0.163284	0.123324	1.324020	0.1857
AC	0.010489	0.014720	0.712591	0.4762
SK	0.010607	0.012478	0.850017	0.3954
AHS	-7.45E-05	0.000114	-0.654011	0.5132
PHI	-0.004210	0.028925	0.028925	0.8843
CD	-0.089136	0.012009	-7.422717	0.0000*
TWD	-0.129059	0.011717	-11.01422	0.0000*
AGE	-0.001011	0.000419	-2.410041	0.0161*
SEX	-0.013949	0.012410	-1.124050	0.2611
FS	-0.003961	0.003450	-1.148097	0.2511
ES1	0.142582	0.014601	9.765097	0.0000*
ES2	0.102324	0.052266	1.957751	0.0504
ES3	0.146884	0.033949	4.326574	0.0000*
R-squared	0.361624			
Adjusted R-squared	0.354693		N	1770
F-statistic	52.17528		Prob (F-statistic)	0.000000

*Significant Coefficients at 5%

The regression analysis shows that the coefficients of the educational level 1 and educational level 2 are positive values, this means that rural residents who complete primary education and middle school education will lead to the increasing rural residents' EQ-5D index score. This result is consistent with previous studies listed in literature review. Education is associated with good health status in rural areas, for two reasons. First, well educated rural residents are more likely to master advanced agricultural knowledge, and get high income. Second, well educated rural residents have healthier lifestyles. They are more likely to receive medical care, to drink less alcohol, and less likely to smoke.

The regression analysis also shows that the coefficient of annual household income shows a positive value, this means that the high annual household income by rural residents will lead to the increasing their EQ-5D index score. This result is in line with previous studies listed in literature review. Moreover, it is widely recognized that poverty is accompanied by ill health. There are probably two reasons in rural areas. First, higher income rural resident can have better food, a better living environment, and some entertainments. Second, higher income rural resident are more likely to access health care.

The result indicates that the coefficient of housing space is positive. It means that rural residents obtain much larger living area, and the EQ-5D index score will

increase. There might be two reasons in rural areas. The smaller housing space stands for overcrowding. On the one hand, overcrowding may increase vulnerability to airborne infections. On the other hand, overcrowding does not help to keep an excellent mood.

The regression analysis shows that the coefficient of employment 1 and employment 3 reveal positive values. It means that rural residents who are employed or student will increase EQ-5D index score. This result is accord with previous studies listed in literature review. In rural areas, people employed means that people do farm work. Employed is correlated with health status, there might be two reasons: first of all, a good amount of farm works are equal to physical exercise. Next, farm works are collectively laboring, and people can feel social support and keep a good mood. Rural residents are students who associated with healthier, and it is easy to be explained. First, students are getting education, and they belong to well educated people. Second, students are young people. As is well known, young people have better health status.

In addition, the result of regression analysis reveals that the coefficients of chronic disease and two-week disease are negative values. It means that rural residents suffer chronic disease or two-week disease, which will result in the decreasing EQ-5D index score. This result is consistent with previous studies listed in literature review. It is easy to be understood, because two-week disease or chronic disease has a direct effect

on individual's physical and mental health.

The regression analysis also figures that the coefficient of age is negative. It means that elderly rural residents will give rise to the decreasing EQ-5D index score. This result is consistent in line with previous studies listed in literature review. The simple reason is that as rural resident grow older; they raise the risk of disease (especially, chronic disease) and earn less.

The results for the second equation are presented in Table 22. The dependent variable in the equation is EQ-5D VAS score. First of all, this equation has 11 significant coefficients. They are constant term, educational level 1, educational level 2, annual household income, alcohol consumption, accessibility of health service, chronic disease, two-week disease, age, employment status 1 and employment status 3. Next, value of R square is 0.320373 that means 32.0373% of dependent variable can be explained by independent variables. The R square of this equation is slightly low, because the selected independent variables may be not the good independents variables for this dependent variable. Finally, value of F test is 43.04580 ($p<0.05$), it means that coefficients of the significant variable in regression equation are not equal to 0, simultaneously.

Table 22 Multiple Regression Results of Factors Affecting Health-Related Quality of Life (2)

Variable	Coefficient	Std.Error	t-Statistic	Prob.
C	81.98205	3.158923	25.95253	0.0000*
EDU1	2.791229	1.114892	2.503587	0.0124*
EDU2	3.676143	1.245202	2.952246	0.0032*
EDU3	2.379320	1.805963	1.317480	0.1879
EDU4	8.497715	5.423315	1.566886	0.1173
INC	1.785494	0.531089	3.361946	0.0008*
HS	0.006888	0.010602	0.649652	0.5160
S	-9.474381	11.14270	-0.850277	0.3953
AC	3.838146	1.296181	2.961118	0.0031*
SK	0.132937	1.134868	0.117139	0.9068
AHS	-0.042174	0.010542	-4.000746	0.0001*
PHI	2.293802	2.186815	1.048924	0.2944
CD	-13.44473	0.964140	-13.94480	0.0000*
TWD	-4.793425	0.922632	-5.195384	0.0000*
AGE	-0.216394	0.037680	-5.742898	0.0000*
SEX	-1.609277	1.090481	-1.475749	0.1402
FS	0.055408	0.320140	0.173075	0.8626
ES1	3.554763	1.335152	2.662440	0.0078*
ES2	6.555566	4.798381	1.366204	0.1721
ES3	6.533865	2.820273	2.316749	0.0206*
R-squared	0.320373			
Adjusted R-squared	0.312930		N	1755
F-statistic	43.04580		Prob (F-statistic)	0.000000

*Significant Coefficients at 5%

The result of the second equation is different with the first equation as following:

The regression analysis shows that the coefficient of alcohol consumption shows a positive value, this means that rural residents have alcohol consumption will lead to the increasing of their EQ 5D VAS score. However, this result is opposite with the

hypothesis. The potential reason is that this study employs whether rural residents drink alcohol to measure alcohol consumption. It should give a more specific classification: daily alcohol consumption, five days a week alcohol consumption, three days a week alcohol consumption, occasional alcohol consumption and no alcohol consumption.

