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Health Insurance Coverage and Impact: A Survey in Three Cities in China

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Abstract

Background China has one of the world's largest health insurance systems, which is composed of government-run basic health insurance and commercial health insurance. The basic health insurance has undergone system-wide reform in recent years. Meanwhile, there is significant development in the commercial health insurance sector. In this article, we provide updated description on several aspects of health insurance in China, including coverage, gross and out-of-pocket medical cost, and coping strategies.

Methods A phone call survey was conducted in three major cities in China, including Beijing, Shanghai and Xiamen, in July and August 2011. Records on 5,097 households were collected. Summary statistics were computed. Univariate and multivariate logistic regression analysis was conducted to identify factors associated with coverage, cost, and coping strategy.

Results Coverage rates were 82.35%, 34.77% and 87.71% for basic insurance, commercial insurance and combined, respectively. Smaller households, higher income, lower expense, presence of at least one inpatient treatment, and living in rural areas were significantly associated with a lower overall coverage rate. In the separate analysis of basic and commercial health insurance, similar factors were also found to have significant associations, although the quantitative conclusions were slightly different. Higher income, presence of chronicle disease, presence of inpatient treatment, higher coverage rate, and living in urban areas were significantly associated with higher gross medical cost. A similar set of factors were also significantly positively associated with out-of-pocket cost. Households with lower income, with inpatient treatment, with a

higher commercial insurance coverage, and living in rural areas were significantly more likely to pursue coping strategies other than salary.

Conclusion The three surveyed cities and surrounding rural areas had socioeconomic status far above China's average. Even in such cities and surrounding areas, there was still a need to increase coverage. Even for households with insurance coverage, there was considerable out-of-pocket medical cost, particularly for households with inpatient treatment and/or chronicle diseases. A small percentage of households were unable to self-finance out-of-pocket medical cost. Such observations suggest possible target for further improving the health insurance system.

Keywords Health insurance in China; coverage; cost; coping; survey

Background

In 2007, the WHO ranked China's health system as 144th in terms of quality and access out of 190 countries, far below poorer countries like Haiti. The obvious discrepancy between economic advancement and health system development had motivated the Chinese government to undertake a system-wide reform of its health sector [1]. An important component of the health sector reform is the reform of health insurance, with the main goal to make health insurance more accessible and more affordable [2].

The present health insurance system in China is composed of basic health insurance and commercial health insurance, and has a main structure similar to that of many other countries. The basic health insurance system is run by the central and local government. It takes different forms in rural and urban China. In particular in rural China, the new rural cooperative medical care system (NCMS) was first introduced by the central government in 2003 [3]. As reported by the central government in 2010, the number of participants of NCMS had reached 835 million, accounting for 96.3% of the total rural population. The goal of NCMS was to protect its population from impoverishment by medical expenses. The prevailing model of NCMS combined medical savings accounts with high-deductible catastrophic hospital insurance (MAS/catastrophic). In urban China, the country has two primary health insurance programs, namely the urban employee basic medical insurance for urban employed (UEBMI) and urban resident basic medical insurance for urban residents (ERBMI). Combined together, according to the Xinhua News Agency, China's basic medical insurance system is providing coverage for more than 1.25 billion people, or more than 93% of the population of the mainland. Despite the significant difference between the basic health care systems in China and its counterparts in other countries, the

commercial health care system in China shares greater similarity with other countries. Currently, there are four major commercial health insurers in China: PICC Health Insurance Co. Ltd., Ping An Health Insurance Co. Ltd., Kunlun Health Insurance Co. Ltd. and Reward Health Insurance Co. Ltd. At present, the Ministry of Health is responsible for NCMS in rural regions; Basic health insurance in the urban regions is under the umbrella of the Ministry of Human Resources and Social Security; and Chinese commercial insurers are supervised by the China Insurance Regulatory Commission.

There has never been a lack of attention and research on Chinese health care and health insurance system. The literature is too vast to be reviewed here. One of the most relevant studies is [1], which provided a comprehensive review of the evolvement of Chinese health care system; The policy aspect of reforming China's urban health insurance system was discussed in [2]; An empirical study of coverage and assessment of the reform was conducted using survey data from 1998 and 2003 in [4]. Because of the significant differences in social and economic developments between urban and rural China, and because China has the world's largest rural population, most recently, more and more attention has been paid to the health insurance system in rural regions. A review of NCMS was provided in [5]. Lei and Lin [6] studied the service and health outcome aspects of NCMS. Qiu and others [7] studied the rural to urban migration and its impact on NCMS. Wang and others [8] discussed the adverse selection problem in NCMS.

