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Public satisfaction with health system in China: Rural and geographic variations during 2013 to 2015

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Title Page

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Abstract

Objective We aimed to explore how the public satisfaction of the health system in China varies with social and economic factors, especially, rural and geographic variations and changes during 2013 to 2015.

Design Population-based, cross-sectional survey performed between July 2013 and July 2015..

Setting General population of China during 2013 to 2015

Participants Totally 15,969 participants (women=49.4%, sample-weighted average age =51.9)

Primary outcome measure Public satisfaction in the health system, defined as "being satisfied " if a respondent's satisfaction score ≥ 70 points

Results 1) The two-year mean of the satisfaction score of the sample is 68.5 out of 100 points and the score in 2015 is higher than 2013 by 3.5 points. 2) Senior respondents (OR=1.19, p=0.000), rural respondents (OR=1.23, p=0.009) and those with higher socioeconomic status are more likely to report being satisfied. Internal migrants (OR=0.75, p=0.000) and those with a higher level of education are less likely to report being satisfied. 3)Total health expenditure percentage of GDP and density of hospital beds have significant positive association (OR=1.13, p=0.000). Meanwhile, the government's share in total health expenditure has a moderate negative association with satisfaction (OR=0.97, p= 0.000). In rural areas, the density of hospital beds has positive association (OR=1.26, p= 0.002). 4) The Northeast region and Shanghai (OR =0.49, p=0.000; OR=0.71, p=0.034) are less likely to report being satisfied, and remained unchanged in 2015.

Conclusion There are considerable disparities in the public satisfaction of health system in China, associated with demographic and socioeconomic characteristics, geographic locations, urban-rural environment and regional health resource abundance. Actions are recommended to improve satisfaction with the public health system, especially in Northeast region of China.

Strengths and limitations of this study

- This study found a moderate negative association with the share of government in the healthcare expenditure, suggesting dissatisfaction derived from the experience with the public health system.

- This study provides empirical evidence about the rural-city disparity and the geographic variations in health satisfaction in China. During the study period, the satisfaction of internal migrants and residents in Northeast region remains unchanged. These findings have important policy implication.

- The survey dataset contains only one global satisfaction score. This data limitation makes it difficult to further attribute the satisfaction or dissatisfaction to specific reform actions or issues of the health system.

- Public satisfaction may be biased by confounding factors, such as media and political discussion, or the citizens' expectations.

Public satisfaction with health system in China: Rural and geographic variations during 2013 to 2015

INTRODUCTION

The public satisfaction with health systems is considered one of the most coherent indicators of the general subjective evaluation of healthcare, as well as the acceptability and effectiveness of the healthcare reform[1, 2]. It is a reflection of the shift towards people-centered health system and the emphasis on the responsiveness of the system[3]. The results of public satisfaction surveys may be influenced by wide-ranging factors, such as respondents' views on the general state of affairs in the country[2], debates around the nature and effectiveness of the health system, social welfare culture and media portrayals of the health system[3, 4].

Public satisfaction indicator has several advantages over patient satisfaction measurement. First, it represents a mixture of citizens' personal experiences with the health system and their broader views[2] beyond the provision of quality services; Second, it gathers information on satisfaction from the whole population, including both users and non-users of services. Third, it may affect how the general population utilizes services and their trust in the system[5]. In short, the public satisfaction with health systems has become integral to cross-country and across-time comparisons of health systems[3, 4, 6], as well as health policy evaluations[3, 7].

For decades the priority of the health system in China is set to meet the basic survival needs, such as reducing the mortality[8, 9]. The public satisfaction was not included in the official measurement in China. However, China has achieved a rapid decline in mortality and an unprecedented increase in life expectancy in the past decade. During the recent years, the public satisfaction in China, among many other aspects of the health system, has received wide attention due to the phenomenal intense physician-patient relationships [8-10]. A People-centered Integrated Care has been set as the goal of transition in Healthy China 2030, the new healthcare reform

program[8].

Currently, there is only a small body of literature studying the public satisfaction of the health system in China and its related factors[11, 12]. Most are only based on small survey samples on province level[13, 14]. Some studies focus on the public dissatisfaction of integration reforms of health insurance schemes[15]. To our knowledge, no prior studies have systematically examined the nation-wide public satisfaction of health system upon the second phase of health reform from 2013 to 2015.

Specifically, the objectives of this study are: (1) to explore the basic factors (demographic, socioeconomic and public healthcare resources) associated with the public satisfaction of the health system in China; (2) to examine how the public satisfaction of the health system differs between the urban and rural residents, as well as the major geographic variations in China; (3) to examine changes in the public satisfaction of the health system between 2013 and 2015.

HEALTH SYSTEM AND REFORM BACKGROUND IN CHINA

Institution Background.

The health system in China is largely a public hospital-based delivery system under the administration of the National Health and Family Planning Commission (NHFPC) of China[16]. Public hospitals provide more than 90% of the services[9]. A national accreditation system classifies hospitals into primary, secondary and tertiary levels according to characteristics such as numbers of beds, professional healthcare force, diagnosis and treatment equipment, and operation area sizes[16]. The basic health insurance coverage in China from three major national health insurance systems has increased significantly during the past decade and has reached 95% of the whole population in recent years[17].

Existing Issues and challenges.

There has been a large volume of literature about the reform of China's health system in the past decade[8, 18-23]. Due to the privatization and market-oriented reform of

the health system in China in the past, by 2000s, there were widespread complaints about the unaffordable basic health services and difficulties to basic healthcare access[23, 24]. The disparity in health status had gradually increased across the country and become a major public policy concern[25]. Meanwhile, due to the fast growth of the economy and the residents' income, together with the rapid urbanization in China, there has been an increasingly unmet demand for health service and higher expectations on the quality and experience with the healthcare system[26].

The major existing issues of the system can be summarized as follows: (1) Rising healthcare cost and high ratio of out-of-pocket expenditure. In 2013, the reimbursement rates for inpatient care were in the range of 50% to 69%, according to a resident's health insurance type, which was based on the permanent residence registration system (rural or urban "Hukou") and/or employment status[17, 27]. (2) there are large socioeconomic disparity and geographic inequity in healthcare source allocation and utilization, especially the dichotomy in urban and rural areas[9]. (3) Financial incentive in the reimbursement and fee-for-service (FFS) payments model lead to excessive treatment and over prescription[9, 28]. In consequence, there has arisen a deep distrust of physicians by the public[8, 10, 26]. (4) Poor healthcare access and service quality perceived by patients. Despite the financial incentive in the reimbursement of health insurance, no strict referral or gate-keeping system has been enforced in China yet. Patients are still free to self-refer to hospitals preferred, regardless of the severity of the sickness[26]. As the results, almost all major hospitals in China are over demanded and operate over the capacity. While the patients' clinic waiting time could be as long as a full day, physicians are overloaded and could only ration a few minutes to meet a patient with technical diagnosis assistance. The minimal physician-patient face time, on one hand, maybe perceived by patients as poor service quality, further deteriorate the patient-physician relationship[9]. Together with the excessive treatment and over-prescription, the deep mistrusts and frustration of the public often outburst as rising numbers of violent incidents against healthcare professionals, peaking at the Year 2012[29-31].

2009 Healthcare Reform in China

In 2009, the Chinese government launched a new wave of healthcare reform actions as part of "the 12th Five-Year Plan", aiming to establish a basic universal health system of safe, effective and affordable service by 2020. To achieve this objective, the government set priorities of achievements in five major areas, including (a) expanding public health insurance, (b) establishment of an Essential Drug System (with the goals of reducing inappropriate use of drugs, especially over-prescription of antibiotics, and ensuring access to safe, effective, affordable medicines for all.) (c) reforming public hospital, (d) providing primary health care service, and (e) equity of public health services[9].

The healthcare reform was implemented in two sequential phases: (1) The first phase (2009 to 2012) aimed to reallocate resources to healthcare development, to expand the coverage of basic health insurance, and to set up an Essential Drug System. (2) The second phase (2013 to 2015) focused on reforming public hospitals, including the pricing models of health service and prescription drugs[23]. To remove the financial incentives of overprescribing, Zero-Mark-up Drug Policy was implemented among provincial public hospitals (the tertiary-level hospitals) during 2013-2015, after pilot tests in county hospitals in 2012[23].

Due to the implementation approach and pilot tests, geographic variation has become a key characteristic of China's health system during the reform[32]. Firstly, the reform was implemented by the governments of provinces and cities, which had the discretion to tailor the service level according to the local fiscal budgets available[9]. Secondly, some reform actions first experimented as pilot projects in selected cities or provinces. For examples, public hospitals in Beijing started diagnosis-related groups (DRGs) payment reform since 2011[9, 33]. 100 pilot cities started drug-zero-markup policy from 2012 to 2015. The implementation of the Provincial Reimbursable Drug List (PRDL) also varies largely in quantity and types of medicine.

METHOD

Data analysis and ethical considerations

Data for this study was collected throughout January to June 2018 by the authors from a range of public data sources. The main data is from the Chinese General Social Survey (CGSS), publicly downloadable at http://www.cnsda.org/index.php. No individual patient data was collected for the study and therefore, this study did not require ethics approval.

Patient and public involvement

Patient and public were not involved in the design or planning of this study.

Data source

The major data source of this study is the Chinese General Social Survey (CGSS), a national representative continuous survey project in China since 2003. The CGSS aims to collect dynamic information about Chinese residents' life quality. It first included a single question about public satisfaction of health system in 2013, and then in 2015 a set of detailed questions about public satisfaction regarding various aspects of public healthcare provision. The timing of these two surveys matched well with the agenda of the 2nd phase of 2009 Health Reform, thus has provided good opportunities to study how the public satisfactions have changed after the implementation of the reform. These data are the latest available ones containing public satisfaction of the health system in China. This study adopts the combined datasets from the two waves in 2013 and 2015.

Administered throughout all 31 provinces or municipalities in China, both waves of CGSS surveys adopted the same multi-stage stratified sampling design. The Primary Sampling Unit (PSU) is a county-level unit and there are 2,762 PSUs in the sampling frame. In each wave, the CGSS sampled about 12,000 households and a KISH grid procedure was used to randomly select one adult respondent (18 years of age or older) from each household for a face-to-face in-home interview. Sampling weights were included to reflect the general population parameters of the survey year.

The final sample contains 15,969 observations from the CGSS 2013 and 2015 combined, after deleting observations with important missing variables. There are only 5566 observations from Wave 2013 because CGSS 2013 designed to sample only about half of all respondents to answer the public health satisfaction survey.

Additionally, the data of healthcare resources and expenditure on the provincial level were obtained from the China Public Health Statistical Yearbook 2013 and 2015.

Dependent variable.

Public satisfaction in the health system. The measurement is based on the single question, 'Taking all aspects into consideration, how is your general satisfaction in the healthcare system?' Respondents were asked to assign a score between 0 to 100, with '0' representing totally unsatisfied and '100' for totally satisfied. To be consistent with literature[5, 34]), we constructed a dummy variable of "being satisfied", which takes the value of '1' if a respondent's satisfaction score is greater than or equals to 70 points[34].

Independent variables

Demographic and socioeconomic characteristics. Control variables included gender (1= female), age group (1= those older or equal to 60 years), minority ethnic group (1= Yes), marital status (1= married/living together), and education levels (a category variable). General physical health condition was measured by a single item: 'How do you evaluate your health condition overall?' Respondents rated on a five-point Likert scale (1=very unhealthy, 2 = unhealthy, 3 = so-so, 4 = healthy, and 5 = very healthy). Socioeconomic information included living areas (urban or rural), internal migrant status (1=Yes), employment status (employed =1), primary health insurance status (1=Yes) and basic pension status (1=Yes). Household social-economic status was measured as 'below the average', 'middle class', 'middle-high', and 'high', according to the respondent's answer to a single item: 'How do you assess your relative economic condition in the society?'.

Healthcare resources on an aggregated level. We include key indicators of the public healthcare resources, such as total health expenditure as a percentage of GDP, the government's percentage of total expenditure on health, out-of-pocket percentage of individuals. We also include the densities of the health workforce and hospital beds[3] (per 10,000 population) in rural and urban areas of each province respectively.

Year and region dummy variables. By economic region classification, there are four

regions in China, namely, East, Central, West, and Northeast regions. We also included dummies to identify four municipalities, namely, Beijing, Shanghai, Tianjin, and Chongqing, which have abundant health resources and are also the pilot cities of some health reforms. A dummy variable was included to identify the survey wave of the year 2015.

Statistical analysis

The baseline model is a multivariate logistic regression model[3, 5, 35, 36], analyzing the major factors associated with Chinese residents' satisfaction of the health system. The dependent variable was the dummy variable of "being satisfied" with the health system. The independent variables included all individual and provincial level variables as introduced in Measures section. In step two, to examine the rural disparities, we added interaction terms of rural and health resource variables. To examine how the satisfaction in rural areas change over 2013 and 2015, we tested with the interaction term of the rural area and year dummy of 2015. In step three, adopting interaction terms of region dummies and Year2015, we examined the changes in the geographic variations over time. All regressions were conducted in STATA 15, weight-adjusted, using the survey weights provided in the original datasets.

RESULTS

Descriptive statistics

Table 1 reports the demographic statistics of the participants (Panel A) and summary information of the healthcare resources in various regions in China (Panel B). As reported in Table 2, the mean satisfaction score of the sample is 68.5 out of 100 points. The scores in 2013 and 2015 are 66.2 and 69.7 respectively. Panel B of Table 2 reports the percentage of respondents who scored above 70 points and are classified as "being satisfied with the health system". This ratio was 52.9% in 2013, then 63.9% in 2015, suggesting that the public satisfaction of the health system in China has made general improvement during the study period.

Baseline analysis

Table 3 reports the logistic regression results of the demographic characteristics of baseline analysis. Senior respondents (older than or equal to 60 years) are significantly more likely by 19 percentage points (OR=1.19, p=0.000) to report being satisfied with the health system.

Respondents from rural areas on average are more likely to report being satisfied (OR=1.23, p=0.009). Those are from ethnic minority groups, with basic health insurance [37, 38], with better self-reported health, or with higher self-rated social-economic status, are at greater odds to report being satisfied. Meanwhile, internal migrants (OR=0.75, p=0.000) and those with a higher level of education[27] are less likely to report being satisfied.

As for the association with province-level health resources and expenditures, higher total health expenditure percentage of GDP and density of hospital beds are significantly associated with a higher probability of reporting being satisfied (OR=1.13, p= 0.000). Meanwhile, the government's share in total health expenditure has a moderate negative association with satisfaction (OR=0.97, p= 0.000). Out-of-pocket percentage and the density of the healthcare workforce are insignificant.

Additionally, in the year 2015, the respondents were on average more likely than in the year 2013 by 51 percentage points to report being satisfied.

Rural disparities and changes

As reported in Panel A of Table 4, in the rural area the density of hospital beds is positively associated with higher satisfaction (OR=1.26, p= 0.002). The effect is even stronger than the main effect (OR=1.02, p= 0.057) in Table 3. The density of the health workforce in rural areas or the dummy variable rural area is not significant in this specification.

Panel B reports the changes in rural areas during the period of 2013 to 2015. The coefficients of Rural*2015 indicates that rural residents are more likely by 57 percentage points in 2015 to report being satisfied (OR=1.57, p=0.000). After including the interaction term of rural areas and year 2015, the odds ratio of the rural area is reduced to be 1.00 and totally insignificant, while the Year 2015 is still significant though its odds ratio became smaller.

Geographic variations

As shown in Table 3, with East China as the baseline region, Middle and West China regions(OR =1.36, p=0.001; OR=1.28, p=0.019), together with Tianjin and Chongqing municipalities (OR =1.48, p=0.001; OR=2.03, p=0.000), are on average more likely to report being satisfied. On another hand, the Northeast region and Shanghai (OR =0.49, p=0.000; OR=0.71, p=0.034) are less likely by about 51 to 30 percentage points respectively. Beijing is not significantly different from the East region.

After the interaction terms of Year2015 and regions are controlled, the results reported in Table 5 indicate that the differences in Middle and West China regions are no longer significant, but the differences in Tianjin, Chongqing, Shanghai and the Northeast region of China are robust and consistent.

Changes in 2015

Dummy variable Year 2015 captures the average changes in the public satisfaction. As reported in Table 3 and Table 5, the odds ratios of Year 2015 are 1.36 and 1.23 respectively, highly significant in both specifications.

In 2015, after controlling the average year effect and region effects, respondents from the Middle (OR=1.60, p=0.000) and the West China regions (OR=1.44, p=0.002) are significantly more likely to report being satisfied than those from the base group of East China region. Meanwhile, there was no significant improvement in the Northeast region or Shanghai City, though respondents from this two regions tend to report less satisfied.

Discussion

Demographic and socioeconomic characteristics

The association relationships between the various demographic characteristics and the public satisfaction of health system found in this study are all consistent with existing literature. For example, the senior[27, 39], those with better self-rated health[37], and those with higher social economic status[40], are more likely to report being satisfied[13, 14]. Those are with a lower level of education[27] and those in rural areas[27, 35] more likely to report being satisfied too[14].

This phenomenon may be explained by the role of respondents' expectation[4, 5]. Residents with a lower level of education and in rural areas of China have had a lower

level of expectation. For decades in the past, they only had very limited access to public healthcare resources and social welfare. Also, they usually are unaware of their entitlements of citizenship or patient rights[41].

Healthcare resources

Generally, more healthcare workforce and resources are associated with a higher level of public satisfaction of the health system[3, 36]. However, this study has mixed findings.

1) There are positive associations between public satisfaction and the healthcare expenditure's percentage in GDP, as well as the density of hospital beds[36]. These findings are consistent with the general perception in literature[3, 34].
2) Generally, lower expense out of pocket is preferred by the population. A higher level of healthcare professionals in the population usually appears to increase overall patient satisfaction[34, 42]. However, the findings of this study suggest that the ratio of expenses out of pocket and density of healthcare professionals are not significant determinants of the public satisfaction in the context of China. This phenomenon may due to the overcrowded and overcapacity situations in public hospitals in the central cities or developed regions in China[9].
3) This study has found that there is a moderate negative association with the share of government in the healthcare expenditure. Despite the government has provided funds to reduce the economic burdens of healthcare spending, the public has become less satisfied. This finding is different from those in European countries[3, 34, 43].