The regression analysis also figures that the coefficient of accessibility of health service is negative. It means that difficult accessibility of health service will give rise to the decreasing EQ 5D VAS score. In this study, accessibility of health service means how long people use transport from home to the nearest health care facility. Short time shows that rural residents can easily get health care, especially, in emergency.

In the second equation, the variable housing space is not significant. But it is significant in the first model.

5.3 Simultaneous Equations Analysis

As can be seen, the income (annual household income) affects the health (health-related quality of life) in term of the multiple regression analysis. However, according to lots of research results, the health also affects the income. In a word, the

health and the income influence each other. To address this problem, Two-Stage Least Square will be used to estimate simultaneous equations.

The resulting outputs for the system of simultaneous equations are shown in Table 23 and Table 24. The dependent variables in simultaneous equations are health-related quality of life (EQ-5D score) and annual household income, respectively. Value of F test is 52.32644 ($p<0.05$) in the first equation and 26.20341 in the second equation, this means that coefficients of the significant variable in simultaneous equations are not equal to 0, simultaneously.

Table 23 The Result of Simultaneous Equations 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.897187	0.044027	20.37806	0.0000*
INC	0.087669	0.039683	2.209247	0.0273*
EDU1	0.035295	0.013960	2.528335	0.0115*
EDU2	0.037703	0.017626	2.139085	0.0326*
EDU3	0.012859	0.026774	0.480290	0.6311
EDU4	0.016677	0.067248	0.248000	0.8042
HS	-0.000243	0.000286	-0.850042	0.3954
S	-0.010062	0.136987	-0.073450	0.9415
AC	0.012063	0.015706	0.768046	0.4426
SK	0.022349	0.013059	1.711345	0.0872
AHS	-8.04E-05	0.000121	-0.662902	0.5075
PHI	0.010285	0.026904	0.382301	0.7023
CD	-0.092785	0.012974	-7.151819	0.0000*
TWD	-0.124982	0.012794	-9.768584	0.0000*
AGE	-0.001690	0.000451	-3.750154	0.0002*
SEX	-0.007145	0.013532	-0.527998	0.5976
R-squared	0.278026			

Adjusted R-squared	0.271841	N	1770
F-statistic	52.32644	Prob (F-statistic)	0.000000

*Significant Coefficients at 5%

Table 24 The Result of Simultaneous Equations 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.345687	0.205153	1.685026	0.0922
HRQoL	1.020158	0.183866	5.548389	0.0000*
EDU1	0.144438	0.054187	2.665549	0.0078*
EDU2	0.266609	0.062456	4.268749	0.0000*
EDU3	0.416838	0.085142	4.895768	0.0000*
EDU4	0.759832	0.257717	2.948319	0.0032*
S	-1.922866	0.530403	-3.625294	0.0003*
AGE	-0.002251	0.001693	-1.329837	0.1837
SEX	-0.117340	0.042500	-2.760957	0.0058*

R-squared	0.091602		
Adjusted R-squared	0.087475	N	1770
F-statistic	26.20341	Prob (F-statistic)	0.000000

*Significant Coefficients at 5%

The results of simultaneous equations show that the first equation has 7 significant coefficients. They are constant term, annual household income, educational level 1, educational level 2, chronic disease, two-week disease and age. The second equation has 7 significant coefficients, which are health-related quality of life, educational level 1, educational level 2, educational level 3, educational level 4, governmental subsidization and sex.

The results of first equation indicates that the coefficients of the annual household income, educational level 1and educational level 2 are positive values. This means

that rural residents have high income or complete primary education and middle school education, which will lead to the increasing rural residents' EQ-5D index score. However, the coefficients of the chronic disease, two-week disease and age are negative values, this means that rural residents suffer chronic disease or two-week disease, or are elderly, which will lead to the decreasing rural residents' EQ-5D index score.

The second equation figures that the coefficient of health-related quality of life and educational level are positive. It means that rural residents have better health status and are educated, which will give rise to the increasing rural residents' annual household income. But the coefficient of governmental subsidization and sex are negative. It means that male rural residents or rural residents getting the governmental subsidization will lead to the decreasing rural residents' annual household income.

This study has discussed how income level affect health. Now, talk about how health affect income level. In rural areas, a healthy individual can devote more time to work and less time to get health care.

5.4 Sensitivity Analysis

In this study, through the EQ-5D value set, EQ-5D five dimensions convert into

EQ-5D index score. Moreover, the dependent variable health-related quality of life is measured by EQ-5D. However, there is no Chinese EQ-5D value set available. UK value set is used in this study. In order to realize the different EQ-5D value set how to influence the coefficient of regression equations, this study carries out the sensitivity analysis and chooses Belgium, Denmark, Europe, Finland, Germany, Slovenia, Spain and UK EQ-5D VAS value set to convert EQ-5D into EQ-5D index score.

