Japan and the Netherlands as partners in *health and medical research*

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Contents

Key takeaways

High academic impact

Japanese-Dutch collaborative medical research exhibits exceptional academic influence, with a Field-Weighted Citation Impact (FWCI) seven times the global average — surpassing the overall FWCI of 5 for Japanese-Dutch research across all disciplines. Individually, Japan's FWCI is near the world average, while the Netherlands' is about twice that, making their joint medical research particularly outstanding. From the Dutch perspective, collaboration with Japan in medical research ranks as their most impactful partnership among the top 20 countries.

Strong growth in collaborative research

Joint Japanese-Dutch medical research has grown eightfold between 2008 and 2024, far exceeding the twofold and fivefold increases seen individually in Japan and the Netherlands, respectively.

Key academic players

The University of Amsterdam contributes nearly a quarter of all joint medical publications, while the Universities of Tokyo and Kyoto lead on the Japanese side. Partnering institutions show high FWCI values ranging from 5 to 25, with Osaka University leading among Japanese universities and Groningen University, Erasmus University, and Utrecht University prominent in the Netherlands.

Impactful multinational collaboration

A significant portion of Japanese-Dutch medical research involves partners from other countries such as the US, Canada, France, Sweden, and the UK. These multinational collaborations often achieve citation impacts up to 20 times the world average, highlighting the global significance and exceptional quality of the Japan-Netherlands medical research partnership.

High-level of academic-corporate partnerships

Joint Japanese-Dutch medical research exhibits a high rate of academic-corporate collaboration, with 29% of all research involving corporate entities. This figure is significantly higher than the individual rates for Japan (6%) and the Netherlands (8%). These partnerships also demonstrate a strong academic impact, with a Field-Weighted Citation Impact (FWCI) of 12.5. Key corporate players in these collaborations include Astellas, Toshiba, Philips, and Cardialysis.

Significant innovation impact

The rate at which Japanese-Dutch medical research is cited in patents is approximately three times the world average, indicating a strong contribution to medical innovation.

Strong policy impact

Japanese-Dutch medical research is cited in policy documents at four times the world average. These policy citations are a proxy of broader societal impact.

Growth potential in regenerative medicine and digital health

There is significant room for growth in Japanese-Dutch collaborative research in regenerative medicine. Currently, their activity in this field is below the world average. However, the existing joint research has a high citation impact, almost nine times the global average, and Japan is quite active in this area — suggesting a strong potential for increased collaboration and impact. In digital health, the Netherlands, alongside Canada and the US, shows a very high level of activity, about 1.6 times the world average. Japan, on the other hand, is below the world average in digital health activity. Interestingly, Japanese-Dutch collaboration in digital health is above the world average, though still below the Netherlands' individual activity, which indicates another promising area for further joint research and development.

Introduction

Japan and the Netherlands share notable commonalities, including their long-lived populations — a hallmark of successful societies. In 2024, average life expectancy in Japan is approximately 88 years for women and 82 for men, while in the Netherlands it is around 84 years for women and 81 for men.

Both countries face challenges from rapidly aging populations and low birthrates, creating pressures on economic, societal, and healthcare systems. These demographic similarities foster closer ties, particularly in medical research collaborations and innovative healthcare solutions.

Nobel contributions from the Netherlands and Japan in Medicine or Physiology

The Netherlands has three Nobel Laureates in Medicine or Physiology

- **Christiaan Eijkman** (1929) for the discovery of vitamins
- **Willem Einthoven** (1924) for inventing the electrocardiogram
- **Nikolaas Tinbergen** (1973) for the organization and elicitation of individual and social behavior patterns in animals

Japan has been awarded with five Nobel Prizes in Medicine or Physiology:

- **Susumu Tonegawa** (1987) for the discovery of the genetic principles of antibody diversity
- **Shinya Yamanaka** (2012) for the discovery that mature cells can be reprogrammed to become pluripotent
- **Satoshi Ōmura (**2015) for the discovery of new antibacterial drugs
- **Yoshinori Ohsumi** (2016) for the discovery of autophagy, a process of cellular self-eating
- **Tasuku Honjo** (2018) for the discovery of cancer therapy by inhibiting negative immune regulation

Traditional Japanese medicine, known as Kanpo, is a distinct system of herbal and other natural remedies rooted in traditional Chinese medicine. Western medicine was introduced into Japan in the 16th century by Jesuit missionaries, followed by the Dutch in the 17th century, accompanied by physicians and botanists of other nationalities working for the Dutch, such as the German Philipp Franz von Siebold and Swedish Carl Peter Thunberg (a disciple of botanist Carl Linneus). The 18th century saw translations of European books on anatomy and internal medicine, bringing a different perspective of medicine to Japan, alongside Kanpo. An important catalyst for this exchange was Tekijuku (directly translating to appropriate learning), a private school of Rangaku (Dutch learning), established in Osaka in 1838 by Dr. Ogata Koan. At Tekijuku, Western medical research was pursued, achieving several medical accomplishments, including a vaccination program and treatment for cholera. Also important to mention is Dr. Seishu Hanaoka, who represents a pivotal moment at the intersection of traditional Japanese medicine and Dutch medical practices. He was arguably the first surgeon to use oral anesthesia for general surgery, combining his expertise in Kanpo and Rangaku to achieve this innovation. Tekijuku further laid the foundation to Osaka University, one of Japan's top national universities. In the Tokyo region, then called Edo, a group of Dutch-trained Japanese physicians founded the Kanda Otamagaike Vaccination Center in 1857, that is regarded as the beginning of the medical faculty of the University of Tokyo. Japan's oldest medical education institution, founded in 1838, is Juntendo University, where both Japanese and Western medicine was taught.