   This paradox may due to the dissatisfaction derived from the experience with the public health system, which usually will not pay for or provide preferred treatments or doctors. For example, upon the implementation of Essential Drug Lists and Drug Zero-mark-up policy in public hospitals, despite less expenditure out of pocket, the availability of preferred therapies are limited too[4, 23]. In the United States, "accessing most preferred care" is highly important to the satisfaction and the perception is stronger there than in other high-income countries[6].

Rural disparities

As reported in Panel A of Table 4, the density of hospital beds in rural areas of China

has an strong positive association with the satisfaction (OR=1.26, p=0.002), whereas odds ratio is only 1.04 (p=0.057) in the baseline model. This phenomenon may be explained as follows. First, hospitalization is often perceived in China as health care with better quality and with more experienced physicians. Second, because inpatient service has a higher reimbursement ratio than outpatient service, hospitalization is often preferred by many patients in China[17, 26]. Third, in rural areas of China, hospitalization can especially be helpful for a patient with having access to quality medical care and alleviating the commuting needs from sparsely located home places[41]. Additionally, if admitted to hospitalization, most rural residents have lower opportunity cost of time than urban residents, since they don't have office-commuting requirement.

While the bed occupancy rate of tertiary hospitals in China could be as high as 107.5% on average, it may be as low as 58.0% in township-level hospitals [44]. It is often difficult to get admitted into tertiary hospitals, or with shorter length of stay[16]. When there is a higher density of hospital beds in rural areas, it may be easier for a patient to get hospitalization admission[45-47]. Therefore, rural residents with easy hospitalization admission may perceive having good quality healthcare with low cost Consequently, they may report having high level of satisfaction.

As shown in Panel B of Table 4, the odds ratio of Rural*2015 is as large as 1.57 (p=0.000). This finding indicates a large and significant enhancement in the satisfaction of the health system in rural areas. After controlling the changes in 2015, the odds ratio of rural area becomes insignificant, while the year dummy of 2015 is still large and highly significant (OR=1.24, p=0.000). Together, these results suggest that the healthcare reform actions of China from 2013 to 2015 have brought significant improvements to the healthcare satisfaction in rural areas.

Geographic variations and changes in 2015

The geographic differences in the healthcare system satisfaction may have reflected the inequality of healthcare resources and quality in China[48]. Beijing, Shanghai, Tianjin, and Chongqing City, the four municipalities are the most important central cities in China with the most advanced and abundant healthcare resources of China. Since they have also piloted many healthcare reform plans, it is not unexpected that there are no significant changes in the public satisfaction of health system during

the studied period.

South and West regions, are more likely to experience a significant and large enhancement of healthcare satisfaction during the reform of 2013-2015, because many of the reform policies were eventually implemented in these regions after piloting in East region of China.

Shanghai has lower level of satisfaction, it may be due to the very crowded hospital environment and resources. As the most modernized city in China, Shanghai has the most skilled professionals and advanced medical equipments. However, all tertiary hospitals in Shanghai are always highly demanded and crowded with patients from all over the country without referral system[16]. Hence, local Shanghai residents actually don't have good experience generally. This situation has not been improved during this round of healthcare reform.

It is noted that the Northeast Region consistently reported a lower level of satisfaction and no significant improvements during the studied period. The low satisfaction actually can be attributed to the weak economy concurrently in this region. Known as China's rustbelt, the three northeastern provinces were plagued by widespread layoffs in the 1990s and were among the weakest economic growth region in 2010s[49]. With the shrinking economy and fiscal deficits, the local governments had a very limited resource available for healthcare and many local healthcare professionals migrated to other developed regions in the country [9, 50]. Additionally, poor economic performance may also directly affect the respondents' perception and lead to a lower rating of the public policies, including the health system[3, 5]. Additionally, Chen et al. (2019) report that patients in the Northeast consistently had the highest mortalities in terms of the overall stroke and each subtype of stroke[51]. The researchers indicate that this may mainly due to the differences in lifestyle and inconsistent medical development and economic level.

Robustness check

As a robustness check, we redefined "being satisfied" as those who scored greater than 80 points and performed the same logistic regressions. We also performed Ordinary Least Square (OLS) regressions, using the original 'satisfaction score' of respondents as the dependent variable and examined the rural and regional disparities. Not reported here, the results of robustness checks are all consistent with our current findings.

LIMITATIONS

As a type of subjective evaluation, public satisfaction has several weaknesses when being adopted to measure the health system performance. First, the data in this study, especially, the CGSS 2013, contain only one global satisfaction score. Therefore, it is difficult to attribute the satisfaction or dissatisfaction to specific reform actions or issues of the health system [5]. With the advancement in research and reform of health system in China, dataset with more detailed information may be available in recent years.

Second, while being related with the quality and outcome of healthcare service, public satisfaction may also be influenced by some external factors, such as media and political discussion [5, 36], or the citizens' expectations. Since these confounding factors are not included in the original survey data and it is almost impossible to identify or recover them from other resources, we cannot completely rule out the possibility of potential bias brought by these factors. While it will be interesting to study how media reports and portrays about physicians and hospitals may influence the public's perception or satisfaction about the health system in China, this topic actually is beyond our research scope and expertise.

CONCLUSION

Using a sample of totally 15,969 observations from Chinese national representative surveys, the CGSS 2013 and 2015, we examined various factors associated with the public satisfaction of the health system in China. We observed considerable disparities in the satisfaction, which are associated with demographic and socioeconomic characteristics, geographic locations and urban-rural environment. We found a moderate negative association with the share of government in the healthcare expenditure, suggesting dissatisfaction derived from the experience with the public health system.

While there was a nation-wide general improvement in the satisfaction level after year 2015, when the 2nd phase of 2009 Health Reform was implemented, the low level of satisfaction among internal migrants and residents in Northeast region

remains unchanged. Especially, close attention and further study about the causal reason of low level satisfaction in Northeast region is recommended.

Ethical Statement

The data used in this study is obtained from a publicly available national database.

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Competing interests statement

No competing financial, professional, or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

Author contributions

JHZ and XP designed the study and developed the methods. XP, JHZ and HZ reviewed literature. JHZ and XP sorted and analyzed the data. XP prepared the tables. JHZ, XP and OOI drafted the manuscript. HZ and OOI provided critical review of the manuscript. All authors have reviewed and approved the final version of the manuscript for publication.

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Table 1 Descriptive statistics of the respondents in CGSS 2013-2015

Panel A: Respondents

	Total	2013	2015	Chi2
N	15969	5566	10403	/
Satisfaction score	68.50	66.21	69.73	/
Being satisfied	60.08%	52.91%	63.93%	/
Age				
Age (years)	51.9	50.8	52.5	/
Age<60	63.4%	66.4%	61.8%	32.34
Age>=60	36.6%	33.6%	38.2%	
Gender				
Male	50.6%	50.8%	50.5%	0.07
Female	49.4%	49.2%	49.5%	
Ethnic group				
Han	92.8%	92.4%	93.1%	2.30
Ethnic minority	7.2%	7.6%	7.0%	
Marital status				
Single/separated/widow/widower	29.3%	28.8%	29.6%	1.10
Cohabitation/Married	70.7%	71.2%	70.4%	
Employment status				
Not working	43.1%	39.8%	44.9%	38.86
Employed/Farm	56.9%	60.3%	55.1%	
Education				
Elementary School or less	37.8%	36.2%	38.7%	10.71
Middle / high School	45.6%	47.0%	44.9%	
College	15.5%	15.8%	15.3%	
Post graduate	1.1%	1.1%	1.1%	
Self-reported health				
Very bad	3.3%	3.4%	3.3%	49.54
Bad	15.3%	14.4%	15.8%	
Average	21.6%	19.8%	22.6%	
Good	38.0%	37.7%	38.1%	
Very good	21.8%	24.7%	20.3%	
Self-reported household economic status				
Far below average	6.0%	5.7%	6.2%	37.26
Below average	32.2%	30.2%	33.3%	
Average	53.7%	57.0%	52.0%	
Above average	8.1%	7.3%	8.2%	
Insurance status				
Without any health Insurance	10.2%	11.3%	9.6%	10.90
With any health insurance	89.8%	88.7%	90.4%	
Residence status				
Urban	60.0%	59.7%	60.2%	0.28
Rural	40.0%	40.3%	39.8%	

Internal migrant				
No	89.0%	88.7%	89.2%	1.09
Yes	11.0%	11.3%	10.8%	
Regions or municipalities				
East china(without Shanghai)	23.2%	23.6%	23.1%	
Middle china	23.9%	22.2%	24.8%	
West china(without Chongqin)	21.7%	21.1%	22.0%	
NEast china	14.2%	14.9%	13.8%	37.28
Beijing	5.1%	4.7%	5.3%	
Shanghai	6.2%	7.0%	5.7%	
Tianjin	3.2%	3.7%	3.0%	
Chongqin	2.6%	3.0%	2.4%	

Panel B: Healthcare resources

	% of healthcare expenditure in GDP		Government % in healthcare expenditure		Out of pocket(%)		hospital beds/10k population		healthcare workforce/10k population	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
Total	5.48	0.005	29.45	0.029	33.12	0.031	6.05	0.019	2.84	0.008
East china (without Shanghai)	4.24	0.006	25.83	0.034	31.89	0.041	5.96	0.035	2.97	0.017
Middle china	5.45	0.005	32.84	0.040	36.87	0.044	5.82	0.038	2.36	0.015
West china (without Chongqin)	6.57	0.008	36.54	0.062	32.13	0.040	5.87	0.043	2.38	0.018
NEast china	5.53	0.011	24.51	0.026	40.41	0.054	6.44	0.056	2.67	0.019
Beijing	7.21	0.015	25.43	0.040	20.45	0.058	7.48	0.065	5.60	0.034
Shanghai	5.59	0.006	20.79	0.017	20.22	0.024	6.89	0.077	4.27	0.003
Tianjin	3.97	0.010	25.86	0.027	34.20	0.089	5.36	0.064	3.15	0.015
Chongqin	5.64	0.009	31.23	0.013	32.22	0.164	4.26	0.026	1.58	0.012

Table 2 Descriptive Statistics of satisfaction about the health system in China (2013-2015)

Panel A

	Satisfaction score					
	Total		2013		2015	
	mean	s.d.	mean	s.d.	mean	s.d.
Satisfaction score	68.50	0.15	66.21	0.24	69.73	0.20
Age						
Age<60	67.43	0.19	65.40	0.29	68.60	0.25
Age>=60	70.35	0.27	67.81	0.45	71.56	0.33
Gender						
Male	68.16	0.23	66.07	0.35	69.29	0.29
Female	68.84	0.21	66.35	0.34	70.17	0.27
Ethnic group						
Han	68.28	0.16	65.94	0.25	69.53	0.21
Ethnic minority	71.26	0.55	69.42	0.89	72.35	0.70
Marital status						
Single/separated/widow/widower	68.07	0.34	65.73	0.54	69.30	0.44
Cohabitation/Married	68.67	0.17	66.40	0.27	69.91	0.22
Employment status						
Not working	69.08	0.25	66.38	0.41	70.37	0.31
Employed/Farm	68.06	0.20	66.09	0.31	69.21	0.26
Education						
Elementary School or less	70.76	0.26	68.15	0.40	72.07	0.33
Middle / high School	67.53	0.23	65.50	0.36	68.68	0.30
College	66.36	0.37	64.32	0.61	67.50	0.46
Post graduate	60.69	1.58	59.17	2.54	61.45	1.99
Self-reported health						
Very bad	66.39	1.14	65.68	1.76	66.79	1.48
Bad	68.28	0.43	65.61	0.70	69.59	0.55
Average	68.18	0.34	65.43	0.55	69.48	0.42
Good	68.62	0.24	66.31	0.38	69.85	0.31
Very good	69.07	0.32	67.09	0.50	70.36	0.42
Self-reported household economic status						
Far below average	65.26	0.86	62.69	1.56	66.51	1.03
Below average	67.16	0.29	65.19	0.47	68.12	0.37
Average	69.37	0.20	66.88	0.30	70.84	0.26
Above average	70.44	0.52	67.87	0.86	71.61	0.64
Insurance status						
Without any health Insurance	65.90	0.53	64.36	0.77	66.86	0.72
With any health insurance	68.79	0.16	66.44	0.26	70.04	0.21
Residence status						
Urban	67.48	0.20	67.12	0.31	67.67	0.26

Rural	70.03	0.24	64.85	0.40	72.85	0.30
Internal migrant						
No	68.99	0.16	66.52	0.26	70.31	0.21
Yes	64.50	0.50	63.76	0.77	64.92	0.65
Regions or municipalities						
East china (without Shanghai)	68.32	0.30	67.26	0.49	68.91	0.38
Middle china	70.53	0.28	66.73	0.45	72.35	0.35
West china (without Chongqin)	70.49	0.33	67.01	0.55	72.29	0.40
NEast china	63.88	0.48	62.88	0.69	64.46	0.65
Beijing	66.10	0.77	63.75	1.05	67.22	1.01
Shanghai	64.33	0.72	62.61	1.13	65.45	0.93
Tianjin	68.84	0.78	70.60	0.79	67.66	1.18
Chongqin	73.94	0.75	71.67	1.34	75.45	0.88

Table 2 Descriptive Statistics of satisfaction about the health system in China (2013-2015)

Panel B

	% of being satisfied					
	Total		2013		2015	
	mean	s.d.	mean	s.d.	mean	s.d.
Satisfaction	60.08%	0.44%	52.91%	0.78%	63.93%	0.52%
Age						
Age<60	57.58%	0.54%	51.41%	0.93%	61.13%	0.66%
Age>=60	64.41%	0.77%	55.86%	1.47%	68.46%	0.89%
Gender						
Male	59.56%	0.64%	53.09%	1.11%	63.04%	0.78%
Female	60.61%	0.61%	52.72%	1.12%	64.83%	0.72%
Ethnic group						
Han	59.70%	0.46%	52.37%	0.82%	63.60%	0.55%
Ethnic minority	65.00%	1.58%	59.46%	2.84%	68.25%	1.87%
Marital status						
Single/separated/widow/widower	60.02%	0.97%	52.19%	1.73%	64.10%	1.15%
Cohabitation/Married	60.10%	0.48%	53.20%	0.86%	63.85%	0.58%
Employment status						
Not working	61.26%	0.69%	53.10%	1.29%	65.14%	0.80%
Employed/Farm	59.18%	0.58%	52.78%	0.99%	62.94%	0.70%
Education						
Elementary School or less	65.71%	0.71%	56.77%	1.32%	70.19%	0.83%
Middle / high School	57.56%	0.65%	51.27%	1.13%	61.10%	0.79%
College	54.58%	1.15%	49.45%	2.01%	57.43%	1.40%
Post graduate	47.99%	4.63%	45.15%	8.14%	49.41%	5.62%
Self-reported health						
Very bad	55.10%	2.63%	50.43%	4.74%	57.69%	3.13%
Bad	58.02%	1.19%	48.76%	2.17%	62.56%	1.40%

Average	58.19%	0.98%	50.13%	1.83%	61.98%	1.15%
Good	61.59%	0.70%	53.78%	1.26%	65.75%	0.84%
Very good	61.52%	0.93%	56.57%	1.54%	64.75%	1.15%
Self-reported household economic status						
Far below average	53.21%	2.02%	46.27%	3.70%	56.59%	2.40%
Below average	56.57%	0.80%	48.96%	1.46%	60.26%	0.96%
Average	61.97%	0.59%	54.62%	1.03%	66.30%	0.71%
Above average	66.66%	1.47%	61.12%	2.72%	69.19%	1.74%
Insurance status						
Without any health Insurance	52.90%	1.50%	46.92%	2.49%	56.66%	1.86%
With any health insurance	60.90%	0.46%	53.67%	0.83%	64.70%	0.55%
Residence status						
Urban	57.67%	0.57%	54.84%	0.99%	59.18%	0.70%
Rural	63.69%	0.69%	50.05%	1.28%	71.10%	0.78%
Internal migrant						
No	61.43%	0.46%	53.60%	0.82%	65.62%	0.55%
Yes	49.10%	1.47%	47.54%	2.60%	49.98%	1.78%
Regions or municipalities						
East china (without Shanghai)	58.66%	0.91%	54.51%	1.65%	60.94%	1.09%
Middle china	66.38%	0.84%	55.28%	1.58%	71.70%	0.98%
West china (without Chongqin)	64.20%	0.92%	53.64%	1.65%	69.64%	1.08%
NEast china	47.22%	1.22%	43.13%	2.10%	49.59%	1.50%
Beijing	53.34%	2.02%	51.63%	3.32%	54.15%	2.50%
Shanghai	52.52%	2.04%	45.36%	3.33%	57.20%	2.48%
Tianjin	65.34%	2.37%	66.85%	3.47%	64.33%	3.18%
Chongqin	74.93%	2.46%	68.61%	4.55%	79.12%	2.73%

Note: "Being satisfied" is a dummy variable, taking the value of "1" if a respondent's satisfaction score is greater than 70 points.

