



Field report

Association between the number of board-certified psychiatrists and volume of rehabilitation provided in Japan: an ecological study

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Abstract

Objectives: This study aimed to determine the relationship between the number of board-certified psychiatrists and the amount of inpatient rehabilitation delivered.

Materials and Methods: We analyzed open data from 2017 in the National Database of Health Insurance Claims and Specific Health Checkups of Japan and compared the volume of inpatient rehabilitation services between prefectures to examine regional disparities. We also examined the relationship between the volume of rehabilitation services provided and the number of board-certified psychiatrists.

Results: The population-adjusted number of inpatient rehabilitation units per prefecture ranged from a maximum of 659,951 to a minimum of 172,097, a disparity of 3.8-fold. The population-adjusted number of board-certified psychiatrists was 4.8 in the highest region and 0.8 in the lowest region, a disparity of 5.8-fold. The population-adjusted number of board-certified psychiatrists was significantly correlated with the population-adjusted total number of inpatient rehabilitation units ($r=0.600$, $P<0.001$). Correlations were between the number of board-certified psychiatrists and the number of rehabilitation units in cerebrovascular and orthopedic services, but not in cardiovascular, respiratory, or oncology services.

Conclusion: Large regional disparities manifested in the amount of inpatient rehabilitation provided in Japan. An association was found between the number of board-certified psychiatrists and rehabilitation units delivered. It may be necessary to train more BCPs in regions with fewer units to eliminate these disparities.

Key words: psychiatrist, rehabilitation, disparity, database, ecological study

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Introduction

The need for rehabilitation services is increasing worldwide as the global population ages and the lifespans of people with disabilities increase¹. Physical function typically

deteriorates in patients with orthopedic conditions and those with cerebrovascular disease due to joint or nerve damage. Reduced physical function is also seen in patients with cardiovascular or respiratory diseases who require hospital admission, during which physical activity is limited. Inpatient rehabilitation plays a significant role in helping these patients recover from disease-related functional impairment and disability, prevent complications during hospitalization, shorten hospital stays, and hasten the return home.

Many countries have education and training programs and certification systems designed to ensure that psychiatrists provide high-quality rehabilitation services². The psychiatrist evaluates the severity of the disability, plans an exercise program, arranges a suitable setting for rehabilitation, and sets goals tailored to the individual patient³. A board-certified psychiatrist (BCP) is a medical graduate cer-

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tified by a governing board that has acquired specific skills and knowledge related to rehabilitation medicine⁴). A previous study of stroke patients showed that hospitals with high participation in BCPs have better rehabilitation outcomes than those with low participation in BCPs⁵). Another study using data from traumatic brain injury model systems in the United States reported that the involvement of BCPs contributed to improving the performance of activities of daily living in patients with brain trauma⁶).

Disparities between regions can sometimes arise in the amount of inpatient rehabilitation provided⁷). However, it is unclear whether a lack of rehabilitation resources contributes to these disparities. We hypothesized that regional differences in the number of BCPs are one of the reasons for the disparities in rehabilitation services. In Japan, the number of BCPs is limited, and many rehabilitation orders are provided by non-BCPs. BCPs are expected to be skilled at arranging the environment for therapists to actively perform rehabilitation and manage patients' physical conditions to enable them to actively participate in training. However, it is not known whether the availability of a BCP is associated with an increase in the amount of rehabilitation provided. The purpose of this study was to determine the relationship between the number of BCPs and the amount of rehabilitation provided.

Materials and Methods

We examined regional differences in the number of inpatient rehabilitation units per 100,000 people in each prefecture in Japan. Then, we counted 20 minutes as a rehabilitation unit. Also, we examined the relationship between the population-adjusted number of BCPs per 100,000 population and the population-adjusted number of rehabilitation units. The population of each prefecture was based on census data from October 1, 2017, from the Statistics Bureau, Ministry of Internal Affairs and Communications⁸).