The resulting outputs for the sensitivity analysis are shown in Table 25. All equations' value of F test: $p<0.05$, this means that coefficients of the significant variable in each equation are not equal to 0.

Table 25 The Result of Sensitivity Analysis

	EQ-5D VAS value set							
	Belgium		**Denmark**		**Europe**		**Finland**	
Variable	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**
C	0.784734	0.0000*	0.789396	0.0000*	0.791752	0.0000*	0.814807	0.0000*
EDU1	0.034049	0.0101*	0.035706	0.0068*	0.033109	0.0072*	0.030365	0.0098*
EDU2	0.048752	0.0013*	0.047255	0.0017*	0.047098	0.0008*	0.043356	0.0012*
EDU3	0.035220	0.1053	0.042576	0.0497*	0.034146	0.0916	0.032958	0.0881
EDU4	0.069007	0.2768	0.068452	0.2794	0.066487	0.2602	0.070909	0.2086
INC	0.021474	0.0007*	0.023394	0.0002*	0.019713	0.0008*	0.019344	0.0006*
HS	0.000262	0.0344*	0.000294	0.0173*	0.000253	0.0285*	0.000258	0.0195*
S	0.175146	0.1896	0.167128	0.2094	0.171943	0.1665	0.168024	0.1568
AC	0.010487	0.5104	0.014797	0.3518	0.009640	0.5157	0.010007	0.4797
SK	0.011763	0.3839	0.005118	0.7040	0.010278	0.4136	0.003463	0.7730
AHS	-8.90E-05	0.4703	-0.000137	0.2642	-7.10E-05	0.5357	-0.000122	0.2646
PHI	0.001809	0.9539	0.005780	0.8531	0.003755	0.8975	0.004796	0.8631
CD	-0.093374	0.0000*	-0.104324	0.0000*	-0.086612	0.0000*	-0.088610	0.0000*

TWD	-0.136408	0.0000*	-0.147415	0.0000*	-0.125820	0.0000*	-0.126197	0.0000*
AGE	-0.000999	0.0278*	-0.001514	0.0008*	-0.000966	0.0223*	-0.001225	0.0024*
SEX	-0.013724	0.3070	-0.008843	0.5092	-0.013598	0.2768	-0.005163	0.6654
FS	-0.004359	0.2433	-0.003221	0.3873	-0.003858	0.2671	-0.003213	0.3330
ES1	0.148292	0.0000*	0.146652	0.0000*	0.147411	0.0000*	0.124398	0.0000*
ES2	0.105265	0.0629	0.137804	0.0147*	0.109637	0.0374*	0.125152	0.0129*
ES3	0.156567	0.0000*	0.139301	0.0001*	0.151662	0.0000*	0.121209	0.0002*

*Significant Coefficients at 5%

Continued

	EQ-5D VAS value set							
	Germany		**Slovenia**		**Spain**		**UK**	
Variable	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**
C	0.793625	0.0000*	0.796244	0.0000*	0.791714	0.0000*	0.797814	0.0000*
EDU1	0.033403	0.0081*	0.036574	0.0052*	0.034146	0.0045*	0.032006	0.0089*
EDU2	0.045415	0.0016*	0.045616	0.0023*	0.044405	0.0012*	0.045737	0.0011*
EDU3	0.029774	0.1509	0.042844	0.0465*	0.036875	0.0620	0.034286	0.0879
EDU4	0.060601	0.3164	0.057653	0.3585	0.058936	0.3067	0.064108	0.2742
INC	0.018579	0.0020*	0.022885	0.0002*	0.020072	0.0005*	0.019972	0.0006*
HS	0.000288	0.0150*	0.000293	0.0170*	0.000255	0.0235*	0.000250	0.0291*
S	0.145324	0.2536	0.126919	0.3368	0.155150	0.2010	0.163284	0.1857
AC	0.008283	0.5856	0.015509	0.3254	0.011791	0.4154	0.010489	0.4762
SK	0.012934	0.3153	0.007828	0.5582	0.011544	0.3470	0.010607	0.3954
AHS	-6.33E-05	0.5902	-0.000125	0.3053	-8.25E-05	0.4612	-7.45E-05	0.5132
PHI	0.000876	0.9766	0.006193	0.8416	0.002678	0.9250	0.004210	0.8843
CD	-0.078367	0.0000*	-0.096576	0.0000*	-0.085286	0.0000*	-0.089136	0.0000*
TWD	-0.113210	0.0000*	-0.141769	0.0000*	-0.127474	0.0000*	-0.129059	0.0000*
AGE	-0.000690	0.1110	-0.001569	0.0005*	-0.001018	0.0137*	-0.001011	0.0161*
SEX	-0.018493	0.1489	-0.013081	0.3252	-0.015532	0.2033	-0.013949	0.2611
FS	-0.005106	0.1517	-0.002413	0.5139	-0.004095	0.2276	-0.003961	0.2511
ES1	0.148364	0.0000*	0.154091	0.0000*	0.153320	0.0000*	0.142582	0.0000*
ES2	0.106758	0.0479*	0.141066	0.0118*	0.112836	0.0283*	0.102324	0.0504
ES3	0.156707	0.0000*	0.142323	0.0001*	0.156125	0.0000*	0.146884	0.0000*

*Significant Coefficients at 5%

Source: Author.

