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# Characteristics of high-cost population in China—a family perspective cross-sectional study from Jiangsu Province

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## Abstract

**Background:** Across a range of healthcare settings, 5% of the population accounts for

half of healthcare spending: these patients are identified as a high-cost population. Characterizing high-cost users is essential for predicting potential high-cost patients and the development of appropriate interventions to improve the management and financing of these patients.

**Objective:** This cross-sectional study aimed to explore the characteristics of this high-cost population from a family perspective in China and provide suggestions for social health insurance policy development.

**Methods:** This study used data from the 5th Health Service Investigation of Jiangsu Province (2013), and 12,600 families were enrolled for analysis. Households whose medical expenditures were among the top 5% were identified to be high-cost families. A t-test, a chi-square test, and a binary logistic regression were used.

**Results:** High-cost families (n=631, 5%) accounted for 44.9% of the total medical expenditure of sampled families. High-cost families had 3.2 members and 1.2 chronic disease patients per household, which is significantly more than the 2.9 members and 0.7 people in the remaining families, respectively ($P$<0.05). Bi-weekly emergency department visits and annual hospitalizations preceding the household investigation of high-cost families were 1.19 and 0.98 per household, which is significantly more than the 0.68 and 0.17 of the remaining families, respectively ($P$<0.05). 97.3% of high-cost families and 97.5% of the remaining families were covered by Social Health Insurance with no statistical difference ($P$>0.05). A binary logistic regression indicated that the number of family members ($OR$=1.092), the number of chronic disease patients ($OR$=1.502), bi-weekly emergency department visits ($OR$=1.215), and annual hospitalizations ($OR$=4.576) were associated with high costs.

**Conclusion:** Social Health Insurance needs to ascertain the priority of lowering the

burden of high-cost families' out-of-pocket expenses. Further, large-scale and cost-effective care management programs need to be initiated to reduce these families' avoidable emergency department and hospitalization services.

**Key words:** High-cost population; Family; Medical expenditure; Social Health Insurance

**Strengths:**

- This is the first study on high-cost populations in a Chinese healthcare setting.
- The study found that the few high-cost families (5%) accounted for approximately half of the healthcare spending. They were also at greater risk of catastrophic health expenditure than other families. These findings are crucial to the Social Health Insurance policy optimization for China and many other economically developing countries.

**Limitations:**

-The data were collected only in Jiangsu Province, which was an economically developed province and might not be representative of other economically developing areas in China. Further research in other economically developing areas or at the national level is needed to provide comprehensive evidence for policymakers.

-Although the high-cost population had attracted attention from many policymakers and researchers from the WHO and the United States for the past decades, there was no consensus on the concept of high-cost population and identity standards. More theoretical studies should be carried out to determine the concept and measurement methods

## Background

Previous studies have shown that across a range of healthcare settings and populations, a small number of patients account for disproportionate amount of costs (1). Within the United States, 5% of the population accounts for approximately half of healthcare spending (1, 2): these patients are known as the high-cost

population (3). Usually these patients have multiple chronic conditions and need more health services than the average person (4, 5). China has 401,517,330 families (6). In Chinese healthcare settings, the family as a social function unit is decisive in family members' healthcare utilization and medical expenditures (7, 8). There are only a few studies on high-cost populations or families; however, the characteristics of these families, which are essential to health policy makers for predicting and financing future high-cost populations (9), are still unknown.

China has made impressive progress in expanding health insurance coverage since the 2009 healthcare reform; however, Social Health Insurance (SHI) faces substantial challenges to lowering the residents' disease burden (10, 11). "Costly access to health care" will still be the main problem to be settled for the next phase of Chinese healthcare reform (12, 13). Therefore, understanding high-cost families' characteristics is likely to be of particular interest to SHI because it is accountable for patients' financial risk. To inform SHI policy making, this paper sought to investigate household expenditures and income, family population composition, healthcare utilization, and SHI coverage of Chinese families. The objectives were to (1) characterize the 5% highest cost families in terms of their medical expenditures, family population composition, healthcare utilization, and SHI coverage and (2) determine the associations between medical expenditures, family population composition, healthcare utilization, and SHI coverage among the population.

## Methods

### Population and data sources

This family perspective study used household investigation data from the 5th Health Service Investigation of Jiangsu Province (2013) (See figure 1). The 2013 investigation

used a multi-stage random cluster sampling method. Eighteen counties/districts from all 102 counties/districts of Jiangsu Province, 5 towns/sub-districts within each selected county/district, and 2villages/communities within each selected town/sub-district were chosen as investigation sites. According to the population size, the enrolled 18 counties/districts were divided into two categories: if the population size of a county/district was larger than the average, 90 families within each village of the county/district were randomly selected; or else, 60 families within each village were randomly selected. In total, this investigation enrolled 18 counties (6 counties with large population and 12 counties with small population), 90 towns/sub-districts, 180 villages/communities and 12600 families to conduct its household investigation (see table 1). Well-trained interviewers who were township hospital physicians, with support from village health workers, visited households and invited the family's head or the member who was most familiar with the healthcare utilization and spending of the family to participate in the survey. Face-to-face interviews using a structured questionnaire were conducted to collect information about household medical expenditures and other expenditures, household income, family population composition, healthcare utilization, and social health insurance coverage.

**Statistical analysis**

We categorized families as "high cost" if their total medical expenditures were among the top 5% for all families assessed (14-17). We used $\chi 2$ and *t* tests in bivariate analyses to compare high-cost families with the remaining families, on the basis of medical expenditure, family population composition, medical care utilization, and SHI coverage. A value of $P<0.05$ was considered to be statistically significant. Data were analyzed with SPSS version 19.0 (SPSS Inc., Chicago, USA;

http://www.spss.com).

**Ethics Statement**

The 5th Health Service Investigation of Jiangsu Province (2013) was the regular work of the Health and Family Planning Commission of Jiangsu Province, which was approved by National Health and Family Planning Commission of the People's Republic of China and Jiangsu Provincial Government. All enrolled families were given a letter explaining the study and they gave written informed consent before the household investigation.

**Results**

**Household medical expenditures**

In this study, household medical expenditures refer to the total expenditures of family members to pay for medical treatment (including drug costs), hospitalization, disease prevention, primary care services for pregnant women and pregnancy, children's health care and other expenses related to medical care. Figure 2 illustrated the overall distribution of medical expenditures referring to the sampled families. High-cost families (n=631, 5%) accounted for 44.9% of total healthcare spending in 2012. Table 2 showed that the average healthcare cost of high-cost families was 31,051.7±33,546.9 yuan, which was significantly higher than the 2,010.5±2,273.9 yuan of the remaining families (n=11969, 95%, $P$<0.05). Moreover, high-cost families faced greater financial risk than the remaining 95% of families. The results showed that high-cost families' medical expenses accounted for 46.9% of the household income that remained after subsistence needs, which was significantly higher than the 7.9% of the remaining families ($P$<0.05).

**Family population composition**

As shown in Table 3, high-cost families were extended families with more aged members in aggregate, when compared with the remaining 95% of families. High-cost families in this provincial investigation had 3.2±1.4 family members per household, which was significantly more than the 2.9±1.3 people of the remaining families ($P$<0.05); old-age dependency ratio per household of high-cost families was 0.436±0.396, which was significantly higher than the 0.348±0.402 of the remaining families ($P$<0.05). Chronic condition prevalence was greater among high-cost families than among the remaining 95% families. High-cost families had 1.24±0.84 patients with chronic conditions per household, which was significantly more than the 0.7±0.75 of the remaining families ($P$<0.05); the proportion of chronic disease patients per household of high-cost families was 0.45±0.35, which was significantly higher than the 0.29±0.34 of the remaining families ($P$<0.05).

**Medical care utilization**

Table 4 described that high-cost families needed more outpatient services paired with inpatient services. Bi-weekly emergency department visits per household preceding the household investigation of high-cost families was 1.19±0.84, which was significantly more than the 0.68±0.76 of the remaining families ($P$<0.05); annual hospitalizations preceding the household investigation per household of high-cost families was 0.98±0.89, which was significantly more than the 0.17±0.43 of the remaining families ($P$<0.05).

**SHI coverage**

Table 5 presented SHI coverage of sampled families: 97.3% of high-cost families were covered by SHI, which had no significant difference from the 97.5% of the remaining families ($P$>0.05).

**Factors associated with the high medical expenditure of high-cost families**

In Table 6, we explored factors associated with the high medical expenditures of high-cost families using a logistic regression model. In general, the study found that families with larger population (*OR*=1.092), more chronic disease patients (*OR*=1.502), and who utilized more outpatient services (*OR*=1.215) and inpatient services (*OR*=4.576) were more likely to be high-cost families.

**Discussion**

In a Chinese healthcare setting, the family plays a decisive role in a member's medical services utilization and medical expenditures. Moreover, the family is usually treated as a whole for SHI financing and payments. Therefore, from this perspective, this initial study to explore the characteristics of high-cost families in a Chinese setting is of particular significance for the development of appropriate interventions to improve the management and financing of the population (18). While little was known about which healthcare system, health insurance system, or socio-demographical characteristics caused a family to be high-cost, thus far, most of the limited evidence comes from case studies. In the present study, we found that high-cost families in China were usually extended families with more chronic disease patients, and they utilized more outpatient and inpatient services than the remaining families. There are 4 factors that might be the main contributors to high medical expenditures and make a household more vulnerable to financial risk. A few previous studies also found that households headed by the elderly, the disabled, the unemployed, or the poor, and those with reduced access to health insurance were more likely to be high-cost households (19, 20).

The characterization of high-cost families is implicational for SHI policy development.

This study indicated that the top 5% highest cost families in the 5th Health Service Investigation of Jiangsu Province (2013) accounted for approximately half of total medical expenses. This finding was consistent with the results reported by Donna M Zulman (2015) (1) and J. Lester Feder (2011) (2). In addition, we found that the average proportions of medical expenditures in household income remaining after subsistence needs of high-cost families and the remaining families has been accounted for was 46.9% and 6.9%, respectively. According to the World Health Organization (WHO), a health expenditure will be viewed as catastrophic whenever it is greater than or equal to 40% of a household's non-subsistence income, i.e., the income available after basic needs have been met (21). The present study indicated that high-cost families have a greater likelihood of a catastrophic health expenditure. In one international perspective study, Ke Xu, et al (2003) (19) proposed that even small costs for common illnesses can be financially disastrous for poor households with no insurance coverage. However, in our study, we surprisingly found that even when covered by Chinese SHI, high-cost families could still face financial disaster. Health reform experiences in many countries highlight that health systems requiring lower out-of-pocket payments for healthcare could offer better protection to the poor against catastrophic spending (22, 23). Therefore, in the next stage of healthcare reform, Chinese SHI designers should understand that the few (5%) high-cost families were the most costly to healthcare services, and policymakers should find solutions to reduce the high out-of-pocket burdens among these families (24).

It is noteworthy that high-cost families used more medical services than the remaining families and their high need might be related to family members who are

older and suffer from chronic disease. A series of previous studies had proven that both groups were high utilizers and accounted for significantly more medical expenditures. For example, analysis of the national databases of Scotland showed that 34% of community members over the age of 65 fall at least once per year and 20% of them contacted a medical service for assistance (25). A study in China found that 54.9% of 4,162 elderly people with cardiovascular disease received outpatient care and 17.7% received inpatient care over the past 12 months (26).

We must be vigilant about avoidable or preventable care utilization in the healthcare system, which was a common occurrence and represented a significant component of high medical expenditures. Within the US setting, overuse and misuse of diagnostic testing, avoidable hospitalization and re-hospitalization, and overuse of emergency department services caused approximately 30% of healthcare costs, or amounted to more than $700 billion wasted per year. High-cost patients accounted for 79.0% of inpatient costs, 9.6% of which were due to preventable hospitalizations; additionally, 43.3% of emergency department spending and 13.5% of inpatient spending were preventable among persistently high-cost patients (27). Policymakers and researchers had suggested it was the responsibility of the medical profession to become cost-conscious and decrease unnecessary care that does not benefit patients but represents a substantial percentage of healthcare costs (28). Many health projects or plans in the United States, such as the Complex Care Management Program, the HealthCare Partners Medical Group, and the Patient-Aligned Care Team, Colorado Access have been implemented to improve the management of care for high-cost Medicaid patients and to reduce their avoidable emergency department services and hospitalizations (29, 30).

However, in China and many other Asian and African countries with scarce health resources, the high-cost population was rarely identified, let alone to design health programs to improve the management. The findings in this study suggested that in China and other countries, this high-cost population definitely existed and might waste more healthcare costs than the general population, because of their higher utilization of preventable medical services. Care management programs to promote the rational use of medical services and to control the medical expenditures of high-cost families should be explored and implemented as soon as possible (31).