Published studies may have the following limitations. First of all, although they provided very valuable insights into the health insurance system at the time of publication, they

can be outdated at present. The health insurance system in China has been undergoing a system-wide reform with fast progress. In 2010, China put forward plans for US$124 billion to be invested in the health reform program over a three year period until 2012 in its bid to ensure that the basic coverage was accessible to the 1.3 billion people. It had been noted that the impact of the reform was fast and tremendous. Second, most published studies had been focused on the basic health insurance, as it might have more important policy implications. With the fast development of commercial health insurance [9], a considerable percentage of Chinese population are now covered by both basic and commercial health insurance. From the perspectives of coverage, impact of ill health conditions and coping strategies, it is not sensible to separate the two insurance systems and focus only on the basic insurance. Third, most studies had been conducted in rural areas. China is undergoing fast urbanization. It was estimated that by the end of 2010, the mainland of China had a total urban population of 665.57 million, 49.68% of the total population. The prediction is that by 2035, 70% of the Chinese population will live in urban areas. Thus, urban areas deserve equal attention as rural areas. This study had been motivated by the need to provide an up-to-date description of some aspects of China's health insurance system in urban areas and the necessity to study both basic and commercial insurance in order to provide a more comprehensive picture.

Methods

Study Design

A survey was conducted by the Data Mining Center, Xiamen University, China, in July and August, 2011. The study was approved by a research ethics review committee at Xiamen University. Three major Chinese cities, Beijing, Shanghai and Xiamen, and their

surrounding rural areas were included in the survey. Beijing is the Capital of China and located in the northern region. As of 2010, the Beijing municipality, which is under the direct administration of the national government, had a population of 19.6 million. The per capita GDP was US$10,672. Shanghai is located in eastern China, at the middle portion of the Chinese coast. Shanghai is also a municipality, with a population of 23 million in 2010. It had a per capita GDP of US$11,134. Xiamen is a major city on the southeast (Taiwan Strait) coast of China. According to the 2010 census, it had an urban population of 1.8 million, and the Xiamen-Zhangzhou metro area had about 5 million people. The per capita GDP was US$9,438. The three cities are located in northern, middle and southern China, respectively, all close to or on the east coastline. They represent major cities with a relatively higher socioeconomic status (in 2010, the per capita GDP for the whole China was $4,382).

Survey

The survey was conducted via phone calls by staff at the Data Mining Center, Xiamen University. The following method was used for RDD (random digit dialing) selection of samples. We draw Mitofsky-Waksberg [10] type samples of active blocks of 100 consecutive telephone numbers from all possible such blocks within each city. The probability of a block's initial selection was a positive linear function of the proportion of the block's 100 numbers that served residences. The study database was updated constantly to ensure that no household was sampled twice. Although cell phone usage in China had been increasing dramatically, "cell phone only" households remained low. In addition, it is difficult to associate a cell phone number with a physical location for the household. Thus, in our sample selection, we focused on landline only.

At the beginning of each phone call, the survey staff would provide a brief introduction of the purpose of survey and Data Mining Center (less than one minute). Basic information on the interviewee was first gathered. The survey would not continue if the interviewee was less than 18 years old (self-report) or could not provide reliable information on the household (self-evaluation). After obtaining agreement from the interviewee, the interviewer would ask 15 questions on demographics, health insurance coverage, impact of ill health conditions and coping strategies. The interviewee would be asked to provide an exact number or select from a set of predefined options (two to five, depending on the questions). Some questions, including for example household size and insurance coverage, were “snapshots” at the time of survey. Other questions, including for example household income, expense, ill health conditions and coping strategies, were designed to reflect the accumulation over a period of 12 months. The answers were then input by the interviewer into a database managed by the supervising staff at Data Mining Center. On average, an interview lasted five minutes. The study collected data on 5,097 households, with 1,578 from Beijing, 1,530 from Shanghai, and 1,989 from Xiamen.

Statistical Analysis

In Asian tradition, household had been the basic functional unit for income and expense [11]. As an important goal of this study was to investigate the financial impact of health insurance, data was collected and analyzed at the household level. We first examined data and found no obviously unreasonable measurements. Thus all 5,097 records were included in analysis. In this study, we were interested in three different aspects of health insurance. The first was coverage. The first quantity of interest was overall coverage. In addition, because of the significant differences between basic and commercial insurance, these two were also analyzed separately. For a household, we computed its

coverage rate as the number of people covered divided by household size. For ease of analysis, we also dichotomized coverage rates at 50% and created dummy variables. The second aspect was medical cost. Here two sets of analysis were conducted, with the first set focusing on gross medical cost (before insurance reimbursement) and the second set focusing on net out-of-pocket medical cost (after insurance reimbursement, only for households with nonzero insurance coverage). In the survey, medical cost was classified into five categories (<1K, 1K<= <3K, 3K<= <5K, 5K<= <10K, 10K<=, all in Chinese RMB Yuan; 6.37 Yuan=$1 USD). Accordingly, cost was analyzed in two different ways. The first was to contrast the differences between low (<1K) and high (1K<=) cost groups; The second was to study the differences between low and moderate cost group (<5K) and extremely high group (5K<=). The third aspect investigated was coping strategy. Strategies for dealing with high and extremely high cost were analyzed separately. We first examined the differences between data collected in difference cities using ANOVA and Chi-squared tests, and determined that it was appropriate to combine the data. As the three response variables of main interest were categorical due to the nature of the survey, univariate and multivariate logistic regression was the main analysis tool. All statistical analysis was conducted using S-Plus Version 8.2 (TIBCO Software Inc).

