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Association between physicians' maldistribution and core clinical competency of resident physicians: a nationwide cross-sectional study

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ABSTRACT

Objectives With physician maldistribution recognised as a global issue, Japan implemented the physician uneven distribution (PUD) index as a strategic measure. Currently, there is a lack of objective assessment of core clinical competencies in regions influenced by varying levels of physician distribution. In this study, we objectively assess the core clinical competencies in regions affected by physician maldistribution and explore the relationship between the PUD index and the clinical competencies of resident physicians.

Design, setting and participants In this cross-sectional study, we gathered data from the January 2023 General Medicine In-Training Examination (GM-ITE) survey. Participants included postgraduate year 1 and 2 resident physicians in Japanese hospitals mandating the GM-ITE or those who voluntarily took it. The GM-ITE scores of the resident physicians were assessed. The PUD index, a Japanese policy indicator, reflects regional physician disparities. A low PUD index signals a medical supply shortage compared with local demand. The trial registration number is 23-7.

Results The high and low PUD index groups included 2143 and 1580 participants, respectively. After adjusting for relevant confounders, multivariate linear regression analyses revealed that the low PUD index group had significantly higher GM-ITE scores than the high PUD index group (adjusted coefficient: 1.14; 95% CI 0.62 to 1.65; p<0.001).

Conclusions The study revealed no clinically differences in GM-ITE scores between residents in regions with disparate physician distributions, suggesting that factors beyond PUD may influence clinical competency. This finding prompts a re-evaluation of whether current assessment methodologies or educational frameworks fully support learning across varied community settings.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study uses nationwide, cross-sectional survey data from a large number of resident physicians across Japan, providing robust insights into physician distribution and clinical competency.
⇒ The study introduces the physician uneven distribution (PUD) index as a novel measure to assess disparities in clinical residency training regions.
⇒ It adjusts for a comprehensive set of potential confounders in multivariate linear regression analyses, ensuring a thorough analysis of the relationship between physician distribution and clinical competency using abundant data resources.
⇒ Limitations include reliance on General Medicine In-Training Examination scores as a proxy for clinical competence.
⇒ It does not account for the baseline clinical competencies of resident physicians at the start of their training, which could potentially influence the results.

INTRODUCTION

Japan is currently experiencing a severe crisis in local healthcare delivery owing to the uneven distribution of physicians, worsening the critical situation in community hospitals in rural areas.[1 2] The insufficient number of physicians in rural areas due to urbanisation remains a serious problem.[3 4] Rural patients also tend to receive less comprehensive medical care than their urban counterparts, indicating an uneven distribution of specialist physicians and limited medical resources in rural areas.[5] However, the issue of physician maldistribution is not unique to Japan; it is a global concern affecting China, India, England, Canada, the USA, Australia and European nations.[1 2]

In 2019, the Ministry of Health, Labour, and Welfare (MHLW) initiated an intervention policy to rectify geographical disparities in physician distribution at the prefectural level.[1 6 7] This policy introduced the physician uneven distribution (PUD) index. The PUD index was designed to gauge the extent of physician maldistribution by considering both medical supply and demand at the prefectural level (online supplemental figure 1). A low PUD index indicates a high level of uneven distribution of physicians across prefectures.

Physician training to create proficient clinical practitioners in Japan involves attending 6 years of medical school and 2 years of clinical training as resident physicians.[8] Resident physicians must undergo supervised training and rotate through seven specialties (internal medicine, surgery, paediatrics, obstetrics and gynaecology, psychiatry, emergency medicine, and community-based medicine). During this 2-year clinical training period, resident physicians are mandated to acquire core clinical competency that enables them to effectively manage common medical conditions in general practice, irrespective of their future specialisation.[9] This clinical training system is currently undergoing a policy review to address concerns regarding recruitment capacity and other aspects, with the aim of mitigating physician maldistribution in various regions and enhancing the quality of clinical training. In Japan, the allocation of medical graduates to residency programmes is determined through a matching system. The Japan Residency Matching Program has been operational since 2004 and uses a specific algorithm to optimally match medical students and graduates with training hospitals based on a combination of test scores, essays and interviews.[10] This system is designed to ensure a fair and systematic distribution of residents across the country, including rural areas, thereby addressing regional imbalances to some extent. However, with recent policy changes aimed at compressing hospital capacity in metropolitan areas, there is an expectation that the number of unmatched students, who must then find training positions independently, may increase, particularly impacting urban hospitals.[11]

The MHLW has conducted a questionnaire survey regarding clinical training in areas characterised by an uneven distribution of physicians.[12] A questionnaire assessing self-perceived competencies related to clinical training revealed no significant differences between prefectures with a relatively high number of physicians and those with a low number of physicians in terms of professionalism (69.4% vs 69.4%), medical knowledge and problem-solving skills (69.9% vs 67.2%), medical skills and patient care (71.6% vs 70.1%), or quality and safety of care (68.2% vs 68.0%). According to the report, resident physicians who received clinical training in areas with a relatively low number of physicians reported higher satisfaction (74.2% vs 79.6%).

