

Assessing the disparity in spatial access to hospital care in ethnic minority region in Sichuan Province, China



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Abstract

Background: Great disparity exists in spatial accessibility to hospital care between ethnic minority and non-minority regions in China, which draws increasing attention in China in recent years. A better understanding of spatial access to hospital care in ethnic minority region in China will be helpful in guiding the allocation of government investment in the future.

Methods: Take Sichuan Province as a sample, apply the shortest path analysis and the enhanced two-step floating catchment area (E2SFCA) method under ArcGIS 10.1 environment.

Results: In Sichuan, healthcare access in ethnic minority region is worse than in non-minority region in terms of time to hospital and the value of spatial accessibility. There is relatively greater inequality in access to doctors and health professionals than in access to hospital beds. In ethnic minority region, the balance between primary, secondary, and tertiary hospitals, as well as between public and private hospitals, is less even, compared with the non-minority region. The disparity within ethnic minority region is larger than in non-minority region.

Conclusion: The combination of shortest path analysis and E2SFCA method is superior to the traditional county ratio method in assessing spatial access to healthcare. Compared to the non-minority region, ethnic minority region rely more heavily on government investment to provide healthcare. In ethnic minority region, the current distribution of primary, secondary and tertiary hospitals is inappropriate, and there is an urgent shortage of healthcare personnel. We therefore recommend that the government use preferential policies to encourage more social capital investment in ethnic minority region, use government investment as a supplement to build a more equitable healthcare market, encourage doctors to work in such regions, and push forward road construction in rural area.

Background

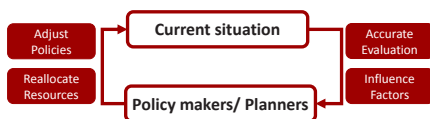
- China has aimed to build a socialist society with justice and equality.
- Disparity exists in many aspects between ethnic majority (the Han) and ethnic minority (the other 55 ethnic groups) in China.
- The Chinese government has implemented many policies to support ethnic minorities, and allocated more resources in ethnic minority regions.
- In 2010, 34.6% of rural respondents to a national survey (83.87 million people) cited distance as a major barrier in getting timely hospital treatment versus only 1.37% of urban residents, ethnic minorities are particularly vulnerable to such inequalities, since many live in remote, rural regions.

In spite of the great effort the Chinese government has done to support ethnic minorities, disparity exists between ethnic minority and non-minority in China in many aspects, including hospital care.

- In China, population-to-provider ratio (PPR) is the preferred method for characterizing the accessibility of healthcare services because it is easy to implement and understand. However, it does not reflect the real world as accessibility differs inside the administrative unit, and cross-border service-seeking behaviors exist.
- The newly developed E2SFCA method evaluates accessibility based on the geographical location, the completion between customers, and the service capacity of suppliers.

Because of the limitations of the traditional PPR method, a number of new techniques have been developed to more accurately evaluate the healthcare accessibility, including the E2SFCA method.

- A more accurate knowledge of the current situation of hospital care between ethnic minority and non-minority region, can be used to analyze why any disparities exist, thus provide scientific suggestions to policy makers.



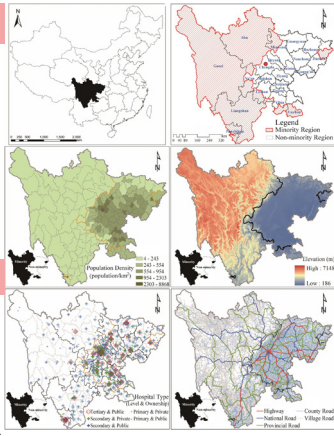
Objectives

- Evaluate the spatial accessibility of hospital-based services in Sichuan Province using the E2SFCA method.
- Compare the accessibility of hospital care between ethnic minority region and non-minority region.
- Analyze why any disparities exist.
- Provide scientific suggestions to policy makers.

Methodology

Study Area

We select Sichuan Province as a sample because it is representative in landscape, ethnic constitution, and social development.



Data

We acquired the data for hospitals, road networks, population, county type and administrative boundaries for analysis.