Results and Discussions

Sample Characteristics

Household summary statistics were computed for the whole cohort and subgroups generated based on insurance coverage rates and presented in Table 1. We conducted between group comparisons (coverage rate >50% versus <=50%) using t-test, Chi-squared test or Fisher's exact test, depending on the characteristics of data. The 5,097

households covered a total of 18,889 members, among which 15,555 (82.35%) were covered by basic insurance, and 6,568 (34.77%) were covered by commercial insurance. Out of the 5,097 households, 4,437 (87.05%) had more than 50% of the household members covered. 4,154 (81.50%) and 977 (19.17%) households had more than 50% of the members covered by basic and commercial health insurance, respectively. Our calculated basic insurance coverage rate was lower than that provided by the central government but considerably higher than that reported in [12]. Smaller households tended to have higher coverage rates. The average household sizes were 3.666 and 3.976 (p-value for difference <0.001) for the high and low coverage groups, respectively. There was a significant difference in income between groups with different coverage rates (p-value from Chi-squared test <0.001). Particularly, households with higher income tended to have more coverage. For example, in the income <30K group, 85.30% households had coverage rate over 50%; As a comparison in the income >150K group, 91.43% had coverage rate over 50%. As household expense is tightly connected to household income, it is no surprise that we observed a similar association between coverage rates and expense. In the survey, we designed two measures of household health conditions. The first was the number of hospitalized inpatient treatments, which could serve as a surrogate for high-cost, low-frequency health shocks. The second measure was the presence of member(s) with chronic disease(s), which was a measure of relatively low-cost, but high-frequency health shocks. There was a significant association between coverage rate and presence of inpatient treatments. Particularly, 38.48% households in the low coverage group had at least one inpatient treatments; As a comparison, 25.26% households in the high coverage group had at least one inpatient treatments (p-value from Chi-squared test<0.001). However, no significant association was observed between the presence of chronic disease and coverage rate. In the survey, we included both urban and rural households. All the rural

households were sampled from areas surrounding the cities. In China, such rural areas tended to have a higher socioeconomic status than more remote rural areas. The rural versus urban status was defined based on “Hukou”, which was a central government-issued ID card for the whole household. 71.3% of the total households surveyed were in the urban areas according to “Hukou”. We observed a significant association between coverage rates and Hukou. Particularly, urban residents had relatively higher coverage rates.

Summary statistics suggested that household size, income, expense, health conditions, and location of household were potentially associated with coverage and financial impact of health insurance, and warranted further analysis. The set of variables we investigated were comparable to those in published studies [11,13,14].

Analysis of coverage

The coverage analysis results were presented in Table 2. Results from univariate and multivariate analysis were mostly consistent. Considering that multiple factors jointly determined coverage, all the conclusions were drawn from multivariate analysis. Table 2 suggested that bigger households had significantly lower overall coverage (odds ratio 0.893), higher basic coverage (odds ratio 4.500) and lower commercial insurance coverage (odds ratio 0.558). For overall and basic coverage, the “between 30K and 50K” income group had significantly lower coverage compared with the baseline. For commercial insurance, three higher income groups had significantly lower coverage (odds ratios 0.634, 0.628, and 0.693, respectively, all p-values<0.001). Compared with baseline, two higher expense groups (between 30K and 50K, and between 50K and 100K) had significantly higher overall coverage. For basic insurance, all expense groups

differed significantly from the baseline group. However, there was no linear relationship between expense and coverage (odds ratios 0.747, 1.687, 2.680, 2.340 respectively; test for linearity, p-value<0.001). For commercial insurance, the “between 10K and 30K” and “over 100K” groups were significantly different from baseline. Presence of chronicle disease was positively associated with higher basic insurance coverage rate, suggesting possible selection bias effects, as chronicle diseases are usually long lasting which allows households with presence of chronicle diseases to get basic insurance coverage to cope with future medical expense. Households with inpatient treatments had lower overall and basic insurance coverage (odds ratios 0.541 and 0.533, respectively, p-values<0.001). No significant difference between cities was observed.

