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ORIGINAL RESEARCH

Comparing Japanese University Hospitals' and Community Healthcare Facilities' Research Contributions on PubMed

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Purpose: Although research in general medicine is important, the contributions and characteristics of general medicine physicians (GMPs) in university hospitals (UH) and community healthcare facilities (CHF) remains unclear. Therefore, this study examines the popularity of research by affiliation, characteristics of journal publication, annual trends, and differences in impact factors (IFs) of journal publications.

Methods: This study is a secondary bibliometric analysis of articles in international journals published in PubMed over the past six years (2015–2020). The analysis compared English articles published by either UH- or CHF-affiliated GMPs in Japan in terms of, among other things, article type, research field, and IF.

Results: Of the 2372 articles analyzed, 1688 (71.2%) were published by physicians affiliated with UHs, 62.6% of which were original. Basic research, international collaboration, and ratio of IFs were significantly higher for such papers. In contrast, the number of CHF articles were significantly higher in the areas of clinical research and practice, with a greater proportion of case reports. There was no significant difference in IF between the disciplines within each affiliation, but the IF was the highest in experimental basic research and the lowest in medical and clinical education. In the six-year time series, the number of original papers by UHs and CHFs increased roughly twofold between 2015 and 2020, but the number of articles in the areas of medical education and healthcare quality and safety remained mostly unchanged.

Conclusion: The number of international papers published by Japanese GMPs has increased since 2015, particularly in terms of original papers and clinical research from UHs. However, there was no significant difference in the IF between UH and CHF publications. Our findings can guide the development of indicators, research, and education strategies regarding Japanese GMPs' research performance.

Keywords: bibliometric study, general medicine, academic generalist, publication, university hospitals

Introduction

The research activities of general medicine physicians (GMPs) are essential for the development of general medicine as a discipline.[1–3] Globally, however, the contribution of GMP research remains meager.[2,4,5] General medicine in Japan has a short history. Established in 2018 as the official 19th certified specialty, the scope and definition of its practice are yet to be clearly identified.[6,7] As a result, little is known about the academic research contributions of Japanese GMPs.[4,8] Many previous studies have reported insufficient academic activity by Japanese GMPs,[8–11] while one study found that only 0.15% of publications in five major journals in the area of primary care were from Japan.[11] Another study found that only 3.7% of the studies presented at the 2010–2012 Japan Primary Care Association Annual Meetings were published in full in MEDLINE.[12] Further, the academic contribution of GMPs has been found to vary greatly depending on whether they are affiliated with a university.[9,12] Unlike the research fields favored by GMPs in Western countries, Japanese GMP researchers have emphasized laboratory basic science research more than clinical research topics that may be more suited

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to those practicing general medicine, as the former has been highly valued in academic medicine. This has resulted in a paucity of research surrounding care quality, patient safety, and medical education.[8,9,13,14] Several previous studies have been based on questionnaire surveys of university hospitals, which cannot capture the actual situation nationwide or the characteristics of research contributions, including the research content and interests of GMPs affiliated with non-university institutions.[8] While there are many indicators to evaluate research performance and contributions, there are no established standards. Impact Factor (IF) has been commonly used to assess the relative importance of a journal within its field and to measure how often the average article in a given journal was cited in a given period of time. While it is not an absolute measure, and its strengths and many weaknesses must be pondered, it can provide a numerical proxy for the journal research contributions by GMPs.[14,15]

Therefore, the primary objective of this study is to elucidate, by using the data on international journal articles published by Japanese GMPs in PubMed, the differences in article types, trends, and research topics between university hospitals (UHs) and community healthcare facilities (CHFs), and the differences in surrogate data for medical journal quality, based on their impact factor. The secondary objective is to identify the actual research trends among Japanese GMPs by examining the changes over the past six years.

Method

This study is a secondary analysis, which uses data from a cross-sectional bibliometric analysis of articles published. We extracted English-language articles published in international journals on PubMed from January 1, 2015 to December 31, 2020, using a search formula combining multiple keywords.[14] The search formula was based on the most common English names of affiliations customarily used in Japan from previous studies:[14]

*Search formula (Japan[ad] AND "General medicine"[ad])OR(Japan[ad] AND "Family medicine"[ad])OR(Japan[ad] AND "General Internal Medicine"[ad])OR(Japan[ad] AND "Hospital Medicine"[ad])OR(Japan[ad] AND "General Medicine and Primary Care"[ad]).