In response to the valid concerns raised regarding the use of self-reported satisfaction data,[13 14] we have placed an emphasis on objective and quantitative assessments of clinical training and proficiency in core clinical competencies. Consequently, the primary focus of this study was to rigorously examine the relationship between physician distribution and clinical competency, as objectively measured by the General Medicine In-Training Examination (GM-ITE) scores.[15 16] In doing so, this study aims to shed light on the significant role that addressing physician maldistribution plays in enhancing the clinical competence of the healthcare workforce, with implications that extend into research, practice and policy domains. This approach ensures that our findings are based on tangible, performance-based outcomes, offering a reliable perspective on the impact of physician distribution on resident physicians' training experience and competencies.

MATERIALS AND METHODS

Study design, setting and participants

A nationwide cross-sectional survey was conducted on 9011 postgraduate resident physicians (approximately 50% of the total number of resident physicians in Japan) from 662 hospitals who had completed the GM-ITE between 17 and 30 January 2023. Of these, 573 resident physicians underwent the examination at locations other than a designated test site. All participants in this study included resident physicians in their first and second postgraduate years (PGY-1 and PGY-2, respectively) in Japanese hospitals, and the GM-ITE was included in their residency programme. The cohort also included resident physicians who voluntarily participated in the GM-ITE. We included the participants of GM-ITE 2022. Participants who refused to use their data for research were excluded (figure 1).

Main outcome

The main outcome of this study was the total score on the GM-ITE, which serves as an objective measure of resident physicians' clinical knowledge. Developed by the non-profit Japan Institute for Advancement of Medical Education Program (JAMEP) in 2021, the GM-ITE is modelled after the methodology of the US Residency Internal Medicine In-Training Examination, ensuring its alignment with internationally recognised standards.[14–16] The examination design and content were rigorously developed by a committee of seasoned attending physicians, making it a reliable and valid tool for assessing core clinical competencies. It comprises 80 multiple-choice questions that span diverse medical domains and is scored on a scale of 0–80, where higher scores denote a stronger grasp of clinical medicine.[17 18] To corroborate the examination's validity, we reference studies that demonstrate the effectiveness of similar in-training exams in reliably measuring clinical knowledge and performance among resident physicians.[16]

In our assessment of the GM-ITE's validity, we found a notable correlation with PLAB 1 scores. However, considering the factors that may influence this correlation is crucial. Urban trainees may benefit from exposure to a more diverse array of clinical cases, some of which may be rare and potentially included in the GM-ITE, as well as from study groups or tutoring services tailored to exam preparation. These advantages could contribute to higher scores that may not necessarily reflect broader clinical competence but rather proficiency in test-taking. To this end, the GM-ITE is designed with a discrimination