The study's strengths comprised the investigation from a family perspective within large geographical areas. Besides, a logistic regression model was used appropriately to adjust the confounders and find the related factors with high medical expenses in Chinese healthcare settings. However, the study had several limitations that should be noted. First, the data were collected only in Jiangsu Province, which was an economically developed province and might not be representative of other economically developing areas in China. Further research in other economically developing areas or at the national level is needed to provide comprehensive evidence for policymakers. Second, although the high-cost population had attracted attention from many policymakers and researchers from the WHO and the United States for the past decades, there was no consensus on the concept of high-cost population and identity standards. More theoretical studies should be carried out to determine the concept and measurement methods (32, 33).

**Conclusion**

In conclusion, our analysis of the high-cost population from a family perspective suggested that while universal SHI had been set up in China, its effectiveness in

lowering high-cost families' risk of catastrophic health expenditure was modest. As only the few high-cost families accounted for half of the healthcare spending, future HIS designers should ensure that the out-of-pocket burden of these populations is lowered. Further, care management programs to promote the rational use of medical services and to control medical expenditures of high-cost families should be addressed.

**Study highlights**

**1. What is known about this topic:**

- Across many healthcare settings and populations, 5% of the population accounts for half of the healthcare spending. They are identified as the high-cost population.
- How to reduce the high-cost populations' preventable medical costs and unreasonable healthcare utilization have become challenges for policymakers and the health insurance system.

**2. What this study adds:**

- The study found that the few high-cost families (5%) accounted for approximately half of the healthcare spending. They were also at greater risk of catastrophic health expenditure than other families.
- The efficacy of Chinese Social Health Insurance in lowering high-cost families' financial risk is modest and future policy needs to ascertain the priority of lowering high-cost families' out-of-pocket burden.
- Within the health delivery system, large scale and cost-effective care management programs need to be initiated to reduce their avoidable emergency department and hospitalization services.

**List of Abbreviations**

SHI, Social Health Insurance

**Data Sharing Statement**

The data are available through the email of the corresponding author.

**Declarations**

**Competing interests**

All authors consent for publication. The authors declare that they have no competing interests: there are no financial/non-financial competing interests.

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**Authors' Contributions**

Yudong Miao participated in the design of the study, performed the statistical analysis, and drafted the manuscript. Prof. Liang Zhang provided guidance on data analysis and policy suggestions. Prof. Dongfu Qian checked the language and modified the manuscript. Dan Hu and Yadong Niu helped to analyze the data and collect references. All authors read and approved the final manuscript.

**Reference**

1. Donna M Zulman, Christine Pal Chee, Todd H Wagner, Jean Yoon, Danielle M Cohen, Tyson H Holmes, Christine Ritchie, Steven M Asch. Multimorbidity and healthcare utilization among high-cost patients in the US Veterans Affairs Health Care System. BMJ Open, 2015, 5:1-9.

2. J. Lester Feder. Predictive Modeling And Team Care For High-Need Patients At HealthCare Partners. Health Affairs, 2014, 33(7):1123-1131.

3. Robert T. Quinlivan, L.C.S.W. Treating High-Cost Users of Behavioral Health Services in a Health Maintenance Organization. PSYCHIATRIC SERVICES, 2000, 51(2):159-162.

4. Xin, Haichang. How Do High Cost-Sharing Policies for Physician Care Affect Inpatient Care Use and Costs Among People With Chronic Disease? Journal of Ambulatory Care Management, 2015, 38 (2):100-108.

5. Sarnak DO, Ryan J. How High-Need Patients Experiences the Health Care System in Nine Countries. Issue Brief (Commonwealth Fund), 2016, 1:1-14.

6. China statistical yearbook 2015.

http://www.stats.gov.cn/tjsj/ndsj/2015/indexch.htm)

7. Zhou Qin, Zang Wenbin, Liu Guoen. Health Insurance Coverage and Medical Financial Risks for Chinese Households, INSURANCE STUDIES, 2013, 7(7):95-107.

8. LI Hui, TANG Jing-xia, QIN Jiang-mei Analysis on the Economic Risks of Diseases, Catastrophic Expenditure on Health and Its Influence Factors of Urban Families in Hami Area. Chinese Health Economics, 2015, 34(7):48-50.

9. Pietz Kenneth, Byrne Margaret, Petersen Laura. A Decision-Theoretic Approach to Identifying Future High-Cost Patients. Medical Care, 2006, 44(9): 842-849.

10. Winnie Yip, William Hsiao. Harnessing the privatization of China's fragmented healthcare delivery. Lancet, 2014, 384: 805-818.

11. YI Hongmei, YAO Yezhou, ZHANG Linxiu. Impact of New Rural Cooperative Medical Scheme on farmers' utilization of medical care and medical expenditure: Evidences from panel data in 5 Provinces. Chinese Journal of Health Policy, 2013, 6(2): 25-29.

12. Qian Long, Ling Xu, Henk Bekedam and Shenglan Tang, Changes in health expenditures in China in 2000s: has the health system reform improved affordability. International Journal for Equity in Health 2013, 12:40.

13. Jens Leth Hougaard, Lars Peter Østerdal, Yi Yu. The Chinese Healthcare System Structure, Problems and Challenges. Appl Health Econ Health Policy, 2011, 9 (1): 1-13.

14. Seyed Abdolmotalleb Izad Shenas, Bijan Raahemi, Mohammad Hossein Tekieh, Craig Kuziemsky. Identifying high-cost patients using data mining techniques and a small set of non-trivial attributes. Computers in Biology and Medicine, 2014, 53: 9-18.

15. Rais S, Nazerian A, Ardal S, Chechulin Y, Bains N, Malikov K. High-cost users of Ontario's healthcare services. Healthcare Policy, 2013, 9(1): 44-51.

16. Calver J, Brameld KJ, Preen DB, Alexia SJ, Boldy DP, McCaul KA. High-cost users of hospital beds in Western Australia: a population-based record linkage study. Med J Aust, 2006, 184(8):393-397.

17. Leena K. Saastamoinen, Jouko Verho. Drug expenditure of high-cost patients and their characteristics in Finland. Eur J Health Econ, 2013: 14:495–502.

18. Walter P. Wodchis, Peter C. Austin, David A. Henry. A 3-year study of high-cost users of health care. CMAJ, 2016, 188(3): 182-188.

19. Ke Xu, David B Evans, Kei Kawabata, Riadh Zeramdini, Jan Klavus, Christopher J L Murray. Household catastrophic health expenditure: a multicountry analysis. Lancet, 2003, 362: 1711–1716.

20. Wyszewianski L. Families with catastrophic health care expenditures. Health Serv Res, 1986, 21: 617–634.

21. World Health Organization 2005. Designing health financing systems to reduce

catastrophic health expenditure.

http://www.who.int/health_financing/documents/cov-pb_e_05_2-cata_sys/en/

22. Ke Xu, David B. Evans, Guido Carrin, Ana Mylena Aguilar-Rivera, Philip Musgrove, Timothy Evans. Protecting Households From Catastrophic Health Spending. Health Affairs, 2007, 26(4):972-983.

23. Jane Falkingham. Poverty, out-of-pocket payments and access to health care: evidence from Tajikistan. Social Science & Medicine, 2004, 58(2):247–258.

24. Yasuyuki Okumura, Hiroto Ito. Out-of-pocket expenditure burdens in patients with cardiovascular conditions and psychological distress: a nationwide cross-sectional study. General Hospital Psychiatry, 2013, 35: 233-238.

25. J Craig, A Murray, S Mitchell, S Clark, L Saunders and L Burleigh. The high cost to health and social care of managing falls in older adults living in the community in Scotland. Scottish Medical Journal, 2013, 58(4): 198–20.

26. Dou L, Liu X, Zhang T, Wu Y. Health care utilization in older people with cardiovascular disease in China. Int J Equity Health, 2015, 14: 59.

27. Karen E. Joynt, Atul A. Gawande, E. John Orav, Ashish K. Jha. Contribution of Preventable Acute Care Spending to Total Spending for High-Cost Medicare Patients. JAMA, 2013, 309(24):2572-2578.

28. Steven E. Weinberger. Providing High-Value, Cost-Conscious Care: A Critical Seventh General Competency for Physicians. Annals of Internal Medicine, 2011, 155:386-388.

29. Clemens S. Hong, Allison L. Siegel, Timothy G. Ferris. Caring for High-Need, High-Cost Patients: What Makes for a Successful Care Management Program? Issue Brief (Commonwealth Fund), 2014, 19: 1-19.

30. Institute of Medicine. The Healthcare Imperative: Lowering Costs and Improving Outcomes. Washington, DC: National Academies Press, 2010.

31. John Billings, Tod Mijanovich. Improving The Management Of Care For High-Cost Medicaid Patients, Health Affairs, 2007, 26(6):1643-1654.

32. Chang HY, Boyd CM, Leff B, Lemke KW, Bodycombe DP, Weiner JP. Identifying Consistent High-Cost Users in a Health Plan: Comparison of Alternative Prediction Models. Med Care. 2016 Jun 18. [Epub ahead of print]

33. Dario Gregori MA, Michele Petrinco, Giulia Barbati, Simona Bo, Alessandro Desideri, Roberto Zanetti, Franco Merletti, Eva Pagano. Extreme regression models for characterizing high-cost patients. Journal of Evaluation in Clinical Practice, 2009, 15: 164–171.

**Legends for figures**

-Figure1. Map of China, Jiangsu: geographic distribution of study places

-Figure2. Overall distribution of medical expenditures referring to the sampled families

**Legends for tables**

- Table 1: Sampled counties/districts and families in this study

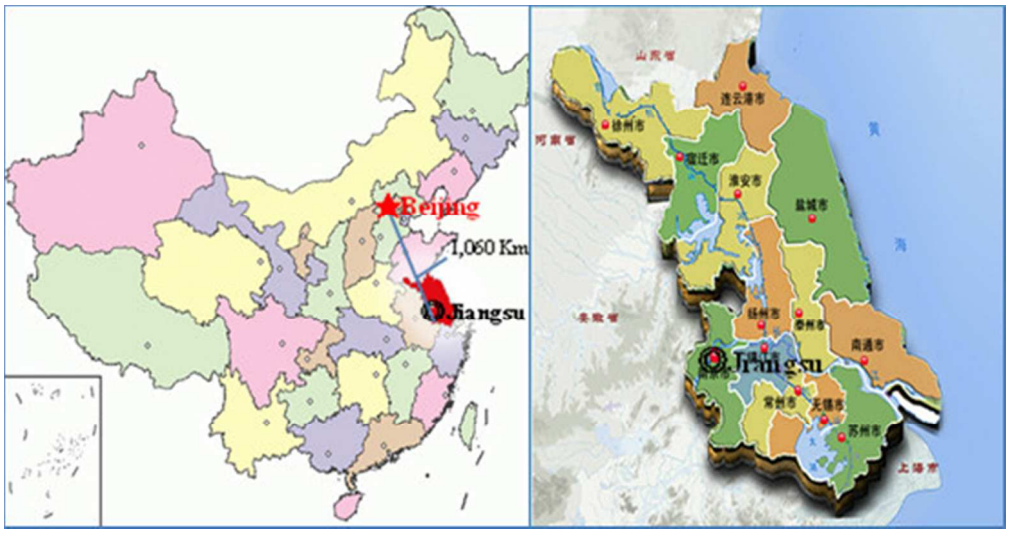
- Table 2: Medical expenditure of sampled families

- Table 3: Population composition of sampled families

- Table 4: Medical care utilization of sampled families

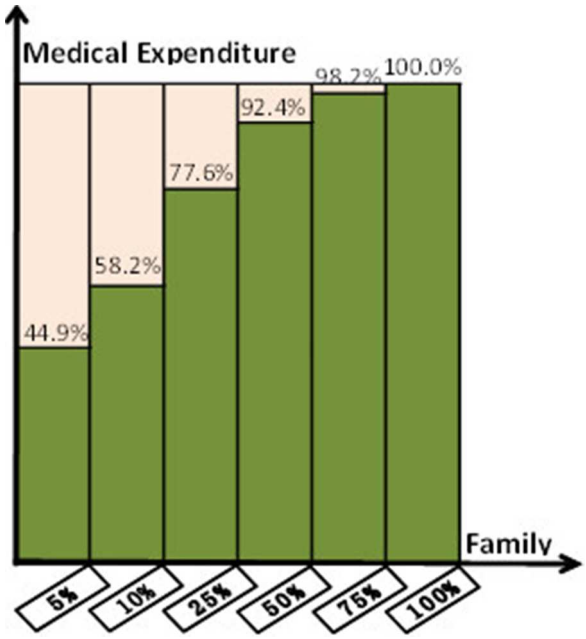
- Table 5: SHI coverage of sampled families

- Table 6: Factors associated the high medical expenditures of high-cost families




Map of China, Jiangsu: geographic distribution of study places

193x101mm (72 x 72 DPI)




Overall distribution of medical expenditures referring to the sampled families

101x111mm (72 x 72 DPI)