Firstly, the sensitivity analysis shows that using Belgium and UK EQ-5D VAS value

set to convert EQ-5D five dimensions; the model has 10 significant coefficients. They are constant term, educational level 1, educational level 2, annual household income, housing space, chronic disease, two-week disease, age, employment status 1 employment status 2 and employment status 3.

Next, the sensitivity analysis figures that using Europe, Finland, Germany and Spain EQ-5 D VAS value set are used to convert EQ-5D five dimensions; the model has 11 significant coefficients. They are constant term, educational level 1, educational level 2, annual household income, housing space, chronic disease, two-week disease, age, employment status 1 and employment status 3.

Lastly, the sensitivity analysis indicates that using Denmark and Slovenia EQ-5D VAS value set are used to convert EQ-5D five dimensions; the model has 12 significant coefficients. They are constant term, educational level 1, educational level 2, educational 3, annual household income, housing space, chronic disease, two-week disease, age, employment status 1 and employment status 3.

In fact, the different EQ-5D VAS value sets' effect on multiple regression equations is very little. We have mentioned above the possible reason. 933 respondents (52.7%) report good health status (report no problem on all EQ-5D five dimensions), and there

are 933 respondents (52.7%) who have the same EQ-5D index score[6] no matter which EQ-5D VAS value set you use.

This study compares the all equations' R-Squared (Table 26) in term of using different EQ-5D VAS set to convert EQ-5D five dimensions.

Table 26 The Equations' R-Squared in Term of Different EQ-5D VAS Set

EQ-5D VAS set	**Belgium**	**Denmark**	**Europe**	**Finland**	**Germany**	**Slovenia**	**Spain**	**UK**
R^2	0.347	0.391	0.353	0.367	0.306	0.384	0.370	0.362

Source: Author.

Many countries which do not have their own EQ-5D value set have one common question. "Which value set should I use?" Because there is no a standard value set which can be used in every countries.

This study faces the same problem. After all, the situation of China is different with European countries, such as population health status, socioeconomic status and geographic factor and so on. These EQ-5D value sets can not accurately convert

[6] The same EQ-5D index score is 1.

EQ-5D five dimensions to an EQ-5D index score. However, by comparison of different EQ-5D VAS set, this study indicates that Denmark and Slovenia EQ-5D VAS value set are more suitable to converting EQ-5D five dimensions in rural areas in Inner Mongolia. The simple reason is that their equations' R-Squared are the highest, and R-Squared means percent of dependent variable can be explained by independent variables.

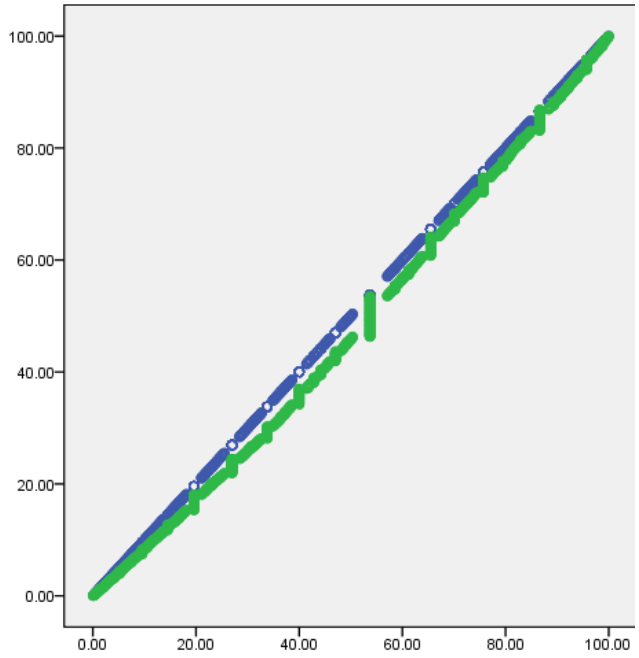
5.5 The Concentration Curve and the Concentration Index

The study uses the concentration curve and concentration index to measure health inequality and chooses two different health variables to describe and calculate the concentration curve and concentration index in Liangcheng County, China. First, EQ-5D VAS score is used as the health variable, which describes and calculates the concentration curve and concentration index. Second, as in most studies, health variable employs prevalence rate of chronic disease.

5.5.1 The Concentration Curve

This study uses SPSS drawing tool to draw the concentration curve (EQ-5D VAS score is the health variable) (see Figure 17).

Figure 17 The Concentration Curve (EQ-5D VAS score is the health variable)

