

# Footprint of reports From Low- and Low- to Middle-Income Countries in the Neurosurgical Data A Study From 2015 to 2017

*by* Franco Servadei

---

**Submission date:** 24-Jul-2020 06:30PM (UTC+0800)

**Submission ID:** 1361553836

**File name:** ountries\_in\_the\_Neurosurgical\_Data\_A\_Study\_From\_2015\_to\_2017.pdf (549.93K)

**Word count:** 6604

**Character count:** 34071



## 8 Footprint of Reports From Low- and Low- to Middle-Income Countries in the Neurosurgical Data: A Study From 2015 to 2017

Franco Servadei<sup>1</sup>, Maria Pia Tropeano<sup>1,2</sup>, Riccardo Spaggiari<sup>1</sup>, Delia Cannizzaro<sup>1</sup>, Asra Al Fauzi<sup>3</sup>, Abdul Hafid Bajamal<sup>3</sup>, Tarik Khan<sup>4</sup>, Angelos G. Koliakos<sup>2,5</sup>, Peter J. Hutchinson<sup>2,5</sup>

**OBJECTIVE:** In 2015, the Lancet Commission on Global Surgery highlighted the disparities in surgical care worldwide. The aim of the present study was to investigate the research productivity of low-income countries (LICs) and low- to middle-income countries (LMICs) in selected journals representing the worldwide neurosurgical data and their ability to report and communicate globally the existing differences between high-income countries (HICs) and LMICs.

**METHODS:** We performed a retrospective bibliometric analysis using PubMed and Scopus databases to record all the reports from 2015 to 2017 by investigators affiliated with neurosurgical departments in LICs and LMICs.

**RESULTS:** A total of 8459 reports by investigators self-identified as members of neurosurgery departments worldwide were identified. Of these, 6708 reports were included in accordance with our method in the final analysis. The systematic search resulted in 459 studies reported by LICs and LMICs. Of these, 334 reports were included for the full text evaluation. Of the 6708 reports, 303 (4.52%) had been reported with an LMIC affiliation and only 31 (0.46%) with an LIC. The leading countries were India with 182 (54.5% among LMICs and LICs; 2.71% overall), followed by Egypt at 66 (19.76% among the LMICs and LICs; 0.98% overall), with a large difference compared with other countries such as Uganda at 9 (2.69% among the LMICs and LICs) and Tunisia and Pakistan at 8 each (2.4% among the

LMICs and LICs). A few reports studies had been generated by collaboration with HIC neurosurgeons.

**CONCLUSIONS:** Our results have shown that research studies from LMICs are underrepresented. Understanding and discussing the reasons for this underrepresentation are necessary to start addressing the disparities in neurosurgical research and care capacity. Future engagements from international journals, more partnership collaboration from HICs, and tailored funding to support investigators, collaborations, and networks could be of help.

### INTRODUCTION

In 2015, the Lancet Commission on Global Surgery highlighted the disparities in surgical care worldwide.<sup>1</sup> Subsequently, the neurosurgical community started giving more attention to the current capacity and deficit in the provision of essential neurosurgical care, focusing, in particular, on low- to middle-income countries (LMICs).<sup>2</sup> Recently, Dewan et al.<sup>3</sup> showed that 44% of neurosurgeons worldwide were based in high-income countries (HICs). An increasing number of studies have reported disparities in epidemiology, patient management, neurosurgical procedures, and complications between HICs and LMICs.<sup>3</sup> Nevertheless, these data have been limited, because the contribution from LMICs to the neurosurgical data

#### Key words

- Developing countries
- Education
- Global neurosurgery
- Literature
- World health

#### Abbreviations and Acronyms

- HIC:** High-income country  
**LIC:** Low-income country  
**LMIC:** Low- to middle-income country  
**TBI:** Traumatic brain injury

From the <sup>1</sup>Department of Neurosurgery, Humanitas Clinical and Research Hospital and Humanitas University, Milan, Italy; <sup>2</sup>National Institute for Health Research Global Health

<sup>25</sup> Research Group on Neurotrauma, University of Cambridge, Cambridge, United Kingdom; <sup>3</sup>Department of Neurosurgery, Dr. Soetomo Academic Medical Center Hospital, University of Airlangga, Surabaya, Indonesia; <sup>4</sup>Department of Neurosurgery, North Western General and Research Hospital, Peshawar, Pakistan; <sup>5</sup>Division of Neurosurgery, Department of Clinical Neurosciences, Addenbrooke's Hospital and University of Cambridge, Cambridge, United Kingdom

To whom correspondence should be addressed: Maria Pia Tropeano, M.D.  
 E-mail: [marpia.tropeano@libero.it](mailto:marpia.tropeano@libero.it)

Citation: *World Neurosurg.* (2019) 130:e822-e830.  
<https://doi.org/10.1016/j.wneu.2019.06.230>

Journal homepage: [www.journals.elsevier.com/world-neurosurgery](http://www.journals.elsevier.com/world-neurosurgery)

Available online: [www.sciencedirect.com](http://www.sciencedirect.com)  
 1878-8750/\$ - see front matter © 2019 Elsevier Inc. All rights reserved.

has been modest. Among the most cited systematic reviews and meta-analyses, no first author from LMICs has been found.<sup>4</sup> Focusing on the reported neurosurgical data, the publication output of LMICs has been very limited. Among the top 20 most publishing countries in the neurosurgical data in 2011, just 1 country (India) belonged to the LMICs or low-income countries (LICs).<sup>5</sup>

Therefore, we conducted a bibliometric analysis of reports from LICs and LMICs to investigate the research productivity of these countries in the worldwide neurosurgical data and their ability to publish and communicate globally the existing differences between HICs and LMICs. In addition, we sought to determine the contribution, in terms of the generation of knowledge, of LMICs and LICs to the neurosurgical data reported in international medical journals and in which LMICs and LICs is this research performed. Moreover, we sought to determine whether the knowledge of the clinical management of neurosurgical disease in these countries could be the basis for any further intervention aimed to improve neurosurgical education and patients care.