**Table 1: Sampled counties/districts and families in this study**

| Investigation sites | Family amount | Average population per family | Investigation sites | Family amount | Average population per family |
|---|---|---|---|---|---|
| Gaochun District | 900 | 3.0 | Gusu District | 600 | 2.5 |
| Liyang County | 900 | 2.7 | Chongchuan District | 600 | 2.9 |
| Haimen County | 900 | 2.3 | Xishan District | 600 | 3.3 |
| Gaoyou County | 900 | 2.8 | Xinpu District | 600 | 2.9 |
| Danyang County | 900 | 3.2 | Jinhu County | 600 | 2.5 |
| Jiangyan County | 900 | 2.6 | Tinghu District | 600 | 3.1 |
| Qinhuai District | 600 | 2.6 | Yangzhong County | 600 | 3.2 |
| Jiangyin County | 600 | 3.3 | Qishuyan District | 600 | 2.8 |
| Pizhou County | 600 | 3.2 | Sucheng District | 600 | 3.4 |

**Table 2: Medical expenditure of sampled families**

| Medical expenditure | High-cost families *N*=631(5%) | Remaining families *N*=11986(95%) | *P* |
|---|---|---|---|
| Total medical expenditure (yuan) | 19593622.7 | 24097853.0 | - |
| Medical expenditure per household (yuan, x±s) | 31051.7±33546.9 | 2010.5±2273.9 | 0.000 |
| The proportion of medical expenditure in household income remaining after subsistence needs (%,x±s) | 0.469±0.210 | 0.079±0.096 | 0.000 |

**Table 3: Population composition of sampled families**

| Population composition | High-cost families *N*=631(5%) | Remaining families *N*=11986(95%) | *P* |
|---|---|---|---|
| Family member amount | 3.2±1.4 | 2.9±1.3 | 0.000 |
| Old-age dependency ratio (%, x±s) | 0.436±0.396 | 0.348±0.402 | 0.000 |
| Chronic disease patients amount per household (x±s) | 1.24±0.84 | 0.7±0.75 | 0.033 |
| Proportion of chronic disease patients per household (%, x±s) | 45.2±34.6 | 28.8±33.9 | 0.013 |

**Table 4: Medical care utilization of sampled families**

| Medical care utilization | High-cost families *N*=631(5%) | Remaining families *N*=11986(95%) | *P* |
|---|---|---|---|
| 2-week emergency department visits per household | 1.19±0.84 | 0.68±0.76 | 0.000 |
| Annual hospitalizations per household | 0.98±0.89 | 0.17±0.43 | 0.000 |

**Table 5: SHI coverage of sampled families**

| SHI | High-cost families *N*=631(5%) | | Remaining families *N*=11986(95%) | | *P* |
|---|---|---|---|---|---|
| | Families amount | Ratio (%) | Families amount | Ratio (%) | |
| Covered | 614 | 97.3 | 11688 | 97.5 | 0.744 |
| Not covered | 17 | 2.7 | 298 | 2.5 | |

**Table 6: Factors associated the high medical expenditures of high-cost families**

| Covariates | *B* | *S.E.* | *Wald* | *P* | *OR* | 95% *C.I.* for *OR* | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| Family member amount | 0.088 | 0.033 | 7.363 | 0.007 | 1.092 | 1.025 | 1.164 |
| Chronic disease patients amount per household | 0.407 | 0.077 | 28.121 | 0.000 | 1.502 | 1.292 | 1.745 |
| 2-week emergency department visits per household | 0.195 | 0.076 | 6.589 | 0.010 | 1.215 | 1.047 | 1.41 |
| Annual hospital admissions per household | 1.521 | 0.058 | 679.422 | 0.000 | 4.576 | 4.082 | 5.131 |

**A Checklist for Reporting Characteristics of high-cost population in China—a family perspective cross-sectional study from Jiangsu Province**

| | | |
|---|---|---|
| **Reporting guideline provided for?** | The characteristics of high-cost population in China from a family perspective | Page 1 |
| **Full bibliographic reference** | Yudong Miao, Dongfu Qian, Ting Ye, Yadong Niu, Dan Hu, Liang Zhang. A Checklist for Reporting Characteristics of high-cost population in China - a family perspective cross-sectional study from Jiangsu Province (CREATE). BMJ Open. | Page 1 |
| **Language** | English | - |
| **Study design** | Economic evaluations | |
| **Applies to the whole report or to individual sections of the report?** | Data, Procedure/Method, Results, Statistical methods and analyses, Study characteristics (participants etc.), Terminology/definitions | Page 3-12 |
| **Tables** | 6 | Page 19-24 |
| **Figures** | 2 | Page 25-26 |
| **What is known about this topic** | -Across many healthcare settings and populations, 5% of the population accounts for half of the healthcare spending. They are identified as the high-cost population.<br>-How to reduce the high-cost populations' preventable medical costs and unreasonable healthcare utilization have become challenges for policymakers and the health insurance system. | Page 12 |
| **What this study adds** | - The study found that the few high-cost families (5%) accounted for approximately half of the healthcare spending. They were also at greater risk of catastrophic health expenditure than other families.<br>- The efficacy of Chinese Social Health Insurance in lowering high-cost families' financial risk is modest and future policy needs to ascertain the priority of lowering high-cost families' out-of-pocket burden.<br>- Within the health delivery system, large scale and cost-effective care management programs need to be initiated to reduce their avoidable emergency department and hospitalization services. | Page 12 |
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# Exploring the Characteristics of high-cost population from family perspective : a cross-sectional study in Jiangsu Province, China

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# Exploring the Characteristics of high-cost population from family perspective : a cross-sectional study in Jiangsu Province, China

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## Abstract

**Background:** Across a range of healthcare settings, 5% of the population accounts for half of health care spending: these patients are identified as a high-cost population. Characterizing high-cost users is essential for predicting potential high-cost patients and the development of appropriate interventions to improve the management and financing of these patients.

**Objective:** This cross-sectional study aimed to explore the characteristics of this high-cost population from a family perspective in China and provide suggestions for social health insurance policy development.

**Methods:** This study used data from the Fifth Health Service Investigation of Jiangsu Province (2013), and 12,600 families were enrolled for analysis. Households whose medical expenditures were among the top 5% were identified to be high-cost families. A t-test, a chi-square test, and a binary logistic regression were used.

**Results:** High-cost families (n=631, 5%) accounted for 44.9% of the total medical expenditure of sampled families. High-cost families had 3.2 members and 1.2 chronic disease patients per household, which is significantly more than the 2.9 members and 0.7 people in the remaining families, respectively ($P$<0.05). Bi-weekly emergency department visits and annual hospitalizations preceding the household investigation of high-cost families were 1.19 and 0.98 per household, which is significantly more than the 0.68 and 0.17 of the remaining families, respectively ($P$<0.05). A binary logistic regression indicated that the number of family members ($OR$=1.152), the number of chronic disease patients ($OR$=1.508), bi-weekly emergency department

visits (*OR*=1.218), and annual hospitalizations (*OR*=4.577)were associated with high costs.

**Conclusion:** The 5% high-cost families in Jiangsu Province accounted for approximately half of medical expenditures. The effectiveness of Chinese Social Health Insurance in lowering high-cost families' risk of catastrophic health expenditure was modest. Policy makers need to ascertain the priority of lowering the burden of high-cost families' out-of-pocket expenses through improving the reimbursement proportion and reducing avoidable medical services.

**Key words:** High-cost population; Family; Medical expenditure; Social Health Insurance

**Strengths and limitations of this study**

- This was a huge study including 12,600 families and the first investigation on high-cost populations in a Chinese healthcare setting.
- The study not only introduced the concept of the high-cost patient to China but also explored the characteristics of this population by quantitative measurement.
- The overall study design was conducted from the family perspective, which plays a significant and extraordinary role in health policy making in China and many other Eastern Asian countries.
-The data were collected only in Jiangsu Province, which was an economically developed province and might not be representative of other economically developing areas in China. Further research in other economically developing areas or at the national level is needed to provide comprehensive evidence for policymakers.
-Although the high-cost population had attracted attention from many policymakers and researchers from the WHO and the United States for the past decades, there was no consensus on the concept of high-cost population and identity standards. More theoretical studies should be carried out to determine and popularize the concept.

**Background**

Previous studies have shown that across a range of health care settings and populations, a small number of patients account for the disproportionate amount of costs (1). Within the United States, 5% of the population accounts for approximately half of healthcare spending (1,2): these patients are known as the high-cost population(3). Usually, these patients have multiple chronic conditions and need more health services than the average person(4,5). Their high need of medical service and the high cost of medical expense have made them a key population for health and medical insurance policy making in many states of the US (2). China has 401,517,330 families(6). In Chinese and many Eastern Asianhealthcare settings, the family as a social function unit is decisive in family members' healthcare utilization and medical expenditures(7,8). There are only a few studies on high-cost populations or families from the US, Hong Kong, and a few European countries (2, 4). However, no study has been undertaken on the high-cost population in Chinese mainland and Jiang Province so far. The characteristics of these families, which are essential to health policy makers for predicting and financing future high-cost populations(9), are still unknown.

In the past few decades, Chinese government attempted to reduce the financial burden of the disease by establishing a Social Health Insurance (SHI) system covering all the people. China has made impressive progress in expanding health insurance coverage since the 2009 health care reform. In the current stage, the SHI consists of the Basic Medical Insurance System for Urban Workers, the Basic Medical Insurance System for Urban Residents and the New Rural Cooperative Medical Service System for Rural Residents, and more than 95% of Chinese residents are covered. Medical

expenditures in China are payed by SHI reimbursement and patient out-of-pocket payment. Therefore SHI is considered to be the guarantee for medical service economically accessible to all Chinese. However, SHI faces substantial challenges to lowering the burden of residents'diseases(10,11). “Costly access to health care” is and will still be the main problem to be settled for the next phase of Chinese healthcare reform(12,13). Therefore, understanding high-cost families’ characteristics are likely to be of particular interest to SHI, which is accountable for patients’ financial risk. Firstly, although China is a country with a huge economy, China has the largest population (more than 1.4 billion) in the world. Even in many economically developed areas of the Chinese mainland, the local government can't budget too much money for SHI. Obviously, a more efficient use of the relatively inadequate SHI funds is critical. Secondly, identifying who needs the SHI reimbursement most is the primary solution to improve the efficiency of SHI funds. Traditionally, the SHI policy makers thought the patients to be same in policy making: No matter how much medical expenditure a patient spends, the distinct proportion of expenses will be reimbursed. Policy making in this way seems fair, however, for those families with high need of medical service and the high cost of medical expenditures, the out-of-pocket expenses after SHI reimbursement is sufficient to cause a patient or family to enter into the state of absolute poverty.

In theory, this population should be reimbursed with a higher proportion rather than a certain proportion according to traditional rules. Therefore to inform SHI policy making, this paper sought to investigate household expenditures and income, family population composition, health care utilization, and SHI coverage of Chinese families. The objectives were to (1) characterize the 5% highest cost families regarding their

medical expenditures, family population composition, health care utilization, and SHI coverage and (2) determine the associations between medical expenditures, family population composition, health care utilization, and SHI coverage among the population.

## Methods

### Population and data sources

This family perspective study used household investigation data from the Fifth Health Service Investigation of Jiangsu Province (2013) (See figure 1). The 2013 investigation used a multi-stage random cluster sampling method and was conducted from August to November 2013. Eighteen counties/districts from all 102 counties/districts of Jiangsu Province, 05 towns/sub-districts within each selected county/district, and 02 villages/communities within each selected town/sub-district were chosen as investigation sites. According to the population size, the enrolled 18 counties/districts were divided into two categories: if the population size of a county/district was larger than the average, 90 families within each village of the county/district were randomly selected; or else, 60 families within each village were randomly selected. In total, this investigation enrolled 18 counties (6 counties with a large population and 12 counties with a small population), 90 towns/sub-districts, 180 villages/communities and 12600 families to conduct its household investigation (see table 1). Each county health bureau was responsible for organizing their local investigation. The household investigation questionnaire used in Jiangsu Province was developed by the national health and Family Planning Commission of the People'sRepublic of China. Well-trained interviewers who were township hospital physicians, with support from village health workers, visited households and invited

the family's head or the member who was most familiar with the healthcare utilization and spending of the family to participate in the survey. Face-to-face interviews using a structured questionnaire were conducted to collect information about household medical expenditures and other expenditures, household income, family population composition, health care utilization, and social health insurance coverage. As the technical supporter of this investigation, we were permitted by the Health and Family Planning Commission of Jiangsu Provinceto to select indicators related to the topic of this study from the overall database anonymously and use them in academic research.

**Table 1: Sampled counties/districts and families in this study**

| Investigation sites | Family amount | Average population per family | Investigation sites | Family amount | Average population per family |
|---|---|---|---|---|---|
| Gaochun District | 900 | 3.0 | Gusu District | 600 | 2.5 |
| Liyang County | 900 | 2.7 | Chongchuan District | 600 | 2.9 |
| Haimen County | 900 | 2.3 | Xishan District | 600 | 3.3 |
| Gaoyou County | 900 | 2.8 | Xinpu District | 600 | 2.9 |
| Danyang County | 900 | 3.2 | Jinhu County | 600 | 2.5 |
| Jiangyan County | 900 | 2.6 | Tinghu District | 600 | 3.1 |
| Qinhuai District | 600 | 2.6 | Yangzhong County | 600 | 3.2 |
| Jiangyin County | 600 | 3.3 | Qishuyan District | 600 | 2.8 |
| Pizhou County | 600 | 3.2 | Sucheng District | 600 | 3.4 |

## Statistical analysis

We categorized families as "high cost" if their total medical expenditures were among the top 5% for all families assessed(14-17). We used $\chi 2$ and *t* tests in bivariate analyses to compare high-cost families with the remaining families, by medical expenditure, family population composition, medical care utilization, and SHI coverage. A value of $P<0.05$ was considered to be statistically significant. Data were analyzed with SPSS version 19.0 (SPSS Inc., Chicago, USA; http://www.spss.com).