Papers in which none of the first, second, or last authors belonged to a general medicine department[14] were excluded. No duplicate references were found among the articles published in PubMed. (Detailed information on the data collection methodology and classification is presented in Supplementary File 1). Next, we classified first authors under "university hospitals" if their first affiliation was a university or community healthcare facility (Figure 1). Based on previous studies,[4,8,9,14] we categorized articles into four types; original articles, case reports, reviews, and letters or others. Original articles were classified into seven categories: clinical research and practice, experimental basic research, public health and epidemiology, health care quality and safety, medical and clinical education, health care services, and others (Figure 1). Next, original articles in clinical research and practice were classified into six subcategories (case-control study, descriptive studies without comparison, prospective cohort, cross-sectional study, randomized control trial, non-randomized control trial).[14] Articles published as original papers but unclassifiable as opinion pieces or essays were included in the "Others" category, which had fewer than 10 entries. The latest (2021) edition of the journal citation reports published annually by Clarivate was used to calculate the IF of each journal.[15] This study is a bibliometric secondary analysis and follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Statistical Analysis

Using standard descriptive statistics, we calculated the number, percentage, median, and interquartile range for each category of publication type. The chi-square test and Fisher's exact test was used to compare nominal variables. For continuous variables, *t*-tests or Wilcoxon rank-sum tests were used as needed. Statistical analysis was performed using the Stata statistical software (version 14.0, StataCorp LLC, College Station, TX, USA). Bonferroni correction was applied for multiple tests.

Results

In total, 2372 PubMed-published articles were included in the analysis, with 96.9% from hospital facilities and only 3.1% from clinics or group authors. As shown in Table 1, a total of 1688 publications were from UHs, 684 of which were from CHFs (community hospital = 611; clinic = 53; nursing care, group authors, and others = 20). Regarding differences in the