Table 3. Baseline analysis (logistic regression)

Dep. Var. = "Being Satisfied"

Variables	Odds ratio	P-value	[95% Conf. Interval]
Demographic			
Age>=60	1.19	0.000	1.08 - 1.32
Female	1.03	0.513	0.95 - 1.11
Cohabitation/Married	0.93	0.108	0.84 - 1.02
Han (Ethnic group)	1.28	0.001	1.11 - 1.49
Rural	1.23	0.009	1.05 - 1.44
Internal migrant	0.75	0.000	0.66 - 0.85
Employed/Farm	0.97	0.452	0.89 - 1.06
With any health insurance	1.18	0.011	1.04 - 1.35
Education			
Primary school / no formal edu.	Ref.		
Middle / high School	0.76	0.000	0.69 - 0.83
College	0.65	0.000	0.57 - 0.75
Post graduate	0.55	0.002	0.37 - 0.80
Self-reported health			
Very bad	Ref.		
Bad	1.04	0.721	0.82 - 1.32
Average	1.18	0.163	0.93 - 1.49
Good	1.45	0.002	1.15 - 1.83
Very good	1.61	0.000	1.27 - 2.04
Self-reported household economic status			
Far below average	Ref.		
Below average	1.21	0.037	1.01 - 1.45
Average	1.59	0.000	1.33 - 1.90
Above average	2.05	0.000	1.64 - 2.55
Resources			
healthcare expenditure % in GDP	1.13	0.000	1.05 - 1.20
Government % in healthcare expenditure	0.97	0.000	0.95 - 0.98
Out of pocket %	1.00	0.570	0.99 - 1.02
Hospital beds/10k population	1.04	0.057	1.00 - 1.08
Healthcare workforce/10k population	0.92	0.117	0.83 - 1.02
Region			
East china (without Shanghai)	Ref.		
Middle china	1.36	0.001	1.14 - 1.62

West china (without Chongqin)	1.28	0.019	1.04 - 1.58
Northeast china	0.49	0.000	0.41 - 0.59
Beijing	0.83	0.342	0.56 - 1.22
Shanghai	0.71	0.034	0.52 - 0.98
Tianjin	1.48	0.001	1.17 - 1.86
Chongqing	2.03	0.000	1.50 - 2.76
Year			
Year2013	Ref.		
Year2015	1.51	0.000	1.36 - 1.66
Constant	0.73	0.437	0.33 - 1.61
Observations	15,969		
R-squared	0.07		

Note: Dep. Var. "Being satisfied" is a dummy variable, taking the value of "1" if a respondent's satisfaction score is greater than 70 points.

Table 4 Regression of Resource, Rural & Years with Being Satisfied

Dep. Var. = "Being Satisfied"

Panel A

Variables	Odds ratio	P-value	[95% Conf. Interval]	
Hospital beds/10k population * Rural	1.26	0.002	1.09	1.47
Healthcare workforce/10k population * Rural	0.96	0.545	0.84	1.09
Rural	1.12	0.243	0.93	1.34
Constant	0.24	0.001	0.10	0.54
Observations	15,969			

Note: The regression has controlled all other variables as listed in Table 3.

Panel B

Variables	Odds ratio	P-value	[95% Conf. Interval]	
Rural	1.00	0.982	0.83	1.20
Rural* Year 2015	1.57	0.000	1.30	1.90
Year 2015	1.24	0.001	1.09	1.41
Constant	0.92	0.845	0.42	2.05
Observations	15,969			

Note: The regression has controlled all other variables as listed in Table 3.

Table 5 Regression of Region & Years with Being Satisfied

Dep.Var.= "Being Satisfied"

Variables	Odds ratio	P-value	[95% Conf.	Interval]
Year 2015	1.23	0.022	1.03	1.46
East china (without Shanghai)				
Middle china	1.00	0.989	0.79	1.27
West china (without Chongqin)	0.99	0.955	0.76	1.29
NEast china	0.46	0.000	0.36	0.60
Beijing	0.83	0.437	0.52	1.32
Shanghai	0.62	0.065	0.38	1.03
Tianjin	1.72	0.004	1.20	2.49
Chongqing	1.67	0.036	1.03	2.69
Year2015* East china (without Shanghai)				
Year2015*Middle china	1.60	0.000	1.27	2.02
Year2015*West china (without Chongqin)	1.44	0.002	1.14	1.82
Year2015*NEast china	1.07	0.610	0.82	1.40
Year2015* Beijing	0.93	0.715	0.64	1.35
Year2015*Shanghai	1.18	0.469	0.76	1.83
Year2015*Tianjin	0.77	0.289	0.48	1.24
Year2015* Chongqin	1.30	0.366	0.74	2.30
Constant	0.93	0.862	0.42	2.06
Observations	15,969			

Note: The regression has controlled the same variables as in Table 3.

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Title Page

Article title: Public satisfaction with the healthcare system in China during 2013-2015: A cross-sectional survey of the associated factors

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Public satisfaction with the healthcare system in China during 2013-2015: A cross-sectional survey of the associated factors

Abstract

Objective We explore how public satisfaction with the healthcare system in China varies with social and economic factors, especially within regional variations and changes during 2013 to 2015.

Design Population-based, cross-sectional survey performed between July 2013 and July 2015.

Setting General population of China during 2013 to 2015

Participants 15,969 total participants (women=49.4%, sample-weighted average age =51.9)

Primary outcome measure Public satisfaction with the healthcare system, defined as "being satisfied" if a respondent's satisfaction score ≥ 70 points

Results 1) The two-year mean of the satisfaction score of the sample is 68.5 out of 100 points and the score in 2015 is higher than 2013 by 3.5 points. 2) Senior respondents (OR=1.19, p<0.001), rural respondents (OR=1.23, p=0.009) and those with higher socioeconomic status are more likely to report being satisfied. Internal migrants (OR=0.75, p<0.001) and those with a higher level of education are less likely to report being satisfied. 3) Total health expenditure as percentage of GDP and density of hospital beds have a significant positive association with satisfaction (OR=1.13, p<0.001). Meanwhile, the government's share in total healthcare expenditures has a moderately negative association with satisfaction (OR=0.97, p<0.001). In rural areas, the density of hospital beds has a positive association with satisfaction (OR=1.26, p= 0.002). 4) The Northeast region and Shanghai (OR =0.49, p<0.001; OR=0.71, p=0.034) are less likely to report being satisfied, and remained unchanged in 2015.

Conclusion There are considerable disparities in public satisfaction with the healthcare system in China, associated with demographic and socioeconomic characteristics, regional locations, urban-rural environment, and regional health resource abundance. Actions are recommended to improve satisfaction with the public healthcare system, especially in the Northeast region of China.

Strengths and limitations of this study

- Public satisfaction with healthcare systems has been considered one of the most coherent indicators of the general subjective evaluation of the healthcare system and effectiveness of the reform.
- This study analyzed a national representative sample of more than 15,969 respondents from two waves of surveys during the ongoing healthcare reform.
- This study provides empirical evidence about the rural-city disparity and the regional variations in healthcare satisfaction in China, which have not yet been well studied.
- The survey dataset contains only one global satisfaction score, making it difficult to further attribute the satisfaction or dissatisfaction to specific reform actions or issues of the healthcare system.
- Public satisfaction may be biased by confounding factors such as media reports and political discussion, or the citizens' expectations.

Public satisfaction with the healthcare system in China during 2013-2015: A cross-sectional survey of the associated factors

INTRODUCTION

Public satisfaction with healthcare systems measures the general population's satisfaction. Unlike patient satisfaction, which focuses on those who directly utilize the healthcare services, public satisfaction has been considered one of the most coherent indicators of the general subjective evaluation of the healthcare system, as well as the acceptability and effectiveness of healthcare reform[1, 2]. A Public satisfaction indicator has several advantages. First, it gathers information on satisfaction from the whole population, including both direct users and non-users of healthcare services. Second, it represents a mixture of citizens' personal experiences with the healthcare system, beyond the provision of quality services[2]. It may also include the broader views of the social affairs in the country, social welfare culture and media portrayals of the healthcare system[3, 4]; Third, it may affect how the general population utilizes services and their trust in the system[5].

In short, public satisfaction with a healthcare system has become integral to cross-country and across-time comparisons of healthcare systems[3, 4, 6], as well as healthcare policy evaluations[4, 7]. During the past decade, studies about public satisfaction have received increasing attention, reflecting the shift towards a people-centered healthcare system and the emphasis on the responsiveness of the system[4].

For decades the priority of the healthcare system in China has been set to meet basic survival needs, such as reducing mortality[8, 9]. Public satisfaction was not included in any official measurement in China. However, since China has achieved a rapid decline in mortality and an unprecedented increase in life expectancy over the past decade, the issue of public satisfaction in China, among many other aspects of the healthcare system, has received increased attention. The phenomenally intense physician-patient relationship has further fueled interest in public satisfaction [8-10]. This has led to the goal of People-centered Integrated Care as the focus of the

transition to Healthy China 2030, the new healthcare reform program.

Currently, there is only a small body of literature studying the public satisfaction of the healthcare system in China and its related factors[11, 12]. Most are only based on small survey samples at the province level[13, 14]. Some studies focus on public dissatisfaction with the integration reforms of health insurance schemes[15]. To our knowledge, no prior studies have systematically examined the nation-wide public satisfaction of the healthcare system upon the second phase of healthcare reform from 2013 to 2015.

Specifically, the objectives of this study are: (1) to explore the basic factors (demographic, socioeconomic and public healthcare resources) associated with public satisfaction of the healthcare system in China; (2) to examine how public satisfaction with the healthcare system differs between the urban and rural residents, as well as in the major economic regions of China; (3) to examine changes in public satisfaction with the healthcare system between 2013 and 2015.

HEALTHCARE SYSTEM AND REFORM BACKGROUND FOR CHINA

Institution Background

The healthcare system in China is largely a public hospital-based delivery system under the administration of the National Health Commission of the People's Republic of China [16]. In China, public hospitals provide more than 90% of healthcare services[9]. A national accreditation system classifies hospitals into primary, secondary and tertiary levels according to characteristics such as numbers of beds, professional healthcare force, diagnosis and treatment equipment, and operational area sizes[16]. The basic health insurance coverage in China provided by three major national health insurance systems has increased significantly during the past decade and has reached 98% of the whole population in recent years[17].

Existing Issues and challenges

There has been a large volume of literature produced about the reform of China's healthcare system in the past decades[8, 18-23]. Due to the privatization and market-oriented reform of the healthcare system in China during the 1980s and 1990s,

by the first decade of the 2000s, there were widespread complaints about unaffordable basic healthcare services and difficulties with basic healthcare access[23, 24]. The disparity in healthcare status had gradually increased across the country and become a major public policy concern[25]. Meanwhile, due to the fast growth of the economy and residents' income, together with rapid urbanization in China, there has been an increasingly unmet demand for healthcare services along with higher expectations for the quality and experience of the healthcare system[26].

The major issues with the system late in the first decade of the 2000s can be summarized as follows: (1) Rising healthcare costs and a high ratio of out-of-pocket expenditure. In 2013, the reimbursement rates for inpatient care were in the range of 50% to 69%, according to a resident's health insurance type, which was based on the permanent residence registration system (rural or urban "Hukou") and/or employment status[17, 27]. (2) There are large socioeconomic disparities and geographic inequities in healthcare source allocation and utilization, especially between the urban and rural areas[9]. (3) The financial incentive in the reimbursement of and fee-for-service (FFS) payment models led to excessive treatment and over prescription[9, 28]. As a consequence, there has arisen a deep distrust of physicians by the public[8, 10, 26]. (4) Difficulties in healthcare access. Despite the financial incentive of the reimbursement of health insurance, no strict referral or gate-keeping system has been enforced in China yet. Patients are still free to self-refer to preferred hospitals regardless of the severity of their sickness[26]. As a result, almost all major hospitals in China are over demanded and operate over their capacity. While a patients' clinic wait time could be as long as a full day, physicians were overloaded and could only ration a few minutes to meet with a patient for technical diagnosis assistance. This minimal physician-patient interaction was perceived by patients as poor service quality and further deteriorated the patient-physician relationship[9]. Together with the deep mistrust and frustration on the part of the public, there had been rising numbers of violent incidents against healthcare professionals in the early 2000's[29-31].

2009 Healthcare Reform in China

In 2009, the Chinese government launched a new wave of healthcare reform actions as part of "the 12th Five-Year Plan", aiming to establish a basic universal healthcare system of safe, effective and affordable service by 2020. To achieve this objective, the government set priorities for achievements in five major areas, including (a) expanding public health insurance, (b) establishment of an Essential Drug System (c) reforming public hospitals, (d) providing primary healthcare service, and (e) equity of public healthcare services[9].

The healthcare reform was implemented in two sequential phases: (1) The first phase (2009 to 2012) aimed to reallocate resources to healthcare development, to expand the coverage of basic health insurance, and to set up an Essential Drug System. (2) The second phase (2013 to 2015) focused on reforming public hospitals, including the pricing models of healthcare services and prescription drugs[23]. To remove the financial incentives of overprescribing, a Zero-Mark-up Drug Policy was implemented among provincial public hospitals (the tertiary-level hospitals) during 2013-2015, after pilot tests in county hospitals in 2012[23].

The implementation of the healthcare reform has varied across provinces and regions in China[32]. Firstly, the governments of provinces and cities had the discretion to tailor the service level according to the availability of local fiscal budgets[9]. Secondly, some reform actions were first experimented with as pilot projects in selected cities or provinces. For example, public hospitals in Beijing started diagnosis-related groups (DRGs) payment reform starting in 2011[9, 33]. 100 pilot cities ran a drug-zero-markup policy from 2012 to 2015.

METHOD

Data availability statement

The survey data analyzed in this study is the Chinese General Social Survey (CGSS), a national representative continuous survey project available in China since 2003, publicly downloadable at http://www.cnsda.org/index.php.

The data of healthcare resources and expenditure on the provincial level were obtained from the China Public Health Statistical Yearbook 2013 and 2015, accessible through subscription-based databases

(http://cdi.cnki.net/Titles/SingleNJ?NJCode=N2010090866)

Data source introduction

The CGSS aims to collect dynamic information about Chinese residents' life quality. It first included a single question about public satisfaction with the healthcare system in 2013, and then in 2015 included a set of detailed questions about public satisfaction regarding various aspects of public healthcare provision. The timing of these two surveys matched well with the agenda of the 2nd phase of the 2009 Healthcare Reform, and thus has provided good opportunities to study how public satisfaction has changed after the implementation of the reform. These data are the latest available ones containing public satisfaction with the healthcare system in China. This study adopts the combined datasets from the two waves in 2013 and 2015.

Administered throughout all 31 provinces and municipalities in China, both waves of the CGSS surveys adopted the same multi-stage stratified sampling design. The Primary Sampling Unit (PSU) is a county-level unit and there are 2,762 PSUs in the sampling frame. In each wave, the CGSS sampled about 12,000 households and a KISH grid procedure was used to randomly select one adult respondent (18 years of age or older) from each household for a face-to-face in-home interview. Sampling weights were included to reflect the general population parameters of the survey year.

The final sample contains 15,969 observations from the CGSS 2013 and 2015 combined, after deleting observations with important missing variables. There are only 5566 observations from the 2013 wave because the CGSS 2013 was designed to sample only about half of all respondents to answer the public healthcare satisfaction survey.

Data analysis and ethical considerations

The Chinese General Social Survey (CGSS), the main data analyzed in this study, was originally collected by the National Survey Research Center at Renmin University of China. The CGSS abides by the Statistics Law of the People's Republic of China. The publicly disclosed survey data has been anonymized, following rigorous ethical practice and academic standards. As for the public healthcare resource data used in this study, they are obtained from the China Public Health Statistical Yearbook, another government publication.

This study analyzes the above-mentioned of publicly available ethical data and did not collect any individual data directly. Therefore, this study did not require extra ethics approval.

Patient and public involvement

In the survey performed by the CGSS, the general population in all 31 provinces and municipalities in China were sampled to respond to administered questionnaires about their living conditions and social activities. The respondents were informed in writing about the aim of the survey and how their privacy and information rights were protected legally. Detailed information can be found in the questionnaire disclosed in the database.

No patients were directly involved in this study. No experimental designs were involved.

Dependent variable

Public satisfaction with the healthcare system. The measurement is based on the single question, 'Taking all aspects into consideration, what is your general satisfaction with the healthcare system?' Respondents were asked to assign a score between 0 to 100, with '0' representing totally unsatisfied and '100' for totally satisfied. As reported in Table 1, the average satisfaction score of the whole sample is 68.5. It is observed that the satisfaction scores of most responses concentrated on four integrals such as 50, 60, 70, and 80 points. In Chinese culture, 60 points mean "Passing/neutral", 70 points means "good, satisfied", 80 points and above means "very good, very satisfied". 40% of the respondents reported a satisfaction score higher than 70 points.

To be consistent with the literature[5, 34], a dummy variable of "being satisfied" was constructed, taking the value of '1' if a respondent's satisfaction score is greater than or equal to 70 points[34].

Independent variables

Demographic and socioeconomic characteristics. Control variables included gender (1= female), age group (1= those equal to or older than 60 years), minority ethnic group (1= Yes), marital status (1= married/living together), and education level (a category variable). General physical health condition was measured by a single item: 'How do you evaluate your health condition overall?' Respondents rated on a

five-point Likert scale (1=very unhealthy, 2 = unhealthy, 3 = so-so, 4 = healthy, and 5 = very healthy). Socioeconomic information included living area (urban or rural), internal migrant status (1=Yes), employment status (employed =1), primary health insurance status (1=Yes) and basic pension status (1=Yes). Household social-economic status was measured as 'below the average', 'middle class', 'middle-high', and 'high', according to the respondent's answer to a single item: 'How do you assess your relative economic condition in the society?'.

Healthcare resources on an aggregated level. Key indicators of the public healthcare resources included total health expenditure as a percentage of GDP, the government's percentage of total expenditure on healthcare, out-of-pocket percentage of individuals, the densities of the health workforce and hospital beds[4] (per 1,000 population) in rural and urban areas of each province respectively.

Year and region dummy variables. Dummy variables were included to identify the major economic regions in China (East, Central, West, and Northeast regions) according to the official classification standard, as well as the municipalities (Beijing, Shanghai, Tianjin, and Chongqing), which have relatively abundant healthcare resources and are also the pilot cities of some healthcare reforms. A dummy variable was included to identify the survey wave of the year 2015.

Statistical analysis

The baseline model is a multivariate logistic regression model[4, 5, 35, 36], analyzing the major factors associated with China residents' satisfaction with the healthcare system. The dependent variable was the dummy variable of "being satisfied" with the healthcare system. The independent variables included all individual and provincial level variables as introduced in the Measures section.