**Ethics Statement**

The fifth health Service Investigation of Jiangsu Province (2013) was the regular work of the Health and Family Planning Commission of Jiangsu Province, which was approved by National Health and Family Planning Commission of the People's Republic of China and National Bureau of Statistics of the People's Republic of China. All enrolled families were given a letter explaining the study, and they gave written informed consent before the household investigation.

**Results**

**Household medical expenditures**

In this study, household medical expenditures refer to the total expenditures of family members to pay for medical treatment (including drug costs), hospitalization, disease prevention, primary care services for pregnant women and pregnancy, children's health care and other expenses related to medical care.Figure 2 illustrated the overall distribution of medical expenditures referring to the sampled families. High-cost families (n=631, 5%) accounted for 44.9% of total healthcare spending in 2012. Table 2 showed that the average healthcare cost of high-cost families was 31,051.7±33,546.9 yuan, which was significantly higher than the 2,010.5±2,273.9 yuan of the remaining families (n=11969, 95%, $P<0.05$). Moreover, high-cost families faced greater financial risk than the remaining 95% of families. The results showed that high-cost families' medical expenses accounted for 46.9% of the household income that remained after subsistence needs, which was significantly higher than the 7.9% of the remaining families ($P<0.05$).

**Table 2: Medical expenditure of sampled families**

| Medical expenditure | High-cost families *N*=631(5%) | Remaining families *N*=11986(95%) | *P* |
|---|---|---|---|
| Total medical expenditure (yuan) | 19593622.7 | 24097853.0 | - |
| Medical expenditure per household (yuan, x±s) | 31051.7±33546.9 | 2010.5±2273.9 | 0.000 |
| The proportion of medical expenditure in household income remaining after subsistence needs (%,x±s) | 0.469±0.210 | 0.079±0.096 | 0.000 |

**Family population composition**

As shown in Table 3, high-cost families were extended families with more elderly members in aggregate, when compared with the remaining 95% of families. High-cost families in this provincial investigation had 3.2±1.4 family members per household, which was significantly more than the 2.9±1.3 people of the remaining families ($P$<0.05); old-age dependency ratio per household of high-cost families was 0.436±0.396, which was significantly higher than the 0.348±0.402 of the remaining families ($P$<0.05). Chronic condition prevalence was greater among high-cost families than among the remaining 95% families. High-cost families had 1.24±0.84 patients with chronic conditions per household, which was significantly more than the 0.7±0.75 of the remaining families ($P$<0.05); the proportion of chronic disease patients per household of high-cost families was 0.45±0.35, which was significantly higher than the 0.29±0.34 of the remaining families ($P$<0.05).

**Table 3: Population composition of sampled families**

| Population composition | High-cost families *N*=631(5%) | Remaining families *N*=11986(95%) | *P* |
|---|---|---|---|
| Family member amount | 3.2±1.4 | 2.9±1.3 | 0.000 |
| Old-age dependency ratio (%, x±s) | 0.436±0.396 | 0.348±0.402 | 0.000 |
| Chronic disease patients amount per household (x±s) | 1.24±0.84 | 0.7±0.75 | 0.033 |
| Proportion of chronic disease patients per household (%, x±s) | 45.2±34.6 | 28.8±33.9 | 0.013 |

**Medical service utilization**

Table 4 described that high-cost families needed more outpatient services paired with inpatient services. Bi-weekly emergency department visits per household preceding the household investigation of high-cost families was 1.19±0.84, which was significantly more than the 0.68±0.76 of the remaining families ($P$<0.05); annual hospitalizations preceding the household investigation per household of high-cost families was 0.98±0.89, which was significantly more than the 0.17±0.43 of the remaining families ($P$<0.05).

**Table 4: Medical care utilization of sampled families**

| Medical care utilization | High-cost families $N$=631(5%) | Remaining families $N$=11986(95%) | $P$ |
|---|---|---|---|
| 2-week emergency department visits per household | 1.19±0.84 | 0.68±0.76 | 0.000 |
| Annual hospitalizations per household | 0.98±0.89 | 0.17±0.43 | 0.000 |

**SHI coverage**

Table 5 presented SHI coverage of sampled families: 97.3% of high-cost families were covered by SHI, which had no significant difference from the 97.5% of the remaining families ($P$>0.05).

**Table 5: SHI coverage of sampled families**

| SHI | High-cost families $N$=631(5%) | | Remaining families $N$=11986(95%) | | $P$ |
|---|---|---|---|---|---|
| | Families amount | Ratio (%) | Families amount | Ratio (%) | |
| Covered | 614 | 97.3 | 11688 | 97.5 | 0.744 |
| Not covered | 17 | 2.7 | 298 | 2.5 | |

**Factors associated with the high medical expenditure of high-cost families**

This study explored factors associated with the high medical expenditures of high-cost families using a binary logistic regression model (see table 6). The regression model used a stepwise selection and used high-cost families, and remaining families as the two explained variables; Family member amount, chronic

disease patients amount per household, 2-week emergency department visits per household and annual hospital admissions per household were taken as potential predictors; Family annual income and family domicile (urban/rural)were used as controlled variables. In general, the study found that families with larger population (*OR*=1.152, 95% C.I. 1.084 to 1.223), more chronic disease patients (*OR*=1.508, 95% C.I. 1.296 to 1.754), and which utilized more outpatient services (*OR*=1.218, 95% C.I. 1.049 to 1.415) and inpatient services (*OR*=4.577, 95% C.I. 4.082 to 5.133) were more likely to be high-cost families. Family annual income and family domicile did not have a significant impact on whether or not a family became a high-cost family.

**Table 6: Factors associated the high medical expenditures of high-cost families**

| Covariates | *B* | *S.E.* | *Wald* | *P* | *OR* | 95% *C.I.* for *OR* | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| Family member amount | 0.150 | 0.034 | 5.215 | 0.037 | 1.152 | 1.084 | 1.223 |
| Chronic disease patients amount per household | 0.410 | 0.077 | 28.227 | 0.000 | 1.508 | 1.296 | 1.754 |
| 2-week emergency department visits per household | 0.197 | 0.076 | 6.654 | 0.010 | 1.218 | 1.049 | 1.415 |
| Annual hospital admissions per household | 1.521 | 0.058 | 676.796 | 0.000 | 4.577 | 4.082 | 5.133 |
| Family annual income | 0.042 | 0.081 | 0.127 | 0.549 | 1.071 | 0.929 | 1.301 |
| Family domicile | 0.028 | 0.090 | 0.097 | 0.755 | 1.029 | 0.862 | 1.228 |

## Discussion

In Chinese healthcare setting, the family as a collection of family members plays a decisive role in a member's medical services utilization and medical expenditures. Moreover, the family is usually treated as a whole for financing and reimbursement. Therefore, from this perspective, this initial study to explore the characteristics of high-cost families in a Chinese setting is of particular significance for the development of appropriate interventions to improve the management and

financing of the population(18). While little was known about which healthcare system, health insurance system, or socio-demographical characteristics caused a family to be high-cost, thus far, most of the limited evidence comes from case studies. KeXu, et al. found that households headed by the elderly, the disabled, the unemployed, or the poor, and those with reduced access to health insurance were more likely to be high-cost households (19, 20). Their results were different from ours to some extent. From the perspective of family, we found that whether or not a family was covered by SHI, or was poor, the household was likely to be a high-cost family. In the present study, we found that four factors, family member amount, chronic disease patient amount per household, 2-week emergency department visits per household, and annual hospital admissions per household were associated with the high medical expenditures of a family and made it more vulnerable to financial risk. The first reason was that families with a larger population tend to need more medical care, and thus the total medical services utilized and medical expenditures are higher than other families. The second reason was the family compostion of high cost population is different from the remaining families. In this study, we found that high cost families had a greater proportion of old-aged members and chronic disease patients within a household. Another possible reason is that the present SHI of China only takes the responsibility of reimbursement, but hardly takes patients' rationale use of medical services into consideration. According to Chen Yingchun, et al., the inappropriate admission rate of township hospital and a county hospital in a selected county in Hubei Province of China, were 13.01% and 12.14%, respectively (21). However, the new Rural Cooperative Medical Service Systemrarely monitored such inappropriate admissions (22). The inappropriate use of medical services might or

should be one of the potential drivers of the high costs of some families.

The characterization of high-cost families is implicational for SHI policy development. This study indicated that the top 5% highest cost families in the Fifth Health Service Investigation of Jiangsu Province (2013) accounted for approximately half of total medical expenses. This finding was consistent with the results reported by Donna M Zulman (2015)(1) and J. Lester Feder (2011)(2). Besides, we found that the average proportions of medical expenditures in household income remaining after subsistence needs of high-cost families and the remaining families have been accounted for was 46.9% and 6.9%, respectively. According to the World Health Organization (WHO), a health expenditure will be viewed as catastrophic whenever it is greater than or equal to 40% of a household's non-subsistence income, i.e., the income available for basic needs have been met(23). The present study indicated that high-cost families have a greater likelihood of a catastrophic health expenditure. In one international perspective study, Ke Xu, et al. (2003)(19) proposed that even small costs for common illnesses can be financially disastrous for poor households with no insurance coverage. However, in our study, we surprisingly found that even when covered by Chinese SHI, high-cost families could still face financial disaster.Health reform experiences in many countries highlight that health systems requiring lower out-of-pocket payments for health care could offer better protection to the poor against catastrophic spending(24,25). Therefore, in the next stage of healthcare reform, Chinese SHI designers should understand that the few (5%) high-cost families were the most costly to healthcare services, and policymakers should find solutions to reduce the high out-of-pocket burdens among these families(26).

It is noteworthy that high-cost families used more medical services than the

remaining families and their high need might be related to family members who are older and suffer from chronic disease. A series of previous studies had proven that both groups were high utilizers and accounted for significantly more medical expenditures. For example, analysis of the national databases of Scotland showed that 34% of community members over the age of 65 falls at least once per year and 20% of them contacted a medical service for assistance(27). A study in China found that 54.9% of 4,162 elderly people with cardiovascular disease received outpatient care and 17.7% received inpatient care over the past 12 months(28). Because these families need more medical services, health policy makers must be vigilant about avoidable or preventable care utilization in the healthcare system, which was a common occurrence and represented a significant component of high medical expenditures. Within the US setting, overuse and misuse of diagnostic testing, avoidable hospitalization and re-hospitalization, and overuse of emergency department services caused approximately 30% of healthcare costs or amounted to more than $700 billion wasted per year. High-cost patients accounted for 79.0% of inpatient costs, 9.6%of which were due to preventable hospitalizations; additionally, 43.3% of emergency department spending and 13.5% of inpatient spending were preventable among persistently high-cost patients(29). Policymakers and researchers had suggested it was the responsibility of the medical profession to become cost-conscious and decrease unnecessary care that does not benefit patients but represents a substantial percentage of healthcare costs(30). Some policy makers have apparently foreseen the greatest significance of the control of irrational medical services utilization for the high-cost population. Many health projects or plans in the United States, such as the Complex Care Management Program, the HealthCare

Partners Medical Group, and the Patient-Aligned Care Team, Colorado Access have been implemented to improve the management of care for high-cost Medicaid patients and to reduce their avoidable emergency department services and hospitalizations (31,32).

However, in China and many other Asian and African countries with scarce health resources, the high-cost population was rarely identified, let alone to design health programs to improve the management. The findings in this study suggested that in China and other countries, this high-cost population existed and might waste more health care costs than the general population. Care management programs to promote the rational use of medical services and to control the medical expenditures of high-cost families should be explored and implemented as soon as possible(33).

The study's strengths comprised the investigation from a family perspective within large geographical areas. Besides, the binary logistic regression model was used appropriately to adjust the confounders and find the related factors with high medical expenses in Chinese healthcare settings. However, the study had several limitations that should be noted. First, the data were collected only in Jiangsu Province, which is an economically developed province and might not be representative of other economically developing areas in China. Further research in other economically developing areas or at the national level is needed to provide comprehensive evidence for SHI policymakers. Second, although the high-cost population had attracted attention from many policymakers and researchers from the WHO and the US for the past decades, there was no consensus on the concept of high-cost population and identity standards. More theoretical studies should be carried out to determine the concept and measurement methods(34, 35).

## Conclusion

In conclusion, our analysis of the high-cost population from a family perspective suggested that while the universal SHI had been set up in China, its effectiveness in lowering high-cost families' risk of catastrophic health expenditure was modest. As only a few high-cost families accounted for half of the healthcare spending, future SHI designers should ensure that the out-of-pocket burden of this population is lowered in priority. Further, care management programs to promote the rational use of medical services and to control medical expenditures of high-cost families should be addressed by SHI of China.