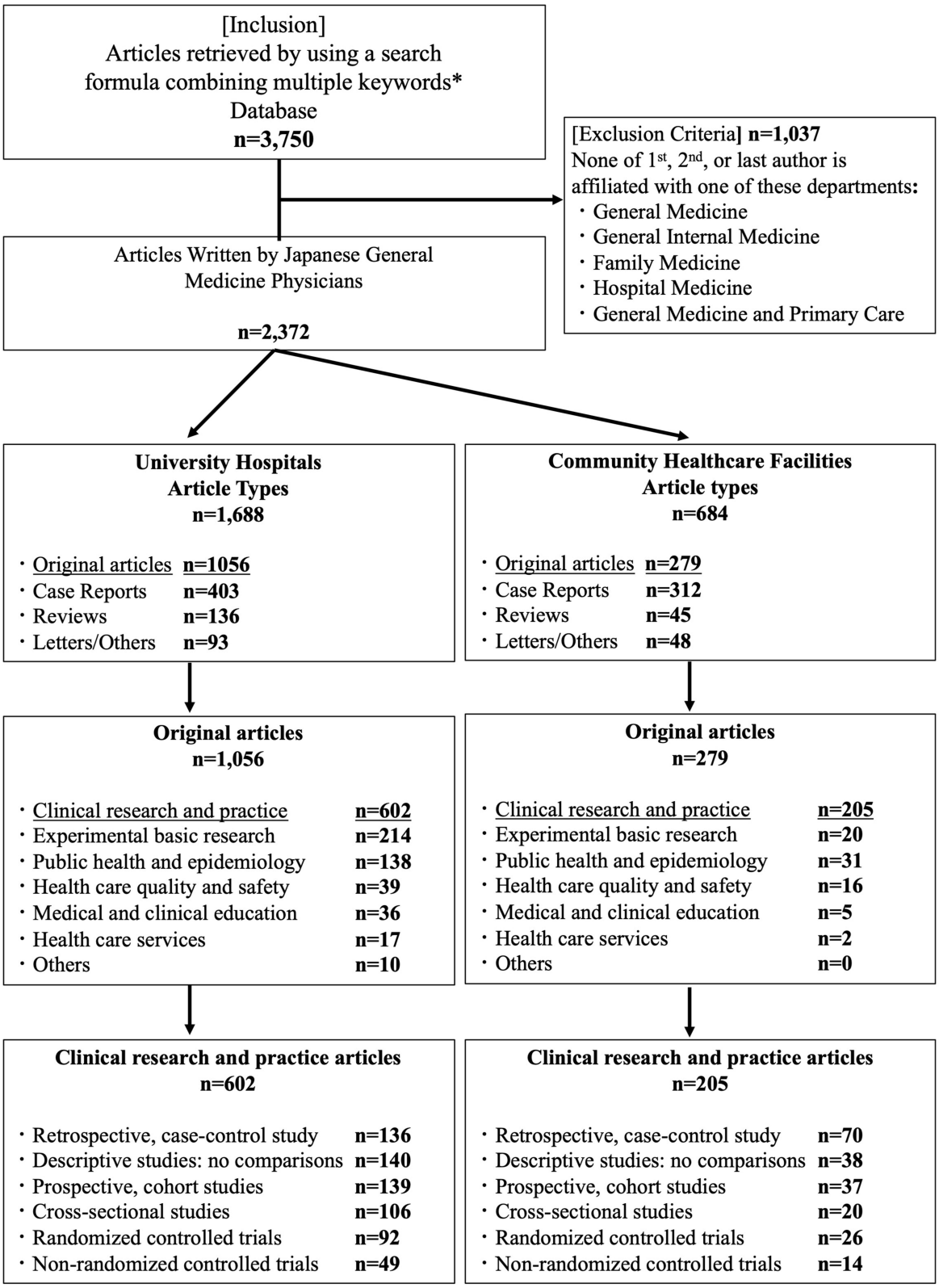

Figure 1 Flowchart for extracting published papers by GMPs in Japan.
Notes: UH assumes that the first author's primary affiliation is a university hospital. Otherwise, they are classified as CHF.

characteristics of articles from UHs and CHFs, the percentage of original papers, international collaborations, and journals with IF were statistically and significantly higher for the former articles. Furthermore, the percentage of original articles from the UHs was significantly higher than those from the CHFs (UHs; n=1056, 62.6% versus CHFs; n=279, 40.8%, p<0.001). Regarding differences in the characteristics of articles from the UHs and CHFs, the percentage of international collaborations (UHs 22.8% versus CHFs; 12.7%, p<0.001), and journals with IF (UHs; 83.8% versus CHFs; 71.8%, p<0.001) were statistically higher for articles from UHs, while GMPs from CHFs published a significantly higher percentage of case reports. Table 1 shows a detailed classification of the 1335 original papers into two levels: clinical studies and their study design. Notably, 20.3% (214) of the original articles published by GMPs from the UHs were basic experimental studies, compared to 7.2% (10) of those from the CHFs. Among CHFs, more than 70% of publications were categorized as clinical research and practice, more closely related to patient care. The share of the disciplines of healthcare quality and safety, medical and clinical education, and healthcare services did not differ between the UHs and CHFs, with both accounting for less than 5% of the research topics among GMPs. Finally, a comparison of the research design classification in the 807 clinical research papers revealed that case-control studies were the most common,

Table 1 Differences in Characteristics of University Hospitals and Community Healthcare Facilities Articles Published on PubMed by Japanese GMPs