The modern medical collaboration between the Netherlands and Japan builds on the shared history and common opportunities and challenges, as well as both nations being strong members of global networks. A key focus of joint research involves conditions such as dementia and cardiovascular disease. For example, collaborative projects funded by international agencies explore novel biomarkers and therapies for neurodegenerative disorders. In regenerative medicine, Japan's expertise in induced pluripotent stem cells (iPSCs) — pioneered by the 2012 Nobel laureate Shinya Yamanaka — combines with Dutch strengths in clinical application and tissue engineering. However, as will be explored in this report, there is potential for greater collaboration in this area. Collaboration is also prominent within digital health, as the Japanese and Dutch develop telemedicine and AI-based tools for managing chronic diseases in elderly populations. Their collaboration includes joint conferences and knowledge exchange to integrate such innovations into healthcare systems effectively.

This report is the second of three reports from Elsevier as a proud sponsor of the Dutch pavilion at the Expo 2025 Osaka, Kansai, Japan. All analysis is based on data and analytics from Elsevier's comprehensive tools Scopus and SciVal. Typically, the most recent six-year period in Scopus and SciVal (2019–2024) is utilized for analysis for this report, unless otherwise indicated. The first report examined overall scientific collaboration between Japan and the Netherlands, highlighting key contributions in academic and corporate sectors, as well as key technologies where photonics and quantum technology were identified as areas with strong potential for expanded bilateral collaboration. The full report can be found here including the information on the databases and search parameters used.

Japan and the Netherlands

A comparative view

With Japan home to five Nobel prizes in physiology/medicine and three for the Netherlands, both nations have outstanding global contribution to medical research. While the US, China and the EU27 lead through scholarly output, Japan and the Netherlands show global impact through their expertise.

Figure 1

Medical sciences world article share and Field Weighted Citation Impact (FWCI) for selected nations and groups

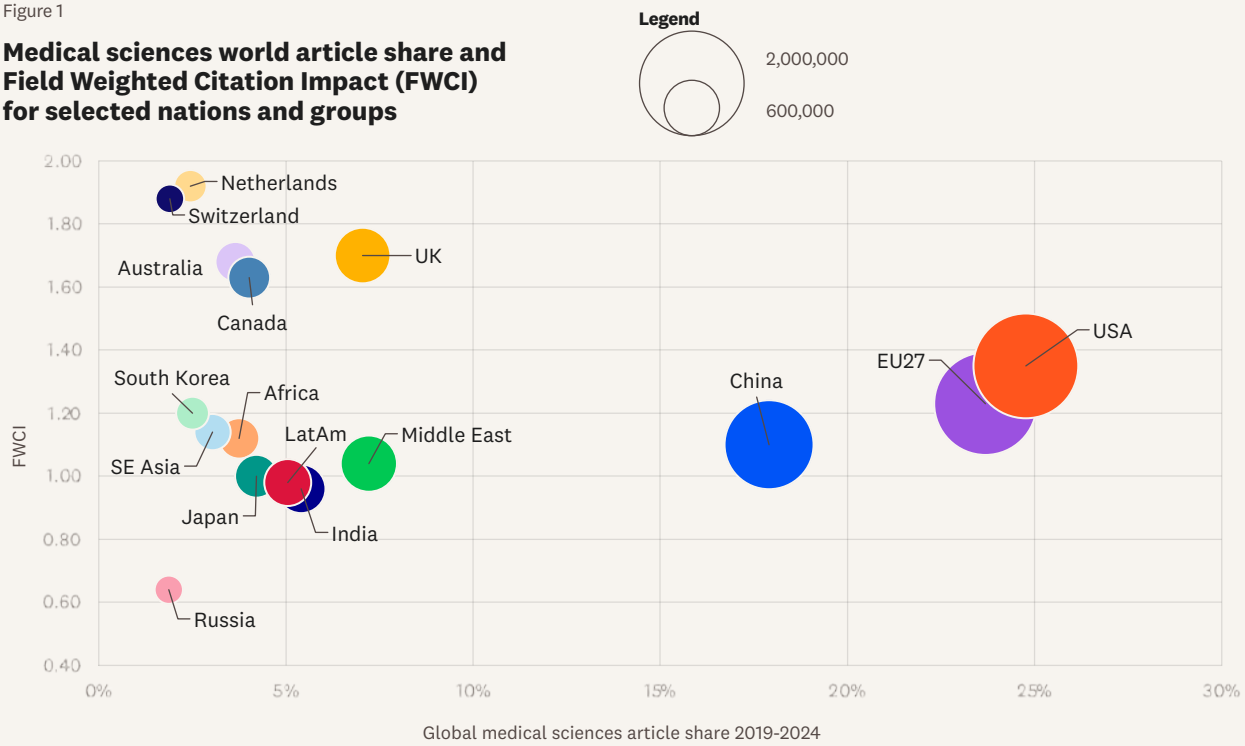


Figure 1 shows Japan and the Netherlands within the global landscape in terms of medical science article share and citation impact. For all sciences Japan's output was twice that of the Netherlands but here we see that for the medical sciences Japan's output is 70% above the Netherlands. The Netherlands particularly stands out in terms of the high Field-Weighted Citation Impact, indicating strong academic impact of Dutch medical research. The USA, EU27 and China are productive players in medical research, where the local corporates in the medical field (Pfizer, Johnson & Johnson and Novartis) also play a significant role.

How much of the overall research output per country is medical research? When we explore the share of medical research of the overall research output, we see a range between 24% to 43% with a global average of 32%. The Netherlands and the US are at the high end of this range: 43% of all their research is medical research. Japan comes in above the world average with 38%. 41% of joint Japanese-Dutch research is medical, which will be further explored in Chapter 2.

Japan overview

Japan is globally renowned for its strong contributions within the clinical and health sciences, with significant contributions to medical technologies, clinical interventions and global disease burden studies.

