



Original Article

Basic and clinical research publications of Indonesian neurosurgeons: Where are we?

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ABSTRACT

Background: With changes in European and the US academia and education systems, research has become a measurement to define academic productivity, as it is a crucial component in the process of becoming a well-trained neurosurgeon. In this recent study, we aimed to reveal the current status and challenges facing neurosurgical research in Indonesia.

Methods: An open-access PubMed MEDLINE database search was performed to reveal all articles published by Indonesian Neurosurgeons from 1980 to July 2021. The detail was extracted to the following parameters: academia center or city of the study, year of publication, study type, topic, journal, institution and Q status, first author, article citation, international collaboration, and the working field. These data were processed and examined.

Results: During 1980 and July 2021, a total of 242 PubMed-indexed papers were published from Indonesia. The number of publications started increasing significantly from 2010 to 2021, with an average of 19 papers per year since 2010. Most of the studies came from Bandung (22.7%), with Universitas Padjadjaran as the center of the study. According to the paper type, the majority of the articles were basic and clinical research (45.5%). The most common study type was case reports (33.5%). Neurotrauma (21.9%) was the most frequent topic followed by neuro-oncology (21.07%) and spine trauma (11.98%).

Conclusion: Published articles in the neurosurgery field in Indonesia has shown a higher, promising trend. Despite many challenges faced in the process, there was significant progress in the past few decades compared to the previous ones. A comprehensive deliberate plan and multidisciplinary effort that focuses on overcoming the problems regarding defining academic productivity is needed for further improvement of neurosurgical care in Indonesia.

Keywords: Indonesia, Neurosurgery, Publications, PubMed

INTRODUCTION

PubMed is a database for the biomedical literature that provides access to MEDLINE, containing bibliographic information on more than 27 million articles from more than 7000 journals which encompass full text for some 4 million of these articles.^[12] Neurosurgery is one of the fields that have witnessed substantial growth over the past few decades, with a proportionate

rise in the number of landmark studies published each year. Engagement in research and academic productivity is crucial components in the training of a neurosurgeon. This process typically begins in residency training. Neurosurgical researches are dedicated to advancing patient care through various discovery science and multidisciplinary approaches, which include basic science research and clinical studies.

Neurosurgery in Indonesia was started in 1948 by the initiation of a Dutch surgeon who was once the pioneer of neurosurgery in the Netherlands as well.^[6] The service was first established in a form of the neurosurgical clinic to help World War victims. Over the past few decades, it grew continuously along with the increasing amount of neurosurgeon training in some regions of Indonesia. This review was conducted to figure out the current status of neurosurgical publications from Indonesia, the current trends, the most common type of research in Indonesia, and also to see if there are disparities between regions regarding the output of publications and differences in academic productivity among neurosurgery centers all around our nation.

The purpose of this study is not only to define or estimate the academic productivity of neurosurgeons in Indonesia but also to emphasize the current challenges facing clinical research, particularly regarding neurosurgery in Indonesia, and to offer potential solutions that can be considered in improving the academic productivity of neurosurgeons in Indonesia.

MATERIALS AND METHODS

An open-access PubMed MEDLINE database search was performed by the authors using various combinations of the following keywords: "Neurosurgery," "Neurosurgeon," "Neurological surgery," "Neurosurgical research," and "Indonesia." The final results were including all studies published between 1980 and July 2021. Subsequently, a PubMed exploration by author name was done for all neurosurgeons and neurosurgery residents studying in Indonesia, based on the registry database available from the Indonesian Society of Neurological Surgeons (ISNS).

The inclusion criteria were as follows: (1) published manuscripts of neurosurgery or neuroscience study, (2) study conducted in Indonesia-based neurosurgery services or academic activities, and (3) published manuscripts with, at least, one of the co-authors being an Indonesian neurosurgeon. The exclusion criteria were research conducted by neurosurgeons with nonneurosurgery topics or not in neuroscience fields. Information was extracted to the following parameters: city or center of the study, year of publication, paper and study type, topic, journal, institution and Q status, first author, article citation, international

collaboration, and the working field. These data were then processed and examined.