	Total	**University Hospitals**			**Community Healthcare Facilities**			**p-value**
	n=2372	**n=1688**			**n=684**			
		n	**%**	**95% CI**	**n**	**%**	**95% CI**	
Original articles	1335	1056	62.6	60.2–64.8	279	40.8	37.2–44.5	<0.001*
Clinical research and practice	807	602	57.0	54.0–60.0	205	73.5	68.0–78.3	<0.001*
Retrospective, case-control study	206	136	22.6	19.4–26.1	70	34.2	28.0–40.9	<0.001*
Descriptive studies: no comparisons	178	140	23.3	20.0–26.8	38	18.5	13.8–24.5	0.159
Prospective, cohort studies	176	139	23.1	19.9–26.6	37	18.1	13.3–23.9	0.131
Cross-sectional studies	106	86	14.3	11.7–17.3	20	9.8	6.4–14.7	0.097
Randomized controlled trials	92	66	11.0	8.7–13.7	26	12.7	8.8–18.0	0.503
Non-randomized controlled trials	49	35	5.8	4.2–8.0	14	6.8	4.1–11.2	0.599
Experimental basic research	234	214	20.3	17.9–22.8	20	7.2	4.7–10.8	<0.001*
Public health and epidemiology	169	138	13.1	11.2–15.2	31	11.1	7.9–15.4	0.382
Health care quality and safety	55	39	3.7	2.7–5.0	16	5.7	3.5–9.1	0.127
Medical and clinical education	41	36	3.4	2.5–4.7	5	1.8	0.7–4.2	0.164
Health care services	19	17	1.6	1.0–2.6	2	0.7	0.2–2.8	0.263
Others	10	10	1.0	0.5–1.7	0	0.0		0.103
Case reports	715	403	23.9	21.9–26.0	312	45.6	41.9–49.4	<0.001*
Reviews	181	136	8.1	6.8–9.5	45	6.6	4.9–8.7	0.219
Letters/Others	141	93	5.5	4.5–6.7	48	7.0	5.3–9.2	0.159
Domestic collaboration	1074	743	44.0	41.7–46.4	331	48.4	44.7–52.1	0.052
International collaboration	472	385	22.8	20.9–24.9	87	12.7	10.3–15.4	<0.001*
Journals with Impact factor	1905	1414	83.8	81.9–85.5	491	71.8	68.3–75.0	<0.001*

Note: The* in the table indicates statistically significant items after t Bonferroni correction.

followed by descriptive studies and cohort studies. However, other than case-control studies, the classification of the study design was not significant. There were no significant differences in classification other than a larger proportion of case-control studies in CHFs. Table 2 shows the median IF of the papers by type of paper and topic. There were no significant differences in the IFs among the articles published by physicians affiliated with UHs or CHFs in terms of article type and clinical research design.

Figures 2 and 3 show the changes in the classification of papers by time series over the six-year period from 2015 to 2020. For UHs, the number of original papers increased 2.55 times, from 109 in 2015 to 278 in 2020; the percentage of original articles increased from 62.3% to 69.8% in the same period, though decreased to 57.1% in 2020. The number of original papers published from CHFs increased 2.06 times from 34 to 70 (Figure 2); however, the percentage of original papers fluctuated and did not show an increasing trend (44.7% in 2015 to 42.7% in 2019). In 2020, the percentage of case reports, compared to original articles, increased for both UHs and CHFs. Both UHs and CHFs showed an increase in the number of original papers, especially in clinical research and practice, by a factor of 2.81 from 54 to 152, and by a factor of 2.14 from 27 to 58, respectively, in this period (Figure 3).

Interestingly, the number of basic experimental research studies by GMPs has remained almost unchanged in UHs, increasing from 34 to 37, and the percentage of basic experimental medicine studies has declined year over year (from 31.2% in 2015 to 21.6% in 2019 and 13.3% in 2020). Instead, the number of publications in the area of public health and

Table 2 IFs of Published Articles Type on PubMed by Japanese GMPs Between University Hospitals and Community Healthcare Facilities