For both basic and commercial insurers, raising coverage is an important objective. Particularly for basic insurance, the ultimate goal for China’s health sector reform was to provide coverage for all of its population. Our analysis provides possible suggestions for future target to raise coverage. Interesting target populations may include large households and households in a certain income range. It is of interest to note the negative association between coverage rate and inpatient treatment. Cost associated with inpatient treatment is an important component of catastrophic health expenditure [15,16], and may directly lead to poverty. From a policy point of view, it is of significant interest to design the insurance system in a way that can protect such households.

Analysis of gross medical cost

Medical cost had been rising significantly in China [17]. We conducted analysis, searching for risk factors associated with higher medical cost. In the survey, household medical cost was designed as a categorical variable, which was easier to manage in survey and less likely to be subject to recall error compared to a continuous variable.

Two sets of analysis were conducted. In the first set, the contrasting groups were “medical cost >1K Yuan” versus “<=1K”. Among the 5,097 households, 3019 (59.23%) were in the high cost group. Results from univariate and multivariate analysis were mostly comparable (Table 3). Multivariate analysis suggested that larger households tended to have higher medical expense, which was intuitively reasonable as the expense was not normalized by household size. Household income was significantly associated with medical expense. For example, with the lowest income group as the baseline, the highest income group had an odd ratio of 1.808 (p-value<0.001). This was at least partly caused by the lack of normalization. Both presences of chronicle disease and inpatient treatment led to higher medical cost (odds ratios 2.181 and 3.340, respectively, both with p-values<0.001). Basic insurance coverage was not significantly associated with medical expense, which could be explained by its government-run, involuntary nature. Commercial insurance coverage was significantly associated with medical expense (odds ratio 1.351, p-value 0.016). Commercial insurance was voluntary and run by public and private companies. The significant positive association reflected its selection-bias nature, with households in worse health conditions more likely to purchase commercial insurance. Urban residents tended to have higher medical cost, as urban health care facilities tended to be more expensive. Even though the difference across cities was not of main interest, to be prudent, city was included as a covariate in regression analysis and found to be significant. In particular, both Beijing and Shanghai households tended to have lower expense, compared with Xiamen. The odds ratios for Beijing and Shanghai were similar (0.708 and 0.806, respectively, p-values <0.001 and 0.004). In the second set of analysis, we contrasted low and moderate cost group (defined as cost <=5K Yuan) with the extremely high cost group (defined as >5K Yuan). Among the 5,097 households, 473 (9.28%) belonged to the extremely high cost group. Compared with the first set of analysis, the effect of

household size was similar. The associations between income levels and expense were mostly insignificant, expect for the “between 50K and 100K” group (odds ratio 0.722, p-value 0.025). Presences of chronicle disease and inpatient treatment were still significantly associated with higher expense (odds ratios 1.929 and 3.241, respectively, p-values<0.001). Both basic insurance and commercial insurance coverage rates were not significantly associated with extremely high expense. The difference between urban and rural residents was no longer significant, and there was no significant difference across cities.

The fast rising of medical cost is a challenge encountered not only by China but also developed countries like the United States. Our analysis could assist identifying the factors that contributed to higher medical cost. As a limitation of this study and surveys of a similar type, we were only able to identify the factors associated with cost, but not the underlying causal factors. Although there is no one-to-one correspondence between cost and quality of care, they tend to be closely related. An important aspect of basic health insurance is to make sure that service is delivered to all patients in an equally manner. From this perspective, our analysis had identified populations with lower medical cost and possibly lower quality of care. From a policy point of view, for example, it is of interest to investigate how to make healthcare more affordable and accessible to low-income group and people living in the rural area.

Analysis of out-of-pocket medical cost

Gross medical cost can be of significant interest to the government and insurance industry. For households, net out-of-pocket cost – medical cost after insurance reimbursement – is of more importance. It provides a more direct measure of the impact

of ill health conditions and effect of medical insurance. It has been noted that in several Asian developing countries, high out-of-pocket cost has been an important contributing factor for poverty [13]. As such, an important goal of China's health reform was to reduce out-of-pocket cost [14].

In this analysis, we first removed households with coverage rate = 0%, as we were interested in the impact of health insurance, and households with no coverage had net cost equal to gross cost. 5,070 out of 5,097 households were included in analysis. Otherwise, the analysis strategy was similar to that for gross medical cost. In Table 4, most results from univariate analysis and multivariate analysis were consistent.