35

## MATERIALS AND METHODS

We performed a bibliometric analysis of reports from publicly available databases (i.e., Scopus and PubMed). From 2015 to 2017, Scopus and PubMed studies reported by investigators affiliated with neurosurgical departments in LICs and LMICs were included. This method has been described in part previously.<sup>6,7</sup> The reports indexed by Scopus and PubMed include the author's departmental location (i.e., city, state, country). This field was used to determine the country of origin. The distribution of countries into LIC and LMIC groups was performed using the World Bank classification<sup>8</sup> (Figure 1). Only reports defined as "journal articles" were included (i.e., original research articles, reviews, trials, and other scientific reports). Occasionally, journals report nonscientific information, such as bibliographies, news items, comments, and roll calls of reviewers. These are not indexed as "journal articles" and, thus, were excluded. We chose 14 neurosurgical journals and 3 general medical journals from the Journal of Citation Reports 2015, primarily using ranking according to their impact factor. Those with the highest ranking for medicine (*New England Journal of Medicine*, *Lancet*, and *Journal of the American Medical Association*), neurology and neurosurgery (*Lancet Neurology*, *Journal of American Medical Association Neurology*, *Journal of Neurology*, *Neurosurgery*, and *Psychiatry*), *Journal of Neurosurgery*, *Neurosurgery*, *World of Neurosurgery*, *Acta Neurochirurgica*, *Neurosurgery Focus*, *Neurosurgical Review*), and the journals best representing neurosurgical subspecialties (*Journal of Neurotrauma*, *Journal of Neurosurgery Spine*, *Spine*, *European Spine Journal*, *Stereotactic and Functional Neurosurgery*). Study selection was an iterative process in which the selected abstracts and full texts were initially reviewed to identify and agree on the inclusion criteria. These were then subsequently "tested" and refined through further review. Two of us (M.P.T., R.S.) independently screened the reports included for full-text review, with one of us (F.S.) providing a third review to determine the inclusion or exclusion status in the case of disagreement. Details of the exact search strategy are included in [Supplementary Appendix 1](#).

## LIC and LMIC Productivity

When an article had been reported by >1 author affiliated with neurosurgical departments in LICs and LMICs, the first author affiliation was chosen. If the other authors were affiliated with an LIC or LMIC, but not the first author, we assigned the report to the country with the highest number of authors. In rare cases of uncertainty, the report was reviewed to determine the relevant contribution from each author and country for that specific study.

## Focus by Topic

Analysis of the focus by topic was performed by grouping the MeSH terms according to neurosurgical subspecialty. We classified the collected articles into 9 topics: trauma (further divided into traumatic brain injury [TBI] and spine injury), tumor (further divided into brain tumor and spine tumor, including both malignant conditions [e.g., glioblastoma multiforme] and benign conditions [e.g., cysts and pituitary adenomas]), vascular neurosurgery (e.g., arteriovenous malformations, cerebral aneurysms, subarachnoid hemorrhage, endovascular procedures, cerebral ischemia), functional neurosurgery (e.g., stereotactic radiosurgery, deep brain stimulation, epilepsy, intractable pain), pediatrics (all subspecialties concerning children and adolescents), hydrocephalus (in adults, including studies of endoscopic third ventriculostomy, cerebrospinal fluid shunts), spine (e.g., all nontraumatic pathologic features affecting the spine but excluding tumors), infection (i.e., all reports whose main topic was an infective process), and miscellaneous (i.e., reports of neurosurgical conditions in different hospitals, a history of neurosurgery in specific countries, peripheral nerve pathologic features, central nervous system plasticity, neurosurgical training).

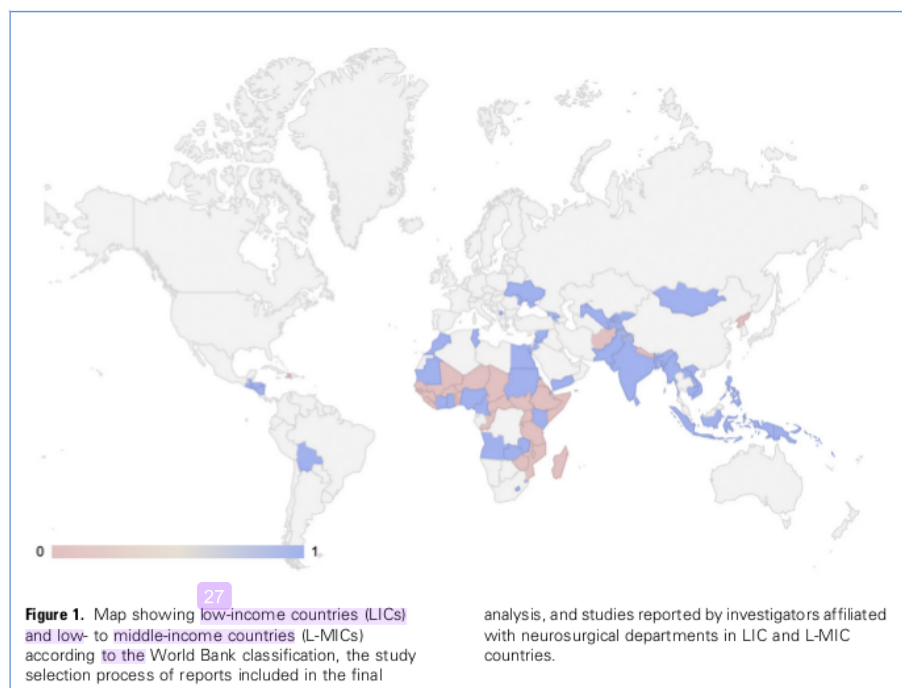
## RESULTS

### LMIC and LIC Productivity

From January 1, 2015 to December 31, 2017, a total of 8459 reports by investigators who had self-identified as members of neurosurgery departments worldwide were identified in 17 journals using our study method. After title and abstract screening, 1751 reports had been eliminated, and 6708 were included in the final analysis. The systematic search resulted in 459 studies reported by LICs and LMIC. After title and abstract screening of these 459 studies, 125 were excluded, leaving 334 studies for full text evaluation. The PRISMA (preferred reporting items for systematic reviews and meta-analyses) method is shown in [Figure 2](#). Of the 6708 studies, 303 (4.52%) had been reported with an LMIC affiliation and only 31 (0.46%) with an LIC ([Figure 3](#)).

The 17 journals containing reports by investigators affiliated with a neurosurgical department in an LMIC or LIC and their 2015 impact factor as assessed using the Journal of Citation Report are listed in [Table 1](#). The leading countries, in terms of contribution, were India with 182 (54.5% of LMICs and LICs; 2.71% overall), followed by Egypt at 66 (19.76% of LMICs and LICs; 0.98% overall), with a large difference compared with the other countries such as Uganda at 9 (2.69% of LMICs and LICs) and Tunisia and Pakistan at 8 each (2.4% each of LMICs and LICs). The contribution to LMIC and LIC research productivity is presented in [Table 2](#). We did not identify any outputs for 54 LICs and LMICs in our analysis.