Seeing growth in both scholarly output and authors, Japanese impact within the medical field continues to grow, being a pioneer in regenerative medicine involving stem cell research and the development of induced pluripotent stem cells (iPSCs) and minimally invasive cardiovascular procedures, to name just a few advancements.

Globally, Japan is engaged in multiple global disease burden studies and other multinational projects – with 23.4% of all medical science output involving international collaboration (see below). Although there is a lower FWCI than some European counterparts, Japan still shows significance with 16.9% of articles among top 10% of journals.

Nearly a quarter of all medical research in Japan involves international collaboration. Roughly a third of these international publications include the US as a partner, and we also see broad participation from a wide range of other countries, including many European nations, Australia, and various Asian countries. However, it is crucial to understand that most of these are not simple two-country partnerships but rather multinational studies, often involving dozens of countries.

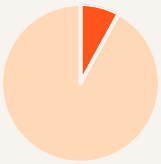
Scholarly output
331,418

Field-Weighted Citation Impact
1.00

Authors
375,854

Outputs in top citation percentiles

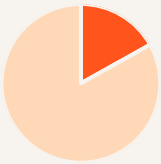
Publications in top 10% most cited worldwide



8.0%

Publications in top journal percentiles

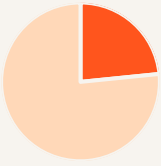
Publications in top 10% journals bye CiteScore



16.9%

International collaboration

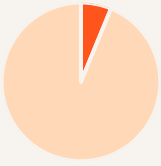
Publications co-authored with institutions in other countries/regions



23.4%

Academic-Corporate collaboration

Publications with both academic and corporate affiliations



6.2%

The Netherlands overview

Among output in the medical sciences, the Netherlands sees impact almost twice the global average, making contributions across clinical research, public health and multidisciplinary studies.

Dutch researchers played a key role in developing the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 guidelines, which set global standards for conducting and reporting systematic reviews, enhancing research transparency and quality.

With 63% of scholarly output involving international collaboration, the Netherlands has a strong global presence, involved in multiple comprehensive studies on the global burden of diseases, which drive international health policies and interventions. Not only are Dutch institutions, such as the University of Amsterdam, often involved in large-scale multinational clinical trials and also leading in open access publishing, but the impact of the output is also reflected in high quality share — 36.2% published in the top journals.

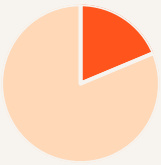
Scholarly output
192,627

Field-Weighted Citation Impact
1.92

Authors
131,024

Outputs in top citation percentiles

Publications in top 10% most cited worldwide



18.7%

Publications in top journal percentiles

Publications in top 10% journals bye CiteScore

36.2%

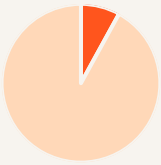
International collaboration

Publications co-authored with institutions in other countries/regions

63.3%

Academic-Corporate collaboration

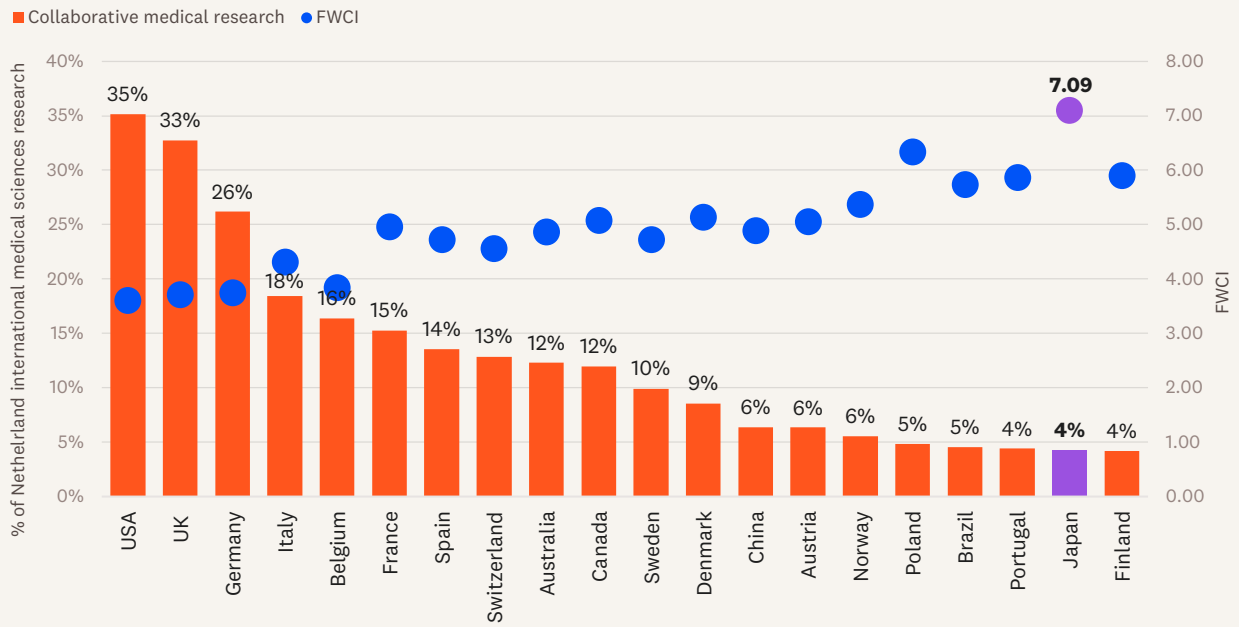
Publications with both academic and corporate affiliations



8.0%

Figure 2

Most prolific countries collaborating with the Netherlands in medical sciences (2019-2024)



Looking at partners in international collaboration (Figure 2), while Japan ranks only 19th out of the top 20 collaborators with the Netherlands in terms of volume, the impact of Dutch-Japanese research is unparalleled. Medical science involving Dutch-Japan collaboration sees seven-times higher impact than the world average. This impact is even higher than Dutch-Japanese collaborative scholarship across all research, which sees a FWCI five times the global average. As Chapter 2 will continue to explore, Japanese-Dutch collaborative research combines the strengths of both nations within the medical sciences to create exceptional impact among global research.