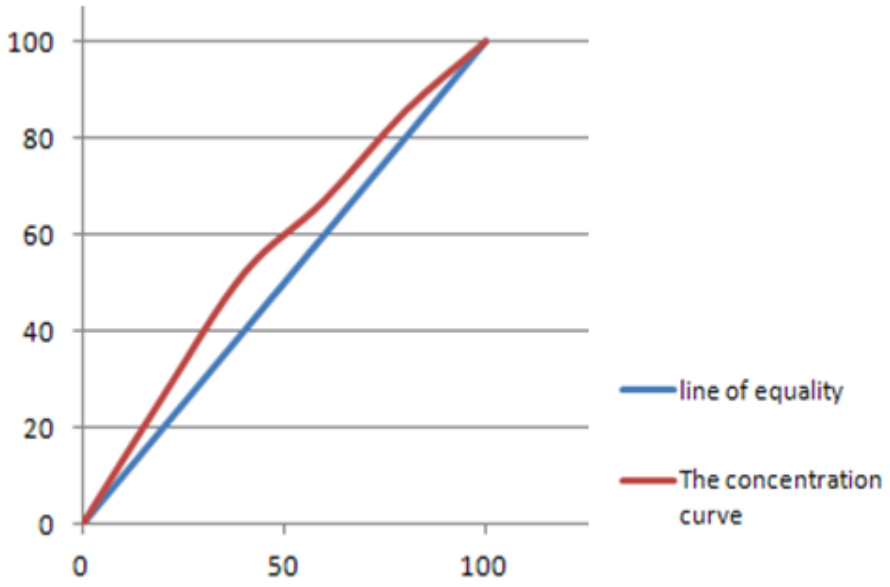


Source: Author.

First of all, the concentration curve lies below the line of equality, which means that the EQ-5D VAS score takes lower value among poorer people. Next, if everyone, irrespective of his or her income level, has exactly the same value of EQ-5D VAS score, the concentration curve will be a 45-degree line. This is known as the line of equality. This figure shows that the concentration curve and line of equality is almost coincident, it means that everyone has very low level relative inequality in term of the definition of the concentration curve.

This study employs Microsoft EXCEL drawing tool to draw the concentration curve (prevalence rate of chronic disease is the health variable) (see Figure 18).

Figure 18 The Concentration Curve (prevalence rate of chronic disease is health variable)



Source: Author.

Using prevalence rate of chronic disease as health variable, the concentration curve is different with previous figure (figure 18). First, the concentration curve lies above the line of equality, and it means that prevalence rate of chronic disease takes higher rates among poorer people. Second, the further concentration curve lies from the line of equality, the greater degree of inequality in health. This figure indicates that the

concentration curve lies far from the line of equality, which means that there is a certain degree of inequality in health in Liangcheng Coungy, China.

5.5.2 The Concentration Index

Through the SPSS17 calculation, then according to the formula:

$$C = 2\mathrm{cov}(y_i R_i)/\mu$$

This study gets the concentration index (see Table 27).

Table 27 The Concentration Index in Liangcheng County (EQ-5D VAS score is the health variable)

	Cov(EQVAS RANKINC)	**μ(EQ VAS)**	**Concentration index**
Liangcheng County	1.907	70.3966	0.0542

Source: Author.

According to the definition of the concentration index, the concentration index is bounded between -1 and 1. It is defined as positive when the concentration curve lies below the line of equality and negative when it lies above the line of equality. When the concentration curve coincides with the line of equality, the concentration index is zero.

The calculated result indicates that the concentration index is 0.0542 which is positive value. It means the EQ-5D VAS score takes lower value among poorer people. Moreover, this value is close to zero, which means that Liangcheng County has very low level relative inequality.

Through the EXCEL calculation, then according to the formula:

$$C = (p_1 L_2 - p_2 L_1) + (p_2 L_3 - p_3 L_2) + \cdots + (p_{T-1} L_T - p_T L_{T-1})$$

This study gets the concentration index (see Table 28).

Table 28 The Concentration Index in Liangcheng County (prevalence rate of chronic disease is health variable)

Wealth group	No. of chronic disease	rel % chronic disease	cumul % chronic disease	Concentration index
Poorest	195	26.6%	26.6%	-0.002455662
2nd	186	25.4%	52.0%	-0.043383356
Middle	111	15.1%	67.1%	-0.023738063
4th	135	18.4%	85.5%	-0.055388813
Richest	106	14.5%	100%	0.000000000
Total/average	733			-0.124965894

Source: Author.

The result indicates that the value of concentration index is negative, and it means that prevalence rate of chronic disease takes higher rates among poorer people. What is more, the concentration index is -0.12497, and it means Liangcheng County has a

certain degree inequality.

As can be seen from the results, this study uses the concentration curve and concentration index that choose different health variables to measure health inequality, but the results are so different. Most importantly the difference is the degree of equality in health. Let us focus on the value concentration index without regard to sign. The concentration index (EQ-5D VAS score is health variable) is 0.054, but the concentration index (prevalence rate of chronic disease is health variable) is -0.12479. Because the concentration index choosing morbidity or mortality to measure health inequality is a common method, the concentration index (-0.12479) is a better reflection of the health inequality in Liangcheng County.

On the contrary, the concentration index (EQ-5D VAS score is health variable) does not work in Liangcheng County. Why does it happen? On the one hand, rural residents may not really understand the EQ visual analogue scale (VAS), so the VAS can not reflect rural residents' health status. On the other hand, there are some limitations of data. There is just some rural residents' information available in this data base, so the income gap is not obvious (without urban residents). This two points may lead to the concentration index (EQ-5D VAS score is health variable) does not correlate well with health equality in Liangcheng County.

CHAPTER VI

CONCLUSION AND RECOMMENDATION

5.1 Summary

The aim of this study is to explain the factors that determine health-related quality of life in Liangcheng County, China and to evaluate health inequality of rural residents. This study gets data from Inner Mongolia Medical College, and the data were conducted in 04-08 August 2009. 948 households were collected.