	Total JIF	JIF from University Hospitals			JIF from Community Healthcare Facilities			p-value
	n=1905	n=1414			n=491			
	n	n	Median of IF	IQR	n	Median of IF	IQR	
Original articles	1188	954	3.02	2.11–4.23	234	2.74	2.09–4.23	0.2743
Clinical research and practice	721	544	2.97	2.02–4.22	177	2.84	2.11–4.16	0.948
Retrospective, case-control study	177	119	2.71	1.88–3.95	58	2.83	2.11–4.01	0.2306
Descriptive studies: no comparisons	166	132	2.74	2.01–4.20	34	2.77	2.21–4.20	0.876
Prospective, cohort studies	163	129	3.37	2.52–4.80	34	3.02	2.57–4.16	0.3169
Cross-sectional studies	90	72	2.74	2.02–4.00	18	2.65	2.02–4.16	0.8361
Randomized controlled trials	84	61	3.18	2.13–4.84	23	3.16	2.13–6.62	0.6265
Non-randomized controlled trials	41	31	3.21	2.02–4.01	10	2.55	1.75–4.16	0.5742
Experimental basic research	217	201	3.90	2.84–5.87	16	5.44	3.49–11.40	0.0803
Public health and epidemiology	150	125	2.96	2.40–3.95	25	2.50	1.79–3.74	0.3142
Health care quality and safety	45	34	2.47	1.96–3.33	11	2.07	1.01–2.50	0.2845
Medical and clinical education	31	28	1.83	1.83–2.50	3	1.14	1.01–2.74	0.2917
Health care services	15	13	2.38	2.04–2.74	2	2.71	2.04–3.4	0.8647
Others	9	9	2.47	2.02–2.74	0	–	–	–
Case reports	438	260	1.91	1.01–3.79	178	1.74	1.01–2.53	0.6906
Reviews	163	119	3.64	2.54–5.98	44	3.74	2.66–6.99	0.5286
Letters/Others	116	81	3.47	1.53–5.09	35	4.18	2.02–5.43	0.193

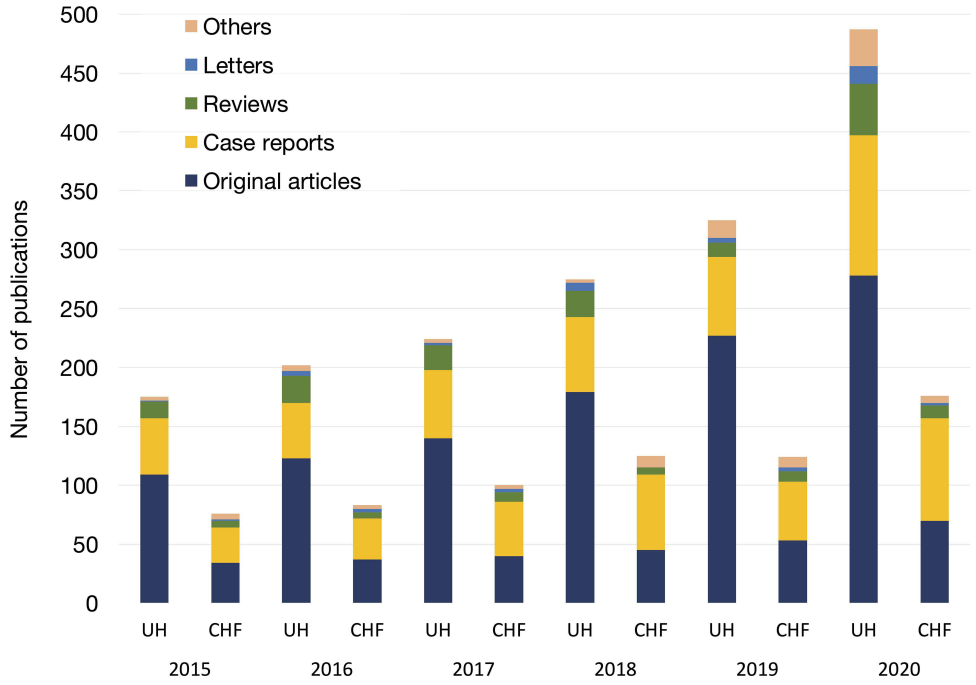

Figure 2 Annual trends in article types for UHs and CHFs (2015–2020).
Abbreviations: UH, university hospitals; CHF, community healthcare facilities.