## List of Abbreviations

SHI, Social Health Insurance

## Data Sharing Statement

The data are available through the email of the corresponding author.

## Declarations

### Competing interests

All authors consent for publication.The authors declare that they have no competing interests: there are no financial/non-financial competing interests.

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over the Fifth Health Service Investigation of Jiangsu Province (2013).

**Authors' Contributions**

Yudong Miao participated in the design of the study, performed the statistical analysis, and drafted the manuscript. Prof. Liang Zhang provided guidance on data analysis and policy suggestions. Prof. DongfuQian and Dr. Ting Ye modified the manuscript. Dr. Sandeep Sandeep helped to edit the language. Dan Hu and YadongNiu helped to analyze the data and collect references. All authors read and approved the final manuscript.

**Reference**

1. Donna M Zulman, Christine Pal Chee, Todd H Wagner, Jean Yoon, Danielle M Cohen, Tyson H Holmes, Christine Ritchie, Steven M Asch. Multimorbidity and healthcare utilization among high-cost patients in the US Veterans Affairs HealthCare System. BMJ Open, 2015, 5:1-9.

2. J. Lester Feder. Predictive Modeling AndTeam Care For High-Need PatientsAt HealthCare Partners. Health Affairs, 2014, 33(7):1123-1131.

3. Robert T. Quinlivan, L.C.S.W.Treating High-Cost Users of behavioural Health Services in Health Maintenance Organization. PSYCHIATRIC SERVICES,2000, 51(2):159-162.

4. Xin, Haichang. How Do High Cost-Sharing Policies for Physician Care Affect Inpatient Care Use and Costs Among People With Chronic Disease? Journal of Ambulatory Care Management, 2015,38(2):100-108.

5. Sarnak DO, Ryan J. How High-Need Patients Experiences the Health Care System in Nine Countries. Issue Brief (Commonwealth Fund), 2016, 1:1-14.

6. China statistical yearbook 2015.

http://www.stats.gov.cn/tjsj/ndsj/2015/indexch.htm)

7. Zhou Qin, Zang Wenbin, Liu Guoen. Health Insurance Coverage and Medical Financial Risks for Chinese Households, INSURANCE STUDIES, 2013,7(7):95-107.

8. LI Hui, TANG Jing-Xia, QIN Jiang-metanalysis on the Economic Risks of Diseases, Catastrophic Expenditure on Health and Its Influence Factors of urban families in Hami Area. Chinese Health Economics, 2015, 34(7):48-50.

9. PietzKenneth, Byrne Margaret, Petersen Laura. A Decision-Theoretic Approach to Identifying Future High-Cost Patients. Medical Care, 2006, 44(9): 842-849.

10. Winnie Yip, William Hsiao. Harnessing the privatization of China's fragmented healthcare delivery. Lancet, 2014, 384: 805-818.

11. YI Hongmei, YAO Yezhou, ZHANG Linxiu. Impact of New Rural Cooperative Medical Scheme on farmers'utilization of medical care and medical expenditure: Evidence from panel data in 5 Provinces. Chinese Journal of Health Policy, 2013, 6(2): 25-29.

12. Qian Long, Ling Xu, Henk Bekedam and Shenglan Tang, Changes in health expenditures in China in2000s: has the health system reform improved affordability. International Journal for Equity in Health 2013, 12:40.

13. Jens Leth Hougaard, Lars Peter Østerdal, Yi Yu. The Chinese Healthcare System Structure, Problems and Challenges. Appl Health Econ Health Policy, 2011, 9 (1): 1-13.

14. SeyedAbdolmotallebIzadShenas, BijanRaahemi, MohammadHosseinTekieh, CraigKuziemsky. Identifying high-cost patients using datamining techniques and a small set of non-trivial attributes. Computers inBiologyandMedicine, 2014,53:9-18.

15. Rais S, Nazerian A, Ardal S, Chechulin Y, Bains N, Malikov K. High-cost users of Ontario's healthcare services. Healthcare Policy, 2013,9(1):44-51.

16. Calver J, Brameld KJ, Preen DB, Alexia SJ, Boldy DP, McCaul KA. High-cost users of hospital beds in Western Australia: a population-based record linkage study. Med JAust, 2006, 184(8):393-397.

17. Leena K. Saastamoinen, Jouko Verho. Drug expenditure of high-cost patients and their characteristics in Finland. Eur J Health Econ, 2013: 14:495–502.

18. Walter P. Wodchis, Peter C. Austin, David A. Henry. A 3-year study of high-cost users of health care. CMAJ,2016, 188(3): 182-188.

19. Ke Xu, David B Evans, Kei Kawabata, Riadh Zeramdini, Jan Klavus, Christopher J L Murray. Household catastrophic health expenditure: a multicountry analysis. Lancet, 2003, 362: 1711–1716.

20. Wyszewianski L. Families with catastrophic health care expenditures.Health Serv Res, 1986, 21: 617–634.

21. Chen Xiaoyan, Zhu Shuo, Wang Cheng, Zhang Meifang, GaoXiaona, Chu Zhaoqun, Chen Yingchun.Effects of the Inappropriate Admission Patients under New Rural Cooperative Medical System on the Use Efficiency of Hospital Fund in a County，Hubei. Medicine and Society, 2013, 26(5):9-11.

22. ZhuShuo,Chen Xiaoyan, Wang Cheng, GaoXiaona, Chu Zhaoqun, Chen Yingchun. The Implication of Research on Inappropriate Hospital Admissions Overseas. Medicine and Society, 2013, 26(4):15-17.

23. World Health Organization 2005.Designing health financing systems to reduce catastrophic health expenditure.
http://www.who.int/health_financing/documents/cov-pb_e_05_2-cata_sys/en/

24. KeXu, David B. Evans, Guido Carrin, Ana Mylena Aguilar-Rivera, Philip Musgrove, Timothy Evans. Protecting Households FromCatastrophic Health Spending. Health

Affairs, 2007, 26(4):972-983.

25. Jane Falkingham. Poverty, out-of-pocket payments and access to health care: evidence from Tajikistan. Social Science & Medicine, 2004, 58(2):247–258.

26. Yasuyuki Okumura, Hiroto Ito. Out-of-pocket expenditure burdens in patients with cardiovascular conditions and psychological distress: a nationwide cross-sectional study. General Hospital Psychiatry, 2013, 35: 233-238.

27. J Craig, A Murray, S Mitchell, S Clark, L Saundersand L Burleigh. The high cost to health and social care of managing falls in older adults living in the community in Scotland. Scottish Medical Journal, 2013, 58(4): 198–20.

28. Dou L, Liu X, Zhang T, Wu Y. Health care utilization in older people with cardiovascular disease in China. Int J Equity Health, 2015,14:59.

29. Karen E. Joynt, Atul A. Gawande, E. John Orav, Ashish K. Jha. The contribution of Preventable Acute Care Spending to Total Spending for High-Cost Medicare Patients. JAMA, 2013, 309(24):2572-2578.

30. Steven E. Weinberger. Providing High-Value, Cost-Conscious Care: A Critical Seventh GeneralCompetency for Physicians. Annals of Internal Medicine, 2011,155:386-388.

31. Clemens S. Hong, Allison L. Siegel, Timothy G. Ferris.Caring for High-Need, High-Cost Patients: What Makes for a Successful Care ManagementProgram?Issue Brief(Commonwealth Fund), 2014, 19:1-19.

32. Institute of Medicine. The Healthcare Imperative: Lowering Costs and Improving Outcomes. Washington, DC: National Academies Press, 2010.

33. John Billings, TodMijanovich. Improving The Management OfCare For High-CostMedicaidPatients, Health Affairs, 2007, 26(6):1643-1654.

34. Chang HY, Boyd CM, Leff B, Lemke KW, Bodycombe DP, Weiner JP. Identifying Consistent High-Cost Users in a Health Plan: Comparison of Alternative Prediction Models.Med Care.2016 Jun 18. [Epub ahead of print]

35. Dario Gregori MA, Michele Petrinco, Giulia Barbati, Simona Bo, Alessandro Desideri, Roberto Zanetti, Franco Merletti, Eva Pagano. Extreme regression models for characterizing high-cost patients. Journal of Evaluation in Clinical Practice, 2009, 15: 164–171.

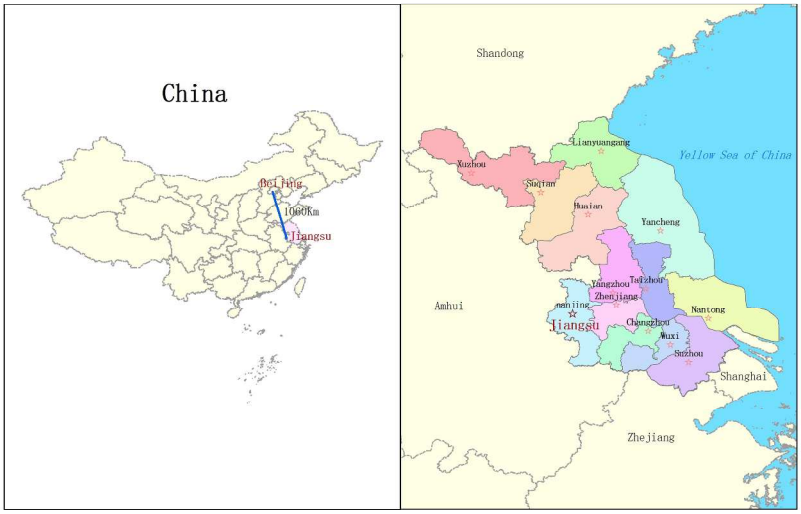
**Legends for figures**

-Figure1. Map of China, Jiangsu: geographic distribution of study places

-Figure2. Overall distribution of medical expenditures referring to the sampled families

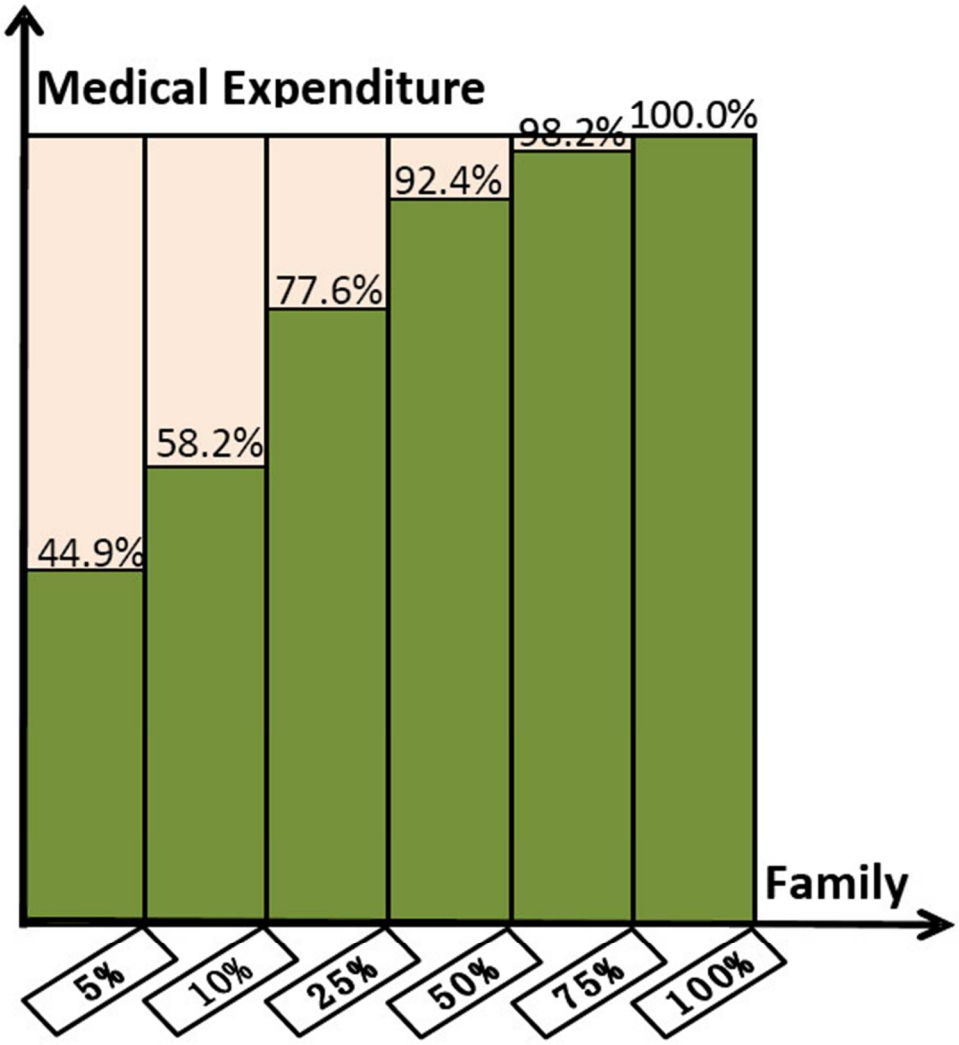
**Legends for tables**

- Table 1: Sampled counties/districts and families in this study
- Table 2: Medical expenditure of sampled families
- Table 3: Population composition of sampled families
- Table 4: Medical care utilization of sampled families
- Table 5: SHI coverage of sampled families
- Table 6: Factors associated with the high medical expenditures of high-cost families