"The modern medical collaboration between the Netherlands and Japan builds on shared history and common opportunities and challenges, while both nations are strong members of global networks. Its impact is substantial, with joint scientific impact as high as 7 times the global average."

Chapter 2

Japanese-Dutch medical collaboration

Exploring common ground

After establishing an understanding of the individual contributions from Japan and the Netherlands, the impact of the joint contribution in medical science can be explored.

Scholarly output

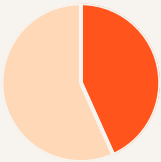
5,244

Field-Weighted Citation Impact

7.08

Outputs in top citation percentiles

Publications in top 10% most cited worldwide

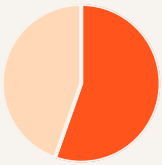


JP-NL Medical Sciences

43.3%

Publications in top journal percentiles

Publications in top 10% journals by CiteScore

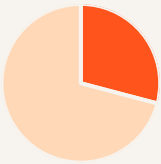


JP-NL Medical Sciences

55.4%

Academic-Corporate collaboration

Publications with both academic and corporate affiliations



JP-NL Medical Sciences

29.1%

Japanese-Dutch collaborative medical research is exceptionally well-cited. Its FWCI is an impressive 7.08 (see above), meaning it is over seven times the world average. This is notably higher than the overall FWCI of 5 for Japanese-Dutch collaborations across all disciplines. It also significantly surpasses the individual medical science FWCIs for Japan (around 1) and the Netherlands (around 1.9).

Other indicators further highlight this substantial impact. For instance, 43% of Japanese-Dutch collaborative medical science publications are among the top 10% most cited, compared to just 8% for Japan and 19% for the Netherlands individually. Similarly, 55% of their joint articles appear in top 10% most cited journals, a stark contrast to 17% for Japan and 36% for the Netherlands. These figures collectively demonstrate the exceptionally high impact of medical research undertaken jointly by Japan and the Netherlands.

It is also noteworthy that Japanese-Dutch medical research exhibits exceptionally high levels of inter-sectional collaboration, with 29% of publications stemming from academic-corporate partnerships. This rate surpasses not only the individual levels for both countries but also the already high 23% seen in overall Japanese-Dutch joint research across all fields, as noted in the first report of this series.

What kind of medical research is most prominent between Japan and the Netherlands?

To gain specific insights from the co-authorship dataset, we used Elsevier's SciVal tool to cluster research papers by citation links and applied generative AI to summarize clusters with more than eight papers. The dataset, originally comprising 5,244 publications, reveals a diverse focus on medical research areas such as disease diagnosis, treatment effectiveness, and patient-centered outcomes. Key topics include COVID-19 (165 papers), addressing various pandemic aspects from public health to mental health. Another prominent area is Percutaneous Coronary Intervention (151 papers), highlighting advances in interventional cardiology for coronary artery disease.

Beyond these high-volume topics, there is a strong emphasis on improving diagnostic imaging and therapy across multiple conditions. "Computed Tomography" frequently appears in studies on stomach cancer, myositis, lung cancer screening, glomerular filtration rate, bladder, and coronary vessels, often linked with "Human Study" and "Quality of Life," underscoring patient-centered use of advanced imaging. Additionally, notable research covers pharmacotherapy for chronic illnesses, with 67 papers on rheumatoid arthritis and related rheumatology topics, and 44 papers on chemotherapy, oncogene proteins, and clinical trials.

Growth in international medical research over time

Figure 3

Trend of international collaboration levels in medical sciences, in the Netherlands, in Japan (left) and in JP-NL co-authorship (right)