13



### Focus Stratified by Neurosurgical Subspecialty

Of the 334 studies reported with affiliation to an LMIC or LIC neurosurgical department, most had discussed topics of tumor (24.85%; divided into brain tumor [20.66%] and spine tumor [4.19%]) and trauma (15.87%; divided into TBI [11.08%] and spine injury [4.79%]), followed by spine (15.27%), miscellaneous (14.37%), and vascular (8.98%). The relative contribution of each country to the productivity according to each subspecialty is listed in **Table 3**. We found that India was the leading contributor for reports about TBI, spinal injury, brain tumors, spine tumors, vascular neurosurgery, spine surgery, and infections (51.4%, 43.8%, 59.4%, 78.6%, 43.3%, 68.6%, and 89.5%, respectively). In contrast, the leading contributor for the topic of functional neurosurgery and hydrocephalus in adults was Egypt, accounting for 52.6% and 55.6% of reports. Ethiopia was the greatest contributor in the field of pediatric neurosurgery, accounting for 22.7% of studies, followed by India (18.2%), Egypt (13.6%), and Mozambique and Uganda (9.1% each), with the most discussed topic hydrocephalus in children.

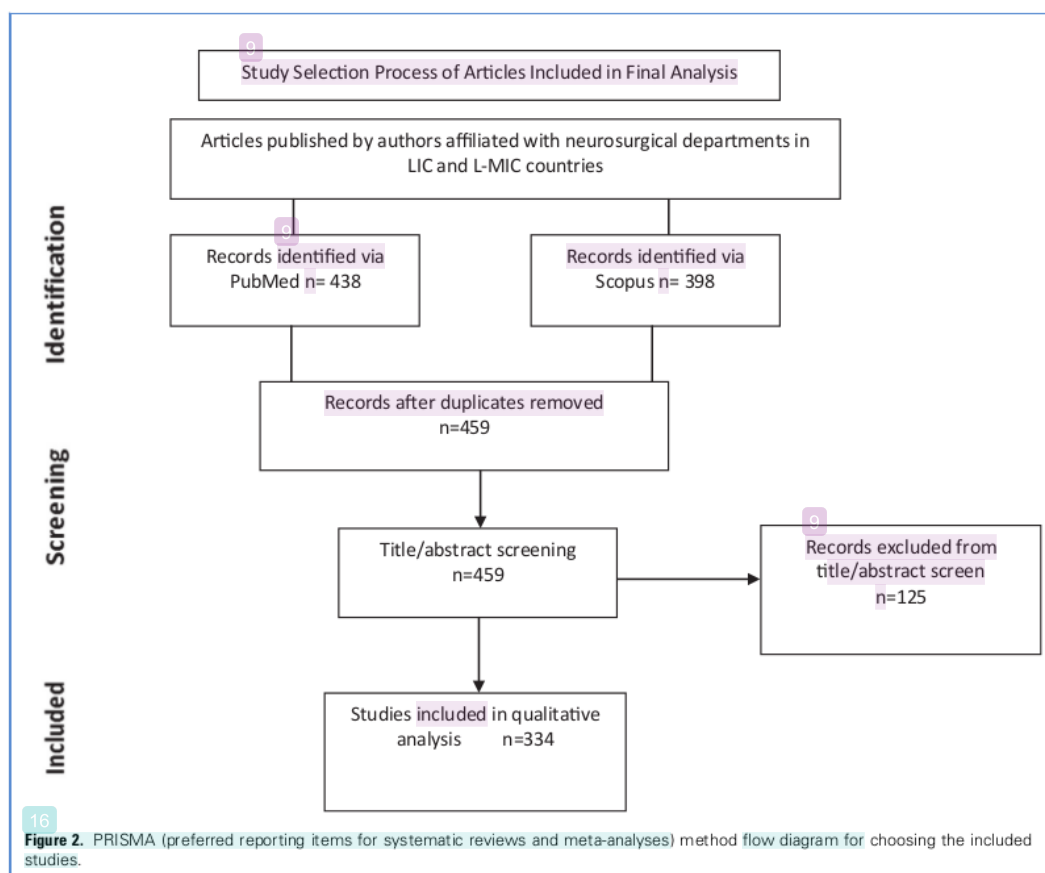
### DISCUSSION

The Lancet Commission on Global Surgery issued a report in 2015, which reported that 5 billion people do not have access to safe, affordable, surgical and anesthetic care in LICs and LMICs, where 9 of 10 people cannot access basic surgical care.<sup>1</sup> The Commission's key findings showed that the human and economic consequences of untreated surgical conditions in LMICs and LICs are large and for many years have been unrecognized. The report concluded that surgery and anesthetic

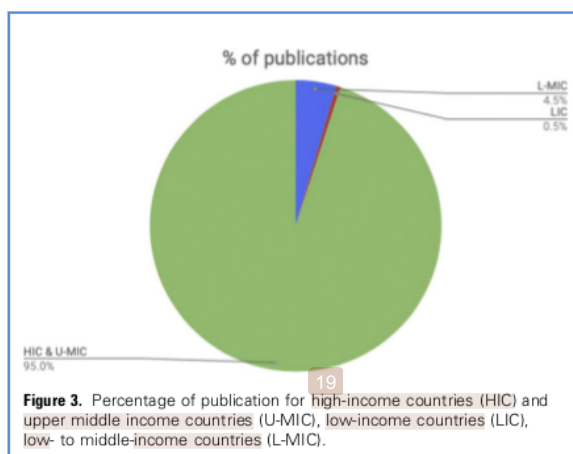
care should be an integral part of a national health system and that urgent investment in human and physical resources for surgical and anesthesia care is needed. Park et al.<sup>8</sup> showed that the worldwide deficits in neurosurgical care are profound and the global effort to ensure safe surgery to all who need it must include the neurosurgical community. The allocation of resources for research in neurosurgery has a direct effect on the progress of health science and the distribution of health. Neurosurgery requires a specific approach that reflects the different realities in LICs and LMICs, including those at the local health system level.<sup>9</sup> This understanding is fundamental to the development of both appropriate health policy and clinical practice. Studies reported in leading journals for neurosurgical practice could help to highlight needs and priorities and demonstrate the effectiveness and, thus, help to implement and develop neurosurgical care in LICs and LMICs. Publications are an indicator of scientific activity in the international scientific community. The number of reported studies and their citations (indirectly reflected in the impact factor) are a useful indicator for assessing the quality and quantity of research and to place them in an international context.<sup>10</sup>