Map of China, Jiangsu: geographic distribution of study places

297x210mm (300 x 300 DPI)




Overall distribution of medical expenditures referring to the sampled families

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**A Checklist for Reporting Characteristics of high-cost population in China—a family perspective cross-sectional study from Jiangsu Province**

| | | |
|---|---|---|
| **Reporting guideline provided for?** | The characteristics of high-cost population in China from a family perspective | Page 1 |
| **Full bibliographic reference** | Yudong Miao, Dongfu Qian, Ting Ye, Yadong Niu, Dan Hu, Liang Zhang. A Checklist for Reporting Characteristics of high-cost population in China - a family perspective cross-sectional study from Jiangsu Province (CREATE). BMJ Open. | Page 1 |
| **Language** | English | - |
| **Study design** | Economic evaluations | |
| **Applies to the whole report or to individual sections of the report?** | Data, Procedure/Method, Results, Statistical methods and analyses, Study characteristics (participants etc.), Terminology/definitions | Page 3-12 |
| **Tables** | 6 | Page 19-24 |
| **Figures** | 2 | Page 25-26 |
| **What is known about this topic** | -Across many healthcare settings and populations, 5% of the population accounts for half of the healthcare spending. They are identified as the high-cost population.<br>-How to reduce the high-cost populations' preventable medical costs and unreasonable healthcare utilization have become challenges for policymakers and the health insurance system. | Page 12 |
| **What this study adds** | - The study found that the few high-cost families (5%) accounted for approximately half of the healthcare spending. They were also at greater risk of catastrophic health expenditure than other families.<br>- The efficacy of Chinese Social Health Insurance in lowering high-cost families' financial risk is modest and future policy needs to ascertain the priority of lowering high-cost families' out-of-pocket burden.<br>- Within the health delivery system, large scale and cost-effective care management programs need to be initiated to reduce their avoidable emergency department and hospitalization services. | Page 12 |
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# Exploring the Characteristics of high-cost population from family perspective : a cross-sectional study in Jiangsu Province, China

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# Exploring the Characteristics of high-cost population from family perspective : a cross-sectional study in Jiangsu Province, China

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## Abstract

**Background:** Across a range of healthcare settings, 5% of the population accounts for half of health care spending: these patients are identified as a high-cost population. Characterizing high-cost users is essential for predicting potential high-cost patients and the development of appropriate interventions to improve the management and financing of these patients.

**Objective:** This cross-sectional study aimed to explore the characteristics of this high-cost population from a family perspective in China and provide suggestions for social health insurance policy development.

**Methods:** This study used data from the Fifth Health Service Investigation of Jiangsu Province (2013), and 12,600 families were enrolled for analysis. Households whose medical expenditures were among the top 5% were identified to be high-cost families. A t-test, a chi-square test, and a binary logistic regression were used.

**Results:** High-cost families (n=631, 5%) accounted for 44.9% of the total medical expenditure of sampled families. High-cost families had 3.2 members and 1.2 chronic disease patients per household, which is significantly more than the 2.9 members and 0.7 people in the remaining families, respectively ($P$<0.05). Bi-weekly emergency department visits and annual hospitalizations preceding the household investigation of high-cost families were 1.19 and 0.98 per household, which is significantly more than the 0.68 and 0.17 of the remaining families, respectively ($P$<0.05). A binary logistic regression indicated that the number of family members ($OR$=1.152), the number of chronic disease patients ($OR$=1.508), bi-weekly emergency department

visits (*OR*=1.218), and annual hospitalizations (*OR*=4.577)were associated with high costs.

**Conclusion:** The 5% high-cost families in Jiangsu Province accounted for approximately half of medical expenditures. The effectiveness of Chinese Social Health Insurance in lowering high-cost families' risk of catastrophic health expenditure was modest. Policy-makers need to ascertain the priority of lowering the burden of high-cost families' out-of-pocket expenses through improving the reimbursement proportion and reducing avoidable medical services.

**Key words:** High-cost population; Family; Medical expenditure; Social Health Insurance

**Strengths and limitations of this study**

- This was a huge study including 12,600 families and the first investigation on high-cost populations in a Chinese healthcare setting.
- The study not only introduced the concept of the high-cost patient to China but also explored the characteristics of this population by quantitative measurement.
- The overall study design was conducted from the family perspective, which plays a significant and extraordinary role in health policy making in China and many other Eastern Asian countries.
-The data were collected only in Jiangsu Province, which was an economically developed province and might not be representative of other economically developing areas in China. Further research in other economically developing areas or at the national level is needed to provide comprehensive evidence for policymakers.
-Although the high-cost population had attracted attention from many policy-makers and researchers from the WHO and the United States for the past decades, there was no consensus on the concept of high-cost population and identity standards. More theoretical studies should be carried out to determine and popularize the concept.

## Background

Previous studies have shown that across a range of health care settings and populations, a small number of patients account for the disproportionate amount of costs (1). Within the United States, 5% of the population accounts for approximately half of healthcare spending (1,2): these patients are known as the high-cost population(3). A few studies from Hong Kong and several European countries also represented similar findings(2, 4). Usually, these high-cost patients have multiple chronic conditions and need more health services than the average person (4,5). Their high need of medical service and the high cost of medical expense have made them a key population for health and medical insurance policy making in many states of the US (2). For this particular population, identifying their characteristics was considered to be essential since to: firstly, quite a few health projects aimed to reduce their irrational use of medical services had been implemented by medical insurance policy-makers in the US, Hong Kong and some European countries, and some medical insurance fund was saved by these projects(6); secondly, the saved fund was re-invested into medical insurance funds so as to support these health projects and lower the economic burden of disease of high-cost population(7). Although high-cost population has attracted the attention of many researchers and medical insurance policy-makers, no study has been undertaken on the high-cost population in Chinese mainland. Besides, the previous studies have been carried out from individual level, however, in the context of China and many Eastern Asian countries, family as a social function unit is decisive in family members' healthcare utilization and medical expenditures(8,9). The characteristics of these families, which are essential to health policy-makers for predicting and financing future high-cost

populations, are still unknown(10).

China is a country with 401,517,330 families(11). Exploring the characteristics of high-cost patient from family perspective are likely to be of particular interest to Chinese medical insurance policy making. In the past few decades, Chinese government attempted to reduce economic burden of disease and lower family financial risk of patients by establishing a Social Health Insurance (SHI) system covering all families. The SHI consists of the Basic Medical Insurance System for Urban Workers (since 1998), the New Rural Cooperative Medical Service System for Rural Residents (since 2003) and the Basic Medical Insurance System for Urban Residents (since 2007). Since the 2009 health care reform, the SHI has made impressive progress and more than 95% of Chinese residents have been covered. After the establishment of SHI, medical expenditures at present are payed jointly by SHI reimbursement and patient out-of-pocket payment in Chinese mainland. Moreover, outpatient services and inpatient services are reimbursed separately, and the reimbursement proportion of inpatient expenditures is usually much higher than outpatient expenditures. Improving the utilization efficiency of SHI funds is therefore thougnt to be crucial in lowering the economic burden of diseases of the residents. However, SHI faces substantial challenges due to a noticeable defect(12, 13). In most regions of Chinese mainland, SHI policy-makers condsider the patients to be same in reimbursement: No matter how much medical expenditure a patient spends, the expenses will be reimbursed in the same proportion. Policy making in this way seems fair, however, for those families with high need of medical service and the high cost of medical expenditures, the out-of-pocket expenses after SHI reimbursement is sufficient to cause a patient or family to enter into the state of absolute poverty. As a

result of this defect in SHI policy design, high-cost families, which need the SHI reimbursement most, could not obtain adequate medical insurance reimbursement funds to avoid entering the dilemma of catastrophic health expenditure. This is one of the reasons why “Costly access to health care” is and will still be the main problem to be settled for the next phase of Chinese healthcare reform(14,15).

Therefore to arouse the attention of Chinese health policy researchers and to inform SHI policy making, this paper sought to investigate household expenditures and income, family population composition, health care utilization, and SHI coverage of Chinese families. The objectives were to (1) characterize the 5% highest cost families regarding their medical expenditures, family population composition, health care utilization, and SHI coverage and (2) determine the associations between medical expenditures, family population composition, health care utilization, SHI coverage, Family annual income and Family domicile among the population.

## Methods

### Population and data sources

This family perspective study used household investigation data from the Fifth Health Service Investigation of Jiangsu Province (2013) (See figure 1). The 2013 investigation used a multi-stage random cluster sampling method and was conducted from August to November 2013. Eighteen counties/districts from all 102 counties/districts of Jiangsu Province, 05 towns/sub-districts within each selected county/district, and 02 villages/communities within each selected town/sub-district were chosen as investigation sites. According to the population size, the enrolled 18 counties/districts were divided into two categories: if the population size of a county/district was larger than the average, 90 families within each village of the county/district were

randomly selected; or else, 60 families within each village were randomly selected. In total, this investigation enrolled 18 counties (6 counties with a large population and 12 counties with a small population), 90 towns/sub-districts, 180 villages/communities and 12600 families to conduct its household investigation (see table 1). Each county health bureau was responsible for organizing their local investigation. The household investigation questionnaire used in Jiangsu Province was developed by the national health and Family Planning Commission of the People'sRepublic of China. Well-trained interviewers who were township hospital physicians, with support from village health workers, visited households and invited the family's head or the member who was most familiar with the healthcare utilization and spending of the family to participate in the survey. Face-to-face interviews using a structured questionnaire were conducted to collect information about household medical expenditures and other expenditures, household income, family population composition, health care utilization, and social health insurance coverage.

**Table 1: Sampled counties/districts and families in this study**

| Investigation sites | Family amount | Average population per family | Investigation sites | Family amount | Average population per family |
|---|---|---|---|---|---|
| Gaochun District | 900 | 3.0 | Gusu District | 600 | 2.5 |
| Liyang County | 900 | 2.7 | Chongchuan District | 600 | 2.9 |
| Haimen County | 900 | 2.3 | Xishan District | 600 | 3.3 |
| Gaoyou County | 900 | 2.8 | Xinpu District | 600 | 2.9 |
| Danyang County | 900 | 3.2 | Jinhu County | 600 | 2.5 |
| Jiangyan County | 900 | 2.6 | Tinghu District | 600 | 3.1 |
| Qinhuai District | 600 | 2.6 | Yangzhong County | 600 | 3.2 |
| Jiangyin County | 600 | 3.3 | Qishuyan District | 600 | 2.8 |
| Pizhou County | 600 | 3.2 | Sucheng District | 600 | 3.4 |

## Statistical analysis

We categorized families as "high cost" if their total medical expenditures were among the top 5% for all families assessed(16-19). We used $\chi 2$ and *t* tests in bivariate analyses to compare high-cost families with the remaining families, by medical expenditure, family population composition, medical care utilization, and SHI coverage. A value of $P<0.05$ was considered to be statistically significant. Data were analyzed with SPSS version 19.0 (SPSS Inc., Chicago, USA; http://www.spss.com).

**Ethics Statement**

The fifth health Service Investigation of Jiangsu Province (2013) was the regular work of the Health and Family Planning Commission of Jiangsu Province, which was approved by National Health and Family Planning Commission of the People's Republic of China and National Bureau of Statistics of the People's Republic of China. All enrolled families were given a letter explaining the study, and they gave written informed consent before the household investigation. The authors were permitted by the Health and Family Planning Commission of Jiangsu Provinceto to select indicators related to the topic of this study from the overall database anonymously and use them in academic research.

**Results**

**Household medical expenditures**

In this study, household medical expenditures refer to the total expenditures of family members to pay for medical treatment (including drug costs), hospitalization, disease prevention, primary care services for pregnant women and pregnancy, children's health care and other expenses related to medical care. Figure 2 illustrated the overall distribution of medical expenditures referring to the sampled families. High-cost families (n=631, 5%) accounted for 44.9% of total healthcare spending in

2012. Table 2 showed that the average healthcare cost of high-cost families was 31,051.7±33,546.9 yuan, which was significantly higher than the 2,010.5±2,273.9 yuan of the remaining families (n=11969, 95%, $P$<0.05). Moreover, high-cost families faced greater financial risk than the remaining 95% of families. The results showed that high-cost families' medical expenses accounted for 46.9% of the household income that remained after subsistence needs, which was significantly higher than the 7.9% of the remaining families ($P$<0.05).