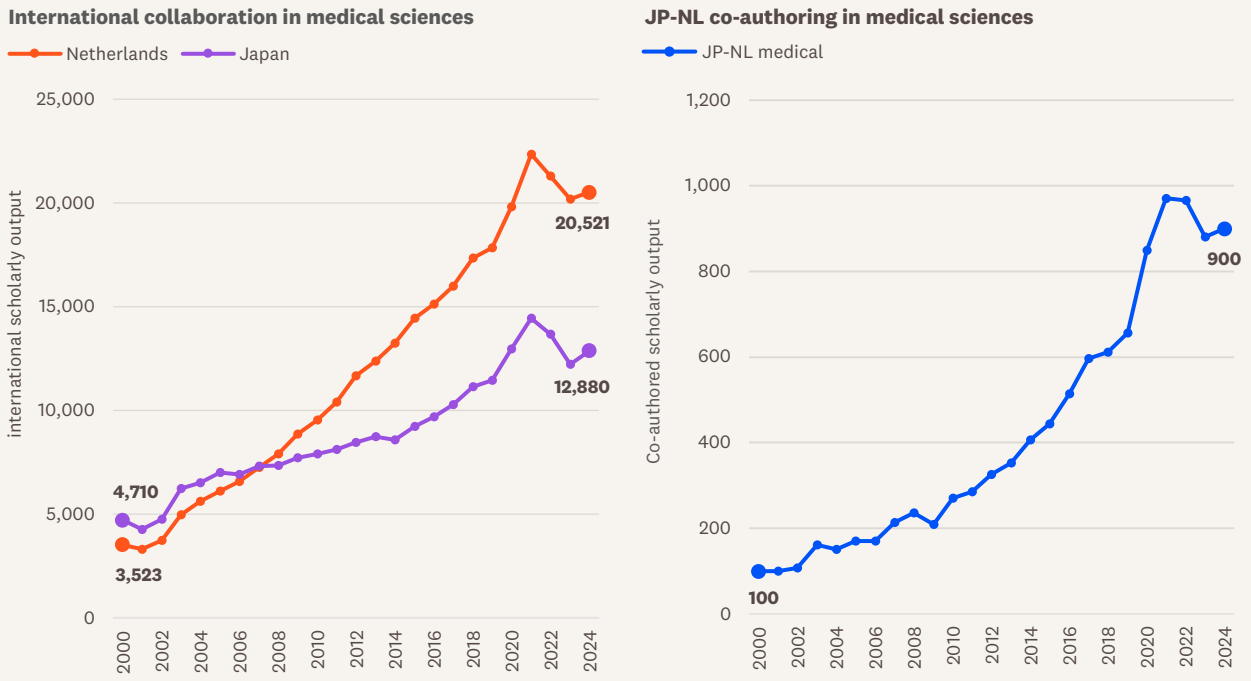


Figure 3 illustrates the significant changes in medical science research output between 2000 and 2024. The left graph tracks Japan and the Netherlands individually. Both nations experienced similar rates of steady growth up until 2008. After this point, the Netherlands' growth trajectory became noticeably steeper, leading it to surpass Japan in overall scholarly output. This sustained higher growth means that the Netherlands' total output increased almost fivefold from 2000, and eightfold specifically from 2008 to 2024, while Japan's output roughly doubled over the entire period. We also see a noticeable "COVID-19 bump" in 2020 and 2021, which may have contributed to a surge in citations and, consequently, the high FWCI mentioned earlier.

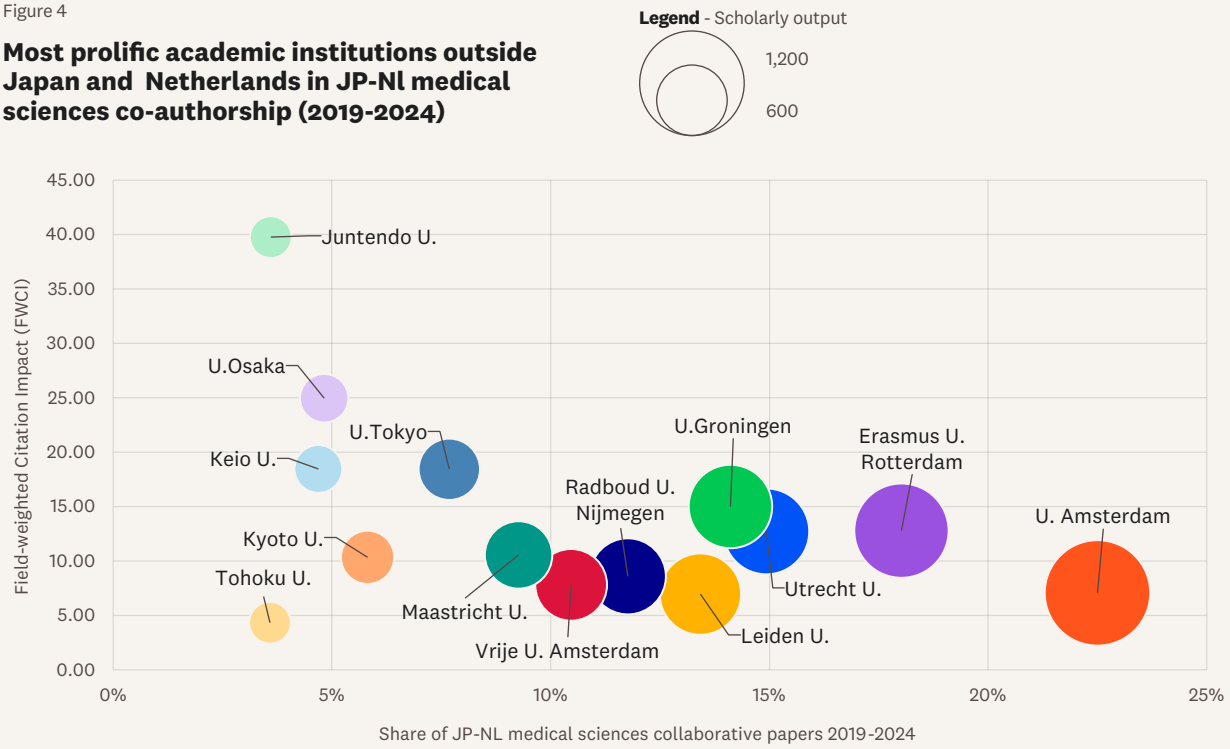
In contrast, the right graph highlights the remarkable growth of joint Japan-Netherlands medical research. This collaboration has clearly outpaced individual national growth rates, increasing by a factor of eight during this timeframe. A similar trend is evident in more recent years: between 2019 and 2024, Japan's international medical research grew by 11%, the Netherlands' by 18%, and joint Japanese-Dutch research by a significant 37%. Whether viewed long-term or short-term, collaborative medical research between Japan and the Netherlands has consistently grown much faster than individual international medical research efforts in either country.

Key academic contributors

Looking at the key academic players in the medical Japanese-Dutch collaborations and their impact, Figure 4 shows the most prolific institutes. Among the leading institutions, the dominance of Dutch universities among the top ten is immediately noticeable. The University of Amsterdam leads, with almost a quarter of all medical research. The Japanese universities contribute around 5% of all articles, with the Universities of Tokyo and Kyoto in the lead, followed closely by Osaka and Keio University.

Figure 4

Most prolific academic institutions outside Japan and Netherlands in JP-Nl medical sciences co-authorship (2019-2024)



All institutes have high FWCI, ranging from 5 to 25 for Osaka University, with the specialized private Juntendo University as an outlier with a very high impact (it should be noted that large international collaborations with more than a thousand authors contribute significantly to this high FWCI value). On the Dutch side Groningen University is in the lead impact-wise, closely followed by Erasmus and Utrecht University.

