Preventing Fatal Risk through Outpatient Medical Insurance: Evidence from Urban Employee Basic Medical Insurance System in Xinjiang Uighur Autonomous Region, China^{*}



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Disease burden from non-communicable diseases (NCDs) has attracted worldwide attention. The 2010 World Health Organization Global Status Report on Non -communicable Diseases showed that deaths caused by NCDs exceeded 36 million and accounted for 63% of the total deaths in 2008^[1]. Moreover, using macroeconomic simulation, the World Economic Forum and School of Public Health at Harvard University predicted that the global economic burden from 5 chronic diseases- cardiovascular disease, chronic respiratory disease, cancer, diabetes, and mental disorder-will reach 47 trillion dollars in economic loss between 2010 and 2030 (75% of the global GDP in 2010)^[2]. The high-level Meeting on the Prevention and Control of NCDs was held during the 66th Session of the UN General Assembly, and a recommendation was made that all governments should develop feasible and effective policies and national plans to cope with economic and social development risks^[3].

The burden from NCDs is higher than that from any other disease in China. In the past 5 years, the NCD prevalence rate rose from 151.1‰ in 2007 to 199.9‰ in 2011, while the mortality also increased from 523.5 per 100 000 in 2007 to 596.3 per 100 000 in 2011^[4]. In 2010, the number of deaths caused by NCDs reached 7.99 million, accounting for 83% of the total deaths, of which 40.2% occurred under age of 60 years^[3].

In an effort to mitigate disease risk, it is evident that medical insurance will influence the economic burden of insured patients with NCDs. Most of the health insurance systems in Western countries cover outpatient services. Moreover, some systems have special arrangements for chronic diseases^[5]. For example, in Germany the diabetes management programs integrated with medical insurance system reduce the mortality of diabetes and medical expenditures of those suffering from diabetes^[6]. Owing to the financial power, the priority of China's medical insurance has always been focused on serious diseases that pose a 'fatal risk' to people. When people are suffering from serious illnesses or facing fatal risks, they usually need to be hospitalized. Since the inpatient service is used to designate 'risk of fatality,' China's health insurance system give more aids to inpatient services, but less aids to outpatient services.

However, effective outpatient services actually play a key role in slowing disease progression. If there is no appropriate outpatient services, the patient's illness may become serious, thereby increasing the probability of complications and the likelihood of hospitalization^[7-8]. As a result, patients suffer from the disease, the economic burden becomes heavy, and the health insurance fund is placed under greater pressure.

Empirical findings have shown that the design of medical insurance mode only emphasizes fatal risks can minimally decrease the economic burden for patients with chronic conditions. A survey conducted in the Ningxia and Shandong provinces in 2008 showed that the New Rural Cooperative Medical Scheme (NCMS), the medical insurance system in rural China, without risk pooling of outpatient visits, provides only limited financial aid for insured patients with chronic conditions to reduce fatal risk^[9]. Another study in central and western China in 2009 indicated that, since NCMS doesn't cover the expensive outpatient services for chronic conditions, it is not effective in protecting rural population from impoverishment due to illness^[10]. Feng and his colleagues (2014) found that those who carry medical insurance that covers the costs of outpatient care were more likely to be aware of their hypertension status, receive treatment and control blood pressure effectively^[11].

Recently, many regions have accepted risk pooling of outpatient services as part of medical

doi: 10.3967/bes2014.068

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insurance. In some less developed areas in central and western China, such as Xinjiang Uighur Autonomous Region, not all outpatient services were covered, although conditions such as hypertension, diabetes, chronic nephropathy and cancer were included in the benefit package^[12].

The risk pooling of China's social medical insurance system are based on city or county^[7-8]. Outpatient medical insurance for chronic conditions varies by regions. In some regions, patients are subsidized with a certain amount of cash whether they receive outpatient services or not (mode 1) while, in other regions, the expenditure is only reimbursed in a certain proportion when outpatient services are received (mode 2)^[13]. Both the insurance mode and benefit level (the amount of cash subsidy in mode 1 and co-payment ratio in mode 2) have influence on people's attitude to outpatient service for chronic diseases. When a patient has a mild illness or is not severely ill, receiving outpatient service would prevent severe health problem for which he or she needs to be hospitalized.