**Table 2: Medical expenditure of sampled families**

| Medical expenditure | High-cost families $N$=631(5%) | Remaining families $N$=11986(95%) | $P$ |
|---|---|---|---|
| Total medical expenditure (yuan) | 19593622.7 | 24097853.0 | - |
| Medical expenditure per household (yuan, x±s) | 31051.7±33546.9 | 2010.5±2273.9 | 0.000 |
| The proportion of medical expenditure in household income remaining after subsistence needs (%,x±s) | 0.469±0.210 | 0.079±0.096 | 0.000 |

**Family population composition**

As shown in Table 3, high-cost families were extended families with more elderly members in aggregate, when compared with the remaining 95% of families. High-cost families in this provincial investigation had 3.2±1.4 family members per household, which was significantly more than the 2.9±1.3 people of the remaining families ($P$<0.05); old-age dependency ratio per household of high-cost families was 0.436±0.396, which was significantly higher than the 0.348±0.402 of the remaining families ($P$<0.05). Chronic condition prevalence was greater among high-cost families than among the remaining 95% families. High-cost families had 1.24±0.84 patients with chronic conditions per household, which was significantly more than the 0.7±0.75 of the remaining families ($P$<0.05); the proportion of chronic disease patients per household of high-cost families was 0.45±0.35, which was significantly

higher than the 0.29±0.34 of the remaining families ($P$<0.05).

**Table 3: Population composition of sampled families**

| Population composition | High-cost families $N$=631(5%) | Remaining families $N$=11986(95%) | $P$ |
|---|---|---|---|
| Family member amount | 3.2±1.4 | 2.9±1.3 | 0.000 |
| Old-age dependency ratio (%, x±s) | 0.436±0.396 | 0.348±0.402 | 0.000 |
| Chronic disease patients amount per household (x±s) | 1.24±0.84 | 0.7±0.75 | 0.033 |
| Proportion of chronic disease patients per household (%, x±s) | 45.2±34.6 | 28.8±33.9 | 0.013 |

## Medical service utilization

Table 4 described that high-cost families needed more outpatient services paired with inpatient services. Bi-weekly emergency department visits per household preceding the household investigation of high-cost families was 1.19±0.84, which was significantly more than the 0.68±0.76 of the remaining families ($P$<0.05); annual hospitalizations preceding the household investigation per household of high-cost families was 0.98±0.89, which was significantly more than the 0.17±0.43 of the remaining families ($P$<0.05).

**Table 4: Medical care utilization of sampled families**

| Medical care utilization | High-cost families $N$=631(5%) | Remaining families $N$=11986(95%) | $P$ |
|---|---|---|---|
| 2-week emergency department visits per household | 1.19±0.84 | 0.68±0.76 | 0.000 |
| Annual hospitalizations per household | 0.98±0.89 | 0.17±0.43 | 0.000 |

## SHI coverage

Table 5 presented SHI coverage of sampled families: 97.3% of high-cost families were covered by SHI, which had no significant difference from the 97.5% of the remaining families ($P$>0.05).

**Table 5: SHI coverage of sampled families**

| SHI | High-cost families $N$=631(5%) | | Remaining families $N$=11986(95%) | | $P$ |
|---|---|---|---|---|---|
| | Families amount | Ratio (%) | Families amount | Ratio (%) | |
| Covered | 614 | 97.3 | 11688 | 97.5 | 0.744 |
| Not covered | 17 | 2.7 | 298 | 2.5 | |

**Factors associated with the high medical expenditure of high-cost families**

This study explored factors associated with the high medical expenditures of high-cost families using a binary logistic regression model (see table 6). The regression model used a stepwise selection and used high-cost families, and remaining families as the two explained variables; Family member amount, chronic disease patients amount per household, 2-week emergency department visits per household and annual hospital admissions per household were taken as potential predictors; Family annual income and family domicile (urban/rural)were used as controlled variables. In general, the study found that families with larger population (*OR*=1.152, 95% C.I. 1.084 to 1.223), more chronic disease patients (*OR*=1.508, 95% C.I. 1.296 to 1.754), and which utilized more outpatient services (*OR*=1.218, 95% C.I. 1.049 to 1.415) and inpatient services (*OR*=4.577, 95% C.I. 4.082 to 5.133) were more likely to be high-cost families. Family annual income and family domicile did not have a significant impact on whether or not a family became a high-cost family.

**Table 6: Factors associated the high medical expenditures of high-cost families**

| Covariates | *B* | *S.E.* | *Wald* | *P* | *OR* | 95% *C.I.* for *OR* | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| Family member amount | 0.150 | 0.034 | 5.215 | 0.037 | 1.152 | 1.084 | 1.223 |
| Chronic disease patients amount per household | 0.410 | 0.077 | 28.227 | 0.000 | 1.508 | 1.296 | 1.754 |
| 2-week emergency department visits per household | 0.197 | 0.076 | 6.654 | 0.010 | 1.218 | 1.049 | 1.415 |
| Annual hospital admissions per household | 1.521 | 0.058 | 676.796 | 0.000 | 4.577 | 4.082 | 5.133 |
| Family annual income | 0.042 | 0.081 | 0.127 | 0.549 | 1.071 | 0.929 | 1.301 |
| Family domicile | 0.028 | 0.090 | 0.097 | 0.755 | 1.029 | 0.862 | 1.228 |

## Discussion

In Chinese healthcare setting, a family is usually treated as a whole for financing and reimbursement. The characterization of high-cost families is implicational for SHI

policy development. This study indicated that the top 5% highest cost families in the Fifth Health Service Investigation of Jiangsu Province (2013) accounted for approximately half of total medical expenses. This finding was consistent with the results reported by Donna M Zulman (2015)(1) and J. Lester Feder (2011)(2). Besides, we found that the average proportions of medical expenditures in household income remaining after subsistence needs of high-cost families and the remaining families have been accounted for was 46.9% and 6.9%, respectively. According to the World Health Organization (WHO), a health expenditure will be viewed as catastrophic whenever it is greater than or equal to 40% of a household's non-subsistence income, i.e., the income available for basic needs have been met(20). The present study indicated that high-cost families have a greater likelihood of a catastrophic health expenditure. In one international perspective study, Ke Xu, et al. (2003)(21) proposed that even small costs for common illnesses can be financially disastrous for poor households with no insurance coverage. However, in our study, we surprisingly found that even when covered by Chinese SHI, high-cost families could still face financial disaster. Health reform experiences in many western countries highlight that health systems requiring lower out-of-pocket payments for health care could offer better protection to the poor against catastrophic spending(22,23). Therefore, in the next stage of healthcare reform, Chinese SHI policy-makers should understand that the few (5%) high-cost families were the most costly to healthcare services, and policy-makers should reimburse their medical expenses in a higher proportion to reduce the high out-of-pocket burdens among these families(24).

The results of the binary logistic regression model is helpful to understand the characteristics of high-cost families and identify them. In the present study, we found

that four factors, family member amount, chronic disease patient amount per household, 2-week emergency department visits per household, and annual hospital admissions per household were associated with the high medical expenditures of a family and made it more vulnerable to financial risk. The first reason was that families with a larger population tend to need more medical care, and thus the total medical services utilized and medical expenditures are higher than other families. The second reason was the family compostion of high-cost population is different from the remaining families. In this study, high cost families had a greater proportion of old-aged members and chronic disease patients within a household. Another possible reason is that the present SHI only takes the responsibility of reimbursement, but hardly takes patients' rationale use of medical services into consideration. According to Chen Yingchun, et al., the inappropriate admission rate of township hospital and a county hospital in a selected county in Hubei Province of China, were 13.01% and 12.14%, respectively (25). However, the New Rural Cooperative Medical Service Systemrarely rarely monitored such inappropriate admissions (26). The inappropriate use of medical services might or should be one of the potential drivers of the high costs of some families.

It is noteworthy that high-cost families used more medical services than the remaining families and their high need might be related to family members who are older and suffer from chronic disease. A series of previous studies had proven that both groups were high utilizers and accounted for significantly more medical expenditures. For example, analysis of the national databases of Scotland showed that 34% of community members over the age of 65 falls at least once per year and 20% of them contacted a medical service for assistance(27). A study in China found

that 54.9% of 4,162 elderly people with cardiovascular disease received outpatient care and 17.7% received inpatient care over the past 12 months(28). Because these families need more medical services, health policy-makers must be particularly vigilant about avoidable or preventable care utilization in the healthcare system, which was a common occurrence and represented a significant component of high medical expenditures. Within the US setting, overuse and misuse of diagnostic testing, avoidable hospitalization and re-hospitalization, and overuse of emergency department services caused approximately 30% of healthcare costs or amounted to more than $700 billion wasted per year. High-cost patients accounted for 79.0% of inpatient costs, 9.6%of which were due to preventable hospitalizations; additionally, 43.3% of emergency department spending and 13.5% of inpatient spending were preventable among persistently high-cost patients(29). Policy-makers and researchers had suggested it was the responsibility of the medical profession to become cost-conscious and decrease unnecessary care that does not benefit patients but represents a substantial percentage of healthcare costs(30). Some policy-makers have apparently foreseen the greatest significance of the control of irrational medical services utilization for the high-cost population. Many health projects or plans in the United States, such as the Complex Care Management Program, the HealthCare Partners Medical Group, and the Patient-Aligned Care Team, Colorado Access have been implemented to improve the management of care for high-cost Medicaid patients and to reduce their avoidable emergency department services and hospitalizations (31,32).

However, in China and many other Asian and African countries with scarce health resources, the high-cost population has never been identified, and there is no health

projects focusing on higih-cost families. The findings in this study suggested that in Chinese mainland care management programs to promote the rational use of medical services and to control the medical expenditures of high-cost families should be explored and implemented by SHI as soon as possible(33).

The study's strengths comprised the investigation from a family perspective within large geographical areas. Besides, the binary logistic regression model was used appropriately to adjust the confounders and find the related factors with high medical expenses in Chinese healthcare settings. However, the study had several limitations that should be noted. First, the data were collected only in Jiangsu Province, which is an economically developed province and might not be representative of other economically developing areas in China. Further research in other economically developing areas or at the national level is needed to provide comprehensive evidence for SHI policymakers. Second, although the high-cost population had attracted attention from many policymakers and researchers from the WHO and the US for the past decades, there was no consensus on the concept of high-cost population and identity standards. More theoretical studies should be carried out to determine the concept and measurement methods(34, 35). Third, family composition is associated with the high cost of medical expenditures in this initiative study, however, how certain family demographics mitigate specific types of spending still needs further exploration. Findings from this interesting problem may produce policy recommendations on high-cost population care management programs to be designed and implemented by Chinese SHI.

**Conclusion**

In conclusion, our analysis of the high-cost population from a family perspective

suggested that while the universal SHI had been set up in Chinese mainland, its effectiveness in lowering high-cost families' risk of catastrophic health expenditure was modest. As only a few high-cost families accounted for half of the healthcare spending, future SHI designers should ensure that the out-of-pocket burden of this population is lowered in priority. Further, care management programs to promote the rational use of medical services and to control medical expenditures of high-cost families should be addressed by SHI of China.

**List of Abbreviations**

SHI, Social Health Insurance

**Data Sharing Statement**

The anonymized data set is available through the email of the corresponding author.

**Declarations**

**Competing interests**

All authors consent for publication.The authors declare that they have no competing interests: there are no financial/non-financial competing interests.

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**Authors' Contributions**

Yudong Miao participated in the design of the study, performed the statistical analysis, drafted and revised the manuscript. Prof. Liang Zhang provided guidance on data analysis and policy suggestions. Prof. Dongfu Qian and Dr. Ting Ye modified the manuscript. Dr. Sandeep Sandeep helped to edit the language, the introduction and the discussion. Dan Hu and YadongNiu helped to analyze the data and collect references. All authors read and approved the final manuscript.

**Reference**

1. Donna M Zulman, Christine Pal Chee, Todd H Wagner, Jean Yoon, Danielle M Cohen, Tyson H Holmes, Christine Ritchie, Steven M Asch. Multimorbidity and healthcare utilization among high-cost patients in the US Veterans Affairs HealthCare System. BMJ Open, 2015, 5:1-9.

2. J. Lester Feder. Predictive Modeling AndTeam Care For High-Need PatientsAt HealthCare Partners. Health Affairs, 2014, 33(7):1123-1131.

3. Robert T. Quinlivan, L.C.S.W.Treating High-Cost Users of behavioural Health Services in Health Maintenance Organization. PSYCHIATRIC SERVICES,2000, 51(2):159-162.

4. Xin, Haichang. How Do High Cost-Sharing Policies for Physician Care Affect Inpatient Care Use and Costs Among People With Chronic Disease? Journal of Ambulatory Care Management, 2015,38(2):100-108.

5. Sarnak DO, Ryan J. How High-Need Patients Experiences the Health Care System in Nine Countries. Issue Brief (Commonwealth Fund), 2016, 1:1-14.

6. Ronksley P E, Kobewka D M, McKay J A, et al. Clinical characteristics and preventable acute care spending among a high cost inpatient population. BMC health services research, 2016, 16(1): 165.

7. Hayes S L, Salzberg C A, McCarthy D, et al. High-Need, High-Cost Patients: Who Are They and How Do They Use Health Care? A Population-Based Comparison of Demographics, Health Care Use, and Expenditures. Issue brief (Commonwealth Fund), 2016, 26: 1-14.