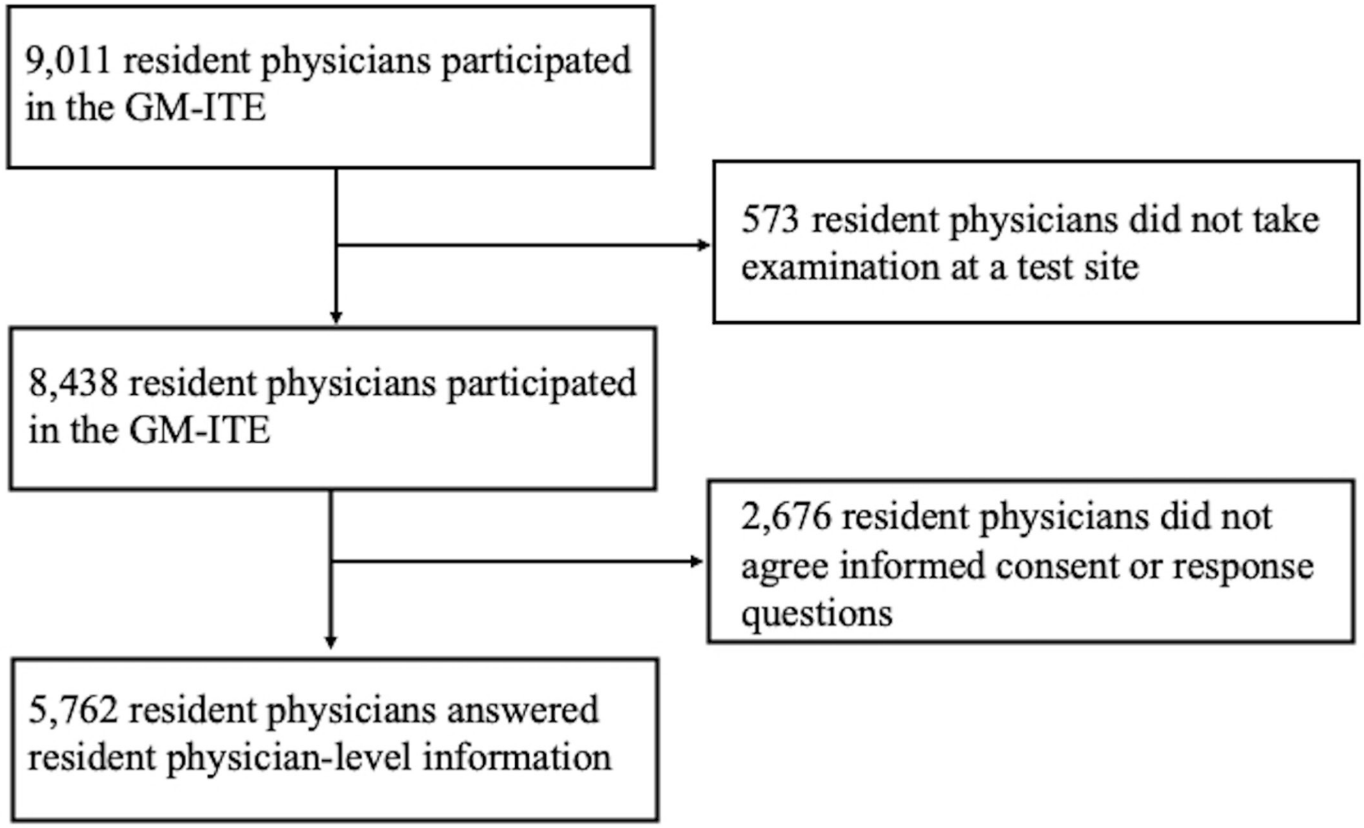

Figure 1 Flow chart of participant inclusion and exclusion. GM-ITE, General Medicine In-Training Examination.

index to effectively differentiate between students based on their aptitude rather than their test-taking skills alone. This metric ensures the examination's discriminative power is on par or superior to that of the PLAB 1 examination.[19 20] Nonetheless, we have included in our discussion the consideration that performance on standardised exams, while suggestive of knowledge acquisition, may not entirely equate to the practical and communicative skills essential to clinical competency.

Exposure and covariates

The exposure in this analysis was the PUD index (updated on 9 August 2023). This policy index was developed and adopted in Japan. It serves as an indicator of regional disparities among physicians within the country. A low PUD index indicates an insufficient medical supply relative to the medical demand in that region. Resident physicians were categorised into three groups based on their range of residency programme scores. The categories were as follows: high PUD index group (PUD index: 353.9–266.9), moderate PUD index group (PUD index: 266.5–230.5) and low PUD index group (PUD index: 228.0–182.5).[12] Resident physicians were also categorised based on their duty hours per week: <60 hours, 60–79 hours and ≥80 hours. The duty hour category was defined with a lower limit indicating no or minimal overtime and an upper limit of 80 hours per week under the new resident physician duty hour limit set by the MHLW. The questionnaire administered in this study included questions regarding the participant's demographic information, such as hospital type (community hospital or university hospital), sex, postgraduate year (PGY-1 or PGY-2), participation in the general medicine rotation and duration of the internal medicine rotation. The resident physicians also reported the number of night shifts per month, the average number of assigned inpatients and self-study time per day.

Statistical analysis

Participants' demographics, characteristics and GM-ITE scores were compared among the three PUD index groups. Multivariate linear regression analysis was used to evaluate the association between the PUD index grade and the GM-ITE score. The results were adjusted for covariates, including hospital type, sex, PGY, rotation in the general medicine department, internal medicine rotation duration, number of night shift duties per month, average number of assigned inpatients, self-study time and duty hours per week. All statistical analyses were conducted using the Statistical Analysis System V.9.4 for Windows (SAS Institute), with the significance level set at $p<0.05$. All statistical tests were two-tailed.