Through data description, this study finds out that female group, elderly group, low educational level group and low income level group have the higher proportion of problems on each EQ-5D dimension. The dimension pain/discomfort is reported the most problems, and the dimension self-care is reported the least problems. In addition, the mean EQ-5D VAS ratings decrease with increasing age and men of three age groups report higher EQ-5D VAS ratings than women.

This study uses multiple regression analysis to estimate determinants of health-related quality of life. It build two models, and the dependent variables are EQ-5D index score which is converted by UK EQ-5D VAS value set and EQ-5D VAS score.

When EQ-5D index score is dependent variable, this model has 10 variables which

are significant. First of all, not all educational levels are significant in this regression model, and educational level 1 and educational level 2 are significant. Annual household income, housing space and employment status 1 and employment status 3 are significant. These variables are positive with health-related quality of life. Secondly, for clinic characteristic factor, chronic disease and two-week disease are significant. Age is significant in this model. These variables have a negative relationship with health-related quality of life.

However, when EQ-5D index score is dependent variable, this model has 11 variables which are significant. It is different with the previous model. First, alcohol consumption is significant, but the coefficient of alcohol consumption shows a positive value. This result is opposite with the hypothesis. Second, accessibility of health service is significant, which is negative with health-related quality of life. Third, housing space is not significant in this model.

The variables health and the income influence each other in multiple regression model, so this study builds a system simultaneous equations to solve this problem. In first equation, the results indicate that annual household income, educational level 1and educational level 2 are significant and are positive with health-related quality of life. Chronic disease, two-week disease and age are also significant, but they are negative with health-related quality of life. In second equation, health-related quality of life

and educational level are significant which have a positive relationship with annual household income. Governmental subsidization and sex are also significant which have a negative relationship with annual household income.

There is no Chinese EQ-5D value set available, so this study employs the sensitivity analysis. The results show that Denmark and Slovenia EQ-5D VAS value set have the same significant variables in multiple regression equations. Belgium and UK EQ-5D VAS value set have the same significant variables. Europe, Finland, Germany and Spain EQ-5 D VAS value set have the same significant variables. With comparison of R-Squared in each equation, this study indicates that Denmark and Slovenia EQ-5D VAS value set are more suitable to converting EQ-5D five dimensions in rural areas in Inner Mongolia.

This study employs the concentration index to evaluate health inequalities in Liangcheng County, China. EQ-5D VAS score and prevalence rate of chronic disease are used as health variables. The result shows that using EQ-5D VAS score as health variable, it cannot evaluate inequalities in Liangcheng County, China. However, the concentration index is -0.1250 when health variable is prevalence rate of chronic disease. This result indicates that prevalence rate of chronic disease takes higher rates among poorer people and Liangcheng County has a certain degree inequality.

5.2 Recommendation

In 2008, the EQ-5D was included in the National Health Services Survey (NHSS) for the first time. NHSS is carried out every five years and expected to start in 2013. From the results of this study, there are some recommendations, regarding EQ-5D in NHSS to MOH.

First of all, the responses record three levels of severity (no problems/some or moderate problems/extreme problems) within a particular EQ-5D dimension, which is called EQ-5D-3L. When using EQ-5D-3L five dimensions to measure health status, there are some problems of sensitivity in this study. It leads to most people's tend to report "no problems". Hence, policy maker in MOH should employ EQ-5D-5L in 2013 NHSS. Unlike the EQ-5D-3L, EQ-5D-5L each dimension now has 5 levels: no problems, slight problems, moderate problems, severe problems and extreme problems. EQ-5D-5L could significantly increase reliability and sensitivity (discriminatory power) (Rabin et al., 2011).

Secondly, because people may not understand EQ-5D visual analogue scale, it leads to overestimating their health status. Therefore, policy maker in MOH should add some notes beside EQ-5D visual analogue scale considering the actual local conditions. And let respondents really understand what is the definition of health.

Finally, due to there is an increasing interest in applying the EQ-5D instrument to China, policy maker in MOH should estimate an EQ-5D value set for Chinese. If Chinese EQ-5D value set is available, it will help to develop cost-utility analysis in China. In my opinion, NHSS and estimating an EQ-5D value set should be performed at the same time. It can save a lot of labors, materials and funds.

In this study, female group, elderly group, low educational level group and low income level group have the higher proportion of problems on each EQ-5D dimension. Moreover, educational level, annual household income and age are significant variables in regression equations. Policy maker in Inner Mongolia should target female, elderly, low educational level people and low income level people. Some recommendations are:

- Continue to strengthen and popularize nine year compulsory education in rural areas.
- Improve the policy system that supports and benefits farmers; raise rural residents' income level earnestly.
- Government should build the project of physical examination and focuses on the elderly and women.

5.3 Limitation of the Study

This study researches about assessment of rural residents' health-related quality of life

and health inequality in Liangcheng County, China. There are some limitations in this study.

First, due to funding limitations, this study has its weakness by researching only within one County of Inner Mongolia, China. It leads to evaluate health inequality restrictively. Moreover, this study is quantitative analysis, so it results in limitation for exploring health-related quality of life and health inequality.

Second, the health measurement does not have uniform standard, this study use the EQ-5D instrument to measure health-related quality of life. However, there is no Chinese EQ-5D VAS value set to convert EQ-5D five dimensions, and we just can use UK EQ-5D VAS value set.

Third, the individual annual income is assessed by annual household income and therefore reflects the economic situation of a household rather than that of the individual.