RESULTS

The articles took place in various centers of study. Between 1980 and July 2021, a total of 242 PubMed-indexed papers were published from Indonesia. Most of the studies came from Bandung ($n = 55$; 22.7%) in which the center of the study was Universitas Padjadjaran, followed by Airlangga University in Surabaya ($n = 54$; 22.3%), Pelita Harapan University in Tangerang ($n = 31$; 12.8%), Udayana University in Bali ($n = 23$; 9.5%), Diponegoro University in Semarang ($n = 13$; 5.4%), Gadjah Mada University in Yogyakarta ($n = 9$; 3.7%), University of Indonesia in Jakarta ($n = 8$; 3.3%), Sumatera Utara University in Medan ($n = 8$; 3.3%), National Brain Center in Jakarta ($n = 6$; 2.5%), Hasanuddin University in Makassar ($n = 6$; 2.5%), and Mataram University in Mataram ($n = 3$; 1.2%). There were two studies from Balikpapan and Manado. A study was conducted in each of these cities: Aceh, Jambi, Malang, Surakarta, Jember, Purwokerto, Kupang, and Pontianak [Figures 1 and 2].

The growth in the number of publications was observed per decade. Only one paper in the period of 1980–1989 was published, with the same amount in the period of 1990–1999. The trend began to rise from 2000 to 2009, in which about 10 papers were published. The number of publications started increasing significantly starting from 2010 to 2019, with a total of 102 papers being published. From 2020 to July 2021, the highest amount of publications occurred with a total of 128 papers [Figures 3 and 4]; even 2021 is not finished yet. There was an average of 19 papers per year since 2010.

According to the paper type, the majority of the articles were basic and clinical research ($n = 110$; 45.5%), followed by literature review – meta-analysis ($n = 41$; 16.9%), case report ($n = 88$; 36.4%), and others, such as meeting report or letter to editor ($n = 3$; 1.2%). Neurotrauma was the most frequent topic ($n = 53$; 21.90%), followed by neuro-oncology ($n = 51$; 21.07%), spine trauma ($n = 29$; 11.98%), spine ($n = 27$;

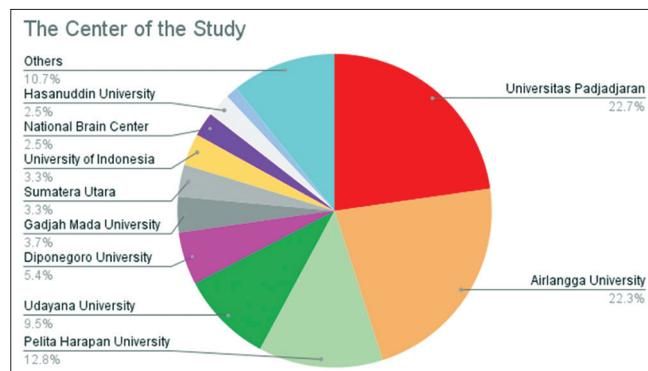


Figure 1: Publications percentage of each neurosurgery center.

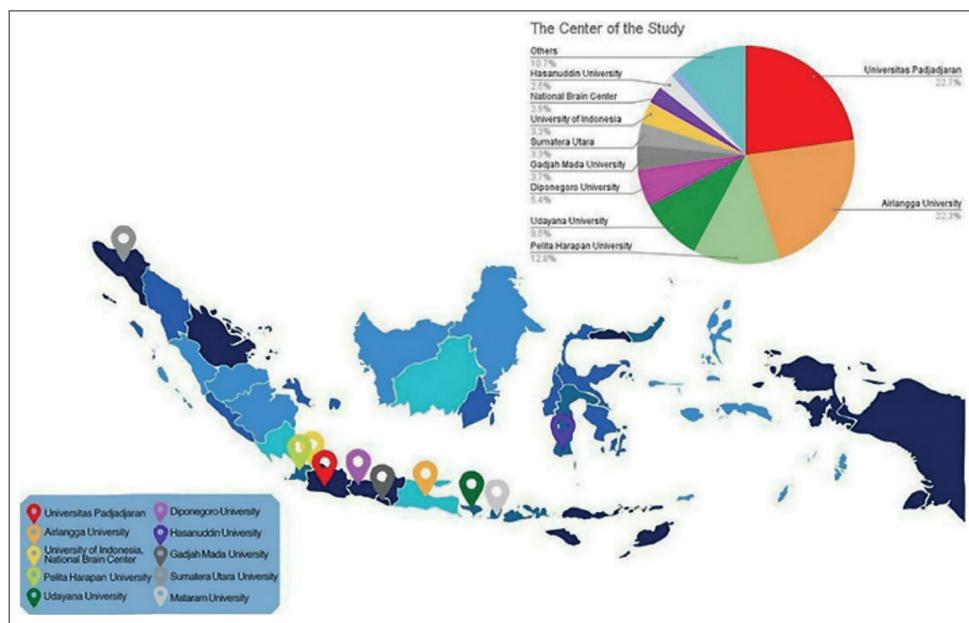


Figure 2: Publications percentage in each city of Indonesia.