Data name	Source	Information
Hospital	The Health and Family Planning Commission of Sichuan Province	<ul style="list-style-type: none"> Name Address (longitude and latitude) Type (public/ private) Level (primary/ secondary/ tertiary) Capacity (number of hospital beds, doctors, and health professionals)
Road network	The National Geomatics Center of China	<ul style="list-style-type: none"> Shape Type (highway, state road, provincial road, county road, village road)
Population	The Department of the Statistics Bureau of Sichuan	<ul style="list-style-type: none"> Number (population of every county-level administration unit)
Administrative boundary	The National Geomatics Center of China	<ul style="list-style-type: none"> Name Shape
County type	The Department of the Statistics Bureau of Sichuan	<ul style="list-style-type: none"> Type (ethnic minority/ non-minority)

Method

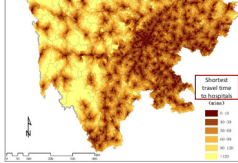
- The nearest-neighbor method
Tool: ArcGIS 10.1
- The E2SFCA method
Tool: ArcGIS 10.1 & Excel 2013

Datasets:

- Road network with speed assigned;
- Hospital points loaded into ArcGIS with longitude and latitude;
- Population points loaded into ArcGIS with longitude and latitude.

Command:

Network analyst – New Closest Facility



Datasets:

- Road network with speed assigned;
- Hospital points with hospital service capacity (beds, doctors, health professionals);
- Population points with population.

Command:

Network analyst – New Service Area

First step:
Calculate the supply-to-demand ratio R_j of every hospital j .

$$R_j = \frac{S_j}{\sum_{i \in N} \frac{D_i}{d_{ij}} + \sum_{k \in N} \frac{S_k}{d_{kj}}}$$

Second step:
calculate the spatial accessibility A_i^f of each population unit i .

$$A_i^f = \sum_{j \in N} \frac{R_j}{d_{ij}^{\alpha}} + \sum_{k \in N} \frac{R_k}{d_{ki}^{\alpha}}$$

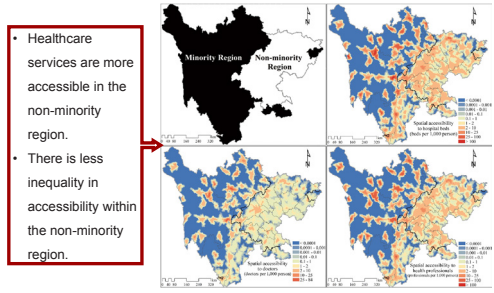
Results

1. The shortest travel time to hospitals

Shortest Travel Time (minutes)	Ethnic minority region			Non-minority region		
	All Hospitals	Public Hospitals	Private Hospitals	All Hospitals	Public Hospitals	Private Hospitals
0-10	1.00	0.86	0.46	5.21	3.95	3.83
10-30	14.19	12.57	7.53	36.62	32.92	32.21
30-60	37.39	39.67	33.63	13.59	15.87	12.60
60-120	35.38	35.44	77.50	5.16	5.31	10.70
>120	11.55	11.72	36.34	5.73	5.82	12.37

- The distribution of hospitals in the non-minority region is more reasonable and convenient to residents.
- Across the whole of Sichuan, public hospitals serve a greater population and area than private hospitals within a 2-hour distance.

2. Spatial accessibility of healthcare services



- Healthcare services are more accessible in the non-minority region.
- There is less inequality in accessibility within the non-minority region.

Hospital Capacity	Region	Public Hospitals			Private Hospitals		
		All Hospitals	Primary	Secondary	Tertiary	Primary	Secondary
Doctors	Minority	0.57	0.07	0.37	0.09	0.04	0.00
	Non-minority	0.90	0.06	0.34	0.33	0.14	0.03
Health Professionals	Minority	1.81	0.18	1.19	0.30	0.13	0.01
	Non-minority	2.86	0.19	1.05	1.07	0.45	0.09
Hospital Beds	Minority	2.26	0.25	1.49	0.29	0.22	0.02
	Non-minority	3.37	0.34	1.22	1.07	0.64	0.10

- Accessibility for doctors, health professionals, and beds are all higher in the non-minority region than in ethnic minority region. Hospitals of different ownership (public and private) and level (primary, secondary, and tertiary) show the same trend.
- Healthcare service distribution differs between the minority and non-minority region by hospital ownership type and level. Secondary public hospital provides the majority of healthcare services in minority region while in non-minority region healthcare services are more evenly distributed between hospitals of different levels.

Conclusion

- Across a wide range of indicators, the ethnic non-minority region in Sichuan has better access to healthcare services.
- In ethnic minority region, the shortage of personnel (doctors and health professionals) is more acute than the shortage of facilities (beds).
- Apart from a shortage of hospitals in ethnic minority region, imbalances in the healthcare market there also need to be addressed.
- Intra-regional disparities in healthcare accessibility are much worse in ethnic minority region.
- Compared with the traditional population-to-provider ratio, our results better reflect actual geographical patterns, and can be used to guide the location of new hospitals and investment in different regions.

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