In this study, we used open data from the National Database of Health Insurance Claims and Specific Health Checkups (NDB)⁹, which has been maintained by the Ministry of Health, Labour and Welfare since 2008. The NDB open data contains information on more than 20 million health insurance claims and specific health checkups per year and has provided data to researchers and government agencies since 2011. From these NDB open data, we obtained the number of units for each type of rehabilitation in 2017 and calculated the number of inpatient rehabilitation units adjusted for the population of each prefecture.

The medical reimbursement system in Japan covers disease-specific inpatient rehabilitation for cardiovascular, cerebrovascular, orthopedic, respiratory, disuse syndrome, cancer, and other conditions. Inpatient rehabilitation is delivered by physical therapists, occupational therapists, and

speech therapists under the direction of a physician. Reimbursement for disease-specific rehabilitation is set per unit, with 20 minutes counted as one unit¹⁰). Facilities must meet specific criteria for the number of physicians and therapists, facility area, and equipment standards to be approved as providers of disease-specific rehabilitation. Cardiovascular rehabilitation providers can treat more than one patient at the same time. We obtained aggregate NDB open data for the number of rehabilitation units delivered for patients with cardiovascular disease, cerebrovascular disease, orthopedic condition, respiratory disease, disuse syndrome, and cancer by prefecture from April 2017 to March 2018.

Several national rehabilitation medical societies have specialty certification requirements that include 2 to 6 years of residency training followed by an examination¹¹). The Japanese Association of Rehabilitation Medicine (JARM) requires that BCPs complete a 3-year residency program at a JARM-certified facility that covers the full scope of rehabilitation medicine (e.g., brain injury, spinal cord injury, cerebral palsy, musculoskeletal disorders, neurological disorders, and amputation)¹²). Approximately 90% of residents pass the examination annually and are certified. Furthermore, JARM requires that the certification be renewed every 5 years. In this study, we used data on the number of BCPs as of Jun. 23, 2017. At that time, there were 2,273 BCPs in Japan. Physicians in Japan can be certified in one or more medical specialties, and nearly 70% of BCPs also hold certification in other medical specialties.

This research did not require a review by our university ethical review committee because the academic value of the NDB open data has already been established and the data therein are generally available and widely used for research purposes. The need for informed consent was waived owing to the anonymity of the data.

Statistical analysis

The population-adjusted number of inpatient rehabilitation units and BCPs are expressed as the mean (standard deviation) and median (interquartile range). Pearson's correlation coefficient was used to examine the relationship between the number of inpatient rehabilitation units and BCPs. The maximum population-adjusted number of rehabilitation units for each prefecture was divided by the minimum number of units to show regional disparities. All statistical analyses were performed using SPSS software (version 23.0; IBM Japan, Tokyo, Japan). Statistical significance was set at $P < 0.05$.

Results

The average population-adjusted number of inpatient rehabilitation units per prefecture was approximately 300,000 units/year, with a maximum of 659,951 and a minimum of

172,097, with a maximum regional disparity of 3.8-fold (Table 1). The maximum regional disparity in the number of units of various types of rehabilitation was 3.4-fold for cerebrovascular disease, 6.5-fold for cardiovascular disease, 9.7-fold for disuse syndrome, 6.8-fold for orthopedic conditions, 6.5-fold for respiratory disease, and 4.0-fold for cancer.

The average population-adjusted number of BCPs per prefecture was 2.2 (Table 1). There was a 5.8-fold difference between the maximum (4.8) and minimum (0.8) population-adjusted number of BCPs.

There was a significant correlation between the total population-adjusted number of rehabilitation units delivered and the population-adjusted number of BCPs ($r=0.600$, $P<0.001$; Figure 1). The correlations between the number of BCPs and the number of disease-specific rehabilitation units are shown in Figures 2–7. The respective correlation coefficients were 0.332 ($P=0.023$) for cardiovascular diseases, 0.567 ($P<0.001$) for cerebrovascular diseases, 0.380 ($P=0.008$) for disuse syndrome, 0.585 ($P<0.001$) for orthopedic conditions, 0.407 ($P=0.005$) for respiratory diseases, and 0.117 ($P=0.433$) for cancer.