Our analysis showed a clear underrepresentation of LMICs and LICs in the neurosurgical data and, more specifically, in the high-impact neurosurgical journals. Of a total of 6708 printed studies reported by investigators self-identified as members of neurosurgery departments in 17 journals, only 4.5% had been reported with an LMIC affiliation, despite the population of LMICs (3.5 billion) constituting 46% of the global population. These countries have ~7000 neurosurgeons, of whom 3500 are in India. However, this is only 15% of the 50,000 neurosurgeons





worldwide.<sup>3</sup> The situation is even worse for LICs, because only 0.5% of all reports had such an affiliation. This imbalance has been reported in other aspects of biomedical studies, such as the composition of editorial boards of peer-reviewed journals,<sup>11</sup>



reports in psychiatry,<sup>12-14</sup> and hematology,<sup>15</sup> and in the overall contribution of studies reported in high-impact journals.<sup>16</sup> The volume of all neurosurgical reports from Asia, Latin America, and Africa had increased slightly from 2015 to 2017. However, the contribution of LICs and LMICs has remained minimal. In our analysis, the leading LMIC and LIC contributors were India (54.5%), followed by Egypt (19.8%), Uganda (2.7%), and Tunisia and Pakistan (2.4%) representing <5% of the worldwide productivity. A total of 54 LICs and LMICs did not have any reports in our analysis. In addition, without the contribution of Egypt and India, the studies reported by LICs and LMICs would have been less than 1% of the reported neurosurgical studies in the included journals.

From our personal experience, we can report that these disparities between LMICs and HICs are not related to the clinical, surgical, or intellectual capacities of our colleagues but to the lack of time and/or economical resources for any type of research. Whenever a microscope and basic instruments are available, the overwhelming number of patients treated will be an important tool to report the data from large surgical experiences such as in India.<sup>17</sup>

A content analysis of the main research topics showed that most reports had focused on tumors (24.8%), especially brain tumors (20,7%). In contrast, TBI was reported in only 11% of reports and

**Table 1.** List of 17 Journals Containing Reports by Investigators Affiliated with a Neurosurgical Department in Low- to Middle-Income Countries or Low-Income Countries and Their 2015 Impact Factor (Assessed Using the Journal of Citation Report)

Journal Title	Total Documents (n)	Reports From LICs or LMICs (n, %)	Main ISSN	eISSN	Impact Factor (2015)
<i>J Neurol Neurosurg Psychiatry</i>	93	2 (2.15)	0022-3050	1468-330X	6.431
<i>J Neurosurg</i>	900	31 (3.44)	0022-3085	1933-0693	3.443
<i>J Neurotrauma</i>	209	1 (0.48)	0897-7151	1557-9042	4.377
<i>Neurosurgery</i>	403	17 (4.22)	0148-396X	1524-4040	3.780
<i>World Neurosurg</i>	2564	186 (7.25)	1878-8750	1878-8769	2.685
<i>J Neurosurg Spine</i>	372	9 (2.42)	1547-5654	1547-5646	2.126
<i>Spine (Phila Pa 1976)</i>	260	5 (1.92)	0362-2436	1528-1159	2.439
<i>Neurosurg Rev</i>	198	11 (5.56)	0344-5607	1437-2320	2.166
<i>Neurosurg Focus</i>	451	15 (3.33)	1092-0684	1092-0684	2.546
<i>Eur Spine J</i>	234	13 (5.56)	0940-6719	1432-0932	2.132
<i>Stereotact Funct Neurosurg</i>	121	0 (0)	1011-6125	1423-0372	1.691
<i>Acta Neurochir (Wien)</i>	766	40 (5.22)	0001-6268	0942-0940	1.617
<i>N Engl J Med</i>	21	1 (4.76)	0028-4793	1533-4406	59.558
<i>Lancet</i>	16	0 (0)	0140-6736	1474-547X	44.002
<i>JAMA</i>	10	0 (0)	0098-7484	1538-3598	37.684
<i>JAMA Neurol</i>	53	3 (5.66)	2168-6149	2168-6157	8.230
<i>Lancet Neurol</i>	37	0 (0)	1474-4422	1474-4465	23.468

LICs, low-income countries; LMICs, low- to middle-income countries; ISSN, international standard serial number; eISSN, electronic international standard serial number.

pediatric neurosurgery, including hydrocephalus, in 9%. Data from the recently reported survey by Dewan et al.<sup>3</sup> have shown that most of the neurosurgical workload in the LICs and LMICs has concerns trauma and pediatric patients. Therefore, a discrepancy exists between the actual workload and publication output. The only exception was the pediatric reports from Uganda and Ethiopia, which were probably driven by collaboration with American<sup>18</sup> and Norwegian<sup>19</sup> universities. Various reasons could be responsible this, including a perception of “what is important.” In general, the neurosurgical data have been dominated by the description of sophisticated surgical techniques and diagnostic modalities. Such studies certainly have a role to play in advancing neurosurgery, especially in advanced healthcare systems, although they will not necessarily

**Table 2.** Contribution to Low- to Middle-Income Countries or Low-Income Countries Research Productivity in Reported Neurosurgical Data

Country	Reports (n)			Documents Worldwide (%)	Reports From LICs and LMICs (%)
	2015	2016	2017		
Armenia	0	0	1	0.02	0.30
Bangladesh	1	2	2	0.08	1.50
Bolivia	0	2	0	0.03	0.60
Cambodia	1	1	2	0.06	1.20
Egypt	16	25	25	0.98	19.76
Ghana	1	1	0	0.03	0.60
Guatemala	1	0	0	0.02	0.30
India	41	69	72	2.71	54.49
Indonesia	0	2	3	0.08	1.50
Kenya	0	2	1	0.05	0.90
Moldova	1	0	2	0.05	0.90
Nigeria	0	0	3	0.05	0.90
Palestine	0	1	2	0.05	0.90
Pakistan	0	4	4	0.12	2.40
Papua New Guinea	0	0	1	0.02	0.30
Philippines	2	0	0	0.03	0.60
Sudan	0	0	1	0.02	0.30
Tunisia	2	4	2	0.12	2.40
Ukraine	0	2	0	0.03	0.60
Uzbekistan	0	0	1	0.02	0.30
Benin	1	0	0	0.02	0.30
Chad	0	1	0	0.02	0.30
Ethiopia	2	3	2	0.10	2.10
Haiti	0	1	0	0.02	0.30
Mozambique	1	0	1	0.03	0.60
Nepal	2	1	0	0.05	0.90
Rwanda	0	1	2	0.05	0.90
Tanzania	0	3	0	0.05	0.90
Togo	0	1	0	0.02	0.30
Uganda	1	2	6	0.13	2.69