RESULTS

Demographics

A total of 5762 resident physicians from 608 hospitals, including 3922 (68.1%) men, participated in this study (table 1). The minority of resident physicians (n=979; 17.0%) were from university hospitals. The high PUD index group included 2143 participants, the moderate PUD index group included 2039 participants and the low PUD index group included 1580 participants. Additionally, 2676 individuals either did not consent to the research or did not respond to the questionnaire. Among these, 1080 were classified as having a high PUD index, constituting 39.6% of the non-participants; 882 were classified as having a moderate PUD index (33.0%), and 734 as having a low PUD index (27.4%).

Overall, the mean GM-ITE score was 45.45±8.23 points. The mean scores of the high, moderate and low PUD index groups were 44.70±8.25 points, 45.69±8.25 points and 46.16±8.09 points, respectively. When examining the mean scores by PGY and PUD index groups, the following was observed (online supplemental table 1): for PGY-1, the mean GM-ITE scores were 44.06±7.70 for the high PUD index, 45.13±7.76 for the moderate PUD index and 45.40±7.75 for the low PUD index groups. For PGY-2, the scores were 45.39±8.76 for the high PUD index, 46.29±8.72 for the moderate PUD index and 47.00±8.37 for the low PUD index groups. The GM-ITE score distribution for the PUD index is shown in figure 2. On further analysis, the effect size between the low and high PUD index groups, as measured by Cohen's d, was determined to be 0.178. This suggests a statistically detectable difference[21]; however, the small magnitude of this effect size indicates that the clinical significance of the score difference is limited. Consequently, although the GM-ITE scores were statistically higher in the low PUD index group, the clinical performance of the groups was interpreted as comparable.

Approximately half (54.4%) of the participants did not undergo a general medicine rotation; 26.8% underwent an internal medicine rotation that lasted 0–5 months, whereas 61.6% underwent an internal medicine rotation that lasted 6–10 months. The reported hours per week were <60 hours in 51.0% of participants, 60–79 hours in 35.5% of participants and ≥80 hours in 13.5% of participants.

Univariate linear regression analysis

As shown in table 2, in the univariate linear regression analysis, a low PUD index was associated with a higher GM-ITE score than a high PUD index (adjusted coefficient: 1.46; 95% CI 0.93 to 1.99; p<0.001). A moderate PUD index was also associated with a higher GM-ITE score (adjusted coefficient: 0.98; 95% CI 0.49 to 1.48; p<0.001) compared with a high PUD index.

Multivariate linear regression analysis

In the multivariate linear regression analysis, a low PUD index was identified as an independent predictor of a higher GM-ITE score compared with a high PUD index (adjusted coefficient: 1.14; 95% CI 0.62 to 1.65; p<0.001) (table 3). A moderate PUD index was also identified as an independent predictor of a higher GM-ITE score (adjusted coefficient: 0.91; 95% CI 0.43 to 1.39; p<0.001) compared with a high PUD index.

Participation in a residency programme at a university hospital was identified as an independent predictor of lower GM-ITE scores compared with participation at a community hospital (adjusted coefficient: −4.05; 95% CI −4.63 to −3.48; p<0.001). PGY-2 status was an independent predictor of a higher GM-ITE score (adjusted coefficient: 0.74; 95% CI 0.27 to 1.20; p=0.002). Having 31–60 (adjusted coefficient: 2.70; 95% CI 1.15 to 4.26; p<0.001), 61–90 (adjusted coefficient: 3.27; 95% CI 1.64 to 4.91; p<0.001), or ≥91 (adjusted coefficient: 4.28; 95% CI 2.38 to 6.17; p<0.001) minutes of study time per week was also indicative of higher GM-ITE scores compared with having 0 min of self-study time. Our analysis indicates that residents working 60–79 hours/week were more likely to achieve higher GM-ITE scores. This observation prompts a discussion on the assessment design of the GM-ITE and whether it adequately captures the breadth of knowledge required for clinical competence or whether it may be more reflective of practical knowledge gained through extensive clinical exposure. Thus, we have included a reflection on the implications of these findings for the assessment design and for residency training programmes, emphasising the need to strike a balance between clinical exposure and adequate study time to ensure comprehensive medical education and resident well-being.