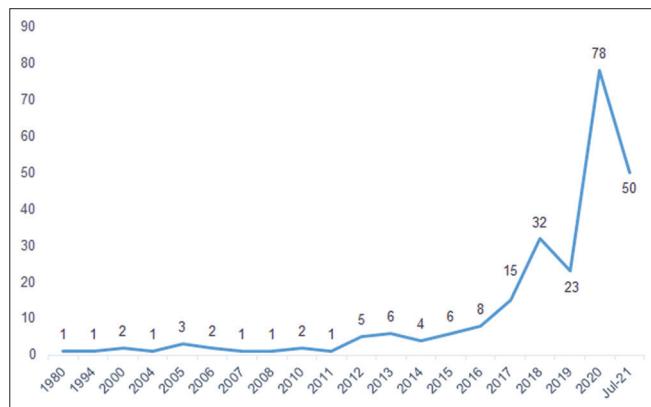


Figure 3: Number of publications each year (1980–July 2021).

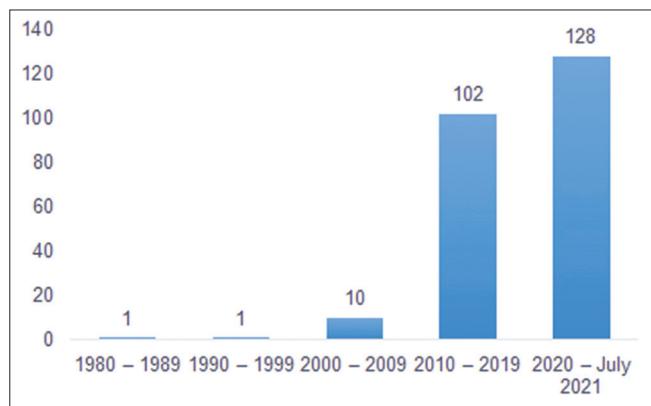


Figure 4: Number of publications in decade.

11.16%), pediatric ($n = 26$; 10.74%), functional ($n = 19$; 7.85%), neurosurgery in COVID-19 era (ranged from

education, emergency cases, neurotrauma, neuro-oncology, and vascular) ($n = 14$; 5.80%), peripheral nerve ($n = 9$; 3.72%), education ($n = 6$; 2.48%), infection ($n = 4$; 1.65%), and others ($n = 4$; 1.65%) [Figures 5 and 6].

DISCUSSION

Our study is the first to define the academic productivity among neurosurgeons in Indonesia during the period 1980–2021. It described not only basic research but also took the condition of clinical research in our nation into discourse. PubMed is a search engine that serves as a database for biomedical literature that plays a significant role in the current academic intellectual landscape. In this study, according to the journal, the majority of the papers were published in Open Access Macedonian Journal of Medical Sciences ($n = 28$; 11.6%), followed by other four common journals consisting of Asian Journal of Neurosurgery ($n = 23$; 9.5%), World Neurosurgery ($n = 23$; 9.5%), Surgical Neurology International ($n = 17$; 7%), and Annals of Medicine and Surgery ($n = 13$; 5%).

In this study, the growth in the number of publications was observed. The number of publications started increasing significantly in the past two decades. Factors that were hindering neurosurgical research, particularly before the two decades, could occur due to undeveloped technology, inadequate health system infrastructure, human resource shortages in research, absence of comprehensive patient data recording systems, problems in patient follow-up, deficits in research funding, regulatory and bioethical considerations, lack of international collaborations, and limited access to

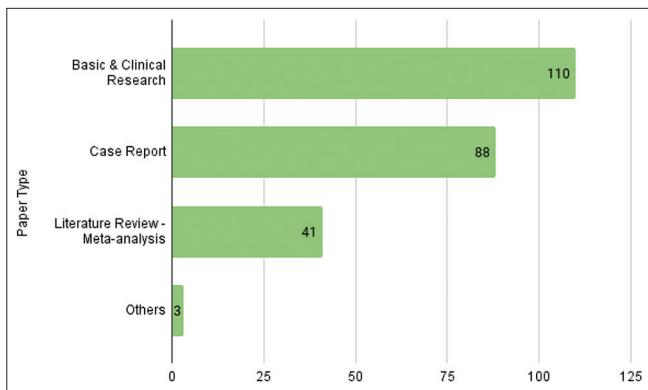


Figure 5: Type of manuscripts published by Indonesian neurosurgeons.