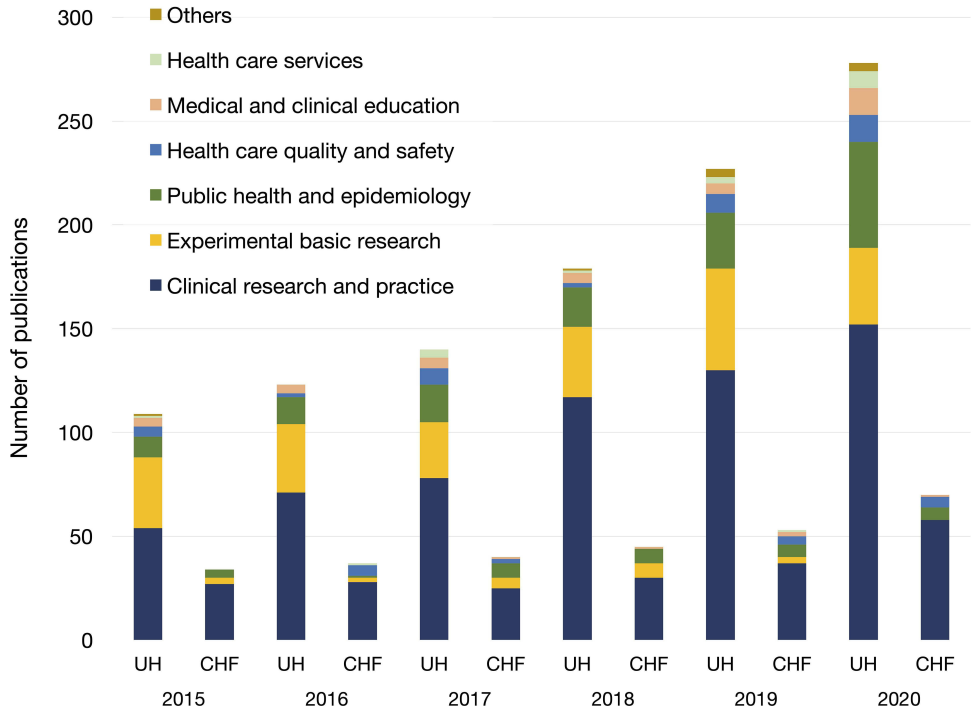

Figure 3 Annual trend of clinical research original papers by theme for UH and CHF (2015–2020).
Abbreviations: UH, university hospitals; CHF, community healthcare facilities.

epidemiology increased 5.1 times, from 10 to 51, especially from UHs (the share rose from 9.2% in 2015 to 11.9% in 2019 and 18.3% in 2020). In summary, there was an overall increase in the number of original papers, particularly in the number of clinical research, public health, and epidemiology studies. The number of articles in the areas of medical

education and healthcare quality and safety at both UHs and CHFs remained almost unchanged, with only a small increase.

Discussion

This study reveals marked differences in in research content and trends published by Japanese GMPs from UHs and CHFs, the former of which publishes nearly 2.5 times more overall publications and over 3.75 times the number of original papers in comparison to the latter. There has been a clear increase in research contributions by GMPs from both UHs and CHFs, especially over the six-year time series. In 2020, however, there was an increase in public health research topics and in the proportion of case reports in both UHs and CHFs, perhaps because of a significant change in the propensity to publish papers related to the COVID-19 pandemic, as previous studies have shown.[17] There was no significant difference in the high IF of the journals between the two groups. As Japan does not have a long history of specialty certification in general medicine,[6,7,16,18] related research fields are still in their infancy.[4,8] Notably, general practice in Japan covers hospital medicine, family medicine, and general internal medicine in a unique system that encompasses both outpatient and acute hospital care, which is rare globally.[6,18] Given this background, we found the following three new discussion points and their characteristics in the research contributions made by Japan's GMP.

Research Contributions of GMPs Affiliated with University Hospitals

This study shows numerically that GMPs affiliated with newly Japanese UHs have a higher research contribution than CHFs. Using the present study methodology, it is not possible to definitely state whether the number of research articles on PubMed by Japanese GMPs is sufficiently large or small. However, according to the Japanese Society of Primary Care, only 1262 (13%) of 9724 physicians with registered affiliations were affiliated with universities as of June 30, 2022.[19] Therefore, we estimate that over the six-year study period, each UH-affiliated physician published 1.28 articles on PubMed, and each CHF-affiliated physician published 0.10 articles, which is an important benchmark. Komagamine et al reported that oral presentation (odds ratio 3.5) and the first author's affiliation with a university institution (odds ratio 2.35) are positive predictors of success in publishing.[12] However, only 11.9% of the abstracts presented orally by a first author affiliated with a university were subsequently published in a peer-reviewed journal.[12] This is very low even for UHs when compared to an approximately 42–47% conversion rate in the other countries.[20–22] Another study examining the productivity of UH GMPs in publishing papers has shown that it is significantly associated with obtaining research grants, leaders' attitudes toward research, presence of graduate degree programs, collaboration with other professionals, and mentoring programs.[9,23,24] These are not limited to the UHs and can be incorporated into the CHF environment, which would lead to higher academic activity in Japan.