While the academic players dominate in their contributions to medical research, medical science is performed outside of academia and the corporate world, with leading Dutch and Japanese contributors listed in the following table. The line-up shows a mix of institutes, such as the Netherlands Cancer Institute and the National Cancer Center Japan, as well as hospitals such as the OLVG in Amsterdam and St. Luke's International Hospital in Tokyo.

Of all the medical collaborations between Japan and the Netherlands, the majority typically involve at least another country (only 7% are purely bilateral). The US is the most frequent third-party country, followed by the UK and Germany. Of the top 10 countries involved in Japanese-Dutch medical partnerships, all are in 'the West' (Europe, North America, Australia) and not one in Japan's region of the world.

Further looking into the prolific institutions contributing to Japanese-Dutch collaborations in medical research beyond the two nations, Harvard leads the way, followed by the University of Toronto, UCL and Paris-Saclay. What jumps out is that these institutes are global powerhouses on medical research, such as Oxford, Karolinska, Imperial, Johns Hopkins, etc. with high impact contributions to Dutch-Japanese medical research (illustrated by FWCI values of around 20 or more - it should be noted that we are looking at a subset of a subset, so low numbers and metrics like the FWCI might not be as reliable as when large, full datasets are studied). In summary, the Dutch-Japanese collaborators succeed in partnering worldwide with the leading institutes in medical research, another line of evidence of the high quality of these collaborations.

Figure 5

Institutions in Japan and in the Netherlands in JP-Nl medical sciences co-authorship (2019-2024)

Institutions in Japan	Scholarly output	Share of JP-NL medical science
National Cancer Center Japan	288	5.5%
National Center of Neurology and Psychiatry Kodaira	137	2.6%
RIKEN	108	2.1%
National Cerebral and Cardiovascular Center	107	2.0%
National Center for Child Health and Development	70	1.3%
National Center for Global Health and Medicine	64	1.2%
National Institute of Infectious Diseases	64	1.2%
Japanese Foundation for Cancer Research	56	1.1%
St. Luke's International Hospital	53	1.0%
National Hospital Organization, Japan	49	0.9%
Institutions in the Netherlands		
Amsterdam UMC	1,136	21.7%
Netherlands Cancer Institute	203	3.9%
Princess Máxima Center for Pediatric Oncology	95	1.8%
National Institute of Public Health and the Environment	82	1.6%
St. Antonius Ziekenhuis	73	1.4%
Onze Lieve Vrouwe Gasthuis	71	1.4%
Catharina Hospital	68	1.3%
Antoni van Leeuwenhoek Hospital	45	0.9%
Isala Clinics	44	0.8%
Sanquin Blood Supply Foundation	38	0.7%

The role of academic-corporate partnerships

Returning to academic-corporate partnerships in medical research, such output globally covers 2.3% of scholarship, 6.2% in Japan and 8.0% in the Netherlands. Japanese-Dutch collaborations see an extremely high rate of collaboration at 29%. The impact of these academic-corporate partnerships in medical research are also very different as measured by the FWCI: 2.1 for the world, 2.7 for Japan, 4.0 for the Netherlands and 12.5 for Japanese-Dutch collaborations — meaning 12.5 times the world average, even higher than the 9.5 for all collaborative research. It is fair to summarize that in the medical field, corporate-academic partnerships are highly impactful for the joint Japanese-Dutch research.

Who are the key corporate players in these academic-corporate partnerships in medical Japanese-Dutch research? The following table lists the most prolific corporates in Japan and the Netherlands and global corporates contributing to joint Japanese-Dutch research. Unsurprisingly, pharmaceutical companies are well represented, such as those from the UK, Switzerland, the US and Germany. However, industries involved in providing medical equipment are also present. The Top 3 from Japan and the Netherlands are Astellas Pharma, Toshiba and Philips. From global contributors, the Top 3 is Samsung, AstraZeneca and Novartis.

Figure 6

Corporates in Japan and in the Netherlands in JP-Nl medical sciences co-authorship (2019-2024)

Corporates in JP or NL	Country	Scholarly output	Share of JP-NL medical science
Astellas Pharma Inc.	Japan	58	1.1%
Toshiba Corporation	Japan	27	0.5%
Koninklijke Philips N.V.	Netherlands	26	0.5%
Daiichi Sankyo Company, Limited	Japan	21	0.4%
Takeda Pharmaceutical Company Limited	Japan	20	0.4%
Cardialysis B.V.	Netherlands	19	0.4%
Advanced Telecommunications Research Institute Int.	Japan	18	0.3%
CYBERDYNE Inc.	Japan	12	0.2%
Nippon Telegraph & Telephone	Japan	11	0.2%
Eisai Co., Ltd.	Japan	8	0.2%
Chugai Pharmaceutical Co. Ltd.	Japan	7	0.1%
Otsuka Pharmaceutical Co Ltd.	Japan	7	0.1%
Shionogi & Co., Ltd.	Japan	7	0.1%
TropIQ Health Sciences	Netherlands	7	0.1%
FrieslandCampina	Netherlands	5	0.1%

Figure 7

Corporates in third party countries in JP-Nl medical sciences co-authorship (2019-2024)

Corporates	Country	Scholarly output	Share of JP-NL medical science
Samsung	South Korea	127	2.4%
AstraZeneca	UK	112	2.1%
Novartis	Switzerland	84	1.6%
MOH Holdings Pte Ltd.	Singapore	77	1.5%
Johnson & Johnson	USA	76	1.4%
Pfizer	USA	70	1.3%
F. Hoffmann-La Roche AG	Switzerland	62	1.2%
Merck	USA	62	1.2%
Eli Lilly	USA	58	1.1%
Bristol-Myers Squibb	USA	55	1.0%
Boehringer Ingelheim GmbH	Germany	52	1.0%
Fresenius AG	Germany	52	1.0%
AbbVie	USA	49	0.9%
Bayer AG	Germany	48	0.9%
GlaxoSmithKline	UK	45	0.9%

The impact of medical research on innovation and policy

Research often forms the basis for innovation, and one measurable manifestation of this is the proportion of research articles cited in patents. Joint Japanese-Dutch medical research demonstrates this impact clearly: its patent citation rate is approximately three times the world average, and significantly higher than that of either Japan or the Netherlands individually. Specifically, while 3.5% of medical research articles are cited in patents globally, this figure stands at 4.4% for Japanese medical research and 5.3% for Dutch research. However, joint Japanese-Dutch medical research truly stands out, with 9.6% of its articles cited in patents.

