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Assessing spatial access to public and private hospitals in Sichuan, China: The influence of the private sector on the healthcare geography in China

Jay Pan [a, b], Hanqing Zhao [c], Xiuli Wang [d], Xun Shi [e, *]

[a] West China School of Public Health, Sichuan University, Chengdu, 610041, China
[b] West China Research Center for Rural Health Development, Sichuan University, Chengdu, 610041, China
[c] China Center for Health Economic Research, Peking University, Beijing, China
[d] College of Architecture and Environment, Sichuan University, Chengdu, 610041, China
[e] Department of Geography, Dartmouth College, Hanover, United States

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ABSTRACT

In 2009, the Chinese government launched a new round of healthcare reform, which encourages development of private hospitals. Meanwhile, many public hospitals in China also became increasingly profit-oriented. These trends have led to concerns about social justice and regional disparity. However, there is a lack of empirical scientific analysis to support the debate. We started to fill this gap by conducting a regional-level analysis of spatial variation in spatial access to hospitals in the Sichuan Province. Such variation is an important indication of (in) equity in healthcare resource allocation. Using data of 2012, we intended to provide a snapshot of the situation that was a few years later since the new policies had set out. We employed two methods to quantify the spatial access: the nearest-neighbor method and the enhanced two-step floating catchment area (E2SFCA) method. We recognized two sub-regions of Sichuan: the rural West Sichuan and the well-developed East Sichuan. We classified the hospitals using both ownership and level. We applied the analysis to the resulting groups of hospitals and their combinations in the two sub-regions. The two sub-regions have a high contrast in the spatial access to hospitals, in terms of both quantity and spatial pattern. Public hospitals still dominated the service in the province, especially in the West Sichuan, which had been solely relying on public hospitals. Private hospitals only occurred in the East Sichuan, and at the primary level, they had surpassed public hospitals in terms of spatial accessibility. However, the governmental health expenditures seemed to be disconnected with the actual situation of the spatial access to hospitals. The government should continue carrying on its responsibility in allocating healthcare resources, be cautious about marketizing public hospitals, and encourage private hospitals to expand into rural areas. Methodologically, the results from the two methods are concurring but not identical. The E2SFCA method calculates population-adjusted density of hospitals, which measures deviation from the *expected* pattern, and therefore is more meaningful in assessing associations of the spatial access to hospitals with other factors (e.g., population density and investment).

1. Introduction

In 2009, the Chinese government launched a new round of nationwide healthcare reform, aiming to provide its people more affordable and accessible healthcare (Pan et al., 2015a). Before the inception of this reform, years of exploration had led to an understanding that while the government should continue increasing its support to public hospitals, a more robust, comprehensive, and affordable healthcare system of the country needs investment from the private sector (CPC Central Committee and State Council, 2009). Thus the new reform includes a series of policies that encourage and facilitate establishment of private healthcare facilities, particularly hospitals (PRC State Council, 2015a,b). Fig. 1 shows the numbers of the two types of hospitals in China during the period of

* Corresponding author.
E-mail addresses: panjie.jay@scu.edu.cn (J. Pan), zhaohanqing25@163.com (H. Zhao), jasmineqya@gmail.com (X. Wang), Xun.Shi@dartmouth.edu (X. Shi).

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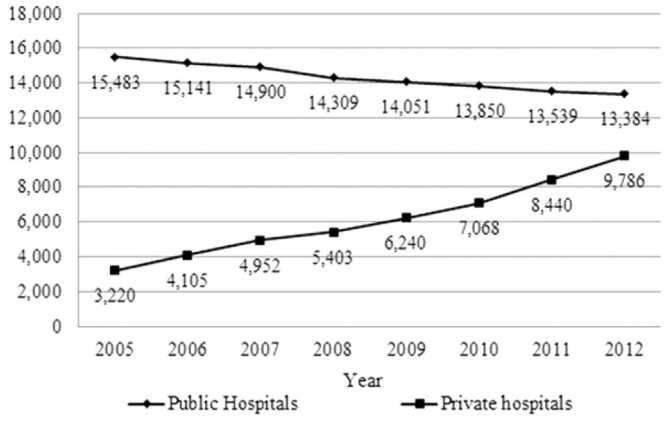

Fig. 1. Number of hospitals by ownership, China, 2005–2012.
Data source: China Health Statistical Yearbook 2013.

2005–2012, demonstrating that the number of public hospitals had been steadily declining during this period, whereas private hospitals had been growing in a remarkable pace, and this growth seemed to have accelerated particularly after 2010, a possible effect of the new policies.