In step two, interaction terms of rural and healthcare resource variables were constructed to examine the rural disparities. An interaction term for the rural area and a year dummy for 2015 was also constructed to examine how the satisfaction in rural areas changed between the years 2013 and 2015.

In step three, interaction terms of region dummies and year 2015 were adopted to examine the changes in the geographic variations over time. All regressions were conducted in STATA 15, weight-adjusted, using the survey weights provided in the original datasets.

RESULTS

Descriptive statistics

Table 1 reports the demographic statistics of the participants (Panel A) and summary information of the healthcare resources in various regions of China (Panel B). The total observation numbers are weight-adjusted, using the survey weights provided in the original datasets.

As reported in Table 2, the mean satisfaction score of the sample is 68.5 out of 100 points. The scores in 2013 and 2015 are 66.2 and 69.7 respectively. Panel B of Table 2 reports the percentage of respondents who scored above 70 points and are classified as "being satisfied with the healthcare system". This ratio was 52.9% in 2013, then 63.9% in 2015, suggesting that public satisfaction with the healthcare system in China had made general improvement during the study period.

Baseline analysis

Table 3 reports the logistic regression results of the demographic characteristics of the baseline analysis. Senior respondents (older than or equal to 60 years) are significantly more likely, by 19 percentage points (OR=1.19, $p<0.001$), to report being satisfied with the healthcare system.

Respondents from rural areas on average are more likely to report being satisfied (OR=1.23, $p=0.009$). Those from ethnic minority groups, with basic health insurance [37, 38], with better self-reported health, or with higher self-rated social-economic status, are at greater odds of reporting being satisfied. Meanwhile, internal migrants (OR=0.75, $p<0.001$) and those with a higher level of education[27] are less likely to report being satisfied.

As for the association with province-level health resources and expenditures, higher total health expenditure as a percentage of GDP and density of hospital beds are significantly associated with a higher probability of reporting as being satisfied (OR=1.13, $p<0.001$). Meanwhile, the government's share in total healthcare expenditure has a moderately negative association with satisfaction (OR=0.97, $p<0.001$). Out-of-pocket percentage and the density of the healthcare workforce are insignificant.

Additionally, in the year 2015, the respondents were on average more likely than in the year 2013 by 51 percentage points to report being satisfied.

Rural disparities and changes

As reported in Panel A of Table 4, in the rural area the density of hospital beds is positively associated with higher satisfaction (OR=1.26, p= 0.002). The effect is even stronger than the main effect (OR=1.02, p= 0.057) in Table 3. The density of the healthcare workforce in rural areas or the dummy variable rural area is not significant in this specification.

Panel B reports the changes in rural areas during the period from 2013 to 2015. The coefficients of Rural*2015 indicates that rural residents are more likely by 57 percentage points in 2015 to report being satisfied (OR=1.57, p<0.001). After including the interaction term of rural areas and year 2015, the odds ratio of the rural area is reduced to be 1.00 and totally insignificant, while the Year 2015 is still significant though its odds ratio became smaller.

Regional variations

As shown in Table 3, with East China as the baseline region, Middle and West China regions (OR=1.36, p=0.001; OR=1.28, p=0.019), together with Tianjin and Chongqing municipalities (OR=1.48, p=0.001; OR=2.03, p<0.001), are on average more likely to report being satisfied. On the other hand, the Northeast region and Shanghai (OR=0.49, p<0.001; OR=0.71, p=0.034) are less likely by about 51 to 30 percentage points respectively. Beijing is not significantly different from the East region.

After the interaction terms of Year 2015 and regions are controlled, the results reported in Table 5 indicate that the differences in Middle and West China regions are no longer significant, but the differences in Tianjin, Chongqing, Shanghai and the Northeast region of China are robust and consistent.

Changes in 2015

The dummy variable Year 2015 captures the average changes in the public satisfaction. As reported in Table 3 and Table 5, the odds ratios of Year 2015 are 1.36 and 1.23 respectively, highly significant in both specifications.

In 2015, after controlling for the average year effect and region effects, respondents from the Middle (OR=1.60, p<0.001) and the West China regions (OR=1.44, p=0.002) are significantly more likely to report being satisfied than those from the base group

of East China region. Meanwhile, there was no significant improvement in the Northeast region or Shanghai City, though respondents from these two regions tend to report being less satisfied.

Discussion

Demographic and socioeconomic characteristics

The association relationships between the various demographic characteristics and the public satisfaction with the healthcare system found in this study are all consistent with existing literature. For example, seniors[27, 39], those with better self-rated health[37], and those with higher social economic status[40] are more likely to report being satisfied[13, 14]. Those are with a lower level of education[27] and those in rural areas[27, 35] are more likely to report being satisfied too[14].

This phenomenon may be explained by the role of the respondents' expectations [3, 5, 36]. Residents with a lower level of education and in rural areas of China have had a lower level of expectation. In past decades, they only had very limited access to public healthcare resources and social welfare. Also, they are usually unaware of their citizenship entitlements or patient rights[17, 27, 41].

Healthcare resources

Generally, a larger healthcare workforce and more resources are associated with a higher level of public satisfaction with the healthcare system[42, 43]. However, this study has mixed findings.

1) There are positive associations between public satisfaction and the expenditure on healthcare as a percentage of GDP, as well as the density of hospital beds. These findings are consistent with the general perception in the literature[4, 34, 42, 43].
2) A higher level of healthcare professionals in the population usually appears to increase overall patient satisfaction[34, 44, 45] , however, the estimates of this factor are not statistically significant in this study. Actually, the higher quality of public hospitals in the developed regions of China has attracted patients from all over the country and is always overcrowded and experiencing overcapacity situations[9].Hence, the nominal healthcare professional density in the population may not reflect the actual healthcare resources accessible by the permanent residents in those areas.
3) Generally, a lower out of pocket expense is preferred by the population [34, 44].

However, this study found no significant role from the ratio of out of pocket expenses. This study has found that there is a moderate negative association with the share of government expenditure on satisfaction with healthcare. This finding is different from those in European countries[4, 34, 45]. There could be several potential explanations about this paradox. First, the negative association may reflect the shares of government expenditures in poorer regions, which have increased as the result of healthcare reform in China. However, it takes a longer time and it is a challenging, systematic task to improve the public satisfaction with the healthcare system in those areas. Second, accessing preferred care is highly important to the satisfaction of some citizens[6], but healthcare choices are further limited when the government is taking a greater share of the expenditure. For example, with the implementation of the Essential Drug Lists and Drug Zero-mark-up policy in public hospitals in China, the availability of preferred therapies are limited[3, 23]. Third, there is also the possibility that some government expenditure on healthcare may have not been allocated appropriately or efficiently. For instance, the funding may have been allocated to sophisticated but unnecessary medical equipment. Future research should continue to explore and investigate this phenomenon.

Rural disparities

As reported in Panel A of Table 4, the density of hospital beds in rural areas of China has a strong positive association with the satisfaction of respondents (OR=1.26, p=0.002), whereas the odds ratio is only 1.04 (p=0.057) in the baseline model. This phenomenon may be explained as follows. First, hospitalization is often perceived in China as health care of better quality and with more experienced physicians. Second, hospitalization is often preferred by many patients in China because inpatient service has a higher reimbursement ratio than outpatient service[17, 26]. Third, in rural areas of China, hospitalization can be especially helpful assuring a patient with having access to quality medical care and alleviating the commuting needs from distantly located home places[41]. Additionally, if admitted to hospitalization, most rural residents have a lower opportunity cost in terms of time than urban residents, since they don't have an office-commuting requirement.

While the bed occupancy rate of tertiary hospitals in China could be as high as 107.5% on average due to temporarily added beds, it may be as low as 58.0% in

township-level hospitals [46]. It is often difficult to get admitted into tertiary hospitals, or for shorter lengths of stay[16]. When there is a higher density of hospital beds in rural areas, it may be easier for a patient to get admitted for hospitalization[47-49]. Therefore, rural residents with easy hospitalization admission may perceive having good quality healthcare with a low cost. Consequently, they may report having a high level of satisfaction.

As shown in Panel B of Table 4, the odds ratio of Rural*2015 is as large as 1.57 ($p<0.001$). This finding indicates a large and significant enhancement in the satisfaction with the healthcare system in rural areas. After controlling the changes in 2015, the odds ratio of the rural area becomes insignificant, while the year dummy of 2015 is still large and highly significant (OR=1.24, $p<0.001$). Together, these results suggest that the healthcare reform actions of China from 2013 to 2015 have brought significant improvements to the healthcare satisfaction in rural areas.

Regional variations and changes in 2015

The regional differences in the healthcare system satisfaction may have reflected the inequality of healthcare resources and quality in China[50]. Beijing, Shanghai, Tianjin, and Chongqing City, the four municipalities, are the most important central cities in China with the most advanced and abundant healthcare resources in China. Since they have also piloted many healthcare reform plans, it is not unexpected that there are no significant changes in public satisfaction with the healthcare system during the studied period.

South and West regions, are more likely to experience a significant and large enhancement in healthcare satisfaction during the reform period of 2013-2015, because many of the reform policies were eventually implemented in these regions after piloting in the East region of China.

Shanghai's lower level of satisfaction may be due to the very crowded hospital environment and overstretched resources. As the most modernized city in China, Shanghai has the most skilled professionals and advanced medical equipment. However, due to the lack of a referral system, all tertiary hospitals in Shanghai are always in high demand and crowded with patients from all over the country[16]. Hence, local Shanghai residents actually don't have a good experience generally. This situation has not improved during this round of healthcare reform.

It is noted that the Northeast Region consistently reported a lower level of satisfaction

and no significant improvements during the studied period. The low satisfaction actually can be attributed to the weak economy concurrently in this region. Known as China's rustbelt, the three northeastern provinces were plagued by widespread layoffs in the 1990s and were among the regions with the weakest economic growth in 2010s[51]. With a shrinking economy and fiscal deficits, the local governments had very limited resources available for healthcare and many local healthcare professionals migrated to other developed regions in the country[9, 52]. Additionally, poor economic performance may also directly affect the respondents' perception and lead to a lower rating of the public policies, including the healthcare system[4, 5]. Additionally, Chen et al. (2019) report that patients in the Northeast consistently had the highest mortalities in terms of the overall stroke and each subtype of stroke[53]. The researchers indicate that this may be mainly due to the differences in lifestyle and inconsistent medical development and a lower economic level.

Robustness check

As a robustness check, "being satisfied" is redefined as scoring equal to or greater than 80 points. About 15% of the sample population scored their satisfaction equal to or greater than 80 points. Logistic regressions of the same model were performed accordingly.

Ordinary Least Square (OLS) regressions were also performed, using the original 'satisfaction score' of respondents as the dependent variable.

The results of the robustness checks above are all consistent with our current findings.

LIMITATIONS

As a type of subjective evaluation, public satisfaction has several weaknesses when being adopted to measure the healthcare system's performance. First, the data in this study, especially, the CGSS 2013, contains only one global satisfaction score. Therefore, it is difficult to attribute the satisfaction or dissatisfaction to specific reform actions or issues of the healthcare system[5]. With the advancement in research and reform of the healthcare system in China, a dataset with more detailed information may be available in more recent or future years. Grey Relational Analysis method, as a novel quantitative method, can also be applied to obtain more detailed results to better understand the fuzzy/grey concept of satisfaction with the health system [54-56].

Second, while being related to the quality and outcome of healthcare service, public satisfaction may also be influenced by some external factors, such as media and political discussion [5, 36], or the citizens' expectations[54-57]. Since these confounding factors are not included in the original survey data and it is almost impossible to identify or recover them from other resources, the possibility of potential bias cannot be completely ruled out. While it will be interesting to study how media reports and portrayals about physicians and hospitals may influence the public's perception or satisfaction with the healthcare system in China, this topic actually is beyond our research scope and expertise. Third, self-reported health status is used as a health measurement in this study. It is generally valid, however, not as ideal as clinical health measurements.

CONCLUSION

Using a total sample of 15,969 observations from Chinese national representative surveys, the CGSS 2013 and 2015, this study examined various factors associated with public satisfaction of the healthcare system in China, such as demographic and individual socioeconomic characteristics, rural areas and regions across the country, as well as the changes of public satisfaction in 2015.

While there was a nation-wide general improvement in the satisfaction level recorded in year 2015, when the 2nd phase of the 2009 Health Reform was implemented, the low level of satisfaction among internal migrants as well as those of residents in the Northeast region of China remained unchanged. Especially, close attention and further study about the causal reason for the low level of satisfaction in the Northeast region is recommended.

Ethical Statement

The data used in this study is obtained from a publicly available national database.

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Competing interests statement

No competing financial, professional, or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

Author contributions

JHZ, XP, CKL designed the study and developed the methods. JHZ, XP, and HZ reviewed literature. JHZ, XP, YJC sorted and analyzed the data. XP prepared the tables. JHZ and XP drafted the manuscript. CKL, HZ and OOI provided a critical review of the manuscript. All authors have reviewed and approved the final version of the manuscript for publication.

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Appendix

Table 1 Descriptive statistics of the respondents in CGSS 2013-2015

Panel A: Respondents

	Total	2013	2015	Chi2
N	15969*	5566	10403	/
Satisfaction	68.50	66.21	69.73	/
Being satisfied	60.08%	52.91%	63.93%	/
Age				
Age(average years)	51.9	50.8	52.5	/
Age<60	63.4%	66.4%	61.8%	32.34
Age>=60	36.6%	33.6%	38.2%	
Gender				
Male	50.6%	50.8%	50.5%	0.07
Female	49.4%	49.2%	49.5%	
Ethnic group				
Han	92.8%	92.4%	93.1%	2.30
Ethnic minority	7.2%	7.6%	7.0%	
Marital status				
Single/separated/widow/widower	29.3%	28.8%	29.6%	1.10
Cohabitation& Married	70.7%	71.2%	70.4%	
Employment status				
Not working	43.1%	39.8%	44.9%	38.86
Employed/Farm	56.9%	60.3%	55.1%	
Education				
Elementary School or less	37.8%	36.2%	38.7%	
Middle / high School	45.6%	47.0%	44.9%	10.71
College	15.5%	15.8%	15.3%	
Postgraduate	1.1%	1.1%	1.1%	
Self-reported health				
Very bad	3.3%	3.4%	3.3%	
Bad	15.3%	14.4%	15.8%	
Average	21.6%	19.8%	22.6%	49.54
Good	38.0%	37.7%	38.1%	
Very good	21.8%	24.7%	20.3%	
Self-reported household economic status				
Far below average	6.0%	5.7%	6.2%	
Below average	32.2%	30.2%	33.3%	37.26
Average	53.7%	57.0%	52.0%	
Above average	8.1%	7.3%	8.2%	
Insurance status				
Without any health Insurance	10.2%	11.3%	9.6%	10.90
With any health insurance	89.8%	88.7%	90.4%	
Residence status				
Urban	60.0%	59.7%	60.2%	0.28

Rural	40.0%	40.3%	39.8%	
Internal migrant				
No	89.0%	88.7%	89.2%	1.09
Yes	11.0%	11.3%	10.8%	
Regions or municipalities				
East china（without Shanghai)	23.2%	23.6%	23.1%	
Middle china	23.9%	22.2%	24.8%	
West china (without Chongqin)	21.7%	21.1%	22.0%	
NEast china	14.2%	14.9%	13.8%	37.28
Beijing	5.1%	4.7%	5.3%	
Shanghai	6.2%	7.0%	5.7%	
Tianjin	3.2%	3.7%	3.0%	
Chongqin	2.6%	3.0%	2.4%	

Note: the total observation number is sample-weighted adjusted.

Panel B (1/2)

	% of healthcare expenditure in GDP			Government % in healthcare expenditure			Out of pocket（%）		
	Mean	Std. Err.	[95% Conf.Interval]	Mean	SE	[95% Conf.Interval]	Mean	Std. Err.	[95% Conf.Interval]
Total	5.48	0.005	(5.47 - 5.49)	29.45	0.029	(29.40 - 29.51)	33.12	0.031	(33.06 - 33.19)
East china （without Shanghai)	4.24	0.006	(4.23 - 4.26)	25.83	0.034	(25.77 - 25.90)	31.89	0.041	(31.81 - 31.97)
Middle china	5.45	0.005	(5.44 - 5.46)	32.84	0.040	(32.77 - 32.92)	36.87	0.044	(36.78 - 36.96)
West china (without Chongqin)	6.57	0.008	(6.55 - 6.59)	36.54	0.062	(36.42 - 36.67)	32.13	0.040	(32.05 - 32.20)
NEast china	5.53	0.011	(5.51 - 5.55)	24.51	0.026	(24.46 - 24.56)	40.41	0.054	(40.30 - 40.51)
Beijing	7.21	0.015	(7.19 - 7.24)	25.43	0.040	(25.35 - 25.51)	20.45	0.058	(20.34 - 20.56)
Shanghai	5.59	0.006	(5.58 - 5.60)	20.79	0.017	(20.76 - 20.83)	20.22	0.024	(20.17 - 20.27)
Tianjin	3.97	0.010	(3.95 - 3.99)	25.86	0.027	(25.81 - 25.91)	34.20	0.089	(34.03 - 34.37)
Chongqin	5.64	0.009	(5.62 - 5.65)	31.23	0.013	(31.20 - 31.26)	32.22	0.164	(31.90 - 32.54)

(To be continued on next page.)