The 2 areas studied (area A and B) are located in the northeastern and central Xinjiang respectively, which are 745 kilometerss away from each other. The economic levels of the 2 areas are similar, and the annual incomes per capita were 19 927.17 and 19 658.69 yuan RMB in area A and B in 2011, respectively^[14]. In these 2 areas, Urban Employee Basic Medical Insurance System (UEBHI) was established in 2001. People diagnosed with hypertension or diabetes are registered in the Health Insurance Center and will then benefit from the local outpatient medical insurance^[12,16]. Mode 1 was adopted in area A in 2005 while mode 2 was adopted in area B in 2003. The details are as follows^[15-16]:

Area A: People covered by outpatient medical insurance are subsidized 400 yuan RMB per year for hypertension and 700 yuan RMB for diabetes.

Area B: The deductible of outpatient expenditure for hypertension and diabetes is 300 yuan RMB, the ceiling is 2 500 yuan RMB per year, and the co-payment ratio is 20%.

In Xinjiang, the average expenditure for outpatient medicines for blood pressure control in patients with hypertension is about 2 000 yuan RMB per year. The annual cost for patients to control plasma glucose levels with oral medicines is 2 500 yuan RMB and for insulin-dependent outpatients is 3 000 yuan RMB. The outpatient service expenditures for two diseases are similar to those reported by the studies conducted in other areas of China^[17]. The outpatient benefit level for hypertension and diabetes in area B is relatively higher than that in area A.

This paper analyzes the influence of different outpatient insurance modes on disease progression and the economic burden for patients with hypertension and diabetes.

Data Two datasets were collected from the local health insurance centers in area A and B. The first dataset, from the Chronic Conditions Registry (CCR), included disease type and demographic data (age, gender, nationality, etc.). In total, 12 006 patients with hypertension and diabetes were registered in the CCR in two areas in 2011. The mean and standard deviations of the variables are listed in Table 1.

The second dataset contained claim data for discharges, including diagnosis, procedure, medical expenditure, length of hospitalization and demographic data (age, gender, nationality, etc.). Among all the patients with hypertension and diabetes registered in the CCR in area A and B, 1 193 and 3 281 patients, respectively, were hospitalized due to poor control of blood pressure and plasma glucose or complications from hypertension or diabetes in 2011. These patients were included into the study groups. Both causes of hospitalization, being complications from other diseases without hypertension or diabetes, were determined by clinical experts. These complications included ischemic encephalopathy, cerebral hemorrhage, ischemic heart disease, heart failure, nephritis, renal failure, eye disease, coma condition, and pedopathy. The patients with these diseases but without hypertension and diabetes who had no outpatient medical insurance were included in the control groups.

All the patients in the study groups were matched with 1 or 2 patients from the control groups according to their living areas, disease diagnosis, gender, and ages (matching method is shown in Table 2). In total, 6 137 inpatients without chronic conditions were selected as controls. The mean and standard deviation of variables for patients hospitalized due to complications and their controls are listed in Table 3.

Indicators (1) Probability of hospitalization of patients with hypertension or diabetes due to ineffective control of blood pressure or plasma glucose; (2) Probability of hospitalization of patients

Variable	Definition	Mean	S.D.
Hopi_cont	Dummy variable = 1 if patient was hospitalized due to failure of blood pressure or plasma glucose control	0.07	0.25
Hopi_comp	Dummy variable = 1 if patient was hospitalized due to hypertension or diabetes complications	0.19	0.39
re_B	Dummy variable = 1 if patient was from area B	0.18	0.38
Conditions			
Hypertension	Dummy variable = 1 if patient was diagnosed with hypertension	0.66	0.47
Diabetes	Dummy variable = 1 if patient was diagnosed with diabetes	0.26	0.44
Hy_Diab	Dummy variable = 1 if patient was diagnosed with hypertension along with diabetes	0.34	0.47
Age	Patient age in years	66.46	10.86
Male	Dummy variable = 1 for male, 0 for female	0.44	0.50