For many readers, it is worth noting that in terms of the roles that public and private hospitals play in a country's healthcare system, the situation in China is quite different from that in many developed countries. For example, in the United States the private sector is dominant in the healthcare system, providing more-extensive and higher-quality services, whereas the public hospitals are mainly for providing basic medical care to the socioeconomically disadvantaged population. On the contrary, the private hospitals in China, despite their rapid development in the past decade, have been, and actually are designated to be, a supplement to public hospitals (PRC State Council, 2010). In China, the resources of healthcare have been centralized to public hospitals, and as a result, the public hospitals in the country are much more advantageous in hiring physicians and providing services (Pan et al., 2016). It is estimated that 90% of medical services in China are provided by public hospitals (China Health Statistical Yearbook, 2013). This almost monopoly of public hospitals used to be the reality in both urban and rural areas in China, and in serving populations of different socioeconomic statuses in this country. A goal of this study is to find out, from the perspective of spatial access, that since the implementation of the policy that encourages the development of private hospitals, if the dominance of public hospitals has changed.

With most of private hospitals in China being for profit, it is not surprising that the service, as well as the geographic locations and distribution of private hospitals in China are largely determined by the market (Pacione, 2014). On the other hand, evidence shows that many public hospitals in China also became increasingly market- and profit-oriented, and this has been attributed to insufficient governmental funding, unreasonable pricing of service and medicine, and the fee-for-service payment system (Luo, 2009; Pan, 2014). Luo (2009) states that while insufficient resources and competing market have sent many public hospitals in China into struggle of survival, there is no simple resolution to this situation due to entangled interests of many stakeholders. What is certain is that when almost the entire hospital system of a country is driven by financial profit, the social justice and public welfare are likely to be compromised (Blumenthal and Hsiao, 2015).

However, there is a serious lack of vigorous analysis of the actual situation that offers empirical evidence at the regional (let alone national) level, needed to support arguments revolving this issue in China and the following policy making and adapting. In this study, we intend to start to fill this gap by conducting a regional-level analysis of spatial variation in spatial access to hospitals in Sichuan Province, China. Spatial access measures how easy to access hospitals in terms of overcoming the travel impedance, which is largely determined by locations and geographic distribution of hospitals, as well as conditions of transportation (Penchansky and Thomas, 1981; Khan, 1992; Shi et al., 2012; Pan et al., 2015b). Since both people and hospitals have "geographies", *i.e.*, different amounts and different kinds of people and hospitals are distributed unevenly across geographic space, there is a geography (spatial variation) of spatial access to hospitals, and this geography of spatial access is an important indication of (in)equity in healthcare resource allocation (Wang et al., 2012). To our knowledge, this present work is one of the earliest on the spatial access regarding China's healthcare system, especially within the context of the ongoing marketization and a turning point of the country's healthcare policy. Temporally, the hospital data used in our analysis are about year 2012, which provide a snapshot of the situation that was a few years later since the new policies had set out. We consider that such a study is able to contribute to the debate about the for-profit tendency in current China's healthcare system, and further to provide scientific support to the policy makers and planners in adjusting and reallocating public health resources.

As will be further described in next section, we selected the Sichuan Province (herein referred to as Sichuan) as our study region, owing to the fact that in many aspects Sichuan is like a scaled-down model of the entire China. The province, just like China, features a flat east portion where most of the population and a well-developed economy are located, and a mountainous west portion that is largely rural and underdeveloped. The demography of this fourth most populated province of China (with 91 million census-registered residents and 81 million long-term residents in 2012) also represents the general characteristics of China's population, which is dominated by the Han population that is mostly located the east portion, along with many ethnic minorities that are mostly located in the west portion. Compared with those more economically active (and thus more "liberal") regions on the east coast of China, e.g., Shanghai and Guangdong, historically the administrative system and policies of Sichuan have been "conservative" (in terms of being less marketization and closely following instructions from the central government). Thus Sichuan is a representative region of the entire country and a good case for examining outcomes of new policies.

Methodologically, using geographic information systems (GIS), our analysis employed two methods to quantify the spatial variation in spatial access to hospitals: the nearest-neighbor method and the enhanced two-step floating catchment area (E2SFCA) method. The former is simple and easy, and has been widely used in spatial access studies, whereas the latter is so far the most sophisticated method for analyzing the spatial access to healthcare service.

2. Study area and data

Sichuan is one of the most populous provinces of China, and has an overall economic development level being in the middle among all provinces. The total population of the province in 2012 is 80.76 million and the total area is about 486,052 km^2. Geographically, the province is almost equally divided by the Hengduan Mountains, resulting in two highly distinctive sub-regions (Fig. 2): the northwest half of the province is mountainous, featured by relatively low population density, small towns and villages, underdeveloped road networks, and a rural economy; and the southeast half is a vast