5.4 Suggestions for Further Study

This study employs quantitative method that leads to limitations; therefore, for the further studies in health-related quality of life and health inequality, it is necessary to

supplement qualitative study for target groups.

If funds are sufficient, the further studies should extend the area to provincial level or even national level. In national level, the further studies can build Chinese EQ-5D value set.

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APPENDICES

Appendix A

EQ-5D

Mobility
I have no problems in walking about ❑
I have some problems in walking about ❑
I am confined to bed ❑

Self-Care
I have no problems with self-care ❑
I have some problems washing or dressing myself ❑
I am unable to wash or dress myself ❑

Usual Activities (*e.g. work, study, housework, family or leisure activities)*
I have no problems with performing my usual activities ❑
I have some problems with performing my usual activities ❑
I am unable to perform my usual activities ❑

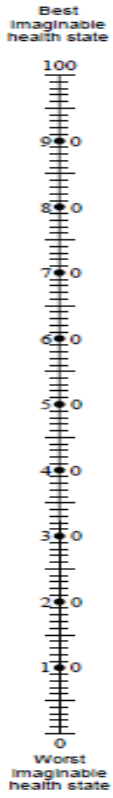
Pain/Discomfort
I have no pain or discomfort ❑
I have moderate pain or discomfort ❑
I have extreme pain or discomfort ❑

Anxiety/Depression
I am not anxious or depressed ❑
I am moderately anxious or depressed ❑
I am extremely anxious or depressed ❑

To help people say how good or bad a health state is, we have drawn a scale (rather like a thermometer) on which the best state you can imagine is marked 100 and the worst state you can imagine is marked 0.

We would like you to indicate on this scale how good or bad your own health is today, in your opinion. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your health state is today.

Your own health state today



Appendix B

EQ-5D VAS set

	Belgium	Europe†	New Zealand	Spain	UK
Full health (11111)	1	1	1	1	1
At least one 2 or 3 (Constant)	-0.152	-0.128	-0.204	-0.150	-0.155
At least one 3 (N3)	-0.256	-0.229	-0.217	-0.212	-0.215
Mobility = 2	-0.074	-0.066	-0.075	-0.090	-0.071
Mobility = 3	-0.148	-0.183	-0.151	-0.179	-0.182
Self care = 2	-0.083	-0.117	-0.071	-0.101	-0.093
Self care = 3	-0.166	-0.156	-0.143	-0.202	-0.145
Usual activities = 2	-0.031	-0.026	-0.014	-0.055	-0.031
Usual activities = 3	-0.062	-0.086	-0.027	-0.110	-0.081
Pain/discomfort = 2	-0.084	-0.093	-0.080	-0.060	-0.084
Pain/discomfort = 3	-0.168	-0.164	-0.160	-0.119	-0.171
Anxiety/depression = 2	-0.103	-0.089	-0.092	-0.051	-0.063
Anxiety/depression = 3	-0.206	-0.129	-0.184	-0.102	-0.124
R^2	–	0.75	0.70	0.97	0.47

	Denmark	Finland	Germany‡	Slovenia
Full health (11111)	1	1	1	1
At least one 2 or 3 (Constant)	-0.225	-0.158	0.926	-0.128
At least one 3 (N3)	–	–	–	–
Mobility = 2	-0.126	-0.058	0.945	-0.206
Mobility = 3	-0.252	-0.230	0.393	-0.412
Self care = 2	-0.112	-0.098	0.808	-0.093
Self care = 3	-0.224	-0.143	0.470	-0.186
Usual activities = 2	-0.064	-0.047	0.880	-0.054
Usual activities = 3	-0.128	-0.131	0.554	-0.108
Pain/discomfort = 2	-0.078	-0.111	0.975	-0.111
Pain/discomfort = 3	-0.156	-0.153	0.467	-0.222
Anxiety/depression = 2	-0.091	-0.160	0.817	-0.093
Anxiety/depression = 3	-0.182	-0.196	0.468	-0.186
R^2	0.82	0.74	0.72	0.65

Appendix C

Multiple Regression Results of Factors Affecting Health-Related Quality of Life (1)

Dependent Variable: HRQOL
Method: Least Squares
Date: 03/29/12 Time: 17:42
Sample: 1 1770
Included observations: 1770

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.797814	0.034299	23.26035	0.0000
EDU1	0.032006	0.012215	2.620189	0.0089
EDU2	0.045737	0.013941	3.280655	0.0011
EDU3	0.034286	0.020082	1.707318	0.0879
EDU4	0.064108	0.058609	1.093828	0.2742
INC	0.019972	0.005820	3.431750	0.0006
HS	0.000250	0.000115	2.184394	0.0291
S	0.163284	0.123324	1.324020	0.1857
AC	0.010489	0.014720	0.712591	0.4762
SK	0.010607	0.012478	0.850017	0.3954
AHS	-7.45E-05	0.000114	-0.654011	0.5132
PHI	0.004210	0.028925	0.145546	0.8843
CD	-0.089136	0.012009	-7.422717	0.0000
TWD	-0.129059	0.011717	-11.01422	0.0000
AGE	-0.001011	0.000419	-2.410041	0.0161
SEX	-0.013949	0.012410	-1.124050	0.2611
FS	-0.003961	0.003450	-1.148097	0.2511
ES1	0.142582	0.014601	9.765097	0.0000
ES2	0.102324	0.052266	1.957751	0.0504
ES3	0.146884	0.033949	4.326574	0.0000