Table 2. Design and Analysis Method of Study Groups and Control Groups

Items	Area A	Area B	Difference	
Study Groups	Hospitalized patients with complications of hypertension or diabetes among patients covered by outpatient insurance in area A (Y1)	Hospitalized patients with complications of hypertension or diabetes among patients covered by outpatient insurance in area B (Y2)	Y2-Y1: Difference by the outpatient insurance mode + other regional difference	
Control Groups	Hospitalized patients with similar clinical courses not covered by outpatient insurance in area A (Y1')	Hospitalized patients with similar clinical courses not covered by outpatient insurance in area B (Y2')	Y2'-Y1': the difference brought by regional diversity excluding that in the outpatient insurance scheme	

Note. The difference due to different outpatient insurance modes: (Y2-Y1)-(Y2'-Y1').

Table 3. Variables and Mean Values of Patients Hospitalized Due to ChronicDiseases and Their Controls (N= 9 418)

Variable	Definition	Mean	S.D.
Surgery	Dummy variable = 1 if patient was treated by a surgical operation	0.03	0.17
Expenditure	Total expenditures per hospitalization (RMB)	7 143.14	8 286.05
LOS	Length of hospitalization (days)	11.29	8.66
Study_g	Dummy variable = 1 if patient was in a study group	0.35	0.48
Re_B	Dummy variable = 1 if patient was from area B	0.17	0.38
St_Re	Dummy variable = 1 if patient was from a study group in area B	0.06	0.24
Age	Patient age in years	69.03	9.21
Male	Dummy variable = 1 for male, 0 for female	0.41	0.49
Diagnoses			
ls_Ence	Dummy variable = 1 if patient was diagnosed with ischemic encephalopathy	0.26	0.44
Ce_Hemo	Dummy variable = 1 if patient was diagnosed with cerebral hemorrhage	0.01	0.10
ls_Hea	Dummy variable = 1 if patient was diagnosed with ischemic heart disease	0.54	0.50
Hea_Fai	Dummy variable = 1 if patient was diagnosed with heart failure	0.05	0.06
Nephritis	Dummy variable = 1 if patient was diagnosed with nephritis	0.01	0.08
Ren_Fai	Dummy variable = 1 if patient was diagnosed with renal failure	0.04	0.17
Eye_dis	Dummy variable = 1 if patient was diagnosed with eye disease	0.01	0.11
Coma	Dummy variable = 1 if patient was diagnosed with a coma condition	0.01	0.05
Pedopathy	Dummy variable = 1 if patient was diagnosed with pedopathy	0.01	0.03

with hypertension or diabetes due to complications; (3) Surgery rate of the patients hospitalized due to complications of hypertension and diabetes; (4) Inpatient medical expenditure; (5) Length of hospitalization.

Limited by the variables, the severity of hospitalized cases could not be measured directly. Since surgery rate and expenditure will be higher and the length of hospitalization will be longer when the disease is more severe, we used surgery rate, medical expenditure and the length of hospitalization as the indirect indicators.

Statistical Models We used Equation (1) to measure the relationship between (A) the probability of hospitalization due to (i) poor control of blood pressure or plasma glucose with the outpatient service or (ii) complications of hypertension or diabetes (Ph) and (B) different outpatient insurance modes (Re_B), after controlling for chronic conditions, age, and gender.

$$\ln\left(\frac{P_{h}}{1-P_{h}}\right) = \theta_{0} + \theta_{1} \operatorname{Re}_{B} + \theta_{2} Condition + \theta_{3} Age + \theta_{4} Male$$
(1)

Equation (2) was used to analyze the difference in surgery probability (Ps) between inpatients with hypertension and those with diabetes. According to the matching method shown in Table 2, the interaction item (St_Re) of study groups (Study_g) and their region (Re_B) stood for 'the difference brought about by 2 outpatient medical insurance modes.' The age, gender, and diagnoses were put into the regression analysis as control variables.

$$\ln\left(\frac{P_{s}}{1-P_{s}}\right) = \theta_{0} + \theta_{1} \operatorname{Re}_{B} + \theta_{2} study g + \theta_{3} St_{Re} + \theta_{4} Age +$$

 θ_5 *Male*+ θ_6 *diagnoses*

Equation (3) was adopted to analyze inpatient expenditure and length of hospitalization (Y).