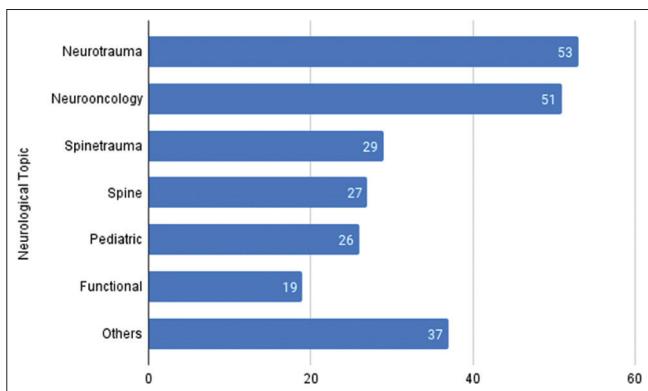


Figure 6: Neurological topic of Indonesian neurosurgeons publications.

current evidence. All these factors still have the potentials to hinder the research process since those aforementioned are the main challenges facing clinical research in Indonesia. To address some challenges, health system recovery must be a top priority in the country's infrastructure-centered agenda.^[5]

Data from the ISNS and Perhimpunan Spesialis Bedah Saraf Indonesia showed that there are only 371 neurosurgeons spread across the country, with a neurosurgeon to population ratio of 1:725,000.^[8] From the data on the center of the study including the city it is in, it was found that there remains a huge disparity in terms of the distribution of neurosurgeons in Indonesia. A study reported that there are five of 34 provinces in Indonesia with no neurosurgeon, consisting of West Sulawesi, Southeast Sulawesi, Maluku, North Maluku, and West Papua.^[16] This can be seen from the results of this study, which showed that there were no published papers that originated from those provinces for decades.

From the top three, the most neurosurgical articles came from Universitas Padjadjaran (22.7%) with an average impact factor (IF) of 1.68, an average Q index of 2.38, and a total citation of 375. It was followed by other four common institutions consisting of Airlangga University (22.3%) with an average IF

of 1.80, an average Q index of 2.33, and a total citation of 315; Pelita Harapan University (12.8%) with an average IF of 1.73, an average Q index of 2.12, and a total citation of 321; Udayana University (9.5%) with an average IF of 1.12, an average Q index of 2.73, and a total citation of 83; and Diponegoro University (5.4%) with an average IF of 1.92, an average Q index of 2, and a total citation of 30. Based on the first author and the amount of publishing, Faried *et al.* ($n = 14$; 5.8%) from Universitas Padjadjaran were found to be the most frequent, followed by Arifin *et al.* ($n = 9$; 3.7%) from Universitas Padjadjaran, Pranata *et al.* ($n = 8$; 3.3%) from Pelita Harapan University, Suryaningtyas *et al.* from Airlangga University, and Arifin *et al.* from Diponegoro University ($n = 7$; 2.9%).

Regarding the published studies, neurotrauma was found to be the most frequent topic, which can be related to the frequency of neurotrauma cases in the country. Neurotrauma, or also commonly known as traumatic brain injury (TBI), is one of the main causes of death not only in low- and middle-income countries (LMICs) but also in high-income countries.^[7] TBI is also associated with high morbidity and mortality rates and high treatment costs. Cases were mainly centered on big cities such as municipalities and provincial capitals in Indonesia, which were also the place for neurosurgical referral centers for their respective regions.^[14] A global pandemic that is COVID-19 has been affecting the country greatly, including neurosurgical care in Indonesia. Neurosurgery departments worldwide have been forced to restructure their training programs due to the COVID-19 pandemic.^[15,17] In this study, topics that were encompassed in COVID-19 had quite a number in 2 recent years, particularly in neurosurgery. In addition, the number of TBI cases has indeed decreased significantly during the pandemic, but after the start of the new normal in Indonesia, traffic flow began to return to normal and increase the number of TBI cases in the neurosurgery centers.^[3]