Discussion

The maximum regional disparity in population-adjusted number of inpatient rehabilitation units was 3.8-fold, and in the population-adjusted number of BCPs was 5.8-fold. The total population-adjusted number of rehabilitation units correlated with the population-adjusted number of BCPs. There were also correlations between the number of BCPs and rehabilitation units delivered for cerebrovascular diseases and

orthopedic conditions; however, the correlations were weak or nonexistent for cardiovascular disease, respiratory disease, and cancer.

Regional disparities in medical resources have been identified in previous studies. One report found large regional disparities in the delivery of surgery, dermatology, obstetrics and gynecology, and ophthalmology services¹³. However, there have been no clear reports on the impact of regional disparities in terms of the number of practicing physicians. Our study suggests that regional disparities in the number of BCPs may affect the amount of rehabilitation provided. Studies in China have found large regional disparities in rehabilitation resources for people with disabilities⁷. Rehabilitation medicine is still an underdeveloped field, and there may be a lack of doctors specializing in rehabilitation worldwide. It has been reported that the supply of BCPs in the US does not match the demand¹⁴. Moreover, in many countries, education and training opportunities in rehabilitation medicine are inadequate, and targeted investment may be necessary to improve the quality of rehabilitation services.

The main reason for the disparities in the population-adjusted number of BCPs from region to region in Japan is a lack of supply as a result of the limited number of universities providing training programs for BCPs. Currently, only one in four national universities in Japan has a department of rehabilitation medicine. There are several possible ways in which a higher volume of BCPs would increase the amount of rehabilitation provided¹⁵. BCPs are trained to manage comorbidities such as pain, defecation, and urinary disorders that may be obstacles to rehabilitation and provide

Table 1 Population-adjusted numbers of inpatient rehabilitation units and board-certified physiatrists per prefecture

	Mean (standard deviation)	Median [Interquartile range]	Range (Minimum–maximum)	Regional disparity (Maximum/minimum)
Total number of rehabilitation units per 100,000 population	302,918 (105,658)	280,688 [223,193–371,441]	172,097–659,951	3.8
Number of cardiovascular rehabilitation units per 100,000 population	5,746 (2,329)	5,502 [4,007–7,214]	1,854–12,005	6.5
Number of cerebrovascular rehabilitation units per 100,000 population	135,346 (42,235)	123,568 [105,492–161,643]	90,723–307,639	3.4
Number of disuse syndrome rehabilitation units per 100,000 population	32,466 (15,134)	31,430 [20,639–39,038]	9,650–93,546	9.7
Number of orthopedic rehabilitation units per 100,000 population	107,938 (51,063)	100,091 [68,383–135,551]	37,381–253,521	6.8
Number of respiratory rehabilitation units per 100,000 population	9,358 (4,381)	8,825 [6,403–10,905]	3,154–20,486	6.5
Number of cancer rehabilitation units per 100,000 population	4,690 (1,991)	4,086 [3,321–5,605]	2,311–9,171	4.0
Number of board-certificated physiatrists per 100,000 population	2.229 (0.885)	2.042 [1.606–2.738]	0.836–4.808	5.8