Panel B（2/2）

	hospital beds/1k population			healthcare workforce/1k population		
	Mean	Std. Err.	[95% Conf.Interval]	Mean	Std. Err.	[95% Conf.Interval]
Total	6.05	0.019	（ 6.01 - 6.08 ）	2.84	0.008	（ 2.82 - 2.85 ）
East china（without Shanghai)	5.96	0.035	（ 5.90 - 6.03 ）	2.97	0.017	（ 2.94 - 3.01 ）
Middle china	5.82	0.038	（ 5.75 - 5.89 ）	2.36	0.015	（ 2.33 - 2.39 ）
West china (without Chongqin)	5.87	0.043	（ 5.79 - 5.96 ）	2.38	0.018	（ 2.34 - 2.41 ）
NEast china	6.44	0.056	（ 6.33 - 6.55 ）	2.67	0.019	（ 2.63 - 2.70 ）
Beijing	7.48	0.065	（ 7.36 - 7.61 ）	5.60	0.034	（ 5.53 - 5.66 ）
Shanghai	6.89	0.077	（ 6.74 - 7.04 ）	4.27	0.003	（ 4.26 - 4.27 ）
Tianjin	5.36	0.064	（ 5.23 - 5.48 ）	3.15	0.015	（ 3.12 - 3.18 ）
Chongqin	4.26	0.026	（ 4.21 - 4.31 ）	1.58	0.012	（ 1.55 - 1.60 ）

Table 2 Descriptive Statistics of satisfaction about the health system in China (2013-2015)
Panel A（1/2）

	Satisfaction score		
	total		
	Mean	Std. Err.	[95% Conf.Interval]
Satisfaction score	68.50	0.15	(68.20 - 68.80)
Age			
Age<60	67.43	0.19	(67.06 - 67.80)
Age>=60	70.35	0.27	(69.83 - 70.88)
Gender			
Male	68.16	0.23	(67.72 - 68.61)
Female	68.84	0.21	(68.42 - 69.26)
Ethnic group			
Han	68.28	0.16	(67.97 - 68.60)
Ethnic minority	71.26	0.55	(70.19 - 72.34)
Marital status			
Single/separated/widow/widower	68.07	0.34	(67.40 - 68.74)
Cohabitation& Married	68.67	0.17	(68.34 - 69.00)
Employment status			
Not working	69.08	0.25	(68.60 - 69.56)
Employed/Farm	68.06	0.20	(67.66 - 68.45)
Education			
Elementary School or less	70.76	0.26	(70.26 - 71.26)
Middle / high School	67.53	0.23	(67.08 - 67.99)
College	66.36	0.37	(65.64 - 67.09)
Postgraduate	60.69	1.58	(57.59 - 63.78)
Self-reported health			
Very bad	66.39	1.14	(64.15 - 68.63)
Bad	68.28	0.43	(67.43 - 69.13)
Average	68.18	0.34	(67.52 - 68.85)
Good	68.62	0.24	(68.15 - 69.10)
Very good	69.07	0.32	(68.43 - 69.70)
Self-reported household economic status			
Far below average	65.26	0.86	(63.57 - 66.95)
Below average	67.16	0.29	(66.59 - 67.73)
Average	69.37	0.20	(68.99 - 69.76)
Above average	70.44	0.52	(69.42 - 71.46)
Insurance status			
Without any health Insurance	65.90	0.53	(64.85 - 66.94)
With any health insurance	68.79	0.16	(68.48 - 69.11)
Residence status			
Urban	67.48	0.20	(67.08 - 67.87)
Rural	70.03	0.24	(69.56 - 70.51)
Internal migrant			
No	68.99	0.16	(68.67 - 69.31)
Yes	64.50	0.50	(63.53 - 65.48)
Regions or municipalities			
East china（without Shanghai)	68.32	0.30	(67.74 - 68.91)

Middle china	70.53	0.28	(	69.98	-	71.08	)
West china (without Chongqin)	70.49	0.33	(	69.86	-	71.13	)
NEast china	63.88	0.48	(	62.94	-	64.82	)
Beijing	66.10	0.77	(	64.58	-	67.62	)
Shanghai	64.33	0.72	(	62.91	-	65.75	)
Tianjin	68.84	0.78	(	67.31	-	70.36	)
Chongqin	73.94	0.75	(	72.46	-	75.41	)

(To be continued)

Panel A (2/2)

	Satisfaction score					
	2013			2015		
	Mean	Std. Err.	[95% Conf.Interval]	Mean	Std. Err.	[95% Conf.Interval]
Satisfaction	66.21	0.24	(65.73 - 66.68)	69.73	0.20	(69.34 - 70.12)
Age						
Age<60	65.40	0.29	(64.82 - 65.97)	68.60	0.25	(68.11 - 69.08)
Age>=60	67.81	0.45	(66.93 - 68.68)	71.56	0.33	(70.91 - 72.21)
Gender						
Male	66.07	0.35	(65.38 - 66.76)	69.29	0.29	(68.72 - 69.86)
Female	66.35	0.34	(65.67 - 67.02)	70.17	0.27	(69.64 - 70.71)
Ethnic group						
Han	65.94	0.25	(65.44 - 66.44)	69.53	0.21	(69.13 - 69.94)
Ethnic minority	69.42	0.89	(67.69 - 71.16)	72.35	0.70	(70.97 - 73.72)
Marital status						
Single/separated/widow/widower	65.73	0.54	(64.68 - 66.79)	69.30	0.44	(68.44 - 70.15)
Cohabitation& Married	66.40	0.27	(65.87 - 66.92)	69.91	0.22	(69.49 - 70.34)
Employment status						
Not working	66.38	0.41	(65.58 - 67.18)	70.37	0.31	(69.77 - 70.97)
Employed/Farm	66.09	0.31	(65.49 - 66.69)	69.21	0.26	(68.69 - 69.72)
Education						
Elementary School or less	68.15	0.40	(67.36 - 68.94)	72.07	0.33	(71.42 - 72.71)
Middle / high School	65.50	0.36	(64.80 - 66.20)	68.68	0.30	(68.09 - 69.27)
College	64.32	0.61	(63.12 - 65.52)	67.50	0.46	(66.60 - 68.39)
Postgraduate	59.17	2.54	(54.19 - 64.15)	61.45	1.99	(57.55 - 65.35)
Self-reported health						
Very bad	65.68	1.76	(62.24 - 69.12)	66.79	1.48	(63.88 - 69.70)
Bad	65.61	0.70	(64.23 - 66.99)	69.59	0.55	(68.52 - 70.66)

Average	65.43	0.55	(	64.35	-	66.50	)	69.48	0.42	(	68.65	- 70.31)
Good	66.31	0.38	(	65.58	-	67.05	)	69.85	0.31	(	69.25	- 70.46)
Very good	67.09	0.50	(	66.11	-	68.06	)	70.36	0.42	(	69.53	- 71.19)
Self-reported household economic status												
Far below average	62.69	1.56	(	59.63	-	65.74	)	66.51	1.03	(	64.49	- 68.53)
Below average	65.19	0.47	(	64.26	-	66.12	)	68.12	0.37	(	67.39	- 68.84)
Average	66.88	0.30	(	66.30	-	67.46	)	70.84	0.26	(	70.34	- 71.34)
Above average	67.87	0.86	(	66.18	-	69.56	)	71.61	0.64	(	70.35	- 72.87)
Insurance status												
Without any health Insurance	64.36	0.77	(	62.86	-	65.87	)	66.86	0.72	(	65.45	- 68.27)
With any health insurance	66.44	0.26	(	65.93	-	66.95	)	70.04	0.21	(	69.63	- 70.44)
Residence status												
Urban	67.12	0.31	(	66.52	-	67.72	)	67.67	0.26	(	67.15	- 68.18)
Rural	64.85	0.40	(	64.06	-	65.64	)	72.85	0.30	(	72.26	- 73.43)
Internal migrant												
No	66.52	0.26	(	66.01	-	67.02	)	70.31	0.21	(	69.91	- 70.72)
Yes	63.76	0.77	(	62.26	-	65.27	)	64.92	0.65	(	63.65	- 66.19)
Regions or municipalities												
East china（without Shanghai)	67.26	0.49	(	66.29	-	68.23	)	68.91	0.38	(	68.16	- 69.66)
Middle china	66.73	0.45	(	65.84	-	67.62	)	72.35	0.35	(	71.67	- 73.04)
West china (without Chongqin)	67.01	0.55	(	65.94	-	68.08	)	72.29	0.40	(	71.50	- 73.08)
NEast china	62.88	0.69	(	61.53	-	64.23	)	64.46	0.65	(	63.20	- 65.73)
Beijing	63.75	1.05	(	61.70	-	65.80	)	67.22	1.01	(	65.23	- 69.21)
Shanghai	62.61	1.13	(	60.40	-	64.83	)	65.45	0.93	(	63.63	- 67.27)
Tianjin	70.60	0.79	(	69.05	-	72.14	)	67.66	1.18	(	65.36	- 69.97)
Chongqin	71.67	1.34	(	69.04	-	74.30	)	75.45	0.88	(	73.73	- 77.17)

Table 2 Descriptive Statistics of satisfaction about the health system in China (2013-2015)
Panel B（1/2）

	% of being satisfied		(Full sample)			
	Mean	Std. Err.	[95%		Conf.Interval]	
Age						
Age<60	57.58%	0.54%	(56.53%	-	58.63%	)
Age>=60	64.41%	0.77%	(62.91%	-	65.92%	)
Gender						
Male	59.56%	0.64%	(58.30%	-	60.81%	)
Female	60.61%	0.61%	(59.41%	-	61.82%	)
Ethnic group						
Han	59.70%	0.46%	(58.80%	-	60.59%	)
Ethnic minority	65.00%	1.58%	(61.90%	-	68.10%	)
Marital status						
Single/separated/widow/widower	60.02%	0.97%	(58.12%	-	61.91%	)
Cohabitation& Married	60.10%	0.48%	(59.16%	-	61.05%	)
Employment status						
Not working	61.26%	0.69%	(59.91%	-	62.61%	)
Employed/Farm	59.18%	0.58%	(58.05%	-	60.31%	)
Education						
Elementary School or less	65.71%	0.71%	(64.31%	-	67.11%	)
Middle / high School	57.56%	0.65%	(56.28%	-	58.84%	)
College	54.58%	1.15%	(52.32%	-	56.84%	)
Postgraduate	47.99%	4.63%	(38.91%	-	57.06%	)
Self-reported health						
Very bad	55.10%	2.63%	(49.94%	-	60.26%	)
Bad	58.02%	1.19%	(55.69%	-	60.35%	)
Average	58.19%	0.98%	(56.26%	-	60.11%	)
Good	61.59%	0.70%	(60.21%	-	62.97%	)
Very good	61.52%	0.93%	(59.70%	-	63.33%	)
Self-reported household economic status						
Far below average	53.21%	2.02%	(49.24%	-	57.18%	)
Below average	56.57%	0.80%	(54.99%	-	58.14%	)
Average	61.97%	0.59%	(60.81%	-	63.12%	)
Above average	66.66%	1.47%	(63.78%	-	69.54%	)
Insurance status						
Without any health Insurance	52.90%	1.50%	(49.97%	-	55.83%	)
With any health insurance	60.90%	0.46%	(59.99%	-	61.80%	)
Residence status						
Urban	57.67%	0.57%	(56.55%	-	58.79%	)
Rural	63.69%	0.69%	(62.35%	-	65.04%	)
Internal migrant						
No	61.43%	0.46%	(60.53%	-	62.33%	)
Yes	49.10%	1.47%	(46.22%	-	51.98%	)
Regions or municipalities						
East china（without Shanghai)	58.66%	0.91%	(56.89%	-	60.44%	)
Middle china	66.38%	0.84%	(64.73%	-	68.03%	)

West china (without Chongqin)	64.20%	0.92%	(	62.40%	-	65.99%	)
NEast china	47.22%	1.22%	(	44.82%	-	49.62%	)
Beijing	53.34%	2.02%	(	49.38%	-	57.29%	)
Shanghai	52.52%	2.04%	(	48.53%	-	56.52%	)
Tianjin	65.34%	2.37%	(	60.70%	-	69.97%	)
Chongqin	74.93%	2.46%	(	70.11%	-	79.74%	)

(To be continued)

Panel B (2/2)

	% of being satisfied									
	2013					2015				
	Mean	Std. Err.	[95%	Conf.Interval]		Mean	Std. Err.	[95%	CI]	
Satisfaction	52.91%	0.78%	(51.37%	- 54.45%	)	63.93%	0.52%	(62.90%	- 64.95%	)
Age										
Age<60	51.41%	0.93%	(49.60%	- 53.23%	)	61.13%	0.66%	(59.85%	- 62.42%	)
Age>=60	55.86%	1.47%	(52.99%	- 58.74%	)	68.46%	0.89%	(66.72%	- 70.19%	)
Gender										
Male	53.09%	1.11%	(50.91%	- 55.27%	)	63.04%	0.78%	(61.52%	- 64.56%	)
Female	52.72%	1.12%	(50.52%	- 54.92%	)	64.83%	0.72%	(63.42%	- 66.25%	)
Ethnic group										
Han	52.37%	0.82%	(50.77%	- 53.97%	)	63.60%	0.55%	(62.53%	- 64.68%	)
Ethnic minority	59.46%	2.84%	(53.89%	- 65.03%	)	68.25%	1.87%	(64.60%	- 71.91%	)
Marital status										
Single/separated/widow/widower	52.19%	1.73%	(48.80%	- 55.59%	)	64.10%	1.15%	(61.86%	- 66.35%	)
Cohabitation& Married	53.20%	0.86%	(51.52%	- 54.88%	)	63.85%	0.58%	(62.72%	- 64.99%	)
Employment status										
Not working	53.10%	1.29%	(50.57%	- 55.64%	)	65.14%	0.80%	(63.56%	- 66.72%	)
Employed/Farm	52.78%	0.99%	(50.84%	- 54.73%	)	62.94%	0.70%	(61.56%	- 64.32%	)
Education										
Elementary School or less	56.77%	1.32%	(54.18%	- 59.37%	)	70.19%	0.83%	(68.56%	- 71.82%	)
Middle / high School	51.27%	1.13%	(49.05%	- 53.49%	)	61.10%	0.79%	(59.55%	- 62.65%	)
College	49.45%	2.01%	(45.51%	- 53.40%	)	57.43%	1.40%	(54.69%	- 60.16%	)
Postgraduate	45.15%	8.14%	(29.20%	- 61.10%	)	49.41%	5.62%	(38.40%	- 60.43%	)
Self-reported health										
Very bad	50.43%	4.74%	(41.14%	- 59.72%	)	57.69%	3.13%	(51.56%	- 63.82%	)
Bad	48.76%	2.17%	(44.51%	- 53.01%	)	62.56%	1.40%	(59.82%	- 65.31%	)

Average	50.13%	1.83%	(	46.54%	-	53.72%	)	61.98%	1.15%	(	59.73%	-	64.24%	)
Good	53.78%	1.26%	(	51.31%	-	56.25%	)	65.75%	0.84%	(	64.10%	-	67.39%	)
Very good	56.57%	1.54%	(	53.55%	-	59.58%	)	64.75%	1.15%	(	62.50%	-	67.00%	)
Self-reported household economic status														
Far below average	46.27%	3.70%	(	39.02%	-	53.52%	)	56.59%	2.40%	(	51.89%	-	61.29%	)
Below average	48.96%	1.46%	(	46.10%	-	51.82%	)	60.26%	0.96%	(	58.39%	-	62.14%	)
Average	54.62%	1.03%	(	52.60%	-	56.63%	)	66.30%	0.71%	(	64.91%	-	67.68%	)
Above average	61.12%	2.72%	(	55.79%	-	66.46%	)	69.19%	1.74%	(	65.78%	-	72.60%	)
Insurance status														
Without any health Insurance	46.92%	2.49%	(	42.05%	-	51.79%	)	56.66%	1.86%	(	53.02%	-	60.31%	)
With any health insurance	53.67%	0.83%	(	52.05%	-	55.30%	)	64.70%	0.55%	(	63.63%	-	65.78%	)
Residence status														
Urban	54.84%	0.99%	(	52.90%	-	56.78%	)	59.18%	0.70%	(	57.81%	-	60.55%	)
Rural	50.05%	1.28%	(	47.54%	-	52.55%	)	71.10%	0.78%	(	69.57%	-	72.62%	)
Internal migrant														
No	53.60%	0.82%	(	51.99%	-	55.21%	)	65.62%	0.55%	(	64.54%	-	66.69%	)
Yes	47.54%	2.60%	(	42.45%	-	52.63%	)	49.98%	1.78%	(	46.50%	-	53.46%	)
Regions or municipalities														
East china（without Shanghai)	54.51%	1.65%	(	51.27%	-	57.76%	)	60.94%	1.09%	(	58.81%	-	63.07%	)
Middle china	55.28%	1.58%	(	52.19%	-	58.37%	)	71.70%	0.98%	(	69.78%	-	73.61%	)
West china (without Chongqin)	53.64%	1.65%	(	50.40%	-	56.88%	)	69.64%	1.08%	(	67.53%	-	71.75%	)
NEast china	43.13%	2.10%	(	39.01%	-	47.24%	)	49.59%	1.50%	(	46.65%	-	52.53%	)
Beijing	51.63%	3.32%	(	45.13%	-	58.14%	)	54.15%	2.50%	(	49.25%	-	59.05%	)
Shanghai	45.36%	3.33%	(	38.83%	-	51.90%	)	57.20%	2.48%	(	52.34%	-	62.07%	)
Tianjin	66.85%	3.47%	(	60.04%	-	73.66%	)	64.33%	3.18%	(	58.10%	-	70.55%	)
Chongqin	68.61%	4.55%	(	59.69%	-	77.53%	)	79.12%	2.73%	(	73.77%		84.48%	)

Note: Dep. Var. "Being satisfied" is a dummy variable, taking the value of "1" if a respondent's satisfaction score is greater than 70 points.