LICs, low-income countries; LMIC, low- to middle-income countries.

advance the care of patients in need of neurosurgery in LMICs. However, it is often the case that what is considered “obvious” or “mundane” will not be reported. In the guidelines for surgery for TBI,<sup>20</sup> no high-quality evidence for large hematoma evacuation is available. We realized that the surgical indications in these countries might be quite different from those in HICs, such as cranial decompression,<sup>21</sup> skull base tumors,<sup>22</sup> and, in general,

Table 3. Contribution of Each Country for Different Neurosurgical Topics

Country	Trauma (%)			Tumor (%)			Functional (%)	Pediatrics (%)	Hydrocephalus (%)	Spine (%)	Infection (%)	Miscellaneous (%)
	Brain	Spine	Brain	Brain	Spine	Spine						
Armenia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08
Bangladesh	5.41	0.00	0.00	0.00	0.00	0.00	4.55	11.11	1.96	0.00	0.00	0.00
Bolivia	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.00	2.08
Cambodia	5.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.17
Egypt	8.11	18.75	30.43	0.00	36.67	52.63	13.64	55.56	9.80	0.00	0.00	10.42
Ghana	0.00	0.00	0.00	0.00	0.00	0.00	4.55	0.00	1.96	0.00	0.00	0.00
Guatemala	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08
India	51.35	43.75	59.42	78.57	43.33	42.11	18.18	33.33	68.63	89.47	50.00	
Indonesia	2.70	6.25	0.00	0.00	0.00	0.00	0.00	0.00	1.96	0.00	0.00	4.17
Kenya	0.00	6.25	0.00	0.00	0.00	0.00	0.00	0.00	1.96	0.00	0.00	2.08
Moldova	2.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.17
Nigeria	0.00	6.25	0.00	0.00	0.00	0.00	4.55	0.00	0.00	0.00	5.26	0.00
Palestine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.96	0.00	0.00	4.17
Pakistan	2.70	0.00	0.00	0.00	3.33	0.00	4.55	0.00	7.84	0.00	0.00	2.08
Papua New Guinea	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Philippines	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.00	2.08
Sudan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.96	0.00	0.00	0.00
Tunisia	2.70	0.00	4.35	21.43	0.00	0.00	4.55	0.00	0.00	0.00	0.00	0.00
Ukraine	0.00	6.25	0.00	0.00	0.00	5.26	0.00	0.00	0.00	0.00	0.00	0.00
Uzbekistan	0.00	0.00	1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benin	2.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chad	0.00	0.00	0.00	0.00	0.00	0.00	4.55	0.00	0.00	0.00	0.00	0.00
Ethiopia	0.00	6.25	0.00	0.00	0.00	0.00	22.73	0.00	0.00	0.00	0.00	2.08
Haiti	0.00	0.00	1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mozambique	0.00	0.00	0.00	0.00	0.00	0.00	9.09	0.00	0.00	0.00	0.00	0.00
Nepal	2.70	0.00	1.45	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rwanda	2.70	6.25	0.00	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tanzania	5.41	0.00	1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Togo	2.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uganda	2.70	0.00	0.00	0.00	0.00	0.00	9.09	0.00	1.96	5.26	0.00	8.33

brain tumors.<sup>33</sup> Moreover, some aspects of neurosurgery in LMICs cannot be compared with those in HICs, simply because of the substantial cost of devices (e.g., a flow diverter),<sup>24,25</sup> making their use prohibitive in LMICs.

After analyzing our results and the reported data, we can suggest several hypotheses for the very low representation of reports from LMICs and LICs. As reported by Servadei et al.,<sup>9</sup> neurosurgical diseases have an enormous effect on society but have not been a priority for governmental or private support. A general obstacle in the research by LMICs and LICs has been the restricted research capacity, including limited institutional and regulatory frameworks, limited infrastructure, low funding, and limited numbers of personnel trained to conduct and report research.<sup>8,9,26</sup> Moreover, it is possible that the themes selected by investigators in LMICs and LICs do not attract interest and might be considered irrelevant to readers who do not work in LMICs or LICs. It is also possible that investigators from LMICs and LICs prefer to report in local and/or regional journals. However, our analysis did not include such neurosurgical journals, because we chose to focus on the “higher impact” journals.

We believe that no intervention is possible without available data; therefore, if we need to improve the quality of care for neurosurgical patients in LMICs, it will be fundamental to better develop and consolidate their research capacity. A series of experiences have been reported after data collection with the help of associated American universities, such as the Cornell University in Tanzania,<sup>27</sup> Duke University in Uganda,<sup>25,26,28</sup> and Harvard University in Cambodia.<sup>29,30</sup> Also studies were reported in collaboration with European universities such as Norwegian universities in Ethiopia<sup>29</sup> and Italian and/or Spanish universities in East Africa.<sup>31</sup> Moreover, China also has African collaborations, such as in Ghana.<sup>32</sup> These are only a few examples of the work performed in Africa by many institutions. These studies represent the result of voluntary-based collaboration between academic neurosurgical institutions from HICs and universities in Africa and Asia. In all these cases, neurosurgical data collection was promoted mainly in the context of an exchange of surgeons who had been primarily focused on implementing on-site surgical activities. The data were jointly reported by the 2 institutions but often with a limited number of investigators from the LMIC. Obviously, important exceptions exist<sup>33</sup>; however, the overarching principle should be the increase in the local research capacity.