DISCUSSION

Resident physicians from training programmes in regions with a low and moderate PUD index (areas facing physician shortages due to regional maldistribution) achieved significantly higher GM-ITE scores than those from programmes in regions with a high PUD index. This finding has prompted further investigations into the role of self-directed learning in physician education, which is potentially fostered by the limited availability of supervising physicians.[22,23] Indeed, the need for resident physicians to be more self-directed during patient care and decision-making processes in low PUD areas could lead to increased engagement and ownership of their learning process, as reflected by their GM-ITE performance. Notably, the presence of fewer attending physicians does not undermine their educational achievements, but rather underscores the adaptability of medical education and the potential for developing competencies in varied clinical settings. This nuanced perspective of educational outcomes in relation to resource distribution invites a broader discussion on how to optimise learning opportunities and foster higher levels of clinical competency, particularly in regions with physician shortages.

Our study's implications extend beyond the identification of maldistribution among physicians. Our results contribute to a growing body of evidence suggesting that adequate, and at times exceptional, educational outcomes are attainable in regions with a low PUD index. This challenges the conventional belief that a higher

Table 1 Baseline characteristics of resident physicians categorised according to the PUD index

	All		PUD index High		Moderate		Low	
	n=5762		n=2143		n=2039		n=1580	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
GM-ITE score	45.45	8.23	44.70	8.25	45.69	8.25	46.16	8.09
	n (%)		n (%)		n (%)		n (%)	
Hospital type								
Community hospital	4783 (83.0)		1691 (78.9)		1703 (83.5)		1389 (87.9)	
University hospital	979 (17.0)		452 (21.1)		336 (16.5)		191 (12.1)	
Sex								
Man	3922 (68.1)		1462 (68.2)		1401 (68.7)		1059 (67.0)	
Woman	1840 (31.9)		681 (31.8)		638 (31.3)		521 (33.0)	
PGY								
1	2989 (51.9)		1107 (51.7)		1055 (51.7)		827 (52.3)	
2	2773 (48.1)		1036 (48.3)		984 (48.3)		753 (47.7)	
General medicine rotation								
No	3136 (54.4)		1099 (51.3)		1094 (53.7)		943 (59.7)	
Yes	2626 (45.6)		1044 (48.7)		945 (46.3)		637 (40.3)	
Internal medicine rotation (month)								
0–5	1542 (26.8)		548 (25.6)		547 (26.8)		447 (28.3)	
6–10	3550 (61.6)		1355 (63.2)		1225 (60.1)		970 (61.4)	
11–15	588 (10.2)		206 (9.6)		231 (11.3)		151 (9.6)	
16–20	60 (1.0)		27 (1.3)		26 (1.3)		7 (0.4)	
≥21	22 (0.4)		7 (0.3)		10 (0.5)		5 (0.3)	
Night shifts per month								
0	157 (2.7)		83 (3.9)		43 (2.1)		31 (2.0)	
1–2	969 (16.8)		415 (19.4)		299 (14.7)		255 (16.1)	
3–5	4086 (70.9)		1443 (67.3)		1451 (71.1)		1192 (75.4)	
≥6	531 (9.2)		199 (9.3)		238 (11.7)		94 (6.0)	
Unknown	19 (0.4)		3 (0.1)		8 (0.4)		8 (0.5)	
Average number of assigned inpatients								
0–4	2222 (38.7)		725 (33.8)		896 (43.9)		601 (38.0)	
5–9	2873 (49.8)		1146 (53.5)		955 (46.8)		772 (48.9)	
10–14	420 (7.3)		187 (8.7)		105 (5.2)		128 (8.1)	
≥15	125 (2.1)		57 (2.7)		36 (1.8)		32 (2.0)	
Unknown	122 (2.1)		28 (1.3)		47 (2.3)		47 (3.0)	
Self-study time per day (min)								
0	103 (1.8)		43 (2.0)		33 (1.6)		27 (1.7)	
1–30	2637 (45.8)		1016 (47.4)		954 (46.8)		667 (42.2)	
31–60	2197 (38.1)		784 (36.6)		770 (37.8)		643 (40.7)	
61–90	642 (11.1)		232 (10.8)		219 (10.7)		191 (12.1)	
≥91	183 (3.2)		68 (3.2)		63 (3.1)		52 (3.3)	
Duty hours per week (hours)								
Category 1 (<60)	2940 (51.0)		1083 (50.6)		1094 (53.7)		763 (48.3)	
Category 2 (60–79)	2045 (35.5)		757 (35.3)		704 (34.5)		584 (37.0)	
Category 3 (≥ 80)	777 (13.5)		303 (14.1)		241 (11.8)		233 (14.7)	

GM-ITE, General Medicine In-Training Examination; PGY, postgraduate years; PUD, physician uneven distribution index.