(2)

$$Y = \theta_0 + \theta_1 \text{Re}_B + \theta_2 study_g + \theta_3 St_\text{Re} + \theta_4 Age + \theta_5 Male + \theta_6 diagnoses$$
(3)

Ethics: A secondary analysis of patient diagnosis records and claim data was conducted. The data did not contain information enabling identification of the patient and did not involve experimentation on either humans or animals.

Descriptive Results Among the 12 006 patients covered by outpatient medical insurance in the 2 areas, 66.24%, 25.91%, and 7.85% were diagnosed with hypertension, diabetes, and hypertension

complicated with diabetes, respectively. Male patients (average age: 66.46 years) accounted for 43.97% of the total. And 9.94% of these patients were hospitalized due to poor control of blood pressure or plasma glucose and 27.32% were hospitalized due to hypertension or diabetes complications.

Among the patients hospitalized due to complications, 52.42% had ischemic heart disease, 25.75% had ischemic encephalopathy, 7.04% had atherosclerosis, and 6.71% had nephritis. The average inpatient expenditure per case with complications was 7 121.88 yuan RMB and the average length of hospitalization was 11.48 d. The patients who needed surgical treatment accounted for 2.98% of the total cases.

Hospitalization Probabilities under Different **Outpatient Insurance Modes** Table 4 shows the results of the regression analysis of the probabilities of hospitalization due to ineffective control of blood pressure or plasma glucose, and hypertension or diabetes complications. With disease types and individual characteristics controlled, the probabilities of hospitalization due to poor control of blood pressure or plasma glucose, and hypertension or diabetes complications in area B were 11% (odds ratio=0.892) and 42% (odds ratio=0.583), respectively, lower than those in area A.

The regression analysis also showed that probability of hospitalization increased with age. There was no significant difference in the hospitalization probability between males and females due to ineffective control of blood pressure or plasma glucose. However, the probability of hospitalization due to hypertension or diabetes complications was higher in males (odds ratio=1.213).

Comparison of Inpatient Cases between Different Outpatient Insurance Modes When measuring the influence of outpatient insurance mode on surgery rate, inpatient expenditure and length of hospitalization, the reliability of the results from the analyses using equations (2) and (3) depends on whether the study group and control group cases are homogeneous. The differences in age, gender and diagnoses of the study group and control group from the 2 areas are listed in Table 5. Regardless of area, the differences in these variables between the study group and control group were not statistically significant.

Variables	Model 1: Hospitalization Due to Poor Control of Blood Pressure or Plasma Glucose		Model 2: Hospitalization Due to Complications of Hypertension or Diabetes			
Area B	-0.114*	(0.074)	[0.892]	-0.539**	(0.054)	[0.583]
Hypertension (control group)						
Diabetes	-0.319 ^{**}	(0.104)	[0.727]	-0.392**	(0.082)	[0.676]
Hypertension complicated with diabetes	0.521**	(0.098)	[1.683]	-0.044	(0.075)	[0.957]
20-40 years old (control group)						
40-50	1.142^{*}	(0.468)	[3.133]	1.137**	(0.323)	[3.117]
50-60	1.571^{**}	(0.461)	[4.811]	1.893 ^{**}	(0.317)	[6.638]
60-70	1.660^{**}	(0.456)	[5.258]	2.285 ^{**}	(0.313)	[9.824]
70-80	1.641**	(0.455)	[5.160]	2.366**	(0.312)	[10.66]
Over 80	0.983*	(0.474)	[2.673]	2.321**	(0.319)	[10.19]
Male	0.076	(0.064)	[1.079]	0.193 ^{**}	(0.044)	[1.213]
Constant	-7.486**	(0.513)	[0.001]	-7.010***	(0.344)	[0.001]
Ν		12 006			12 006	
Prob. > F		0.000			0.000	

Table 4. Logistic Regression Analysis of the Hospitalization Probability of Patients with Hypertension or Diabetes Covered by Outpatient Insurance

Note. *Statistically significant at the 5% level; **statistically significant at the 1% level; standard deviation in parentheses; odd ratio = Exp (coefficient) in square brackets.