We believe that neurosurgeons and researchers in HICs should be seeking to develop equitable partnerships with neurosurgeons and researchers from LMICs to strengthen the research capacity in the LMICs. Policy makers, funding agencies, and universities in HICs can help by creating a healthy environment for such collaborations by recognizing the role of HICs in advancing the care for patients in LMICs, directing the necessary funds, and overcoming institutional barriers.<sup>34</sup> For example, in 2017, the UK Department of Health funded the establishment of multicountry groups and units, with a total of £162 million to stimulate healthcare research that should directly benefit patients in LMICs. Approximately, £1.8 million was awarded for the establishment of the National Institute for Health Research Global Health Research Group on Neurotrauma, which brings together clinicians and researchers from 11 LMICs and 3 HICs. The group has mainly sought to build high-quality, sustainable,

**Table 4.** Suggestions to Improve Access to Journals by Low- to Middle-Income Country Neurosurgeons

Suggestions to Improve Access to Journals
An agreement by neurosurgery journal editors that to advance neurosurgery worldwide, a commitment to publish methodologically sound reports from LMICs is needed; novelty should not be a prerequisite
Broadening of participation of surgeons from LMICs on editorial boards
Online research method training for neurosurgeons from LMICs
Development of a system of “research mentors” specifically for surgeons from LMICs
LMICs, low- to middle-income countries.

research programs in the participating LMICs, because these are considered necessary to address the reported disparities in neurosurgical care.<sup>34</sup> To achieve this, the group has partnered with the British Medical Journal Research to Publication program<sup>35</sup> and is offering education for online research methods for the staff in all participating institutions. We believe that a multifaceted approach will be required to improve the situation; some suggestions are listed in Table 4.

#### 15 Study Limitations

When interpreting the results of the present study, several limitations should be remembered. First, the present study was limited to studies reported within 3 years (2015–2017) indexed within the PubMed and Scopus databases, which do not encompass all types of research. Specifically, meeting abstracts, letters, comments, and unpublished halted and/or terminated studies would not have been captured, representing a potential source of bias. Second, using the departmental affiliation and country of origin represents another consideration. Cases in which neurosurgeons were involved but whose department was not reported would not have been included. This could be of particular concern in multidisciplinary areas of neurosurgery. We are aware that many humanitarian initiatives have not been included in our report, which was intended to raise awareness of the magnitude of the problem and not to be a comprehensive review of neurosurgery practice in LMICs. We also did not include in our review the smaller local and regional neurosurgical journals and non-English journals, because we had chosen to assess the footprint of LMICs and LICs in the higher impact journals. This choice could have been a limitation of our study; however, our aim was not the revision of every reported study but to determine the influence of these countries on the best international neurosurgical data.

#### CONCLUSIONS

The fast development of neurosurgery in high-income settings has not been followed by the same rate of growth in middle- or poor-income settings. Research studies from a major part of the global population have remained underrepresented in the higher impact neurosurgical journals. Understanding and discussing the reasons for this underrepresentation are necessary to start addressing the



disparities in neurosurgical research capacity and care. New strategies should be developed to resolve this vicious circle in which poor outputs results from and contributes to limited support for research. The development of appropriate practices in

neurosurgical care in LMICs and LICs requires research and, hence, resources and engagement from international journals, partnership collaborations from HICs, and tailored funding to support investigators, collaborations, and networks.

## REFERENCES

- Meara JG, Hagander L, Leather AJM. Surgery and global health: a lancet commission. *Lancet*. 2014; 383:12-13.
- The World Bank. The global economy: heightened tensions, subdued growth. Available at: <http://www.worldbank.org/>. Accessed January 14, 2018.
- Dewan MC, Rattani A, Fieggen G, et al. Global neurosurgery: the current capacity and deficit in the provision of essential neurosurgical care. Executive summary of the global neurosurgery initiative at the program in global surgery and social change. *J Neurosurg*. 2018;1-10.
- Uthman OA, Okwundu CI, Wiysonge CS, Young T, Clarke A. Citation classics in systematic reviews and meta-analyses: who wrote the top 100 most cited articles? *PLoS One*. 2013;8:e78517.
- Hauptman JS, Chow DS, Martin NA, Itagaki MW. Research productivity in neurosurgery: trends in globalization, scientific focus, and funding. *J Neurosurg*. 2001;115:1262-1272.
- Chow DS, Itagaki MW. Interventional oncology research in the United States: slowing growth, limited focus, and a low level of funding. *Radiology*. 2010;257:410-417.
- Cruccu G, Deuschl G, Federico A. Scientific publications of European neurologists: a survey commissioned by the European Academy of Neurology. *Eur J Neurol*. 2018;25:1128-1133.
- Park KB, Johnson WD, Dempsey RJ. Global neurosurgery: the unmet need. *World Neurosurg*. 2016;88:32-35.
- Servadei F, Rossini Z, Nicolosi F, Morselli C, Park KB. The role of neurosurgery in countries with limited facilities: facts and challenges. *World Neurosurg*. 2018;112:315-321.
- King DA. The scientific impact of nations. *Nature*. 2004;430:311-316.
- Horton R. Medical journals: evidence of bias against the diseases of poverty. *Lancet*. 2003;361:712-713.
- Saxena S, Paraje G, Sharan P, Karam G, Sadana R. The 10/90 divide in mental health research: trends over a 10-year period. *Br J Psychiatry*. 2006;188:81-82.
- Patel V, Kim YR. Contribution of low- and middle-income countries to research published in leading general psychiatry journals, 2002-2004. *Br J Psychiatry*. 2007;190:77-78.
- Patel V, Sumathipala A. International representation in psychiatric literature: survey of six leading journals. *Br J Psychiatry*. 2001;178:406-409.
- Morimoto T, Rahman M, Fukui T. International comparison of research productivity in hematology. *Int J Hematol*. 2003;77:192-195.
- Sumathipala A, Siribaddana S, Patel V. Underrepresentation of developing countries in the research literature: ethical issues arising from a survey of five leading medical journals. *BMC Med Ethics*. 2004;5:E5.
- Goel A, Kothari M. Academics and Indian neurosurgery. *World Neurosurg*. 2013;79:632-635.
- Haglund MM, Warf B, Fuller A, et al. Past, present, and future of neurosurgery in Uganda. *Neurosurgery*. 2017;80:656-661.
- Lund-Johansen M, Laeke T, Tirsit A, et al. An Ethiopian training program in neurosurgery with Norwegian support. *World Neurosurg*. 2017;99:403-408.
- Carney N, Totten AM, O'Reilly C, et al. Guidelines for the management of severe traumatic brain injury, fourth edition. *Neurosurgery*. 2017;80:6-15.
- Adeleye AO, Olusanya AA. Single-stage surgical reconstruction of posttraumatic compound complex fronto-basal cranial vault fracture in a resource-limited practice. *J Craniofac Surg*. 2016;27:1302-1305.
- Adeleye AO, Fasunla JA, Young PH. Skull base surgery in a large, resource-poor, developing country with few neurosurgeons: prospects, challenges, and needs. *World Neurosurg*. 2012;78:35-43.
- Helal AE, Abouzahra H, Fayed AA, Rayan T, Abbassy M. Socioeconomic restraints and brain tumor surgery in low-income countries. *Neurosurg Focus*. 2018;45:E11.
- Walcott BP, Stapleton CJ, Choudhri O, Patel AB. Flow diversion for the treatment of intracranial aneurysms. *JAMA Neurol*. 2016;73:1002-1008.
- Twitchell S, Abou-Al-Shaar H, Reese J, et al. Analysis of cerebrovascular aneurysm treatment cost: retrospective cohort comparison of clipping, coiling, and flow diversion. *Neurosurg Focus*. 2018; 44:E3.
- Langer A, Diaz-Olavarrieta C, Berdichevsky K, Villar J. Why is research from developing countries underrepresented in international health literature, and what can be done about it? *Bull World Health Organ*. 2004;82:802-803.
- Smart LR, Mangat HS, Issarow B, et al. Severe traumatic brain injury at a tertiary referral center in Tanzania: epidemiology and adherence to Brain Trauma Foundation guidelines. *World Neurosurg*. 2017;105:238-248.
- Vaca SD, Kuo BJ, Nickenig Vissoci JR, et al. Temporal delays along the neurosurgical care continuum for traumatic brain injury patients at a tertiary care hospital in Kampala, Uganda. *Neurosurgery*. 2019;84:95-103.
- Chua MH, Hong R, Rydeth T, et al. Spine trauma as a component of essential neurosurgery: an outcomes analysis from Cambodia. *World Neurosurg*. 2018;114:375-380.
- Peeters S, Blaine C, Vycheth I, Nang S, Vuthy D, Park KB. Epidemiology of traumatic brain injuries at a major government hospital in Cambodia. *World Neurosurg*. 2017;97:580-589.
- Spanu F, Piquer J, Panciani PP, Qureshi MM. Practical challenges and perspectives for the development of neurosurgery in a peripheral East African hospital during a one-volunteer midterm mission. *World Neurosurg*. 2018;111: 326-334.
- Yang X, Richard SA, Lei C, Liu J, Huang S. Spinal extradural angioliopoma: a report of two cases and review of literature. *J Spine Surg*. 2018;4:490-495.
- Kulkarni AV, Schiff SJ, Mbabazi-Kabachelor E, et al. Endoscopic treatment versus shunting for infant hydrocephalus in Uganda. *N Engl J Med*. 2017;377:2456-2464.
- Kolias AG, Rubiano AM, Figaji A, Servadei F, Hutchinson PJ. Traumatic brain injury: global collaboration for a global challenge. *Lancet Neurol*. 2019;18:136-137.
- Research to Publication. Strengthening research output. Available at: <https://rtpop.bmj.com/>. Accessed May 4, 2019.