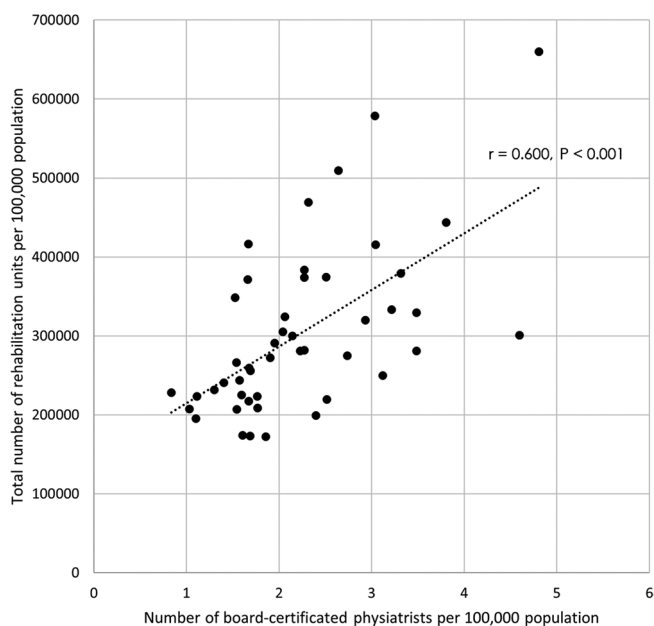


Figure 1 Correlation between the number of board-certified physiatrists and total rehabilitation units.

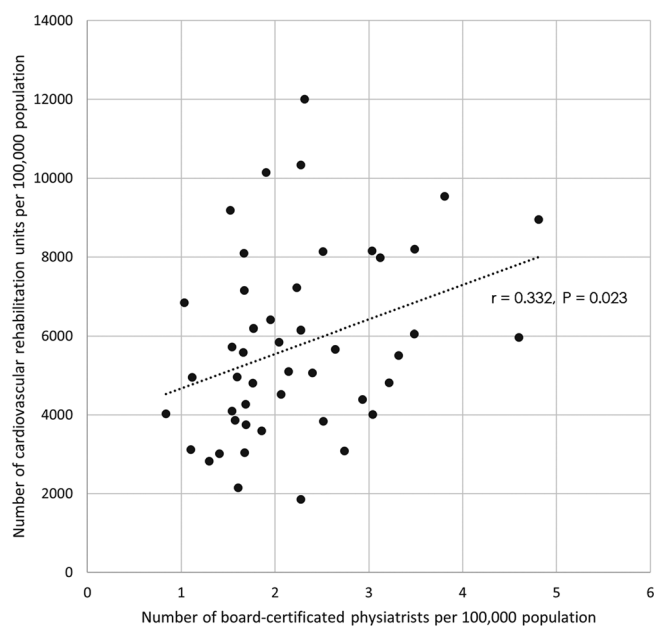


Figure 2 Correlation between the number of board-certified physiatrists and cardiovascular rehabilitation units.

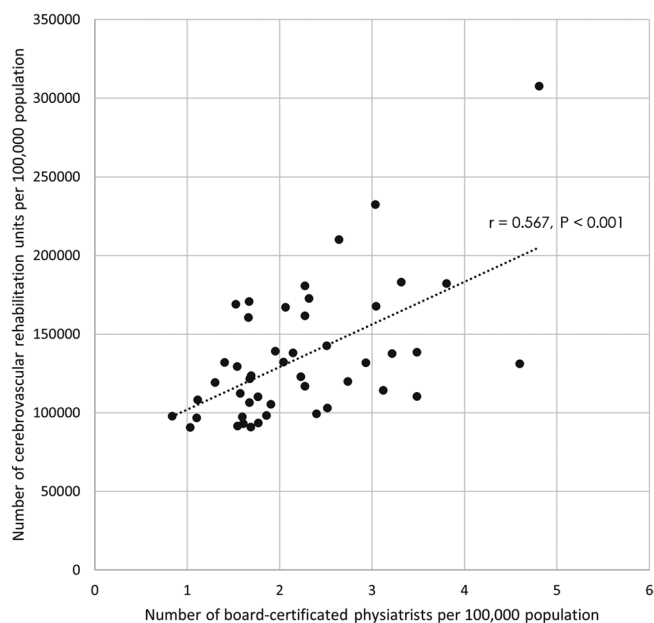


Figure 3 Correlation between the number of board-certified physiatrists and cerebrovascular rehabilitation units.

