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Original article

Study on healthcare level and its relationship with medical radiation in China

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ABSTRACT

Objective: To evaluate the health-care level (HCL), one of the most extensively used indicators to assess the level of medical exposure, and its influencing factors in China.
Methods: Based on the data from the *China Statistical Yearbook* of the National Bureau of Statistics and other public documents, HCL was calculated in terms of the number of physicians per head of population throughout the country. Multiple linear regression was used to analyze the association of HCL with main socioeconomic factors, including population size, area, number of administrative divisions and gross domestic product (GDP).
Results: Since 2015, there has been at least one physician for every 1,000 people in China on average. However, by 2019, there has yet been one physician for more than 1,000 people in each of two provinces. By 2020, there was at least one physician for every 1,000 people across all 31 provincial-level administrative districts (provinces). The population size and GDP were the influencing factors on HCL, with correlation coefficients of 0.416 and −0.583, respectively. Furthermore, a moderate correlation was found between HCL and the frequency of medical exposure (FME) to ionizing radiation ($r = -0.620$, $P = 0.028$).
Conclusion: There has been at least one physician for every 1,000 people since 2015, but there are great differences between various provinces. HCL as an indicator to evaluate level of medical exposure is warranted further research in China.

1. Introduction

According to United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), medical exposure is currently the largest human-made source of radiation exposure of the world's population, with an annual effective dose per caput of 0.57 mSv (excluding radiotherapy).[1] Medical exposure refers to exposure of patients to medical examinations and disease-based diagnoses or treatments, as well as of persons who provide health care service for patients and of volunteers in biomedical research programs. Mettler et al.[2] reported a good correlation between the population per physician and the frequency of medical exposure (FME) in various countries in 1987, and they established a health-care model for the related prediction. Since the 1988 UNSCEAR Report,[3] health-care level (HCL) has been used as an indicator to evaluate level of medical exposure in countries where survey data may be insufficient.

Because the detailed data on FME for China were not as much as for other member states, the HCL-based results were used in the UNSCEAR reports. China has moved from an HCL II country in 2008 to an HCL I country as noted in the 2020/2021 UNSCEAR Report.[1] However, systematic and in-depth studies on HCL are insufficient. Therefore, based on a preliminary analysis of HCL and its association with FME, the present study evaluated the usefulness of HCL as an indicator to evaluate the FME in China.

2. Materials and methods

2.1. Population and physicians

For this study, data on the population and number of physicians were collected from the electronic version of *the China Statistical Yearbook* released by the National Bureau of Statistics of China.[4] The term "practicing physicians" in yearbook included physicians who were qualified to practice medicine, and rural doctors and health workers working in village clinics where medical radiation equipment was unavailable. In the UNSCEAR reports, "physician" refers to medical practitioners who were qualified to diagnose and treat patients, but did not practice medicine in village clinics. Consequently, the calculation of physicians in the

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