To understand the areas of focus within these patent-cited papers, we analyzed their SciVal topics classification using AI. This revealed a strong emphasis on novel therapeutic strategies, advanced diagnostics, and fundamental biological mechanisms with clinical significance, notably immunotherapy and targeted drug development. Much research aims to improve diagnostic accuracy and understand disease pathogenesis through advanced imaging and biomarkers. In summary, joint Japanese-Dutch medical research is a strong basis for innovation, with patent citations about three times the world average and 50% higher than across all fields.

Research has a significant role in influencing policymaking, and this also holds true for medical research. We can gain insight into this translational impact by examining how often research is cited in policy documents. Globally, roughly 7.1% of medical research is cited in policy documents. For individual countries, this figure stands at 5.6% for Japan and 15.9% for the Netherlands. However, joint Japanese-Dutch medical research truly excels, with a remarkable 27.4% of its articles cited in policy — nearly four times the world average. Across all disciplines, 17% of Japanese-Dutch research is cited in policy, indicating the high policy impact of medical research. The same AI analysis of SciVal topics related to these policy cited papers, revealed dominant themes in managing and preventing chronic diseases with significant public health burdens, particularly diabetes and cancer. The frequent appearance of “Quality of Life” and “Randomized Controlled Trial” underscores a patient-centered, evidence-based approach essential for policy decisions. The research also addresses global health crises and infectious diseases, such as COVID-19 and Monkeypox, demonstrating direct contributions to public health policy. Additionally, there is strong emphasis on optimizing diagnostic and therapeutic interventions through advanced medical imaging and immunotherapy.

The contribution of regenerative medicine and digital health

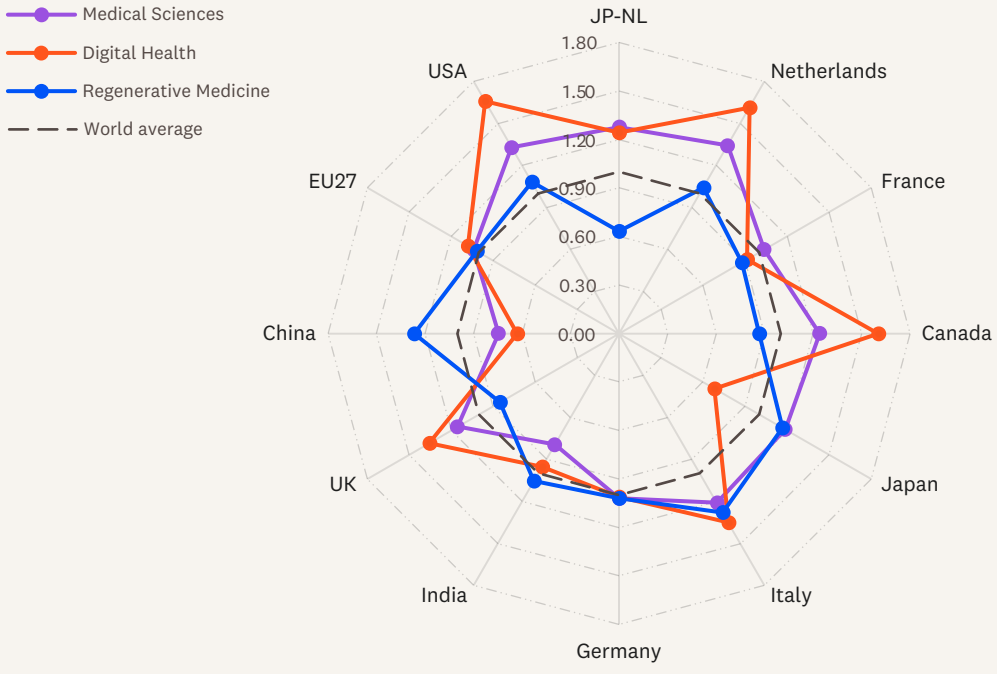
The Relative Activity Index (RAI) provides insight into how active a country or region is within a specific field compared to global activity levels. For this analysis, the RAI has been calculated for the medical sciences, digital health, and regenerative medicine, as shown in Figure 8. To illustrate, globally, 32.3% of all research falls within the medical sciences; this global average is assigned an RAI of 1.00. Consequently, a country dedicating more than 32.3% of its research to medical sciences will have an RAI greater than 1.00. For example, the Netherlands allocates 43.4% of its research to medical sciences, resulting in an RAI of 1.34 – an activity level 34% above the global average.

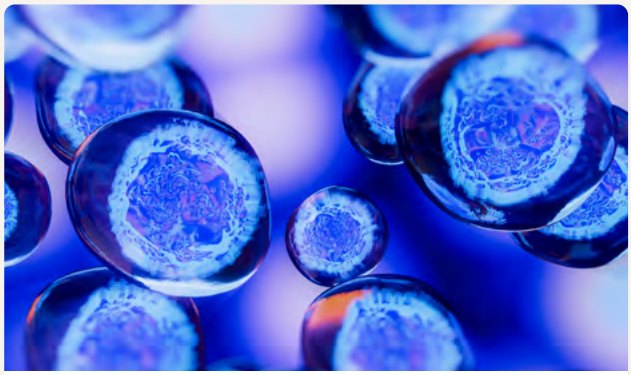
Beyond the broader medical sciences, the Netherlands is particularly active in digital health (RAI 1.61), an area where it leads alongside the US and Canada. Japan, meanwhile, shows high activity in the medical sciences (RAI 1.19) and regenerative medicine (RAI 1.17), often alongside China.