In the analysis of low (<=1K Yuan) versus high (>1K Yuan) cost, household size was significant, with larger households tended to have higher cost (odds ratio 1.198). With cost <30K as baseline, three higher income levels were significantly associated with higher cost. The only insignificant level was "between 100K and 150K". Presences of chronicle disease and inpatient treatment were significantly associated with higher cost (odds ratios 2.175 and 2.743, respectively, p-values<0.001). This result suggested that health insurance was not able to fully remove the financial burden caused by illness. Similar observations had been made in recent studies conducted in South Korea and Vietnam [11,13]. The association for basic insurance coverage was not significant (p-value 0.660), whereas it was significant for commercial insurance (odds ratio 1.476, p-value=0.003). Wagstaff and Lindelow [18] suggested that such an observation could be explained by supplier-induced demand. In the literature, there were conflicting observations on the association between out-of-pocket cost and insurance coverage in China. In particular, Wagstaff and Lindelow [18] reported a positive association,

whereas Xiao and others [19] and Wagstaff and others [20] reported negative associations. We note that those three studies were all focused on NCMS, which covered rural areas. Our analysis results might provide insights into the association for urban and surrounding residents. There was a significant difference between urban and rural areas, with urban residents paying more out-of-pocket cost (odds ratio 1.237). This could be explained by the higher quality of care in urban areas. Residents in Shanghai paid significantly more out-of-pocket cost than Xiamen residents (odds ratio 1.234). It is noted that for covariates overlapped with those investigated in [14], the qualitative findings were mostly consistent.

Most results from the comparison of low and moderate cost (<=5K Yuan) versus extremely high cost (>5K Yuan) were comparable to those described above. The effect of household size remained significant. However, most associations between income levels and cost were not significant. Only the “between 30K and 50K” group showed a significant higher level of cost, compared with the baseline. The effects of presence of chronicle disease and inpatient treatment remained significant, with the odds ratios slightly lower than those for the gross cost. The effect of basic insurance was not significant, whereas a higher commercial insurance coverage rate was positively correlated with higher cost (odds ratio 2.977). Urban residents tended to have a lower probability of extremely high out-of-pocket cost. A possible explanation was that the reimbursement system in urban areas was more developed, leading to a higher amount and percentage of reimbursement and hence a lower probability of extremely high cost. More importantly, the urban basic health insurance system had a better coverage for catastrophic expense. We note that this result may need to be interpreted cautiously, as only 137 records fell in the category of “rural residents and extremely high out-of-pocket

cost". Residents of Shanghai had a higher probability of having extremely high cost (odds ratio 1.353, p-value 0.028), compared with Xiamen.

Analysis of coping strategies

With a considerable amount of out-of-pocket medical cost, the means that households pay for the cost are of significant interest. In the survey, the interviewees were asked what was the *most important* financial source to pay for out-of-pocket medical cost, with answers including (A) salary from last month, (B) saving, (C) help from family and friends, (D) loan, and (E) reducing daily living cost. In the whole cohort, percentages of answering (A)-(E) were 60.53%, 34.06%, 0.57%, 0.65% and 4.20%, respectively. The majority of the households were able to self-finance out-of-pocket cost (answers A and B). Such a result was more optimistic than those observed in previous studies, mainly because that the three surveyed cities had a relatively high income. Two sets of analyses were conducted. In the first set of analysis, we compared strategies (A) versus (B)-(E). Covering medical cost using last month's salary was the "best" coping strategy, imposing the least long term impact. In the second set of analysis, we compared strategies (A)-(B) versus (C)-(E), as options (A) and (B) corresponded to self-finance. Analysis results were presented in Table 5.

In the first set of analysis, we coded the outcome variable "using salary" as 0 and "using other means" as 1. Table 5 suggested a high degree of consistency between univariate and multivariate analysis. Our analysis suggested that household size was not an important factor in deciding coping strategies. The influence of income was significant, with higher income groups less likely to pursue means other than salary (odds ratios 0.674, 0.816, 0.732, and 0.835, respectively). However, there was a lack of linear

relationship (p-value<0.001). This result showed that in the three surveyed cities, high-income households were able to cover out-of-pocket medical cost with regular income, without having to suffer any long term financial impact from illness. The odds ratio for the presence of chronicle disease was 0.770 (p-value<0.001). Chronicle diseases are recurrent, with low to moderate cost for each episode. Well-planned households usually have well-adjusted coping plans that can cover cost using monthly income without having to resort to outside financial sources. The odds ratio for the presence of inpatient treatment, on the other hand, was significant (1.353, p-value<0.001). Inpatient treatments happened with low frequencies and hit households “without warning”. As it was usually difficult to plan for such incidents ahead, households were more likely to pursue coping strategies other than salary. The effect of basic insurance was not significant, while the effect of commercial insurance was (odds ratio 0.722, p-value 0.010). This suggested the commercial insurance’s positive effect on eliminating the long-term financial impact of illness. Urban residents were more likely to use salary (p-value<0.001), which was caused by the higher salary income for urban residents as well as the cultural difference between urban and rural China. Both residents of Beijing and Shanghai had a higher likelihood of pursuing coping strategies other than salary.