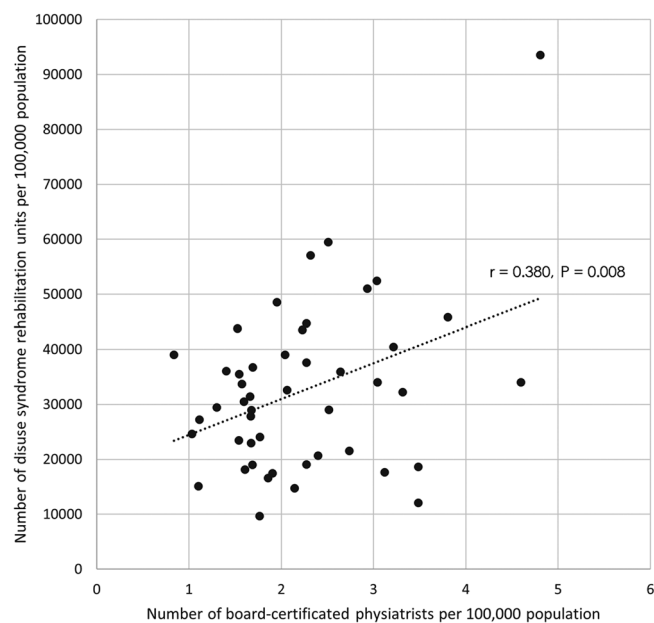


Figure 4 Correlation between the number of board-certified physiatrists and disuse syndrome rehabilitation units.

systemic management that may allow for active rehabilitation. Polypharmacy is common in older patients because of the greater likelihood of comorbidities, such as malnutrition. Overuse of medication and malnutrition can have a negative impact on the ability to participate in a rehabilitation program^{16, 17}. BCPs can optimize nutrition and medication to make patients more suitable for rehabilitation and

increase their effectiveness. BCPs may also help therapists manage safety issues so that patients can feel more secure during active rehabilitation. Therefore, BCPs may contribute to increasing the amount of rehabilitation provided.

There is little evidence of a relationship between the number of BCPs available and the amount of rehabilitation provided for patients with cancer, respiratory disease,

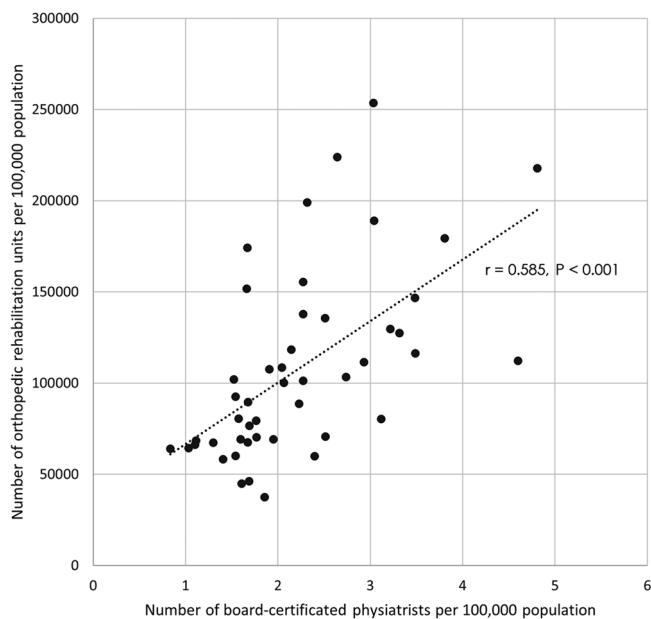


Figure 5 Correlation between the number of board-certified physiatrists and orthopedic rehabilitation units.