Table 5. Characteristics of the Stud	y and Control Groups in the 2 Areas
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	Area A			Area B		
ltems	Study group	Control group	χ ² (<i>P</i> value)	Study group	Control group	χ ² (P value)
Percentage of cases by age (%)						
20-40	0.51	0.49	2 998	0.30	0.31	1 057
40-50	3.04	2.82	(0.700)	4.46	4.42	(0.958)
50-60	8.77	7.19		10.16	10.28	
60-70	27.15	30.61		31.32	30.32	
70-80	52.45	50.83		44.90	45.38	
Over 80	8.09	8.07		8.85	9.28	
Percentage of cases by gender (%)						
Male	45.87	45.68	0.006	40.18	40.11	0.003
Female	54.13	54.32	(0.904)	59.82	59.89	(0.956)
Percentage of cases by diagnoses (%)						
Ischemic encephalopathy	29.68	31.20	8.801	24.89	24.49	10.444
Cerebral hemorrhage	1.52	1.36	(0.359)	1.08	1.02	(0.402)
Ischemic heart disease	53.46	56.56		52.19	53.66	
Heart failure	0.51	0.39		0.41	0.41	
Nephritis	0.78	0.60		0.97	0.63	
Renal failure	5.23	3.21		3.13	2.84	
Eye disease	2.53	1.85		1.34	1.02	
Coma condition	0.50	0.40		0.63	0.49	
Pedopathy	0.17	0.14		0.27	0.24	
Other	5.63	4.30		15.09	15.21	

The regression analysis results of the influence of the 2 outpatient insurance modes on surgery rate, inpatient medical expense and length of are shown in Table 6. Controlling for diagnosis, age, and gender, the surgery rate and medical expenditure per hospitalization were 32% and 1 750.46 yuan RMB in area B, lower than those in area A, the differences were statistical significant.

Social health policy has great influence on people's health^[18]. The prevention, control and treatment of chronic conditions are a concern both medicine and policy. The findings of this study indicate that the improvement of outpatient insurance will decrease the probability of hospitalization of patients with chronic conditions. Moreover, even if they are hospitalized, the surgery rates and medical expenditures will be reduced. Evidence suggests that outpatient medical insurance mode has a direct influence on disease progression for patients with chronic disease.

Since 1990s, one of China's social development objectives has been the expanding of coverage of health care insurance. By the end of 2011, social medical insurance coverage exceeded 95%^[19], so China has made more efforts to ensure the fund of its medical insurance system. With increasing disease burden from NCDs, more medical insurance fund for these diseases are needed. Therefore, it is important to find a solution for this issue by developing appropriate medical insurance policies.

There were significant differences in both the mode and benefit levels of outpatient medical insurance between the 2 study areas. Under the 'cash subsidy' mode in area A, in addition to buying

medicines or services for treating hypertension or diabetes, the patients may use the subsidy for other health care services. However, the co-payment mode in area B guarantees outpatient services for chronic diseases. In other words, the 'cash subsidy' mode reduces the cost of health care services for chronic conditions and other diseases, while the co-payment mode directly decreases the cost of outpatient services for hypertension and diabetes^[20]. Therefore, if the benefit levels are same in the 2 areas, the co-payment mode in area B would be more easily accepted and encourage people to receive outpatient services for chronic disease patients because the degree of cost reduction is relatively larger. Thus, compared with the mode of outpatient insurance in area A, the mode in area B is more effective in encouraging patients with chronic conditions to receive outpatient service rather than inpatient services.

Furthermore, the benefit level of outpatient medical insurance in area B is higher than in area A. This also encourages people to receive outpatient services in cases of mild illnesses. This can explain the empirical findings that the fatal risk from chronic disease in area B is significantly lower than that in area A. Even if patients are hospitalized, the surgery rate and medical expenditure in area B are not as high as those in area A. These results are consistent with the findings of Feng and his colleagues (2014) using a sample of people aged >45 years at national level^[11].