In the second set of analysis, we coded the outcome variable “salary or saving” as 0 and “other means” as 1. Table 5 showed that although there were some quantitative differences, the qualitative conclusions were similar to the first set of analysis. Notable differences included income level “between 50K and 100K”, which had an odds ratio greater than 1 (1.637, p-value<0.001), showing that this group was more likely to pursue other coping strategies than the baseline group. Another difference was that for both Beijing and Shanghai, the difference from Xiamen was not significant, with estimated odds ratios very close to 1.

The majority of households surveyed in this study were able to self-finance out-of-pocket medical cost using salary and saving, without having to rely on outside financial sources or reducing daily living cost. However, there were still 5% of the households that warranted further attention. Future policy development may focus on this subcohort that may suffer a long financial impact caused by out-of-pocket medical cost.

Limitations

Investigating both basic and commercial insurance might provide a more comprehensive description of households' insurance status. However, a tradeoff is that the policy implications of the study results could be less lucid as the *net* effect of basic insurance could not be investigated – it is thus not clear how the government should tune the basic insurance policy. In the survey, all the samples were drawn from three major cities and surrounding areas. As can be partly seen from the GDP figures and city locations, the samples were not representative of the Chinese population. However, as it is estimated that at least 60% of Chinese population live within 400 kilometers of the east coastline, our study may still be of significant value. Nevertheless, a counterpart study focusing on poor, more remote rural areas should be pursued in future studies. Because of the phone call survey nature of this study, the collected information might not be detailed enough. Particularly, the data were either snapshot at the time of survey or aggregated data over 12 months. Such data had limitations. For example, the insurance status (particularly for commercial insurance) and household size might change over time. The aggregated data, including inpatient treatment, presence of chronicle disease, out-of-pocket cost and coping strategies, could not describe the variations across different disease episodes and their differences in financial consequences. In addition, it had been suggested that measuring out-of-pocket cost as

a single item might result in a biased estimation (usually under-estimation; [21]). On the other hand, the present design might also have advantages. Particularly, households often had multiple ill episodes, and they tended to remember the total cost and how they paid for all of them in general, rather than for a single episode. It was possible or even likely that multiple coping strategies were taken, while in the survey we focused on the *most important* coping strategy.

Conclusion

The healthcare sector in China is undergoing tremendous reform. Its development and progress may provide valuable information for reform in other developing countries. In this study, we conducted a phone call survey in three major cities. Our findings suggested that the surveyed population were well covered by basic and commercial health insurance, although there was still room for improvement. Possible target subpopulations to further increase coverage were identified. This study also identified factors that contributed to high gross and net out-of-pocket medical cost. More attention should be paid to these factors in the process of reform. We also identified the subgroup that had to cope with out-of-pocket medical cost by borrowing or reducing daily living cost. Potentially, illness can lead to poverty for such subgroup. Policy interventions should be developed targeting that group. Despite several limitations, this study may provide valuable information on the current conditions of China's health insurance and serve as basis for future policy development.

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Authors' contributions
All authors were involved in study design, data analysis, and paper writing. All authors read and approved the final manuscript.

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

Table 1. Basic characteristics of all subjects and stratified by insurance status.

Variable	Total	Overall coverage		Basic insurance coverage		Commercial insurance coverage	
		>50%	=<50%	>50%	=<50%	>50%	=<50%
Sample	5097	4437	660	4154	943	977	4120
Beijing	1578	1380	198	1294	284	319	1259
Shanghai	1530	1342	188	1258	272	308	1222
Xiamen	1989	1715	274	1602	387	350	1639
P value		(0.363)		(0.368)		(0.074)	
Household size Mean (sd)	3.706 (1.520)	3.666 (1.559)	3.976 (1.196)	3.633 (1.576)	4.029 (1.192)	2.896 (1.599)	3.898 (1.435)
P value		(<0.001)		(<0.001)		(<0.001)	
Household income (Percentage)							
Less than 30,000	23.76	23.28	26.97	23.42	25.24	29.17	22.48
30,000-50,000	23.29	21.57	34.85	20.73	34.57	17.09	24.76
50,000-100,000	25.23	26.14	19.09	26.38	20.15	20.06	26.46
100,000-150,000	15.81	16.50	11.21	17.02	10.50	15.46	15.90
More than 150,000	11.91	12.51	7.88	12.45	9.54	18.22	10.41
P value		(<0.001)		(<0.001)		(<0.001)	
Household expense (Percentage)							
Less than 10,000	12.11	11.52	16.06	10.74	18.13	15.05	11.41
10,000-30,000	30.23	28.92	39.09	28.60	37.43	22.93	31.97
30,000-50,000	31.53	32.43	25.45	33.25	23.97	25.08	33.06
50,000-100,000	16.77	17.35	12.88	17.53	13.47	18.63	16.33
More than 100,000	9.36	9.78	6.52	9.89	7.00	18.32	7.23