*Conflict of interest statement: Angelos Kolias and Peter Hutchinson are supported by the National Institute for Health Research (NIHR) Cambridge Biomedical Research Centre and the NIHR Global Health Research Group on Neurotrauma. Peter Hutchinson is also supported by a NIHR Research Professorship. The NIHR Global Health Research Group on Neurotrauma was commissioned by the United Kingdom NIHR using Official Development Assistance funding (project no. 16/137/105). The views expressed in this manuscript are those of the authors and are not necessarily those of the United Kingdom National Health Service, NIHR, or the Department of Health. The remaining authors declare that the article content was composed in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.*

Received 7 June 2019; accepted 29 June 2019

Citation: *World Neurosurg*. (2019) 130:e822-e830. <https://doi.org/10.1016/j.wneu.2019.06.230>

Journal homepage: [www.journals.elsevier.com/world-neurosurgery](http://www.journals.elsevier.com/world-neurosurgery)

Available online: [www.sciencedirect.com](http://www.sciencedirect.com)

1878-8750/\$ - see front matter © 2019 Elsevier Inc. All rights reserved.

### SUPPLEMENTARY APPENDIX 1

We searched Scopus using the following string: (AFFILCOUNTRY (country name) AND AFFILORG (neurosurgery) AND DOCTYPE (ar) AND PUBYEAR = 2015). We changed the country name (checking all the countries listed as affiliated to the low-income country [LIC] and low- to middle-income country [LMIC] on the World Bank website) in the field AFFILCOUNTRY and the years 2015, 2016, and 2017 in the PUBYEAR field. Only documents from the 17 journals of interest were included among the overall results.

We searched PubMed using the following string: (((((((((((((((("Journal of neurology, neurosurgery, and psychiatry"[Journal])) OR "Journal of neurosurgery"[Journal]) OR "World

neurosurgery"[Journal]) OR "Neurosurgery"[Journal]) OR "Journal of neurosurgery, Spine"[Journal]) OR "Spine"[Journal]) OR "Journal of neurotrauma"[Journal]) OR ("European spine journal: official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society"[Journal])) OR "Neurosurgical review"[Journal]) OR "Neurosurgical focus"[Journal]) OR "Acta neurochirurgica"[Journal]) OR ("Stereotactic and functional neurosurgery"[Journal])) OR "The New England journal of medicine"[Journal]) OR "JAMA neurology"[Journal]) OR "The Lancet Neurology"[Journal]) OR "JAMA"[Journal]) OR "Lancet (London, England)"[Journal]) AND neurosurgery[Affiliation]) AND country name [Affiliation]). The filters used were journal article and customized year.

