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Original article

Assessment of radiotherapy and diagnosis resources allocation in Shanghai, China

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ABSTRACT

Objective: To evaluate the equity of medical resources in radiotherapy and diagnosis in Shanghai, China, based on population, geography, and economic factors.

Methods: Data on medical resources including institutions, equipment, and staff in radiotherapy/diagnosis were collected from all 16 districts of Shanghai, China in 2022. Separate data were collected for institutions and devices in CT. The Gini coefficient (*G*) and Lorenz curves were used to assess fairness based on population and geography, while the Theil index (*T*) was employed to evaluate health equity based on economic factors. Health resource agglomeration degree (HRAD) and population agglomeration degree (PAD) were utilized to analyze the equity and accessibility of medical resources considering both population and geography.

Results: In 2022, Shanghai had a total of 992 institutions, 4,925 devices, and 10,282 personnel in radiotherapy and diagnosis. Additionally, there were 381 institutions conducting CT examinations and 776 CT machines in Shanghai. The Gini coefficients for institutions, devices, and personnel in radiotherapy and diagnosis based on population ranged from 0.2 to 0.4, while for CT, the Gini coefficients for institutions and devices ranged from 0.2 to 0.4. When considering geography, all Gini coefficients were greater than 0.5. The results of the Theil index indicated that inequities in distribution may be influenced by economic factors. The HRAD and PAD revealed disparities in the accessibility of institutions, devices, and personnel in radiotherapy/diagnosis and CT in Shanghai.

Conclusions: Inequities in the distribution of institutions, equipment, and personnel for radiotherapy/diagnosis and CT were observed in Shanghai in 2022, both geographically and economically. There is a critical need to enhance the allocation of resources for radiological equipment and personnel and to establish a scientifically robust urban resource planning framework.

1. Introduction

Radiation-based imaging, encompassing both diagnostic radiology and radiotherapy, is a pivotal medical technique employed for disease diagnosis, medical intervention, and health assessments by harnessing controlled radiation exposure. This domain comprises diagnostic radiology, interventional radiology, nuclear medicine, and radiation therapy.[1] Notably, X-ray computed tomography (CT) stands out as a globally prevalent diagnostic radiology modality essential for medical diagnostics, treatment strategizing, and simulation positioning.[2]

With advancements in technology and economic growth, imaging technologies in China have been steadily improving. In 2018, there were a total of 55,902 institutions dedicated to radiodiagnosis and radiotherapy, employing 93,559 radiation workers nationwide.[3] The number of CT devices per 1,000,000 population in China was 14.25 in 2015, nearly five times that of 1998.[4] By 2012, the number of institutions solely conducting X-ray radiodiagnosis in Shanghai, China, had grown by more than double compared to 1998, reaching 1,279 establishments. Both the equipment and personnel in the field of radiotherapy and diagnosis are experiencing annual growth.[5] Specifically, the number of X-ray radiodiagnosis devices in Shanghai increased by 57.7% during the same period.[6]

However, evaluating the efficient utilization of radiotherapy and diagnostic equipment, as well as the sufficiency of healthcare personnel

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