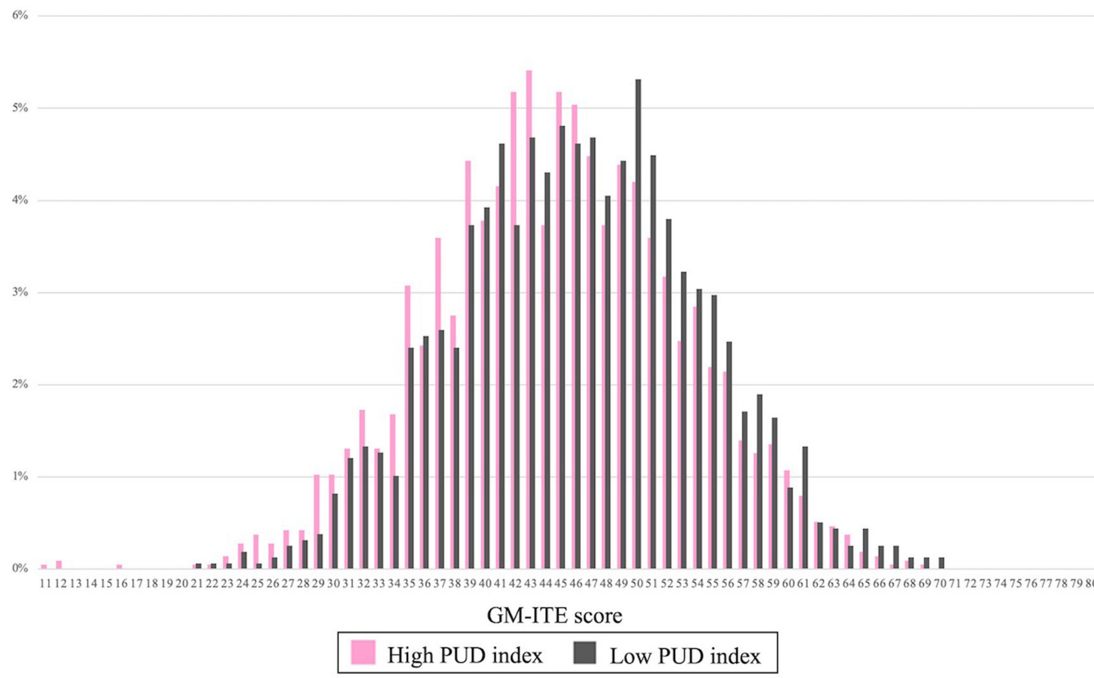

Figure 2 General Medicine In-Training Examination (GM-ITE) score distribution between resident physicians in low and high PUD index prefectures. PUD, physician uneven distribution index.

concentration of attending physicians is synonymous with superior education and patient care. We posit that the adaptability and potential of medical education in diverse contexts, particularly in rural areas with fewer resources, deserve greater attention. This perspective is corroborated by recent studies demonstrating that rural training programmes can uphold high educational standards, often through innovative approaches tailored to their unique settings.[23–25] While acknowledging the global issue of physician maldistribution and its impact on healthcare accessibility,[26–28] our commentary reflects on Japan's documented physician shortage and regional disparities, suggesting that innovative changes to the medical education system could help address these challenges.[24 25] The counterintuitive association between lower PUD indices and higher GM-ITE scores opens the door to re-evaluating how medical education and healthcare services might be delivered more effectively, even despite persistent physician shortages.