Basic Experimental Medicine by GMPs

For the first time in the literature, the present study demonstrates the characteristics of GMPs contributing to basic experimental medicine in Japan. Such evidence of a large number of GMPs engaged primarily in basic experimental research is a trend rarely seen outside of Japan.[25] However, in a survey conducted among the general medicine departments of UHs, 9% of the respondents indicated that basic experimental medicine was the main research theme of their courses and department, which is consistent with the results of this study.[8] The reason for this is that, despite belonging to general medicine, they were originally specialists and tend to continue conducting basic research in their specialty, or their research supervisors often do so. These results also reflect that, while 7% of the original papers in CHF originated from general medicine departments, the researchers are actually engaged in other areas of medicine or are conducting research as graduate students from the general medicine department. Further, this study elucidates that the percentage of basic experimental research studies is decreasing every year.

Low Attention Toward Quality and Safety, Medical Services, and Medical Education

Internationally, medical education is an extremely important part of general practice research.[22,26–29] Medical education is an important central task, especially in academic centers such as UHs.[28,30] In addition, medical education, which covers consultation, diagnosis, therapeutics, and hidden curricula, is highly compatible with primary care in the

context of patient-centeredness. Furthermore, as a discipline, general medicine considers interventions from a bird's eye view and cross-sectional perspective of hospital-wide and community issues (such as patient satisfaction), and has a high affinity with research on medical quality and patient safety.[4,13,18,31–34] Based on the fundamental principle of patient-centeredness, GMP is an inherently interesting area for research and one that will continue to develop in Japan.[13,35] Although the study confirms the reality and characteristics of the current situation, further research is necessary on how to develop this research field and foster academic generalists who will be active at UHs as well as CHFs.[36]

Limitations

This study has several limitations. First, it is not possible to explain why the number of papers published by GMPs has increased. It could be, for example, due to an increase in the overall number of GMPs, an increase in the productivity of a single physician or a few, or a better support system for clinical research. Second, the stated affiliation in the article does not necessarily indicate the true affiliation or role of a general medicine physician in clinical practice because it is possible that some physicians are dispatched from universities to CHFs, and the definition of "first affiliation" may underestimate the actual status. Third, there is a possibility that the results would differ if Japanese- and English-language papers not published in PubMed were included. Finally, the IF does not necessarily explain the importance or excellence of an article, and its usefulness as an indicator of GMP research performance remains debatable.[11,37,38] However, because of the study design, it was not possible to employ other indicators, such as the number of author citations or the h-index,[14] and we were forced to adopt the indicator used by the most widely known indicator of the importance of a journal to its field.

Despite the above limitations, this study is still the first to compare the research performance of Japanese GMPs across UH and CHF affiliations and identify their characteristics. We showed that Japanese GMPs have made great strides recently, along with numerical evidence of their research contributions, which have been difficult to promote in international publications.

Conclusion

Overall, the number of international papers by Japanese GMPs, especially those affiliated with UHs, has increased since 2015. We found no significant difference in the publications' IF between UH- and CHF-affiliated GMPs. The proportion of basic laboratory experimental research by GMPs is decreasing yearly, but their contributions to clinical research and public health have increased significantly. However, research contributions in the fields of healthcare quality and safety, and medical education still need to be improved. This study will serve as a landmark for the development of research and education strategies, as well as an indicator of the research contribution of Japan's GMPs. Further research is needed to determine why there are differences in research contributions between UHs and CHFs and what interventions would help general medicine research develop in the future.

Data Sharing Statement

The data supporting the findings of this study are available from the corresponding author, T.W., upon reasonable request.

Ethics Statement

As this was purely a bibliometric study, approval by the Institutional Review Board of Shimane University was not required, and informed consent was not obtained.

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Author Contributions

All authors have made a significant contribution to the work reported, whether in conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas, took part in drafting, revising or critically reviewing the article, gave final approval of the version to be published, agreed on the journal to which the article has been submitted, and agreed to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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