Joint Japanese-Dutch research demonstrates above-average activity in both the medical sciences and digital health (both around RAI 1.25). However, their collaboration in regenerative medicine (RAI 0.63) is currently well below the global average, highlighting a clear opportunity for increased joint effort. This potential is further underscored by the high citation impact of their existing joint research in these areas: regenerative medicine boasts an impressive FWCI of 8.8, and digital health an FWCI of 7.4. While acknowledging that FWCI values from smaller datasets like these are less robust than those from larger ones, these high impact scores strongly suggest that regenerative medicine and digital health are prime areas for expanding Japanese-Dutch collaboration.

Figure 8

Relative Activity in selective medical sciences, a comparison among G7 countries, EU, China, and India (2019-2024)





Regenerative Medicine

Further AI-supported analysis of joint Japanese-Dutch regenerative medicine shows a strong recurrence of “Stem Cell” across various contexts, such as “Stem Cell; Tissue Engineering,” “Hematopoietic Stem Cell,” “Neural Stem Cell,” and “Induced Pluripotent Stem Cell” – not surprising given Japan’s strength in stem cell research. This dominance demonstrates comprehensive engagement with core elements of regenerative biology. These collaborations delve into the basic science of cell differentiation and proliferation, while simultaneously exploring the therapeutic potential of stem cells for specific applications like spinal cord injury and retinal repair, areas where Japan, notably Keio University and RIKEN, have done pioneering research and moves towards clinical practice.

Furthermore, we find research with emphasis on cutting-edge materials science and targeted delivery mechanisms for application of advanced biomaterials and sophisticated nanoscale drug delivery systems. The frequent appearance of “Hydrogel” and “Nanofiber” alongside “Stem Cell” highlights work in creating scaffolds and matrices vital for guiding tissue regeneration. The prominent and repeated mention of “Exosome” linked to “Neoplasm” and “Drug Delivery System” highlights a focus on these nanoscale vesicles, intercellular carriers, as next-generation cell-free therapies and precision drug carriers.

Digital Health

Moving on to AI-supported analysis with a focus on digital health, recurring themes include artificial intelligence, notably machine learning, and deep learning, particularly applied to medical imaging, such as breast cancer diagnosis. Good to mention here is the Japanese government’s significant push for the clinical adoption of LLMs and Large Multimodal Models (LMMs). This initiative is seen to be gaining strong momentum and is very much top-of-mind across the medical field, especially since the release of GPT models. Robotics is also prominent, covering medical imaging, assistive technologies, and human-robot interaction, indicating joint efforts to integrate automation into healthcare.

Telemedicine and electronic health records feature heavily, reflecting a shared goal to modernize healthcare infrastructure and patient data management. Advanced diagnostic imaging, particularly computed tomography, often appears alongside patient-centered terms including “Quality of Life” and “Human Study,” with AI-driven techniques such as image segmentation and object detection playing central roles.

Robotics research focuses on therapeutic and assistive applications, such as motor control and expression recognition, pushing automated healthcare interventions forward. Beyond diagnostics and robotics, collaborations cover data-driven health management, with topics like digital epidemiology focused on COVID-19, public health, and digital tools such as sentiment analysis, natural language processing, digital microfluidics, and wearable sensors. This broad scope highlights the comprehensive, multi-dimensional nature of Japan-Netherlands teamwork in digital health innovation.

Conclusion

In conclusion, the enduring partnership between Japan and the Netherlands in medical research exemplifies the power of their shared scientific vision and complementary expertise. Both nations face similar demographic challenges from aging populations, which has spurred collaborative efforts to develop innovative healthcare solutions. Rooted in a rich history of medical exchange dating back to the 17th century, this relationship continues to evolve, underscored by the distinguished achievements of researchers from both countries, including multiple Nobel laureates.

Our analysis highlights that both Japan and the Netherlands are substantial contributors to global medical science, with individual Field-Weighted Citation Impact (FWCI) values of approximately 1.0 and 1.9, respectively. However, their joint research efforts yield an impact far exceeding their individual outputs. The Dutch-Japanese collaboration in medical science achieves an impressive FWCI of 7, reflecting citation rates more than seven times the world average. Our previous report highlighted the exceptional impact of Japanese-Dutch collaborative research across all sciences, with an FWCI five times above the global average. In comparison to all sciences, medical science performs even better across all metrics. In addition to the FWCI of 7, corporate contribution is characterized by robust international partnerships and a strong presence of academic-corporate alliances, which contribute 29% of joint medical research output (23% for all sciences) and exhibit an FWCI of 12.5, underscoring their extraordinary impact on innovation. Further, medical science sees an innovation impact thrice the world average (twice for all sciences) and a policy impact of four times the world average (2.5 the world average for all sciences).

Moreover, the partnership's focus on regenerative medicine and digital health exemplifies how the countries leverage their distinct strengths to advance cutting-edge fields. Although joint activity in regenerative medicine remains below the global average, with a Relative Activity Index (RAI) of approximately 0.6, the FWCI of 8.8 highlights the exceptional quality and influence of this research. In digital health, the collaboration performs above average (RAI around 1.25), integrating advances in artificial intelligence, telemedicine, and robotics. Japan's leadership in stem cell biology and tissue engineering complements the Netherlands' expertise in clinical application and digital technologies, creating a synergistic effect that drives high-impact outcomes.

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