Physician maldistribution is a global problem that hinders patients' access to healthcare services.[29] Physicians are geographically maldistributed, with too few physicians in rural areas.[30 31] In Japan, there is a well-documented issue of physician shortages and regional maldistribution, where approximately 90% of physicians are clustered in urban areas.[32] As an example of countermeasures, changing the medical education system so that it selects, trains and retains physicians who are more likely to practice in rural areas can remedy the problems of rural geographical maldistribution.[27]

Resident physicians who train in areas with a high PUD index may have a more passive attitude towards clinical training than those who train in areas with a low PUD index. This passive attitude could be attributed to the possibility that clinical experiences in areas with a high PUD index might not offer diverse or challenging opportunities compared with areas with a lower PUD index. In high PUD index areas, opportunities for the supervising physician to allow resident physicians to make independent judgements may be limited, leading to an observational training style. Furthermore, the higher patient load or complexity in these high PUD index areas could overshadow the emphasis on hands-on experience, prioritising efficiency over educational value.[33]

Areas with a high number of supervising physicians and nurses involved with resident physicians have disadvantages. When resident physicians interact with several different senior physicians and nurses, it takes time to establish relationships and build trust, which may lead to inefficient learning and reduced effectiveness. A lower number of supervising physicians in small PUD areas, including medical resident physicians, is therefore associated with higher GM-ITE scores.[34]

Resident physicians in Japan require at least 60–65 duty hours/week during their clinical training to acquire a certain level of clinical knowledge.[16] However, clinical knowledge does not proportionately increase with an increase in duty hours. The optimal number of duty hours that maximises the development of resident physicians' competencies must be determined. In Japanese areas with a low PUD index, resident physicians face moderately longer working hours than those in areas with a high PUD index, which may contribute to skill development.

Resident physicians from areas with a low PUD index dedicated more time to self-study than those from areas with a high PUD index. Self-study time was strongly

Table 2 Factors associated with GM-ITE score in univariate regression analysis

	Adjusted coefficient	95% CI Lower	95% CI Upper	P value
Physician uneven distribution index				
High	(Ref)			
Moderate	0.98	0.49	1.48	<0.001
Low	1.46	0.93	1.99	<0.001
Hospital type				
Community hospital	(Ref)			
University hospital	–4.81	–5.36	–4.25	<0.001
Sex				
Man	(Ref)			
Woman	–1.03	–1.48	–0.57	<0.001
PGY				
1	(Ref)			
2	1.34	0.92	1.77	<0.001
General medicine rotation				
No	(Ref)			
Yes	1.29	0.86	1.71	<0.001
Internal medicine rotation (month)				
0–5	(Ref)			
6–10	1.02	0.53	1.51	<0.001
11–15	2.25	1.47	3.03	<0.001
16–20	1.96	–0.16	4.08	0.070
≥ 21	0.24	–3.21	3.70	0.890
Night shifts per month				
0	(Ref)			
1–2	1.25	–0.12	2.62	0.074
3–5	3.98	2.68	5.28	<0.001
≥ 6	4.74	3.29	6.19	<0.001
Unknown	2.66	–1.22	6.53	0.179
Average number of assigned inpatients				
0–4	(Ref)			
5–9	1.87	1.42	2.33	<0.001
10–14	1.86	1.01	2.72	<0.001
≧15	2.51	1.04	3.98	<0.001
Unknown	0.31	–1.18	1.80	0.685
Self-study time per day (min)				
0	(Ref)			
1–30	1.30	–0.31	2.90	0.113
31–60	3.27	1.66	4.88	<0.001
61–90	4.23	2.53	5.92	<0.001
≥ 91	5.34	3.37	7.30	<0.001
Duty hours per week (hours)				
Category 1 (<60)	(Ref)			
Category 2 (60–79)	2.10	1.64	2.56	<0.001
Category 3 (≥80)	2.06	1.41	2.70	<0.001

GM-ITE, General Medicine In-Training Examination; PGY, postgraduate years.

Table 3 Factors associated with GM-ITE score in multivariate linear regression analysis

	Adjusted coefficient	95% CI Lower	95% CI Upper	P value
Physician uneven distribution index				
High	(Ref)			
Moderate	0.91	0.43	1.39	<0.001
Low	1.14	0.62	1.65	<0.001
Hospital type				
Community hospital	(Ref)			
University hospital	–4.05	–4.63	–3.48	<0.001
Sex				
Man	(Ref)			
Woman	–0.63	–1.07	–0.20	0.005
PGY				
1	(Ref)			
2	0.74	0.27	1.20	0.002
General medicine rotation				
No	(Ref)			
Yes	0.95	0.54	1.37	<0.001
Internal Medicine rotation (month)				
0–5	(Ref)			
6–10	0.46	–0.05	0.97	0.074
11–15	1.20	0.38	2.03	0.004
16–20	1.29	–0.76	3.35	0.217
≥ 21	0.17	–3.14	3.49	0.918
Night shifts per month				
0	(Ref)			
1–2	–0.10	–1.43	1.23	0.882
3–5	1.01	–0.27	2.29	0.122
≥ 6	1.45	0.01	2.90	0.049
Unknown	1.64	–2.10	5.39	0.390
Average number of assigned inpatients				
0–4	(Ref)			
5–9	1.43	0.99	1.87	<0.001
10–14	1.62	0.78	2.45	<0.001
≥15	1.80	0.37	3.24	0.014
Unknown	–0.12	–1.56	1.32	0.870
Self-study time per day (min)				
0	(Ref)			
1–30	1.30	–0.24	2.85	0.098
31–60	2.70	1.15	4.26	<0.001
61–90	3.27	1.64	4.91	<0.001
≥ 91	4.28	2.38	6.17	<0.001
Duty hours per week (hours)				
Category 1 (<60)	(Ref)			
Category 2 (60–79)	1.27	0.81	1.72	<0.001
Category 3 (≥80)	0.83	0.17	1.48	0.014