8. Zhou Qin, Zang Wenbin, Liu Guoen. Health Insurance Coverage and Medical Financial Risks for Chinese Households, INSURANCE STUDIES, 2013,7(7):95-107.

9. LI Hui, TANG Jing-Xia, QIN Jiang-metanalysis on the Economic Risks of Diseases, Catastrophic Expenditure on Health and Its Influence Factors of urban families in Hami Area. Chinese Health Economics, 2015, 34(7):48-50.

10. PietzKenneth, Byrne Margaret, Petersen Laura. A Decision-Theoretic Approach to Identifying Future High-Cost Patients. Medical Care, 2006, 44(9): 842-849.

11. China statistical yearbook 2015.

http://www.stats.gov.cn/tjsj/ndsj/2015/indexch.htm)

12. Winnie Yip, William Hsiao. Harnessing the privatization of China's fragmented healthcare delivery. Lancet, 2014, 384: 805-818.

13. YI Hongmei, YAO Yezhou, ZHANG Linxiu. Impact of New Rural Cooperative Medical Scheme on farmers'utilization of medical care and medical expenditure: Evidence from panel data in 5 Provinces. Chinese Journal of Health Policy, 2013, 6(2): 25-29.

14. Qian Long, Ling Xu, Henk Bekedam and Shenglan Tang, Changes in health expenditures in China in2000s: has the health system reform improved affordability. International Journal for Equity in Health 2013, 12:40.

15. Jens Leth Hougaard, Lars Peter Østerdal, Yi Yu. The Chinese Healthcare System Structure, Problems and Challenges. Appl Health Econ Health Policy, 2011, 9 (1):

1-13.

16. SeyedAbdolmotallebIzadShenas, BijanRaahemi, MohammadHosseinTekieh, CraigKuziemsky. Identifying high-cost patients using datamining techniques and a small set of non-trivial attributes. Computers inBiologyandMedicine, 2014,53:9-18.

17. Rais S, Nazerian A, Ardal S, Chechulin Y, Bains N, Malikov K. High-cost users of Ontario's healthcare services. Healthcare Policy, 2013,9(1):44-51.

18. Calver J, Brameld KJ, Preen DB, Alexia SJ, Boldy DP, McCaul KA. High-cost users of hospital beds in Western Australia: a population-based record linkage study. Med JAust, 2006, 184(8):393-397.

19. Leena K. Saastamoinen, Jouko Verho. Drug expenditure of high-cost patients and their characteristics in Finland. Eur J Health Econ, 2013: 14:495–502.

20. World Health Organization 2005.Designing health financing systems to reduce catastrophic health expenditure.
http://www.who.int/health_financing/documents/cov-pb_e_05_2-cata_sys/en/

21. Ke Xu, David B Evans, Kei Kawabata, Riadh Zeramdini, Jan Klavus, Christopher J L Murray. Household catastrophic health expenditure: a multicountry analysis. Lancet, 2003, 362: 1711–1716.

22. KeXu, David B. Evans, Guido Carrin, Ana Mylena Aguilar-Rivera, Philip Musgrove, Timothy Evans. Protecting Households FromCatastrophic Health Spending. Health Affairs, 2007, 26(4):972-983.

23. Jane Falkingham. Poverty, out-of-pocket payments and access to health care: evidence from Tajikistan. Social Science & Medicine, 2004, 58(2):247–258.

24. Yasuyuki Okumura, Hiroto Ito. Out-of-pocket expenditure burdens in patients with cardiovascular conditions and psychological distress: a nationwide

cross-sectional study. General Hospital Psychiatry, 2013, 35: 233-238.

25. Chen Xiaoyan, Zhu Shuo, Wang Cheng, Zhang Meifang, GaoXiaona, Chu Zhaoqun, Chen Yingchun.Effects of the Inappropriate Admission Patients under New Rural Cooperative Medical System on the Use Efficiency of Hospital Fund in a County，Hubei. Medicine and Society, 2013, 26(5):9-11.

26. ZhuShuo,Chen Xiaoyan, Wang Cheng, GaoXiaona, Chu Zhaoqun, Chen Yingchun. The Implication of Research on Inappropriate Hospital Admissions Overseas. Medicine and Society, 2013, 26(4):15-17.

27. J Craig, A Murray, S Mitchell, S Clark, L Saundersand L Burleigh. The high cost to health and social care of managing falls in older adults living in the community in Scotland. Scottish Medical Journal, 2013, 58(4): 198–20.

28. Dou L, Liu X, Zhang T, Wu Y. Health care utilization in older people with cardiovascular disease in China. Int J Equity Health, 2015,14:59.

29. Karen E. Joynt, Atul A. Gawande, E. John Orav, Ashish K. Jha. The contribution of Preventable Acute Care Spending to Total Spending for High-Cost Medicare Patients. JAMA, 2013, 309(24):2572-2578.

30. Steven E. Weinberger. Providing High-Value, Cost-Conscious Care: A Critical Seventh GeneralCompetency for Physicians. Annals of Internal Medicine, 2011,155:386-388.

31. Clemens S. Hong, Allison L. Siegel, Timothy G. Ferris.Caring for High-Need, High-Cost Patients: What Makes for a Successful Care ManagementProgram?Issue Brief(Commonwealth Fund), 2014, 19:1-19.

32. Institute of Medicine. The Healthcare Imperative: Lowering Costs and Improving Outcomes. Washington, DC: National Academies Press, 2010.

33. John Billings, TodMijanovich. Improving The Management OfCare For High-CostMedicaidPatients, Health Affairs, 2007, 26(6):1643-1654.

34. Chang HY, Boyd CM, Leff B, Lemke KW, Bodycombe DP, Weiner JP. Identifying Consistent High-Cost Users in a Health Plan: Comparison of Alternative Prediction Models.Med Care.2016 Jun 18. [Epub ahead of print]

35. Dario Gregori MA, Michele Petrinco, Giulia Barbati, Simona Bo, Alessandro Desideri, Roberto Zanetti, Franco Merletti, Eva Pagano. Extreme regression models for characterizing high-cost patients. Journal of Evaluation in Clinical Practice, 2009, 15: 164–171.

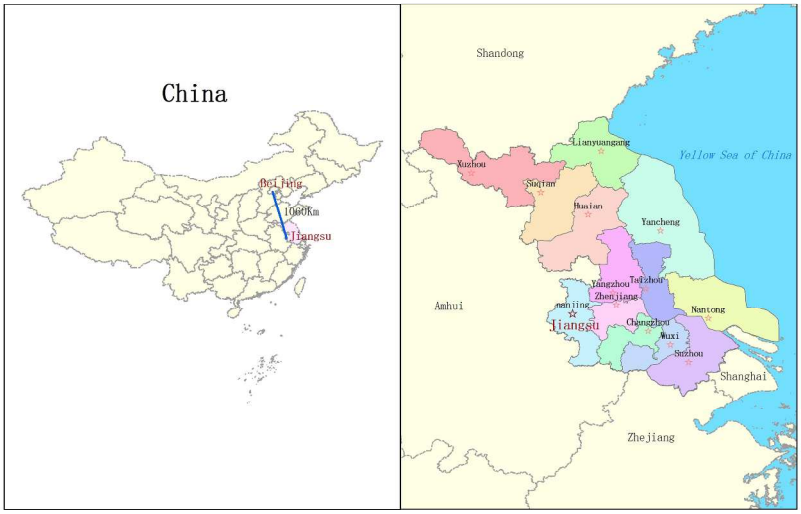
**Legends for figures**

-Figure1. Map of China, Jiangsu: geographic distribution of study places

-Figure2. Overall distribution of medical expenditures referring to the sampled families

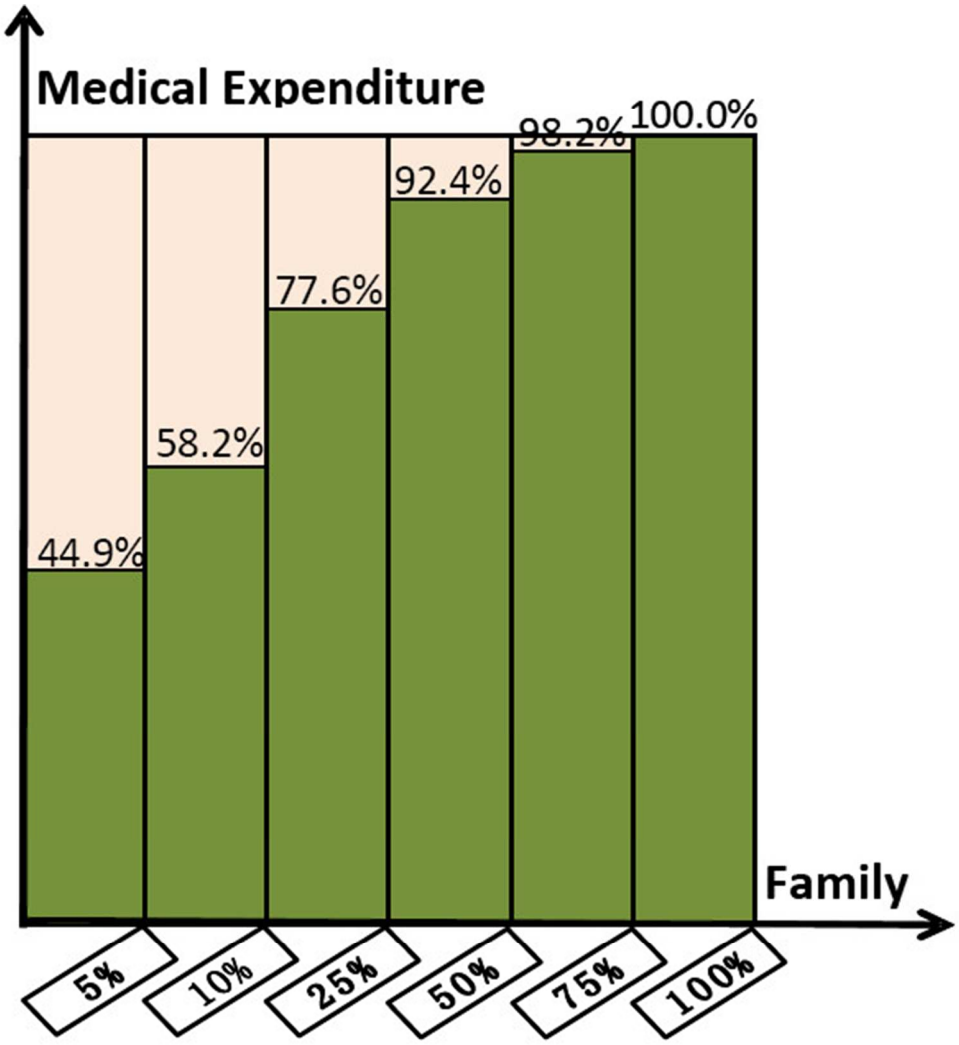
**Legends for tables**

- Table 1: Sampled counties/districts and families in this study
- Table 2: Medical expenditure of sampled families
- Table 3: Population composition of sampled families
- Table 4: Medical care utilization of sampled families
- Table 5: SHI coverage of sampled families
- Table 6: Factors associated with the high medical expenditures of high-cost families




Map of China, Jiangsu: geographic distribution of study places

297x210mm (300 x 300 DPI)




Overall distribution of medical expenditures referring to the sampled families

214x223mm (300 x 300 DPI)

**A Checklist for Reporting Characteristics of high-cost population in China—a family perspective cross-sectional study from Jiangsu Province**

| | | |
|---|---|---|
| **Reporting guideline provided for?** | The characteristics of high-cost population in China from a family perspective | Page 1 |
| **Full bibliographic reference** | Yudong Miao, Dongfu Qian, Ting Ye, Yadong Niu, Dan Hu, Liang Zhang. A Checklist for Reporting Characteristics of high-cost population in China - a family perspective cross-sectional study from Jiangsu Province (CREATE). BMJ Open. | Page 1 |
| **Language** | English | - |
| **Study design** | Economic evaluations | |
| **Applies to the whole report or to individual sections of the report?** | Data, Procedure/Method, Results, Statistical methods and analyses, Study characteristics (participants etc.), Terminology/definitions | Page 3-12 |
| **Tables** | 6 | Page 19-24 |
| **Figures** | 2 | Page 25-26 |
| **What is known about this topic** | -Across many healthcare settings and populations, 5% of the population accounts for half of the healthcare spending. They are identified as the high-cost population.<br>-How to reduce the high-cost populations' preventable medical costs and unreasonable healthcare utilization have become challenges for policymakers and the health insurance system. | Page 12 |
| **What this study adds** | - The study found that the few high-cost families (5%) accounted for approximately half of the healthcare spending. They were also at greater risk of catastrophic health expenditure than other families.<br>- The efficacy of Chinese Social Health Insurance in lowering high-cost families' financial risk is modest and future policy needs to ascertain the priority of lowering high-cost families' out-of-pocket burden.<br>- Within the health delivery system, large scale and cost-effective care management programs need to be initiated to reduce their avoidable emergency department and hospitalization services. | Page 12 |
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