It is generally understood that investments for medical insurance should be increased in order to establish outpatient medical insurance^[21]. The growing

Variables	Model 3: Surgery Rate (Logistic)	Model 4: Inpatient Medical Expense (Linear Regression)	Model 5: Length of Stay (Linear Regression)
Effect from outpatient medical insurance	-0.487 [*] (0.294)	-1 750.46** (500.12)	0.552 (0.465)
Area B	1.129 ^{**} (0.167)	-2 065.21** (303.85)	1.566 ^{**} (0.280)
Study group	0.045 (0.164)	236.14 (209.80)	-0.115 (0.211)
Constant	-24.12 (63.93)	4 815.72 ^{**} (1777.61)	13.33 ^{**} (1.638)
Ν	9 416	9 416	9 416
Adj. R ²	-	0.393	0.124
Prob. > F	0.000	0.000	0.000

 Table 6. Regression Analysis of Disease Severity in Inpatients with Hypertension or Diabetes Covered by

 Different Outpatient Insurance Modes

Note. All variables in Table 3, including age, gender, and diagnosis, were controlled in these regressions but are not shown here due to space limitations. Standard errors are in parentheses. ^{*}Statistically significant at the 5% level; ^{**}statistically significant at the 1% level.

coverage of outpatient insurance can be attributed to the improved financing power as a result of economic development. However, the study still revealed that outpatient medical insurance could not only improve the benefit package for chronic disease sufferers, but could also contribute to risk control.

One limitation of this study is that the annual medical expenditures for chronic disease in the 2 areas were not estimated, so further study is needed in the future. A major limitation of outpatient insurance system in China is that only medical services for patients diagnosed with NCDs are covered, while chronic disease prevention services are not included. This is the situation in the study areas in Xinjiang. Some researchers pointed out that since the prevention and control of chronic diseases is a long term task, it is reasonable to include public health services into the benefit package of medical insurance^[7]. However, public health services are provided by the government rather than medical insurance system $^{[2\bar{2}]}$, and this has led to resistance to the reform of medical insurance system. This means that China's macro policy design confines the health insurance fund to the medical service and limits relevant input in prevention service.

Some regions have tried to solve this issue at the local level. For example, 'capitation payment' was implemented in 2 pilot counties of Ningxia province^[23]. Capitation can motivate medical service providers to provide more public health services for the reduction of the prevalence or incidence of diseases, the reduction of medical cost and the increase of net revenue^[24]. Such designs might improve the medical insurance system in China so that it can play a better role in the prevention and control of chronic diseases.

One of the most important approaches for NCD control is to provide primary care to control NCD risk at a low level, thereby delaying disease progression. Since medical insurance will impact the behavior of the insured through economic incentives, an appropriate design of the insurance mode may encourage patients with NCDs to receive primary care more effectively. The empirical findings provide evidence that improvement in the outpatient insurance benefit package would facilitate the control of the risk of chronic disease at a low level and, in turn, prevent fatal risks.

Since the health risk of insured persons generally is high, the financial risk of the health insurance fund is also high, improving outpatient medical insurance would benefit both patients with NCDs and the health insurance provider. Outpatient medical insurance could decrease the probability of hospitalization and related expenditures. How to design the medical insurance mode to reach such goals needs further study.

To ensure that medical insurance system to have more impact in controlling chronic diseases, it is necessary to include public health services into the benefits package. This would facilitate the integration of the prevention, control and treatment of chronic disease and control the risk of chronic conditions at a low level.

AbbreviationsNCDs, non-communicablediseases; NCMS, New Rural Cooperative MedicalScheme; CCR, Chronic Conditions Registry.

Competing interests The authors declare that they have no competing interests.

Authors' contributions JING Ming Xia carried out the data collection, participated in data analysis, and drafted the manuscript. JIAN Wei Yan conceived and designed the study, performed the statistical analysis, and wrote the paper. LI Xiao Juparticipated in the data collection and analysis. All authors read and approved the final paper.

We thank Ms. LIAO Li Na, Ms. GAI Li Li, and Ms. ZHAO Xin Hui for their assistance with the data collection. We would also like to thank Ms. BAI Jing for her help with language copyediting.

^{*}The research was funded by the National Natural Science Foundation of China (ID: 71003002) and the Science and Technology Plan Project of Production and Construction Corps (ID: 2012BA044).

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Received: January 8, 2014; Accepted: June 10, 2014

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