GM-ITE, General Medicine In-Training Examination; PGY, postgraduate years.

correlated with GM-ITE scores, suggesting that self-directed learning is crucial for enhancing competency, irrespective of the region (rural or urban). The positive relationship between longer self-study time and higher GM-ITE scores in this study is consistent with the results of a previous report.[35] William Osler noted, "To study the phenomena of disease without books is to sail an uncharted sea, while to study books without patients is not to go to sea at all".[36] Hence, ensuring the optimal equilibrium between the two elements is imperative within a limited time constraints. In Japan, physicians' work-style reforms, including establishing working hour limits for physicians and resident physicians, are scheduled to be implemented in April 2024.[37] Resident physicians working <60 hours/week reported less self-study time than those working 60–65 hours/week.[16] Therefore, innovative self-study tools that efficiently demonstrate educational concepts in a limited time are needed.

This study has some limitations. First, our reliance on GM-ITE scores as a measure of clinical competence is another limitation, as this examination primarily tests theoretical knowledge and only partially assesses practical skills and aspects of communication.[38] Second, the lack of data regarding the baseline clinical competencies of resident physicians at the start of their training restricts our ability to fully assess the impact of the PUD index on the baseline quality of resident physicians. Generally, there is a proven association between the residency admission examinations and the in-training exam scores throughout residency.[39] This absence of baseline data is an important limitation because the baseline competencies could have a significant bearing on GM-ITE scores. We did not have access to detailed admissions data or specific metrics that could provide insights into the initial qualifications of residents who chose to work in areas with varying PUD indices. Consequently, we are unable to definitively determine whether resident physicians in lower PUD index areas have inherently better baseline qualities or whether there is a selection bias towards certain hospitals based on their PUD index. Third, the potential for selection bias cannot be ruled out. Because the GM-ITE is voluntary for training hospitals, only half of the resident physicians in Japan participated in this study. Fourth, a bias may exist between data from community and university hospitals. Similar to previous studies regarding GM-ITE, resident physicians from university hospitals had lower GM-ITE scores in this study.[40] The low PUD index group had a lower proportion of university hospitals, which may be a confounding factor. Fifth, this investigation did not evaluate the actual number of supervising physicians in each hospital, their years of clinical experience or their teaching abilities. Although hospitals in areas with a high PUD index tend to have a larger number of supervising physicians, the impact of attending physicians' teaching abilities across facilities with different PUD indices remains unclear. Additionally, hospitals in areas with a low PUD index may offer higher financial incentives,[29] potentially influencing the quality of supervision and training. These factors, which contribute to the educational environment, may have affected the GM-ITE scores. Sixth, the current study relied heavily on GM-ITE scores as a primary measure of clinical competence. Although the GM-ITE is a validated tool, it predominantly assesses theoretical knowledge rather than practical skills. Seventh although the regions were categorised based on the PUD index, intraregional disparities may exist. Different areas within a single region may have varying physician densities, leading to heterogeneity in the clinical exposure and training of residents within the same PUD category. While the GM-ITE assesses medical interviewing for communication skills, it does not sufficiently evaluate crucial aspects such as interpersonal literacy and interprofessional communication essential for effective leadership in contemporary medicine.

CONCLUSIONS

The study revealed no clinically differences in GM-ITE scores between residents in regions with disparate physician distributions, suggesting that factors beyond PUD may influence clinical competency. This achievement highlights the close relationship between efforts and address physician maldistribution and the enhancement of clinical competency among resident physicians in Japan. This finding prompts a re-evaluation of whether current assessment methodologies or educational frameworks fully support learning across varied community settings.

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