The article with the most amount of citations was titled "Impact of cerebrovascular and cardiovascular diseases on mortality and severity of COVID-19 systematic review, meta-analysis, and meta-regression" by Pranata *et al.*, which was published in 2020 with a total citation of 166. It was followed by "Consensus statement from the International Consensus Meeting on the Role of Decompressive Craniectomy in the Management of TBI: Consensus statement" (citation of 61) by Hutchinson *et al.* in 2019; "Multiple spinal extradural arachnoid cysts occurring in a child" (citation of 52) by Suryaningtyas *et al.* in 2007; "Delayed Ischemic Stroke after Stent-assisted Coil Placement in Cerebral Aneurysm: Characteristics and Optimal Duration of Preventative Dual Antiplatelet Therapy" (citation of 51) by Hwang *et al.* in 2014; and "Stand-alone Cervical Cages Versus Anterior Cervical Plates in 2-Level Cervical Anterior Interbody Fusion Patients: Analysis of Adjacent Segment Degeneration" (citation of 50) by Ji *et al.* in 2015. According to international collaborators based on the first author's country, about 43 of the first

authors came from overseas and were involved in the research collaboration with Indonesia. The common five countries consisted of Japan ($n = 10$; 4.1%), Korea ($n = 8$), China ($n = 6$; 2.5%), Canada ($n = 3$; 1.2%), and the United States ($n = 3$; 1.2%). The five most common working field with international collaborators were in neuro-oncology ($n = 10$; 4.1%), spine ($n = 10$; 4.1%), functional ($n = 6$; 2.5%), education ($n = 4$; 1.65%), and pediatric ($n = 4$; 1.65%) [Table 1].

Globally, it is estimated that more than 143 million additional surgical procedures are required to prevent mortalities and morbidities. Almost half of these unmet surgical needs can be found in South and Southeast Asia, two regions, where most of the countries are in the LMIC category. If all dimensions of access to surgery (i.e., timeliness, the capacity of workforce and infrastructure, surgical safety, and affordability) are analyzed, slightly more than 90% of the population in Southeast Asia does not have proper access to surgery.^[11] One factor that contributes to the global burden of surgical care is neurosurgical disease.^[4] Like most LMIC, Indonesia has an inadequate supply of surgical and neurosurgical services.^[1,13] Organized neurosurgery (such as the Foundation for International Education in Neurosurgery, the WFNS, the Asian Australasian Society of Neurological Surgeons, the American Association of Neurological Surgeons, the European Society of Pediatric Neurosurgery, and the International Society of Pediatric Neurosurgery) has long been engaged in international neurosurgery education and additional demand for more supply of neurosurgeons is a crucial issue to address.^[10]

The primary aim of a neurosurgical educational program is to prepare the neurosurgeon of the future to provide service to a large number of patients where needed, without compromising the quality of care.^[9] One of many ways to shed light on that matter is through exploring academic productivity which can be seen in the publication of neurosurgical research. The opportunistic approach to enhance the quality and boost our endeavors as a center of excellence in neurosurgical research is to engage in international partnerships, such as international joint academic projects through research collaboration. This technique has been implemented as it can be seen from the results of the study, in which 43 of the papers (17.8%) involved international first authors. The international collaborations took place in various working fields (neuro-oncology, spine, functional, education, pediatric, etc.). It also

helps in mediating countries to share experiences according to each specialty or strong field of the study.^[2]

We are aware that this study has several limitations. First, we only use PubMed as a search engine accessing primarily the MEDLINE database of references and abstracts; some keywords for searching may not cover all, and as the consequence some of the publications will be skipped; thus, we only include the English journal indexed. Second, we only collecting the half-year of 2021 since we do not want to miss the momentum to summarize the last data that we could. Finally, we do not acknowledge the increasing number of neurosurgeons growth over the years, which might contribute to the publication's growth spurt.

CONCLUSION

The number of neurosurgical publications in Indonesia has been showing a higher, promising trend. Despite many challenges faced in the process, there was significant progress in the past few decades compared to the previous decades. A comprehensive deliberate plan and multidisciplinary effort that focuses on overcoming the problems regarding defining academic productivity is needed for further improvement of neurosurgical care in Indonesia.

Authors' contributions

Ahmad Faried and Eko Prasetyo designed and supervised the entire study. Muhammad Kamil, Dilli Marayuzan Akbar Pratam, and Sheila Sumargo searched the database. Dilli Marayuzan Akbar Pratam and Sheila Sumargo extracted data and reported results. Ahmad Faried and Eko Prasetyo and Muhammad Kamil reviewed the report and provided recommendations on the discussion and conclusion. All authors read and approved the final manuscript.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

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Table 1: International collaborators based on first author's country.

First author's country	No. of publications (n)
Japan	Ten published papers
Korea	Eight published papers
China	Six published papers
Canada	Three published papers
United States	Three published papers
Others	Thirteen published papers

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