Table 3. Baseline analysis (logistic regression)

Dep. Var. = "Being Satisfied"

Variables	Odds ratio	P-value	[95% Conf. Interval]
Demographic			
Age>=60	1.19	<0.001	1.08 - 1.32
Female	1.03	0.513	0.95 - 1.11
Cohabitation/Married	0.93	0.108	0.84 - 1.02
Han (Ethnic group)	1.28	0.001	1.11 - 1.49
Rural	1.23	0.009	1.05 - 1.44
Internal migrant	0.75	<0.001	0.66 - 0.85
Employed/Farm	0.97	0.452	0.89 - 1.06
With any health insurance	1.18	0.011	1.04 - 1.35
Education			
Elementary School or less	Ref.		
Middle / high School	0.76	<0.001	0.69 - 0.83
College	0.65	<0.001	0.57 - 0.75
Postgraduate	0.55	0.002	0.37 - 0.80
Self-reported health			
Very bad	Ref.		
Bad	1.04	0.721	0.82 - 1.32
Average	1.18	0.163	0.93 - 1.49
Good	1.45	0.002	1.15 - 1.83
Very good	1.61	<0.001	1.27 - 2.04
Self-reported household economic status			
Far below average	Ref.		
Below average	1.21	0.037	1.01 - 1.45
Average	1.59	<0.001	1.33 - 1.90
Above average	2.05	<0.001	1.64 - 2.55
Resources			
healthcare expenditure % in GDP	1.13	<0.001	1.05 - 1.20
Government % in healthcare expenditure	0.97	<0.001	0.95 - 0.98
Out of pocket %	1.00	0.570	0.99 - 1.02
Hospital beds/10k population	1.04	0.057	1.00 - 1.08
Healthcare workforce/10k population	0.92	0.117	0.83 - 1.02
Region			
East china (without Shanghai)	Ref.		
Middle china	1.36	0.001	1.14 - 1.62
West china (without Chongqin)	1.28	0.019	1.04 - 1.58
Northeast china	0.49	0.000	0.41 - 0.59
Beijing	0.83	0.342	0.56 - 1.22
Shanghai	0.71	0.034	0.52 - 0.98
Tianjin	1.48	0.001	1.17 - 1.86
Chongqing	2.03	<0.001	1.50 - 2.76
Year			
Year2013	Ref.		
Year2015	1.51	0.000	1.36 - 1.66

Constant	0.73	0.437	0.33	-	1.61
Observations	15,969				
R-squared	0.07				

Note: Dep. Var. "Being satisfied" is a dummy variable, taking the value of "1" if a respondent's satisfaction score is greater than 70 points.

Table 4 Regression of Resource, Rural & Years with Being Satisfied

Dep. Var. = "Being Satisfied"

Panel A

Variables	Odds ratio	P-value	[95% Interval]	Conf.
Hospital beds/1k population * Rural	1.26	0.002	1.09	1.47
Healthcare workforce/1k population * Rural	0.96	0.545	0.84	1.09
Rural	1.12	0.243	0.93	1.34
Constant	0.24	0.001	0.10	0.54
Observations	15,969			

Note: The regression has controlled all other variables as listed in Table 3.

Panel B

Variables	Odds ratio	P-value	[95% Interval]	Conf.
Rural	1.00	0.982	0.83	1.20
Rural* Year 2015	1.57	<0.001	1.30	1.90
Year 2015	1.24	0.001	1.09	1.41
Constant	0.92	0.845	0.42	2.05
Observations	15,969			

Note: The regression has controlled all other variables as listed in Table 3.

Table 5 Regression of Region & Years with Being Satisfied

Dep.Var.= "Being Satisfied"

Variables	Odds ratio	P-value	[95% Conf.	Interval]
Year 2015	1.23	0.022	1.03	1.46
East china (without Shanghai)				
Middle china	1.00	0.989	0.79	1.27
West china (without Chongqin)	0.99	0.955	0.76	1.29
NEast china	0.46	<0.001	0.36	0.60
Beijing	0.83	0.437	0.52	1.32
Shanghai	0.62	0.065	0.38	1.03
Tianjin	1.72	0.004	1.20	2.49
Chongqing	1.67	0.036	1.03	2.69
Year2015* East china (without Shanghai)				
Year2015*Middle china	1.60	<0.001	1.27	2.02
Year2015*West china (without Chongqin)	1.44	0.002	1.14	1.82
Year2015*NEast china	1.07	0.610	0.82	1.40
Year2015* Beijing	0.93	0.715	0.64	1.35
Year2015*Shanghai	1.18	0.469	0.76	1.83
Year2015*Tianjin	0.77	0.289	0.48	1.24
Year2015* Chongqin	1.30	0.366	0.74	2.30
Constant	0.93	0.862	0.42	2.06
Observations	15,969			

Note: The regression has controlled the same variables as in Table 3.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract:[Page1]
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found:[Page1]
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported:[Page4-7]
Objectives	3	State specific objectives, including any prespecified hypotheses:[Page5]
Methods		
Study design	4	Present key elements of study design early in the paper:[Page10]
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection:[Page7-8]
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants:[Page9]
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable:[Page9-10]
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group:[Page12-13&Page38-40]
Bias	9	Describe any efforts to address potential sources of bias:[Page9,16]
Study size	10	Explain how the study size was arrived at:[Page7-8]
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why:[Page9]
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding:[Page10]
		(*b*) Describe any methods used to examine subgroups and interactions:[Page10]
		(*c*) Explain how missing data were addressed:[Page8]
		(*d*) If applicable, describe analytical methods taking account of sampling strategy:[N/A]
		(*e*) Describe any sensitivity analyses:[Page9,16]
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed:[Page8,10-11]
		(b) Give reasons for non-participation at each stage:[N/A]
		(c) Consider use of a flow diagram:[N/A]
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders:[Page 11,24-25]
		(b) Indicate number of participants with missing data for each variable of interest:[N/A]
Outcome data	15*	Report numbers of outcome events or summary measures:[Page11-13,24-40]
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included:[Page13-16,26-40]

		(*b*) Report category boundaries when continuous variables were categorized:[Page9]
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period:[N/A]
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses:[Page14-16]
Discussion		
Key results	18	Summarise key results with reference to study objectives:[Page17]
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias:[Page16-17]
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence:[Page13-17]
Generalisability	21	Discuss the generalisability (external validity) of the study results:[Page16]
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based:[Page17-18]

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Title Page

Article title: Public satisfaction with the healthcare system in China during 2013-2015: A cross-sectional survey of the associated factors

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Public satisfaction with the healthcare system in China during 2013-2015: A cross-sectional survey of the associated factors

Abstract

Objective We explore how public satisfaction with the healthcare system in China varies with social and economic factors, especially within regional variations and changes during 2013 to 2015.

Design Population-based, cross-sectional survey performed between July 2013 and July 2015.

Setting General population of China during 2013 to 2015

Participants 15,969 total participants (women=49.4%, sample-weighted average age =51.9)

Primary outcome measure Public satisfaction with the healthcare system, defined as "being satisfied" if a respondent's satisfaction score ≥ 70 points

Results 1) The two-year mean of the satisfaction score of the sample is 68.5 out of 100 points and the score in 2015 is higher than 2013 by 3.5 points. 2) Senior respondents (OR=1.19, p<0.001), rural respondents (OR=1.23, p=0.009) and those with higher socioeconomic status are more likely to report being satisfied. Internal migrants (OR=0.75, p<0.001) and those with a higher level of education are less likely to report being satisfied. 3) Total health expenditure as percentage of GDP and density of hospital beds have a significant positive association with satisfaction (OR=1.13, p<0.001). Meanwhile, the government's share in total healthcare expenditures has a moderately negative association with satisfaction (OR=0.97, p<0.001). In rural areas, the density of hospital beds has a positive association with satisfaction (OR=1.26, p= 0.002). 4) The Northeast region and Shanghai (OR =0.49, p<0.001; OR=0.71, p=0.034) are less likely to report being satisfied, and remained unchanged in 2015.

Conclusion There are considerable disparities in public satisfaction with the healthcare system in China, associated with demographic and socioeconomic characteristics, regional locations, urban-rural environment, and regional health resource abundance. Actions are recommended to improve satisfaction with the public healthcare system, especially in the Northeast region of China.

Strengths and limitations of this study

- Public satisfaction with healthcare systems has been considered one of the most coherent indicators of the general subjective evaluation of the healthcare system and effectiveness of the reform.
- This study analyzed a national representative sample of more than 15,969 respondents from two waves of surveys during the ongoing healthcare reform.
- This study provides empirical evidence about the rural-city disparity and the regional variations in healthcare satisfaction in China, which have not yet been well studied.
- The survey dataset contains only one global satisfaction score, making it difficult to further attribute the satisfaction or dissatisfaction to specific reform actions or issues of the healthcare system.
- Public satisfaction may be biased by confounding factors such as media reports and political discussion, or the citizens' expectations.

Public satisfaction with the healthcare system in China during 2013-2015: A cross-sectional survey of the associated factors

INTRODUCTION

Public satisfaction with healthcare systems measures the general population's satisfaction. Unlike patient satisfaction, which focuses on those who directly utilize the healthcare services, public satisfaction has been considered one of the most coherent indicators of the general subjective evaluation of the healthcare system, as well as the acceptability and effectiveness of healthcare reform[1, 2]. A Public satisfaction indicator has several advantages. First, it gathers information on satisfaction from the whole population, including both direct users and non-users of healthcare services. Second, it represents a mixture of citizens' personal experiences with the healthcare system, beyond the provision of quality services[2]. It may also include the broader views of the social affairs in the country, social welfare culture and media portrayals of the healthcare system[3, 4]; Third, it may affect how the general population utilizes services and their trust in the system[5].

In short, public satisfaction with a healthcare system has become integral to cross-country and across-time comparisons of healthcare systems[3, 4, 6], as well as healthcare policy evaluations[4, 7]. During the past decade, studies about public satisfaction have received increasing attention, reflecting the shift towards a people-centered healthcare system and the emphasis on the responsiveness of the system[4].

For decades the priority of the healthcare system in China has been set to meet basic survival needs, such as reducing mortality[8, 9]. Public satisfaction was not included in any official measurement in China. However, since China has achieved a rapid decline in mortality and an unprecedented increase in life expectancy over the past decade, the issue of public satisfaction in China, among many other aspects of the healthcare system, has received increased attention. The phenomenally intense physician-patient relationship has further fueled interest in public satisfaction [8-10]. This has led to the goal of People-centered Integrated Care as the focus of the

transition to Healthy China 2030, the new healthcare reform program.

Currently, there is only a small body of literature studying the public satisfaction of the healthcare system in China and its related factors[11-13]. Most are only based on small survey samples at the province level[14, 15]. Some studies focus on public dissatisfaction with the integration reforms of health insurance schemes[16]. To our knowledge, no prior studies have systematically examined the nation-wide public satisfaction of the healthcare system upon the second phase of healthcare reform from 2013 to 2015.

Specifically, the objectives of this study are: (1) to explore the basic factors (demographic, socioeconomic and public healthcare resources) associated with public satisfaction of the healthcare system in China; (2) to examine how public satisfaction with the healthcare system differs between the urban and rural residents, as well as in the major economic regions of China; (3) to examine changes in public satisfaction with the healthcare system between 2013 and 2015.

HEALTHCARE SYSTEM AND REFORM BACKGROUND FOR CHINA

Institution Background

The healthcare system in China is largely a public hospital-based delivery system under the administration of the National Health Commission of the People's Republic of China [17]. In China, public hospitals provide more than 90% of healthcare services[9]. A national accreditation system classifies hospitals into primary, secondary and tertiary levels according to characteristics such as numbers of beds, professional healthcare force, diagnosis and treatment equipment, and operational area sizes[17]. The basic health insurance coverage in China provided by three major national health insurance systems has increased significantly during the past decade and has reached 98% of the whole population in recent years[18].

Existing Issues and challenges

There has been a large volume of literature produced about the reform of China's healthcare system in the past decades[8, 19-24]. Due to the privatization and market-oriented reform of the healthcare system in China during the 1980s and 1990s,

by the first decade of the 2000s, there were widespread complaints about unaffordable basic healthcare services and difficulties with basic healthcare access[24, 25]. The disparity in healthcare status had gradually increased across the country and become a major public policy concern[26]. Meanwhile, due to the fast growth of the economy and residents' income, together with rapid urbanization in China, there has been an increasingly unmet demand for healthcare services along with higher expectations for the quality and experience of the healthcare system[27].

The major issues with the system late in the first decade of the 2000s can be summarized as follows: (1) Rising healthcare costs and a high ratio of out-of-pocket expenditure. In 2013, the reimbursement rates for inpatient care were in the range of 50% to 69%, according to a resident's health insurance type, which was based on the permanent residence registration system (rural or urban "Hukou") and/or employment status[13, 18]. (2) There are large socioeconomic disparities and geographic inequities in healthcare source allocation and utilization, especially between the urban and rural areas[9]. (3) The financial incentive in the reimbursement of and fee-for-service (FFS) payment models led to excessive treatment and over prescription[9, 28]. As a consequence, there has arisen a deep distrust of physicians by the public[8, 10, 27]. (4) Difficulties in healthcare access. Despite the financial incentive of the reimbursement of health insurance, no strict referral or gate-keeping system has been enforced in China yet. Patients are still free to self-refer to preferred hospitals regardless of the severity of their sickness[27]. As a result, almost all major hospitals in China are over demanded and operate over their capacity. While a patients' clinic wait time could be as long as a full day, physicians were overloaded and could only ration a few minutes to meet with a patient for technical diagnosis assistance. This minimal physician-patient interaction was perceived by patients as poor service quality and further deteriorated the patient-physician relationship[9]. Together with the deep mistrust and frustration on the part of the public, there had been rising numbers of violent incidents against healthcare professionals in the early 2000's[29-31].

2009 Healthcare Reform in China

In 2009, the Chinese government launched a new wave of healthcare reform actions as part of "the 12th Five-Year Plan", aiming to establish a basic universal healthcare system of safe, effective and affordable service by 2020. To achieve this objective, the government set priorities for achievements in five major areas, including (a) expanding public health insurance, (b) establishment of an Essential Drug System (c) reforming public hospitals, (d) providing primary healthcare service, and (e) equity of public healthcare services[9].

The healthcare reform was implemented in two sequential phases: (1) The first phase (2009 to 2012) aimed to reallocate resources to healthcare development, to expand the coverage of basic health insurance, and to set up an Essential Drug System. (2) The second phase (2013 to 2015) focused on reforming public hospitals, including the pricing models of healthcare services and prescription drugs[24]. To remove the financial incentives of overprescribing, a Zero-Mark-up Drug Policy was implemented among provincial public hospitals (the tertiary-level hospitals) during 2013-2015, after pilot tests in county hospitals in 2012[24].

The implementation of the healthcare reform has varied across provinces and regions in China[32]. Firstly, the governments of provinces and cities had the discretion to tailor the service level according to the availability of local fiscal budgets[9]. Secondly, some reform actions were first experimented with as pilot projects in selected cities or provinces. For example, public hospitals in Beijing started diagnosis-related groups (DRGs) payment reform starting in 2011[9, 33]. 100 pilot cities ran a drug-zero-markup policy from 2012 to 2015.

METHOD

Data availability statement

The survey data analyzed in this study is the Chinese General Social Survey (CGSS), a national representative continuous survey project available in China since 2003, publicly downloadable at http://www.cnsda.org/index.php.

The data of healthcare resources and expenditure on the provincial level were

obtained from the China Public Health Statistical Yearbook 2013 and 2015, accessible through subscription-based databases (http://cdi.cnki.net/Titles/SingleNJ?NJCode=N2010090866)

Data source introduction

The CGSS aims to collect dynamic information about Chinese residents' life quality. It first included a single question about public satisfaction with the healthcare system in 2013, and then in 2015 included a set of detailed questions about public satisfaction regarding various aspects of public healthcare provision. The timing of these two surveys matched well with the agenda of the 2nd phase of the 2009 Healthcare Reform, and thus has provided good opportunities to study how public satisfaction has changed after the implementation of the reform. These data are the latest available ones containing public satisfaction with the healthc are system in China. This study adopts the combined datasets from the two waves in 2013 and 2015.

Administered throughout all 31 provinces and municipalities in China, both waves of the CGSS surveys adopted the same multi-stage stratified sampling design. The Primary Sampling Unit (PSU) is a county-level unit and there are 2,762 PSUs in the sampling frame. In each wave, the CGSS sampled about 12,000 households and a KISH grid procedure was used to randomly select one adult respondent (18 years of age or older) from each household for a face-to-face in-home interview. Sampling weights were included to reflect the general population parameters of the survey year.

The final sample contains 15,969 observations from the CGSS 2013 and 2015 combined, after deleting observations with important missing variables. There are only 5566 observations from the 2013 wave because the CGSS 2013 was designed to sample only about half of all respondents to answer the public healthcare satisfaction survey.

Data analysis and ethical considerations

The Chinese General Social Survey (CGSS), the main data analyzed in this study, was originally collected by the National Survey Research Center at Renmin University of China. The CGSS abides by the Statistics Law of the People's Republic of China. The publicly disclosed survey data has been anonymized, following rigorous ethical practice and academic standards. As for the public healthcare resource data used in

this study, they are obtained from the China Public Health Statistical Yearbook, another government publication.

This study analyzes the above-mentioned of publicly available ethical data and did not collect any individual data directly. Therefore, this study did not require extra ethics approval.

Patient and public involvement

We discussed with physicians and government officials of public healthcare administration in China about their viewpoint of the public satisfaction about the health care system. We also discussed with them about the analysis results in this study.

No patients were directly involved in this study. No experimental designs were involved.

Dependent variable

Public satisfaction with the healthcare system. The measurement is based on the single question, 'Taking all aspects into consideration, what is your general satisfaction with the healthcare system?' Respondents were asked to assign a score between 0 to 100, with '0' representing totally unsatisfied and '100' for totally satisfied. As reported in Table 1, the average satisfaction score of the whole sample is 68.5. It is observed that the satisfaction scores of most responses concentrated on four integrals such as 50, 60, 70, and 80 points. In Chinese culture, 60 points mean "Passing/neutral", 70 points means "good, satisfied", 80 points and above means "very good, very satisfied". 40% of the respondents reported a satisfaction score higher than 70 points.

To be consistent with the literature[5, 34], a dummy variable of "being satisfied" was constructed, taking the value of '1' if a respondent's satisfaction score is greater than or equal to 70 points[34].