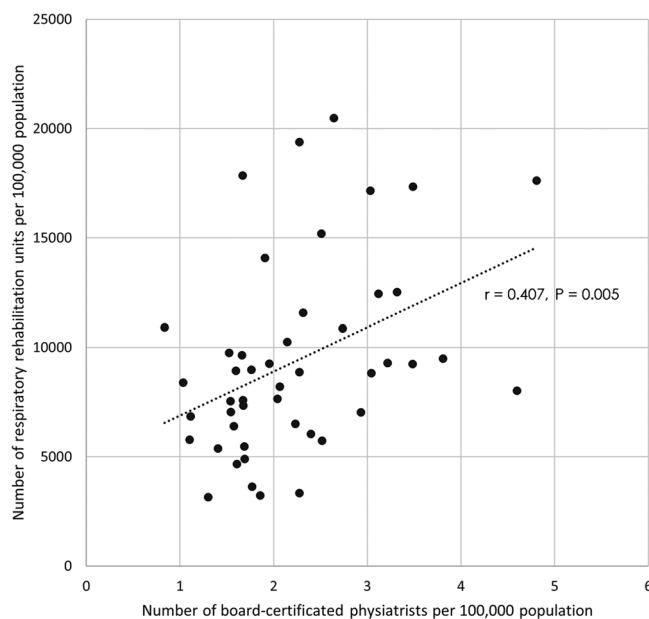


Figure 6 Correlation between the number of board-certified physiatrists and respiratory rehabilitation units.

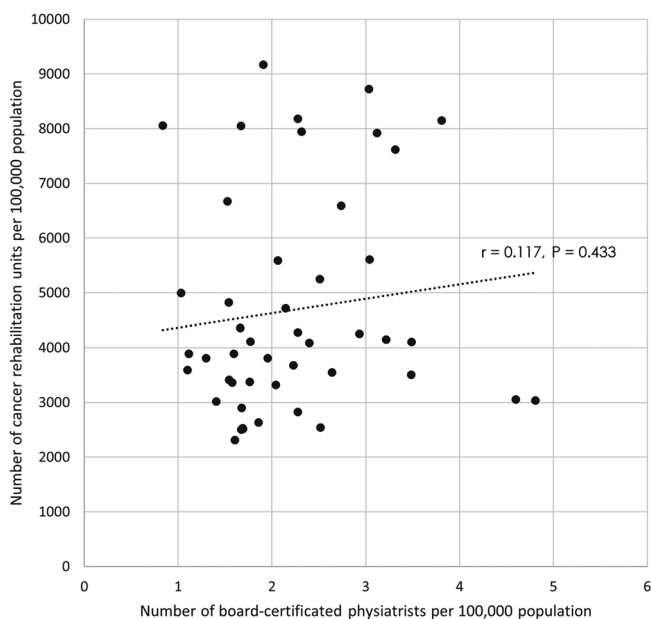


Figure 7 Correlation between the number of board-certified physiatrists and cancer rehabilitation units.

or cardiovascular disease. After the overall condition has stabilized in these patients, the primary physician consults the rehabilitation department, probably because the initiation and amount of rehabilitation provided depends on the judgment of the primary physician.

Increasing the number of BCPs may have a positive impact on the delivery of rehabilitation. A review published in

2002 suggested that increasing the number of BCPs available would improve the quality of care¹⁸). However, it is still difficult to estimate the optimal number of BCPs required, despite numerous studies from various countries¹⁹). Further research is needed to determine the number of BCPs required in each country.

Our study used the NDB database, which contains minimal information bias because it contains health insurance claims for more than 90% of the Japanese population, and almost all rehabilitation data can be extracted. However, this study had some limitations. First, it may contain an element of ecological fallacy in that although we found a correlation between the amount of rehabilitation provided and the number of BCPs available, it is unclear whether this relationship would be valid within an individual hospital. Second, the cross-sectional design of the study means that the correlation between the amount of rehabilitation provided and the number of BCPs cannot be extended to causality. Third, the details of the diseases that led to the need for rehabilitation are unknown. There is variation in the causative diseases, even for rehabilitation in the same reimbursement category, and additional investigations that include causative diseases may be necessary. Finally, the type of therapist who implemented rehabilitation was unknown. Inpatient rehabilitation is provided by physical, occupational, and speech therapists. However, this study did not differentiate between these therapists and could not examine the degree of delivery by each type of therapist or any regional disparities in the number of therapists available.

Conclusion

This study found regional disparities in the amount of rehabilitation provided and evidence of a relationship between these regional disparities and the number of BCPs. It may be necessary to train more BCPs in regions with fewer units to eliminate these disparities.

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