P value		(<0.001)		(<0.001)		(<0.001)	
The number of inpatient treatment (Percentage)							
None	73.02	74.74	61.52	75.49	62.14	77.69	71.92
One	17.99	16.11	30.61	15.67	28.21	16.07	18.45
Two	6.34	6.56	4.85	6.07	7.53	4.09	6.87
Three	1.24	1.42	0	1.52	0	0	1.53
Four	0.16	0.18	0	0.19	0	0.82	0
Five or more	1.26	0.99	3.03	1.06	2.12	1.33	1.24
P value		(<0.001)		(<0.001)		(<0.001)	
Presence of chronic diseases (Percentage)							
Yes	25.11	25.4	23.18	24.84	26.3	23.44	25.51
No	74.89	74.6	76.82	75.16	73.7	76.56	74.49
P value		(0.240)		(0.374)		(0.193)	
Hukou (Percentage)							
Urban	71.3	73	59.85	73.38	62.14	76.25	70.12
Rural	28.7	27	40.15	26.62	37.86	23.75	29.88
P value		(<0.001)		(<0.001)		(<0.001)	

*Values in “()” are p-values of Chi-squared or Fisher’s exact test.

Table 2. Coverage rate (>50%): univariate/multivariate logistic regressions. Numbers presented are "odds ratio (p-value)".

	Overall		Basic		Commercial	
	Univariate	Multivariate	Univariate	Multivariate	Univariate	Multivariate
Household size	0.880 (<0.001)	0.893 (<0.001)	0.849 (<0.001)	4.500 (<0.001)	0.571 (<0.001)	0.558 (<0.001)
Income (baseline: <30K)						
B: between 30K and 50K	0.717 (0.002)	0.599 (<0.001)	0.646 (<0.001)	0.856 (<0.001)	0.532 (<0.001)	0.634 (<0.001)
C: between 50K and 100K	1.586 (<0.001)	1.207 (0.209)	1.411 (0.001)	0.449 (0.210)	0.584 (<0.001)	0.628 (0.001)
D: between 100K and150K	1.704 (<0.001)	1.275 (0.155)	1.747 (<0.001)	0.847 (0.758)	0.749 (0.010)	0.693 (0.013)
E: over 150K	1.839 (<0.001)	1.246 (0.289)	1.405 (0.010)	1.048 (0.097)	1.349 (0.008)	0.899 (0.510)
Expense (baseline: <10K)						
B: between 10K and 30K	1.031 (0.806)	1.171 (0.249)	1.290 (0.020)	0.747 (<0.001)	0.544 (<0.001)	0.653 (0.001)
C: between 30K and 50K	1.777 (<0.001)	1.548 (0.007)	2.342 (<0.001)	1.687 (<0.001)	0.575 (<0.001)	0.816 (0.180)
D: between 50K and 100K	1.879 (<0.001)	1.540 (0.020)	2.197 (<0.001)	2.680 (<0.001)	0.865 (0.249)	1.215 (0.241)
E: over 100K	2.094 (<0.001)	1.381 (0.162)	2.387 (<0.001)	2.340 (<0.001)	1.921 (<0.001)	2.465 (<0.001)
Presence of chronicle disease	1.129 (0.220)	0.994 (0.956)	0.927 (0.352)	2.184 (0.005)	0.894 (0.180)	0.901 (0.265)
Inpatient treatment (>0)	0.541 (<0.001)	0.505 (<0.001)	0.533 (<0.001)	0.516 (<0.001)	0.735 (0.002)	0.973 (0.769)
Urban	1.813 (<0.001)	1.600 (0.000)	1.679 (<0.001)	0.784 (<0.001)	1.369 (<0.001)	0.851 (0.087)
City (Xiamen as baseline)						
Beijing						

Shanghai	1.113 (0.282) 1.140 (0.195)	0.953 (0.642) 1.002 (0.984)	1.101 (0.268) 1.117 (0.206)	1.527 (0.548) 0.947 (0.823)	1.186 (0.047) 1.181 (0.056)	1.091 (0.343) 1.068 (0.478)

Table 3. Medical cost: univariate/multivariate logistic regressions. Numbers presented are "odds ratio (p-value)".