Independent variables

Demographic and socioeconomic characteristics. Control variables included gender (1= female), age group (1= those equal to or older than 60 years), minority ethnic group (1= Yes), marital status (1= married/living together), and education level (a

category variable). General physical health condition was measured by a single item: 'How do you evaluate your health condition overall?' Respondents rated on a five-point Likert scale (1=very unhealthy, 2 = unhealthy, 3 = so-so, 4 = healthy, and 5 = very healthy). Socioeconomic information included living area (urban or rural), internal migrant status (1=Yes), employment status (employed =1), primary health insurance status (1=Yes) and basic pension status (1=Yes). Household social-economic status was measured as 'below the average', 'middle class', 'middle-high', and 'high', according to the respondent's answer to a single item: 'How do you assess your relative economic condition in the society?'.

Healthcare resources on an aggregated level. Key indicators of the public healthcare resources included total health expenditure as a percentage of GDP, the government's percentage of total expenditure on healthcare, out-of-pocket percentage of individuals, the densities of the health workforce and hospital beds[4] (per 1,000 population) in rural and urban areas of each province respectively.

Year and region dummy variables. Dummy variables were included to identify the major economic regions in China (East, Central, West, and Northeast regions) according to the official classification standard, as well as the municipalities (Beijing, Shanghai, Tianjin, and Chongqing), which have relatively abundant healthcare resources and are also the pilot cities of some healthcare reforms. A dummy variable was included to identify the survey wave of the year 2015.

Statistical analysis

The baseline model is a multivariate logistic regression model[4, 5, 35, 36], analyzing the major factors associated with China residents' satisfaction with the healthcare system. The dependent variable was the dummy variable of "being satisfied" with the healthcare system. The independent variables included all individual and provincial level variables as introduced in the Measures section.

In step two, interaction terms of rural and healthcare resource variables were constructed to examine the rural disparities. An interaction term for the rural area and a year dummy for 2015 was also constructed to examine how the satisfaction in rural areas changed between the years 2013 and 2015.

In step three, interaction terms of region dummies and year 2015 were adopted to examine the changes in the geographic variations over time. All regressions were

conducted in STATA 15, weight-adjusted, using the survey weights provided in the original datasets.

RESULTS

Descriptive statistics

Table 1 and Table 2reports the demographic statistics of the participants Table 1and summary information of the healthcare resources in various regions of China (Table 2). The total observation numbers are weight-adjusted, using the survey weights provided in the original datasets.

As reported in Table 3, the mean satisfaction score of the sample is 68.5 out of 100 points. The scores in 2013 and 2015 are 66.2 and 69.7 respectively. Panel B of Table 3reports the percentage of respondents who scored above 70 points and are classified as "being satisfied with the healthcare system". This ratio was 52.9% in 2013, then 63.9% in 2015, suggesting that public satisfaction with the healthcare system in China had made general improvement during the study period.

Baseline analysis

Table 4 reports the logistic regression results of the demographic characteristics of the baseline analysis. Senior respondents (older than or equal to 60 years) are significantly more likely, by 19 percentage points (OR=1.19, p<0.001), to report being satisfied with the healthcare system.

Respondents from rural areas on average are more likely to report being satisfied (OR=1.23, p=0.009). Those from ethnic minority groups, with basic health insurance [37, 38], with better self-reported health, or with higher self-rated social-economic status, are at greater odds of reporting being satisfied. Meanwhile, internal migrants (OR=0.75, p<0.001) and those with a higher level of education[13] are less likely to report being satisfied.

As for the association with province-level health resources and expenditures, higher total health expenditure as a percentage of GDP and density of hospital beds are significantly associated with a higher probability of reporting as being satisfied (OR=1.13, p<0.001). Meanwhile, the government's share in total healthcare expenditure has a moderately negative association with satisfaction (OR=0.97, p<0.001). Out-of-pocket percentage and the density of the healthcare workforce are

insignificant.

Additionally, in the year 2015, the respondents were on average more likely than in the year 2013 by 51 percentage points to report being satisfied.

Rural disparities and changes

As reported in Table 5, in the rural area the density of hospital beds is positively associated with higher satisfaction (OR=1.26, p= 0.002). The effect is even stronger than the main effect (OR=1.02, p= 0.057) in Table 4. The density of the healthcare workforce in rural areas or the dummy variable rural area is not significant in this specification.

Table 6 reports the changes in rural China during the period from 2013 to 2015. The coefficients of Rural*2015 indicates that rural residents are more likely by 57 percentage points in 2015 to report being satisfied (OR=1.57, p<0.001). After including the interaction term of rural area and Year 2015, the odds ratio of the rural area is reduced to be 1.00 and totally insignificant, while Year 2015 is still significant though the absolute value of its coefficient became smaller.

Regional variations

As shown in Table 4, with East China as the baseline region, Middle and West China regions (OR=1.36, p=0.001; OR=1.28, p=0.019), together with Tianjin and Chongqing municipalities (OR=1.48, p=0.001; OR=2.03, p<0.001), are on average more likely to report being satisfied. On the other hand, the Northeast region and Shanghai (OR=0.49, p<0.001; OR=0.71, p=0.034) are less likely by about 51 to 30 percentage points respectively. Beijing is not significantly different from the East region.

After the interaction terms of Year 2015 and regions are controlled, the results reported in Table 7 indicate that the differences in Middle and West China regions are no longer significant, but the differences in Tianjin, Chongqing, Shanghai and the Northeast region of China are robust and consistent.

Changes in 2015

The dummy variable Year 2015 captures the average changes in the public satisfaction. As reported in Table 4 and Table 7, the odds ratios of Year 2015 are 1.36

and 1.23 respectively, highly significant in both specifications.

In 2015, after controlling for the average year effect and region effects, respondents from the Middle (OR=1.60, p<0.001) and the West China regions (OR=1.44, p=0.002) are significantly more likely to report being satisfied than those from the base group of East China region. Meanwhile, there was no significant improvement in the Northeast region or Shanghai City, though respondents from these two regions tend to report being less satisfied.

Discussion

Demographic and socioeconomic characteristics

The association relationships between the various demographic characteristics and the public satisfaction with the healthcare system found in this study are all consistent with existing literature. For example, seniors[13, 39], those with better self-rated health[37], and those with higher social economic status[40] are more likely to report being satisfied[14, 15]. Those are with a lower level of education[13] and those in rural areas[13, 35] are more likely to report being satisfied too[15].

This phenomenon may be explained by the role of the respondents' expectations [3, 5, 36]. Residents with a lower level of education and in rural areas of China have had a lower level of expectation. In past decades, they only had very limited access to public healthcare resources and social welfare. Also, they are usually unaware of their citizenship entitlements or patient rights[13, 18, 41].

Healthcare resources

Generally, a larger healthcare workforce and more resources are associated with a higher level of public satisfaction with the healthcare system[42, 43]. However, this study has mixed findings.

1) There are positive associations between public satisfaction and the expenditure on healthcare as a percentage of GDP, as well as the density of hospital beds. These findings are consistent with the general perception in the literature[4, 34, 42, 43].
2) A higher level of healthcare professionals in the population usually appears to increase overall patient satisfaction[34, 44, 45] , however, the estimates of this factor are not statistically significant in this study. Actually, the higher quality of public hospitals in the developed regions of China has attracted patients from all

over the country and is always overcrowded and experiencing overcapacity situations[9].Hence, the nominal healthcare professional density in the population may not reflect the actual healthcare resources accessible by the permanent residents in those areas.

3) Generally, a lower out of pocket expense is preferred by the population [34, 44]. However, this study found no significant role from the ratio of out of pocket expenses. This study has found that there is a moderate negative association with the share of government expenditure on satisfaction with healthcare. This finding is different from those in European countries[4, 34, 45]. There could be several potential explanations about this paradox. First, the negative association may reflect the shares of government expenditures in poorer regions, which have increased as the result of healthcare reform in China. However, it takes a longer time and it is a challenging, systematic task to improve the public satisfaction with the healthcare system in those areas. Second, accessing preferred care is highly important to the satisfaction of some citizens[6], but healthcare choices are further limited when the government is taking a greater share of the expenditure. For example, with the implementation of the Essential Drug Lists and Drug Zero-mark-up policy in public hospitals in China, the availability of preferred therapies are limited[3, 24]. Third, there is also the possibility that some government expenditure on healthcare may have not been allocated appropriately or efficiently. For instance, the funding may have been allocated to sophisticated but unnecessary medical equipment. Future research should continue to explore and investigate this phenomenon.

Rural disparities

As reported in Table 5, the density of hospital beds in rural areas of China has a strong positive association with the satisfaction of respondents (OR=1.26, p=0.002), whereas the odds ratio is only 1.04 (p=0.057) in the baseline model. This phenomenon may be explained as follows. First, hospitalization is often perceived in China as health care of better quality and with more experienced physicians. Second, hospitalization is often preferred by many patients in China because inpatient service has a higher reimbursement ratio than outpatient service[18, 27]. Third, in rural areas of China, hospitalization can be especially helpful assuring a patient with having

access to quality medical care and alleviating the commuting needs from distantly located home places[41]. Additionally, if admitted to hospitalization, most rural residents have a lower opportunity cost in terms of time than urban residents, since they don't have an office-commuting requirement.

While the bed occupancy rate of tertiary hospitals in China could be as high as 107.5% on average due to temporarily added beds, it may be as low as 58.0% in township-level hospitals [46]. It is often difficult to get admitted into tertiary hospitals, or for shorter lengths of stay[17]. When there is a higher density of hospital beds in rural areas, it may be easier for a patient to get admitted for hospitalization[47-49]. Therefore, rural residents with easy hospitalization admission may perceive having good quality healthcare with a low cost. Consequently, they may report having a high level of satisfaction.

As shown in Table 6, the odds ratio of Rural*2015 is as large as 1.57 ($p<0.001$). This finding indicates a large and significant enhancement in the satisfaction with the healthcare system in rural areas. After controlling the changes in 2015, the odds ratio of the rural area becomes insignificant, while the year dummy of 2015 is still large and highly significant (OR=1.24, $p<0.001$). Together, these results suggest that the healthcare reform actions of China from 2013 to 2015 have brought significant improvements to the healthcare satisfaction in rural areas.

Regional variations and changes in 2015

The regional differences in the healthcare system satisfaction may have reflected the inequality of healthcare resources and quality in China[50]. Beijing, Shanghai, Tianjin, and Chongqing City, the four municipalities, are the most important central cities in China with the most advanced and abundant healthcare resources in China. Since they have also piloted many healthcare reform plans, it is not unexpected that there are no significant changes in public satisfaction with the healthcare system during the studied period.

Middle and West regions, are more likely to experience a significant and large enhancement in healthcare satisfaction during the reform period of 2013-2015, because many of the reform policies were eventually implemented in these regions after piloting in the East region of China.

Shanghai's lower level of satisfaction may be due to the very crowded hospital

environment and overstretched resources. As the most modernized city in China, Shanghai has the most skilled professionals and advanced medical equipment. However, due to the lack of a referral system, all tertiary hospitals in Shanghai are always in high demand and crowded with patients from all over the country[17]. Hence, local Shanghai residents actually don't have a good experience generally. This situation has not improved during this round of healthcare reform.

It is noted that the Northeast Region consistently reported a lower level of satisfaction and no significant improvements during the studied period. The low satisfaction actually can be attributed to the weak economy concurrently in this region. Known as China's rustbelt, the three northeastern provinces were plagued by widespread layoffs in the 1990s and were among the regions with the weakest economic growth in 2010s[51]. With a shrinking economy and fiscal deficits, the local governments had very limited resources available for healthcare and many local healthcare professionals migrated to other developed regions in the country[9, 52]. Additionally, poor economic performance may also directly affect the respondents' perception and lead to a lower rating of the public policies, including the healthcare system[4, 5]. Additionally, Chen et al. (2019) report that patients in the Northeast consistently had the highest mortalities in terms of the overall stroke and each subtype of stroke[53]. The researchers indicate that this may be mainly due to the differences in lifestyle and inconsistent medical development and a lower economic level.

Robustness check

As a robustness check, "being satisfied" is redefined as scoring equal to or greater than 80 points. About 15% of the sample population scored their satisfaction equal to or greater than 80 points. Logistic regressions of the same model were performed accordingly.

Ordinary Least Square (OLS) regressions were also performed, using the original 'satisfaction score' of respondents as the dependent variable.

The results of the robustness checks above are all consistent with our current findings.

LIMITATIONS

As a type of subjective evaluation, public satisfaction has several weaknesses when being adopted to measure the healthcare system's performance. First, the data in this

study, especially, the CGSS 2013, contains only one global satisfaction score. Therefore, it is difficult to attribute the satisfaction or dissatisfaction to specific reform actions or issues of the healthcare system[5]. With the advancement in research and reform of the healthcare system in China, a dataset with more detailed information may be available in more recent or future years. Grey Relational Analysis method, as a novel quantitative method, can also be applied to obtain more detailed results to better understand the fuzzy/grey concept of satisfaction with the health system [54-56].

Second, while being related to the quality and outcome of healthcare service, public satisfaction may also be influenced by some external factors, such as media and political discussion [5, 36], or the citizens' expectations[54-57]. Since these confounding factors are not included in the original survey data and it is almost impossible to identify or recover them from other resources, the possibility of potential bias cannot be completely ruled out. While it will be interesting to study how media reports and portrayals about physicians and hospitals may influence the public's perception or satisfaction with the healthcare system in China, this topic actually is beyond our research scope and expertise. Third, self-reported health status is used as a health measurement in this study. It is generally valid, however, not as ideal as clinical health measurements.

CONCLUSION

Using a total sample of 15,969 observations from Chinese national representative surveys, the CGSS 2013 and 2015, this study examined various factors associated with public satisfaction of the healthcare system in China, such as demographic and individual socioeconomic characteristics, rural areas and regions across the country, as well as the changes of public satisfaction in 2015.

While there was a nation-wide general improvement in the satisfaction level recorded in year 2015, when the 2nd phase of the 2009 Health Reform was implemented, the low level of satisfaction among internal migrants as well as those of residents in the Northeast region of China remained unchanged. Especially, close attention and further study about the causal reason for the low level of satisfaction in the Northeast region is recommended.

Ethical Statement

The data used in this study is obtained from a publicly available national database.

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Competing interests statement

No competing financial, professional, or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

Author contributions

JHZ, XP, CKL designed the study and developed the methods. JHZ, XP, and HZ reviewed literature. JHZ, XP, YJC sorted and analyzed the data. XP prepared the tables. JHZ and XP drafted the manuscript. CKL, HZ and OOI provided a critical review of the manuscript. All authors have reviewed and approved the final version of the manuscript for publication.

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Table 1 Descriptive statistics of the respondents in CGSS 2013-2015

	Total	2013	2015	Chi2
N	15969*	5566	10403	/
Satisfaction	68.50	66.21	69.73	/
Being satisfied	60.08%	52.91%	63.93%	/
Age				
Age(average years)	51.9	50.8	52.5	/
Age<60	63.4%	66.4%	61.8%	32.34
Age>=60	36.6%	33.6%	38.2%	
Gender				
Male	50.6%	50.8%	50.5%	0.07
Female	49.4%	49.2%	49.5%	
Ethnic group				
Han	92.8%	92.4%	93.1%	2.30
Ethnic minority	7.2%	7.6%	7.0%	
Marital status				
Single/separated/widow/widower	29.3%	28.8%	29.6%	1.10
Cohabitation& Married	70.7%	71.2%	70.4%	
Employment status				
Not working	43.1%	39.8%	44.9%	38.86
Employed/Farm	56.9%	60.3%	55.1%	
Education				
Elementary School or less	37.8%	36.2%	38.7%	
Middle / high School	45.6%	47.0%	44.9%	10.71
College	15.5%	15.8%	15.3%	
Postgraduate	1.1%	1.1%	1.1%	
Self-reported health				
Very bad	3.3%	3.4%	3.3%	
Bad	15.3%	14.4%	15.8%	
Average	21.6%	19.8%	22.6%	49.54
Good	38.0%	37.7%	38.1%	
Very good	21.8%	24.7%	20.3%	
Self-reported household economic status				
Far below average	6.0%	5.7%	6.2%	
Below average	32.2%	30.2%	33.3%	37.26
Average	53.7%	57.0%	52.0%	
Above average	8.1%	7.3%	8.2%	
Insurance status				
Without any health Insurance	10.2%	11.3%	9.6%	10.90
With any health insurance	89.8%	88.7%	90.4%	
Residence status				
Urban	60.0%	59.7%	60.2%	0.28
Rural	40.0%	40.3%	39.8%	
Internal migrant				

No	89.0%	88.7%	89.2%	1.09
Yes	11.0%	11.3%	10.8%	
Regions or municipalities				
East China(without Shanghai)	23.2%	23.6%	23.1%	
Middle China	23.9%	22.2%	24.8%	
West China (without Chongqing)	21.7%	21.1%	22.0%	
Northeast China	14.2%	14.9%	13.8%	
Beijing	5.1%	4.7%	5.3%	37.28
Shanghai	6.2%	7.0%	5.7%	
Tianjin	3.2%	3.7%	3.0%	
Chongqing	2.6%	3.0%	2.4%	

Note:* the total observation number is sample-weight adjusted.