R-squared	0.361624	Mean dependent var	0.830891
Adjusted R-squared	0.354693	S.D. dependent var	0.233227
S.E. of regression	0.187354	Akaike info criterion	-0.500399
Sum squared resid	61.42762	Schwarz criterion	-0.438493
Log likelihood	462.8533	Hannan-Quinn criter.	-0.477528
F-statistic	52.17528	Durbin-Watson stat	1.586881
Prob(F-statistic)	0.000000		

Appendix D

Multiple Regression Results of Factors Affecting Health-Related Quality of Life (2)

Dependent Variable: EQVAS
Method: Least Squares
Date: 03/31/12 Time: 21:26
Sample (adjusted): 1 1755
Included observations: 1755 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	81.98205	3.158923	25.95253	0.0000
AC	3.838146	1.296181	2.961118	0.0031
AGE	-0.216394	0.037680	-5.742898	0.0000
AHS	-0.042174	0.010542	-4.000746	0.0001
CD	-13.44473	0.964140	-13.94480	0.0000
EDU1	2.791229	1.114892	2.503587	0.0124
EDU2	3.676143	1.245202	2.952246	0.0032
EDU3	2.379320	1.805963	1.317480	0.1879
EDU4	8.497715	5.423315	1.566886	0.1173
ES1	3.554763	1.335152	2.662440	0.0078
ES2	6.555566	4.798381	1.366204	0.1721
ES3	6.533865	2.820273	2.316749	0.0206
FS	0.055408	0.320140	0.173075	0.8626
HS	0.006888	0.010602	0.649652	0.5160
INC	1.785494	0.531089	3.361946	0.0008
PHI	2.293802	2.186815	1.048924	0.2944
S	-9.474381	11.14270	-0.850277	0.3953
SEX	-1.609277	1.090481	-1.475749	0.1402
SK	0.132937	1.134868	0.117139	0.9068
TWD	-4.793425	0.922632	-5.195384	0.0000

R-squared	0.320373	Mean dependent var	70.39658
Adjusted R-squared	0.312930	S.D. dependent var	20.91820
S.E. of regression	17.33903	Akaike info criterion	8.555128
Sum squared resid	521613.8	Schwarz criterion	8.617467
Log likelihood	-7487.125	Hannan-Quinn criter.	8.578169
F-statistic	43.04580	Durbin-Watson stat	1.459122
Prob(F-statistic)	0.000000		

Appendix E

Dependent Variable: HRQOL
Method: Two-Stage Least Squares
Date: 04/03/12 Time: 15:02
Sample: 1 1770
Included observations: 1770
Instrument list: EDU1 EDU2 EDU3 EDU4 HS S AC SK AHS PHI CD TWD AGE SEX FS ES1 ES2 ES3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.897187	0.044027	20.37806	0.0000
INC	0.087669	0.039683	2.209247	0.0273
EDU1	0.035295	0.013960	2.528335	0.0115
EDU2	0.037703	0.017626	2.139085	0.0326
EDU3	0.012859	0.026774	0.480290	0.6311
EDU4	0.016677	0.067248	0.248000	0.8042
HS	-0.000243	0.000286	-0.850042	0.3954
S	-0.010062	0.136987	-0.073450	0.9415
AC	0.012063	0.015706	0.768046	0.4426
SK	0.022349	0.013059	1.711345	0.0872
AHS	-8.04E-05	0.000121	-0.662902	0.5075
PHI	0.010285	0.026904	0.382301	0.7023
CD	-0.092785	0.012974	-7.151819	0.0000
TWD	-0.124982	0.012794	-9.768584	0.0000
AGE	-0.001690	0.000451	-3.750154	0.0002
SEX	-0.007145	0.013532	-0.527998	0.5976

R-squared	0.278016	Mean dependent var	0.830891
Adjusted R-squared	0.271841	S.D. dependent var	0.233227
S.E. of regression	0.199018	Sum squared resid	69.47281
F-statistic	52.32644	Durbin-Watson stat	1.538035
Prob(F-statistic)	0.000000	Second-Stage SSR	65.13645

Appendix F

The Result of Simultaneous Equations 2

Dependent Variable: INC
Method: Two-Stage Least Squares
Date: 04/03/12 Time: 15:03
Sample: 1 1770
Included observations: 1770
Instrument list: EDU1 EDU2 EDU3 EDU4 HS S AC SK AHS PHI CD TWD AGE SEX FS ES1 ES2 ES3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.345687	0.205153	1.685026	0.0922
HRQOL	1.020158	0.183866	5.548389	0.0000
EDU1	0.144438	0.054187	2.665549	0.0078
EDU2	0.266609	0.062456	4.268749	0.0000
EDU3	0.416838	0.085142	4.895768	0.0000
EDU4	0.759832	0.257717	2.948319	0.0032
S	-1.922866	0.530403	-3.625294	0.0003
AGE	-0.002251	0.001693	-1.329837	0.1837
SEX	-0.117340	0.042500	-2.760957	0.0058

R-squared	0.091602	Mean dependent var	1.151246
Adjusted R-squared	0.087475	S.D. dependent var	0.869818
S.E. of regression	0.830904	Sum squared resid	1215.796
F-statistic	26.20341	Durbin-Watson stat	0.950585
Prob(F-statistic)	0.000000	Second-Stage SSR	1193.668

BIOGRAPHY

PERSONAL DATA

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EDUCATION AND TRAINING

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