	Medical cost>1000		**Medical cost>5000**	
	Univariate	Multivariate	Univariate	Multivariate
Household size	1.139 (<0.001)	1.155 (<0.001)	1.124 (<0.001)	1.113 (0.003)
Income (baseline: <30K)				
B: between 30K and 50K	1.191 (0.039)	1.229 (0.025)	0.906 (0.467)	0.939 (0.664)
C: between 50K and 100K	1.376 (<0.001)	1.359 (0.001)	0.773 (0.063)	0.722 (0.025)
D: between 100K and150K	1.332 (0.002)	1.210 (0.060)	0.839 (0.262)	0.733 (0.057)
E: over 150K	1.725 (<0.001)	1.808 (<0.001)	0.953 (0.771)	0.985 (0.931)
Presence of chronicle disease	2.735 (<0.001)	2.181 (<0.001)	2.524 (<0.001)	1.929 (<0.001)
Inpatient treatment (>0)	3.777 (<0.001)	3.340 (<0.001)	3.658 (<0.001)	3.241 (<0.001)
Basic insurance	0.990 (0.928)	1.220 (0.092)	1.018 (0.920)	1.420 (0.069)
Commercial insurance	0.852 (0.119)	1.351 (0.016)	0.889 (0.499)	1.401 (0.107)
Urban	1.473 (<0.001)	1.413 (<0.001)	0.986 (0.895)	0.969 (0.790)
City (Xiamen as baseline)	0.890	0.708	0.959	0.814
Beijing	(0.089)	(<0.001)	(0.712)	(0.090)
Shanghai	0.867 (0.038)	0.806 (0.004)	0.939 (0.590)	0.920 (0.498)

Table 4. Out-of-pocket medical cost: univariate and multivariate logistic regressions. Numbers presented are "odds ratio (p-value)". Sample size = 5070.

	Medical cost>1000		**Medical cost>5000**	
	Univariate	Multivariate	Univariate	Multivariate
Household size	1.170 (<0.001)	1.198 (<0.001)	1.043 (0.227)	1.100 (0.020)
Income (baseline: <30K)				
B: between 30K and 50K	1.206 (0.032)	1.296 (0.006)	1.172 (0.292)	1.377 (0.041)
C: between 50K and 100K	1.390 (<0.001)	1.376 (<0.001)	0.781 (0.126)	0.811 (0.210)
D: between 100K and150K	1.236 (0.027)	1.105 (0.334)	0.806 (0.239)	0.757 (0.142)
E: over 150K	1.718 (<0.001)	1.759 (<0.001)	1.140 (0.475)	1.209 (0.320)
Presence of chronicle disease	2.635 (<0.001)	2.175 (<0.001)	2.006 (<0.001)	1.751 (<0.001)
Inpatient treatment (>0)	3.287 (<0.001)	2.743 (<0.001)	2.702 (<0.001)	2.489 (<0.001)
Basic insurance	0.860 (0.175)	1.054 (0.660)	1.036 (0.868)	1.391 (0.134)
Commercial insurance	0.875 (0.204)	1.476 (0.003)	1.931 (<0.001)	2.977 (<0.001)
Urban	1.317 (<0.001)	1.237 (0.005)	0.805 (0.061)	0.681 (0.003)
City (Xiamen as baseline)				
Beijing	1.276 (<0.001)	1.115 (0.150)	1.380 (0.015)	1.254 (0.098)
Shanghai	1.240 (0.003)	1.234 (0.006)	1.354 (0.023)	1.353 (0.028)

Table 5. Analysis of coping strategy: univariate and multivariate logistic regressions. Numbers presented are "odds ratio (p-value)".

	Other than "Salary"		**Other than "Salary + Saving"**	
	Univariate	Multivariate	Univariate	Multivariate
Household size	1.001 (0.944)	0.969 (0.171)	0.978 (0.601)	0.906 (0.051)
Income (baseline: <30K)				
B: between 30K and 50K	0.661 (<0.001)	0.674 (<0.001)	0.447 (<0.001)	0.656 (0.003)
C: between 50K and 100K	0.839 (0.030)	0.816 (0.019)	0.306 (<0.001)	1.637 (<0.001)
D: between 100K and150K	0.819 (0.031)	0.732 (0.001)	0.341 (<0.001)	0.490 (<0.001)
E: over 150K	0.894 (0.265)	0.835 (0.094)	0.082 (<0.001)	0.335 (<0.001)
Presence of chronicle disease	0.864 (0.028)	0.770 (<0.001)	1.813 (<0.001)	0.101 (<0.001)
Inpatient treatment (>0)	1.314 (<0.001)	1.353 (<0.001)	1.606 (<0.001)	1.499 (0.004)
Basic insurance	0.976 (0.824)	1.002 (0.988)	0.715 (0.129)	0.972 (0.901)
Commercial insurance	0.968 (0.748)	0.722 (0.010)	0.629 (0.050)	0.528 (0.027)
Urban	0.805 (<0.001)	0.763 (<0.001)	0.599 (<0.001)	0.357 (<0.001)
City (Xiamen as baseline)				
Beijing	3.016 (<0.001)	3.130 (<0.001)	0.995 (0.969)	1.095 (0.555)
Shanghai	3.047 (<0.001)	3.193 (<0.001)	0.965 (0.809)	1.089 (0.585)