Table 2 **Descriptive statistics of the medical resource in CGSS 2013-2015**

	Healthcare expenditure percent in GDP(%)			Government percent in healthcare expenditure(%)			Out of pocket(%)			Hospital beds/1k population			Healthcare workforce/1k population		
	Mean	95% CI		Mean	95% CI		Mean	95% CI		Mean	95% CI		Mean	95% CI	
Total	5.48	5.47 to	5.49	29.45	29.40 to	29.51	33.12	33.06 to	33.19	6.05	6.01 to	6.08	2.84	2.82 to	2.85
East China(without Shanghai)	4.24	4.23 to	4.26	25.83	25.77 to	25.90	31.89	31.81 to	31.97	5.96	5.90 to	6.03	2.97	2.94 to	3.01
Middle China	5.45	5.44 to	5.46	32.84	32.77 to	32.92	36.87	36.78 to	36.96	5.82	5.75 to	5.89	2.36	2.33 to	2.39
West China (without Chongqing)	6.57	6.55 to	6.59	36.54	36.42 to	36.67	32.13	32.05 to	32.20	5.87	5.79 to	5.96	2.38	2.34 to	2.41
Northeast China	5.53	5.51 to	5.55	24.51	24.46 to	24.56	40.41	40.30 to	40.51	6.44	6.33 to	6.55	2.67	2.63 to	2.70
Beijing	7.21	7.19 to	7.24	25.43	25.35 to	25.51	20.45	20.34 to	20.56	7.48	7.36 to	7.61	5.60	5.53 to	5.66
Shanghai	5.59	5.58 to	5.60	20.79	20.76 to	20.83	20.22	20.17 to	20.27	6.89	6.74 to	7.04	4.27	4.26 to	4.27
Tianjin	3.97	3.95 to	3.99	25.86	25.81 to	25.91	34.20	34.03 to	34.37	5.36	5.23 to	5.48	3.15	3.12 to	3.18
Chongqing	5.64	5.62 to	5.65	31.23	31.20 to	31.26	32.22	31.90 to	32.54	4.26	4.21 to	4.31	1.58	1.55 to	1.60

Table 3 Descriptive statistics of satisfaction about the healthcare system in China (2013-2015)
Panel A: Satisfaction Score about the healthcare system in China (2013-2015)

	Full sample				Subsample of Year 2013				Subsample of Year 2015			
	Mean	95% CI			Mean	95% CI			Mean	95% CI		
Satisfaction	68.50	68.20	to	68.80	66.21	65.73	to	66.68	69.73	69.34	to	70.12
Age												
Age<60	67.43	67.06	to	67.80	65.40	64.82	to	65.97	68.60	68.11	to	69.08
Age>=60	70.35	69.83	to	70.88	67.81	66.93	to	68.68	71.56	70.91	to	72.21
Gender												
Male	68.16	67.72	to	68.61	66.07	65.38	to	66.76	69.29	68.72	to	69.86
Female	68.84	68.42	to	69.26	66.35	65.67	to	67.02	70.17	69.64	to	70.71
Ethnic group												
Han	68.28	67.97	to	68.60	65.94	65.44	to	66.44	69.53	69.13	to	69.94
Ethnic minority	71.26	70.19	to	72.34	69.42	67.69	to	71.16	72.35	70.97	to	73.72
Marital status												
Single/separated/widow/widower	68.07	67.40	to	68.74	65.73	64.68	to	66.79	69.30	68.44	to	70.15
Cohabitation/Married	68.67	68.34	to	69.00	66.40	65.87	to	66.92	69.91	69.49	to	70.34
Employment status												
Not working	69.08	68.60	to	69.56	66.38	65.58	to	67.18	70.37	69.77	to	70.97
Employed/Farm	68.06	67.66	to	68.45	66.09	65.49	to	66.69	69.21	68.69	to	69.72
Education												
Elementary School or less	70.76	70.26	to	71.26	68.15	67.36	to	68.94	72.07	71.42	to	72.71
Middle / high School	67.53	67.08	to	67.99	65.50	64.80	to	66.20	68.68	68.09	to	69.27
College	66.36	65.64	to	67.09	64.32	63.12	to	65.52	67.50	66.60	to	68.39
Post graduate	60.69	57.59	to	63.78	59.17	54.19	to	64.15	61.45	57.55	to	65.35
Self-reported health												
Very bad	66.39	64.15	to	68.63	65.68	62.24	to	69.12	66.79	63.88	to	69.70
Bad	68.28	67.43	to	69.13	65.61	64.23	to	66.99	69.59	68.52	to	70.66
Average	68.18	67.52	to	68.85	65.43	64.35	to	66.50	69.48	68.65	to	70.31
Good	68.62	68.15	to	69.10	66.31	65.58	to	67.05	69.85	69.25	to	70.46
Very good	69.07	68.43	to	69.70	67.09	66.11	to	68.06	70.36	69.53	to	71.19
Self-reported household economic status												
Far below average	65.26	63.57	to	66.95	62.69	59.63	to	65.74	66.51	64.49	to	68.53
Below average	67.16	66.59	to	67.73	65.19	64.26	to	66.12	68.12	67.39	to	68.84
Average	69.37	68.99	to	69.76	66.88	66.30	to	67.46	70.84	70.34	to	71.34
Above average	70.44	69.42	to	71.46	67.87	66.18	to	69.56	71.61	70.35	to	72.87
Insurance status												
Without any health Insurance	65.90	64.85	to	66.94	64.36	62.86	to	65.87	66.86	65.45	to	68.27
With any health insurance	68.79	68.48	to	69.11	66.44	65.93	to	66.95	70.04	69.63	to	70.44
Residence status												
Urban	67.48	67.08	to	67.87	67.12	66.52	to	67.72	67.67	67.15	to	68.18
Rural	70.03	69.56	to	70.51	64.85	64.06	to	65.64	72.85	72.26	to	73.43
Internal migrant												
No	68.99	68.67	to	69.31	66.52	66.01	to	67.02	70.31	69.91	to	70.72
Yes	64.50	63.53	to	65.48	63.76	62.26	to	65.27	64.92	63.65	to	66.19
Regions or municipalities												
East China (without Shanghai)	68.32	67.74	to	68.91	67.26	66.29	to	68.23	68.91	68.16	to	69.66
Middle China	70.53	69.98	to	71.08	66.73	65.84	to	67.62	72.35	71.67	to	73.04
West China (without Chongqing)	70.49	69.86	to	71.13	67.01	65.94	to	68.08	72.29	71.50	to	73.08
Northeast China	63.88	62.94	to	64.82	62.88	61.53	to	64.23	64.46	63.20	to	65.73
Beijing	66.10	64.58	to	67.62	63.75	61.70	to	65.80	67.22	65.23	to	69.21
Shanghai	64.33	62.91	to	65.75	62.61	60.40	to	64.83	65.45	63.63	to	67.27
Tianjin	68.84	67.31	to	70.36	70.60	69.05	to	72.14	67.66	65.36	to	69.97
Chongqing	73.94	72.46	to	75.41	71.67	69.04	to	74.30	75.45	73.73	to	77.17

Panel B: Being satisfied with the healthcare system in China (%)*

	Full sample				Subsample of Year 2013				Subsample of Year 2015			
	Mean	95% CI			Mean	95% CI			Mean	95% CI		
Satisfaction	60.08	59.22	to	60.94	52.91	51.37	to	54.45	63.93	62.90	to	64.95
Age												
Age<60	57.58	56.53	to	58.63	51.41	49.60	to	53.23	61.13	59.85	to	62.42
Age>=60	64.41	62.91	to	65.92	55.86	52.99	to	58.74	68.46	66.72	to	70.19
Gender												
Male	59.56	58.30	to	60.81	53.09	50.91	to	55.27	63.04	61.52	to	64.56
Female	60.61	59.41	to	61.82	52.72	50.52	to	54.92	64.83	63.42	to	66.25
Ethnic group												
Han	59.70	58.80	to	60.59	52.37	50.77	to	53.97	63.60	62.53	to	64.68
Ethnic minority	65.00	61.90	to	68.10	52.37	53.89	to	65.03	68.25	64.60	to	71.91
Marital status												
Single/separated/widow/widower	60.02	58.12	to	61.91	52.19	48.80	to	55.59	64.10	61.86	to	66.35
Cohabitation / Married	60.10	59.16	to	61.05	53.20	51.52	to	54.88	63.85	62.72	to	64.99
Employment status												
Not working	61.26	59.91	to	62.61	53.10	50.57	to	55.64	65.14	63.56	to	66.72
Employed / Farmer	59.18	58.05	to	60.31	52.78	50.84	to	54.73	62.94	61.56	to	64.32
Education												
Elementary School or less	65.71	64.31	to	67.11	56.77	54.18	to	59.37	70.19	68.56	to	71.82
Middle / high School	57.56	56.28	to	58.84	51.27	49.05	to	53.49	61.10	59.55	to	62.65
College	54.58	52.32	to	56.84	49.45	45.51	to	53.40	57.43	54.69	to	60.16
Post graduate	47.99	38.91	to	57.06	45.15	29.20	to	61.10	49.41	38.40	to	60.43
Self-reported health												
Very bad	55.10	49.94	to	60.26	50.43	41.14	to	59.72	57.69	51.56	to	63.82
Bad	58.02	55.69	to	60.35	48.76	44.51	to	53.01	62.56	59.82	to	65.31
Average	58.19	56.26	to	60.11	50.13	46.54	to	53.72	61.98	59.73	to	64.24
Good	61.59	60.21	to	62.97	53.78	51.31	to	56.25	65.75	64.10	to	67.39
Very good	61.52	59.70	to	63.33	56.57	53.55	to	59.58	64.75	62.50	to	67.00
Self-reported household economic status												
Far below average	53.21	49.24	to	57.18	46.27	39.02	to	53.52	56.59	51.89	to	61.29
Below average	56.57	54.99	to	58.14	48.96	46.10	to	51.82	60.26	58.39	to	62.14
Average	61.97	60.81	to	63.12	54.62	52.60	to	56.63	66.30	64.91	to	67.68
Above average	66.66	63.78	to	69.54	61.12	55.79	to	66.46	69.19	65.78	to	72.60
Insurance status												
Without any health Insurance	52.90	49.97	to	55.83	46.92	42.05	to	51.79	56.66	53.02	to	60.31
With any health insurance	60.90	59.99	to	61.80	53.67	52.05	to	55.30	64.70	63.63	to	65.78
Residence status												
Urban	57.67	56.55	to	58.79	54.84	52.90	to	56.78	59.18	57.81	to	60.55
Rural	63.69	62.35	to	65.04	50.05	47.54	to	52.55	71.10	69.57	to	72.62
Internal migrant												
No	61.43	60.53	to	62.33	53.60	51.99	to	55.21	65.62	64.54	to	66.69
Yes	49.10	46.22	to	51.98	47.54	42.45	to	52.63	49.98	46.50	to	53.46
Regions or municipalities												
East China（without Shanghai)	58.66	56.89	to	60.44	54.51	51.27	to	57.76	60.94	58.81	to	63.07
Middle China	66.38	64.73	to	68.03	55.28	52.19	to	58.37	71.70	69.78	to	73.61
West China(without Chongqing)	64.20	62.40	to	65.99	53.64	50.40	to	56.88	69.64	67.53	to	71.75
Northeast China	47.22	44.82	to	49.62	43.13	39.01	to	47.24	49.59	46.65	to	52.53
Beijing	53.34	49.38	to	57.29	51.63	45.13	to	58.14	54.15	49.25	to	59.05
Shanghai	52.52	48.53	to	56.52	45.36	38.83	to	51.90	57.20	52.34	to	62.07
Tianjin	65.34	60.70	to	69.97	66.85	60.04	to	73.66	64.33	58.10	to	70.55
Chongqing	74.93	70.11	to	79.74	68.61	59.69	to	77.53	79.12	73.77	to	84.48

Note: "Being satisfied" is a dummy variable, taking the value of "1" if a respondent's satisfaction score is greater than 70 points.

Table 4 Baseline analysis of public satisfaction with the healthcare system in China (Logistic Regression)

Dep. Var. = "Being Satisfied"

Variables	Odds Ratio	P-value	95% CI
Demographic			
Age>=60	1.19	<0.001	1.08 to 1.32
Female	1.03	0.513	0.95 to 1.11
Cohabitation &Married	0.93	0.108	0.84 to 1.02
Han (Ethnic minority)	1.28	0.001	1.11 to 1.49
Rural	1.23	0.009	1.05 to 1.44
Internal migrant	0.75	<0.001	0.66 to 0.85
Employed/Farm	0.97	0.452	0.89 to 1.06
With any health insurance	1.18	0.011	1.04 to 1.35
Education			
Elementary School or less	Ref.		
Middle / high School	0.76	<0.001	0.69 to 0.83
College	0.65	<0.001	0.57 to 0.75
Post graduate	0.55	0.002	0.37 to 0.80
Self-reported health			
Very bad	Ref.		
Bad	1.04	0.721	0.82 to 1.32
Average	1.18	0.163	0.93 to 1.49
Good	1.45	0.002	1.15 to 1.83
Very good	1.61	0.000	1.27 to 2.04
Self-reported household economic status			
Far below average	Ref.		
Below average	1.21	0.037	1.01 to 1.45
Average	1.59	<0.001	1.33 to 1.90
Above average	2.05	<0.001	1.64 to 2.55
Healthcare resource			
Healthcare expenditure percent in GDP (%)	1.13	<0.001	1.05 to 1.20
Government percent in healthcare expenditure (%)	0.97	<0.001	0.95 to 0.98
Out of pocket (%)	1.00	0.570	0.99 to 1.02
Hospital beds /1k population	1.04	0.057	1.00 to 1.08
Healthcare workforce /1k population	0.92	0.117	0.83 to 1.02
Region			
East China (without Shanghai)	Ref.		
Middle China	1.36	0.001	1.14 to 1.62
West China (without Chongqing)	1.28	0.019	1.04 to 1.58
Northeast China	0.49	0.000	0.41 to 0.59
Beijing	0.83	0.342	0.56 to 1.22
Shanghai	0.71	0.034	0.52 to 0.98
Tianjin	1.48	0.001	1.17 to 1.86
Chongqing	2.03	<0.001	1.50 to 2.76
Year			
Year2013	Ref.		
Year2015	1.51	<0.001	1.36 to 1.66
Constant	0.73	0.437	0.33 to 1.61
Observations	15,969		

R-squared	0.07

Note: Dep. Var. "Being satisfied" is a dummy variable, taking the value of "1" if a respondent's satisfaction score is greater than 70 points.

Table 5 Association between public satisfaction with the healthcare system and healthcare resources in rural China during 2013 to 2015 (Logistic Regression)

Dep. Var. = "Being Satisfied"

Variables	Odds Ratio	P-value	95% CI
Hospital beds/1k population * Rural	1.26	0.002	1.09 to 1.47
Healthcare workforce/1k population * Rural	0.96	0.545	0.84 to 1.09
Rural	1.12	0.243	0.93 to 1.34
Constant	0.24	0.001	0.10 to 0.54
Observations	15,969		

Note: The regression has controlled all other variables (including demographic, education, self-reported health, self-reported household economic status, healthcare resource, region, and year) as listed in Table 4.

Table 6 The changes of public satisfaction with the healthcare system in rural China during 2013 to 2015 (Logistic Regression)

Dep. Var. = "Being Satisfied"

Variables	Odds Ratio	P-value	95% CI
Rural	1.00	0.982	0.83 to 1.20
Rural* Year 2015	1.57	<0.001	1.30 to 1.90
Year 2015	1.24	0.001	1.09 to 1.41
Constant	0.92	0.845	0.42 to 2.05
Observations	15,969		

Note: The regression has controlled all other variables (including demographic, education, self-reported health, self-reported household economic status, healthcare resource, region, and year) as listed in Table 4.

Table 7 Association between public satisfaction with the healthcare system and regions of China during 2013 to 2015 (Logistic Regression)

Dep. Var.= "Being Satisfied"

Variables	Odds Ratio	P-value	95% CI
Year 2015	1.23	0.022	1.03 to 1.46
East China (without Shanghai)	Ref.		
Middle China	1.00	0.989	0.79 to 1.27
West China (without Chongqing)	0.99	0.955	0.76 to 1.29
Northeast China	0.46	<0.001	0.36 to 0.60
Beijing	0.83	0.437	0.52 to 1.32
Shanghai	0.62	0.065	0.38 to 1.03
Tianjin	1.72	0.004	1.20 to 2.49
Chongqing	1.67	0.036	1.03 to 2.69
Year2015*East China (without Shanghai)	Ref.		
Year2015*Middle China	1.60	<0.001	1.27 to 2.02
Year2015*West China (without Chongqing)	1.44	0.002	1.14 to 1.82
Year2015*Northeast China	1.07	0.610	0.82 to 1.40
Year2015*Beijing	0.93	0.715	0.64 to 1.35
Year2015*Shanghai	1.18	0.469	0.76 to 1.83
Year2015*Tianjin	0.77	0.289	0.48 to 1.24
Year2015*Chongqing	1.30	0.366	0.74 to 2.30
Constant	0.93	0.862	0.42 to 2.06
Observations	15,969		

Note: The regression has controlled all other variables (including demographic, education, self-reported health, self-reported household economic status, healthcare resource, region, and year) as listed in Table 4.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract:[Page1]
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found:[Page1]
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported:[Page4-7]
Objectives	3	State specific objectives, including any prespecified hypotheses:[Page5]
Methods		
Study design	4	Present key elements of study design early in the paper:[Page10]
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection:[Page7-8]
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants:[Page9]
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable:[Page9-10]
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group:[Page12-13&Page38-40]
Bias	9	Describe any efforts to address potential sources of bias:[Page9,16]
Study size	10	Explain how the study size was arrived at:[Page7-8]
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why:[Page9]
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding:[Page10]
		(*b*) Describe any methods used to examine subgroups and interactions:[Page10]
		(*c*) Explain how missing data were addressed:[Page8]
		(*d*) If applicable, describe analytical methods taking account of sampling strategy:[N/A]
		(*e*) Describe any sensitivity analyses:[Page9,16]
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed:[Page8,10-11]
		(b) Give reasons for non-participation at each stage:[N/A]
		(c) Consider use of a flow diagram:[N/A]
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders:[Page 11,24-25]
		(b) Indicate number of participants with missing data for each variable of interest:[N/A]
Outcome data	15*	Report numbers of outcome events or summary measures:[Page11-13,24-40]
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included:[Page13-16,26-40]

		(*b*) Report category boundaries when continuous variables were categorized:[Page9]
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period:[N/A]
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses:[Page14-16]
Discussion		
Key results	18	Summarise key results with reference to study objectives:[Page17]
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias:[Page16-17]
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence:[Page13-17]
Generalisability	21	Discuss the generalisability (external validity) of the study results:[Page16]
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based:[Page17-18]

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.