# Footprint of reports From Low- and Low- to Middle-Income Countries in the Neurosurgical Data A Study From 2015 to 2017

## ORIGINALITY REPORT

19%

SIMILARITY INDEX

13%

INTERNET SOURCES

18%

PUBLICATIONS

0%

STUDENT PAPERS

## PRIMARY SOURCES

- 1 Jason S. Hauptman. "Research productivity in neurosurgery: trends in globalization, scientific focus, and funding : A review", Journal of Neurosurgery, 08/26/2011 3%

Publication
- 2 Franco Servadei, Zefferino Rossini, Federico Nicolosi, Carlotta Morselli, Kee B. Park. "The Role of Neurosurgery in Countries with Limited Facilities: Facts and Challenges", World Neurosurgery, 2018 2%

Publication
- 3 [www.repository.cam.ac.uk](http://www.repository.cam.ac.uk) 2%

Internet Source
- 4 [hdl.handle.net](http://hdl.handle.net) 1%

Internet Source
- 5 Angelos G Koliaas, Andres M Rubiano, Anthony Figaji, Franco Servadei, Peter J Hutchinson. "Traumatic brain injury: global collaboration for a global challenge", The Lancet Neurology, 2019 1%

---

6	James Richard Bean. "International Neurosurgical Care: Attending to Those in Need", World Neurosurgery, 2018 Publication	1%
7	www.science.gov Internet Source	1%
8	www.lib.unair.ac.id Internet Source	1%
9	Reem D. Almutairi, Ivo S. Muskens, David J. Cote, Mark D. Dijkman et al. "Gross total resection of pituitary adenomas after endoscopic vs. microscopic transsphenoidal surgery: a meta-analysis", Acta Neurochirurgica, 2018 Publication	1%
10	www.lstmed.ac.uk Internet Source	1%
11	bulletin.facs.org Internet Source	<1%
12	thejns.org Internet Source	<1%
13	"Contents", World Neurosurgery, 2019 Publication	<1%
14	www.ajronline.org Internet Source	<1%

---



15

[surgicalneurologyint.com](http://surgicalneurologyint.com)

Internet Source

<1%

---

16

[res.mdpi.com](http://res.mdpi.com)

Internet Source

<1%

---

17

Cohen, E.. "An absence of pediatric randomized controlled trials in general medical journals, 1985-2004", *Journal of Clinical Epidemiology*, 200702

Publication

<1%

---

18

Bin Xu, Hongyu Meng, Shiji Qin, Yueju Liu, Zhiyong Li, Junming Cao, Yongsheng Lin, Yingze Zhang, Zhihong Wang. "How international are the editorial boards of leading spine journals? A STROBE-compliant study", *Medicine*, 2019

Publication

<1%

---

19

[stats.oecd.org](http://stats.oecd.org)

Internet Source

<1%

---

20

[creativecommons.org](http://creativecommons.org)

Internet Source

<1%

---

21

G. Cruccu, G. Deuschl, A. Federico. "Scientific publications of European neurologists: a survey commissioned by the European Academy of Neurology", *European Journal of Neurology*, 2018

Publication

<1%

---

22 Maria Pia Tropeano, Riccardo Spaggiari, Hernán Ileyassoff, Kee B. Park et al. "A comparison of publication to TBI burden ratio of low- and middle-income countries versus high-income countries: how can we improve worldwide care of TBI?", *Neurosurgical Focus*, 2019  
Publication

---

23 Alireza Mansouri, Jerry C. Ku, Kathleen J. Khu, Muhammad R. Mahmud et al. "Exploratory Analysis into Reasonable Timeframes for the Provision of Neurosurgical Care in Low- and Middle-Income Countries", *World Neurosurgery*, 2018  
Publication

---

24 Jason Yuen. "Comparison of Impact Factor, Eigenfactor Metrics, and SCimago Journal Rank Indicator and h -index for Neurosurgical and Spinal Surgical journals", *World Neurosurgery*, 2018  
Publication

---

25 [journals.plos.org](http://journals.plos.org)  
Internet Source

---

26 [docplayer.com.br](http://docplayer.com.br)  
Internet Source

---

27 [www.preventionweb.net](http://www.preventionweb.net)  
Internet Source

28

[www.angelo Franzini.com](http://www.angelo Franzini.com)

Internet Source

<1%

29

Bilal Abou El Ela Bourquin, Sujit Gnanakumar, Michael F. Bath, Tom Bashford, David K Menon, Peter J Hutchinson. "The international health elective: a stepping stone for tomorrow's global surgeons and anaesthetists", Perspectives on Medical Education, 2018

Publication

<1%

30

Maria Pia Tropeano, Riccardo Spaggiari, Hernán Ileyassoff, Delisile J.D. Mabunda et al. "Traumatic Spine Injury: Which Discrepancy Between the Research Output and the Actual Burden of the Disease?", World Neurosurgery, 2020

Publication

<1%

31

[maryland.ccproject.com](http://maryland.ccproject.com)

Internet Source

<1%

32

[jpma.org.pk](http://jpma.org.pk)

Internet Source

<1%

33

[www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)

Internet Source

<1%

34

[journals.lww.com](http://journals.lww.com)

Internet Source

<1%

35

[dns2.asia.edu.tw](http://dns2.asia.edu.tw)

<1%

36

"CAEP/ACMU 2014 Scientific Abstracts, May 31 to June 4, 2014, Ottawa, Ontario", CJEM, 2015

Publication

<1%

37

Christos Gogos, Konstantinos Kodonas, Anastasia Fardi, Nikolaos Economides. "Top 100 cited systematic reviews and meta-analyses in dentistry", Acta Odontologica Scandinavica, 2019

Publication

<1%

38

[link.springer.com](http://link.springer.com)

Internet Source

<1%

39

"EANM'16", European Journal of Nuclear Medicine and Molecular Imaging, 2016

Publication

<1%

40

Laura Dean, Stefanie Gregorius, Imelda Bates, Justin Pulford. "Advancing the science of health research capacity strengthening in low-income and middle-income countries: a scoping review of the published literature, 2000–2016", BMJ Open, 2017

Publication

<1%

41

Hannah K. Weiss, Roxanna M. Garcia, Jesutofunmi A. Omiye, Dominique Vervoort et al. "A Systematic Review of Neurosurgical Care

<1%



# in Low-Income Countries", World Neurosurgery: X, 2020

Publication

---

---

Exclude quotes      On

Exclude matches      Off

Exclude bibliography      On

# Footprint of reports From Low- and Low- to Middle-Income Countries in the Neurosurgical Data A Study From 2015 to 2017

---

## GRADEMARK REPORT

---

FINAL GRADE

**/100**

GENERAL COMMENTS

**Instructor**

---

PAGE 1

---

PAGE 2

---

PAGE 3

---

PAGE 4

---

PAGE 5

---

PAGE 6

---

PAGE 7

---

PAGE 8

---

PAGE 9

---