



Seizure and epilepsy publication in nonneurology journals

Victoria S.S. Wong^{a,b,*}, Matthew Stevenson^c, Jared Mott^d, Kinshuk Sahaya^{e,f}

^a Department of Medicine, John A. Burns School of Medicine at the University of Hawai'i at Mānoa, Honolulu, HI, United States of America

^b Neuroscience Institute, The Queen's Medical Center, Honolulu, HI, United States of America

^c MultiCare Neuroscience Center of Washington, Puyallup, WA, United States of America

^d Mary Bridge Children's Neurology Clinic, Tacoma, WA, United States of America

^e Department of Neurology, University of Arkansas for Medical Sciences, Little Rock, AR, United States of America

^f Minnesota Epilepsy Group, P.A., St. Paul, MN, United States of America

ARTICLE INFO

Article history:

Received 12 December 2018

Revised 23 January 2019

Accepted 23 January 2019

Available online 16 February 2019

Keywords:

Seizures

Epilepsy

Publishing

Neurology

Interdisciplinary communication

Intersectoral collaboration

ABSTRACT

Purpose: The prevalence and characteristics of seizure and epilepsy research published in nonneurology journals are unknown. Characterizing this published research allows for insight into the relevance of seizures and epilepsy in other specialties and may increase opportunity for cross-specialty collaboration.

Methods: In this observational study, we reviewed the top five highly cited clinical journals within eleven specialties in the InCites Journal Citation Reports (JCR) database (2016). For each specialty, we collected 2013–2017 PubMed data on publications with *MeSH Major Topic* of “seizures,” “epilepsy,” or “status epilepticus.” Medical subject headings (MeSH) in PubMed are standardized terms assigned by subject analysts. *MeSH Major Topic* identifies articles in which a specified topic is the major focus of the article. We also retrieved author country and medical specialty affiliations. We analyzed whether author specialty affiliation was 1) concordant with journal medical specialty, 2) neurology-related, or 3) other.

Results: Articles on “seizures,” “epilepsy,” or “status epilepticus” had the following prevalence in specialty clinical journals: cardiac and cardiovascular systems (0.01%); clinical neurology (5.34%); critical care medicine (0.20%); emergency medicine (0.47%); general and internal medicine (0.44%); neuroimaging (2.05%); neurosurgery (2.23%); obstetrics and gynecology (0.16%); oncology (0.01%); pediatrics (0.69%); and psychiatry (0.23%). Within general and internal medicine, neuroimaging, and pediatrics, seizure-related articles are more likely to be first-authored by someone with a neurology-related affiliation. Within critical care medicine, emergency medicine, neurosurgery, and obstetrics and gynecology, seizure-related articles were more likely to be first-authored by someone whose affiliation is within the field.

Conclusions: Our study characterizes seizure and epilepsy research published in nonneurology journals. We found that there is a paucity of such research published in nonneurology journals, whether authored by neurologists or other specialists. This is not ideal since nonneurologists are often first-line providers for recognizing, diagnosing, or managing seizures prior to assessment by a neurologist. Cross-specialty collaboration should be strongly encouraged in clinical research.

© 2019 Elsevier Inc. All rights reserved.

1. Introduction

The importance of cross-disciplinary research collaboration in science is gaining attention [1–3]. In clinical research, cross-specialty research collaborations are essential, given the scope of diseases and conditions that affect multiple organ systems and require multispecialty attention. Cross-specialty collaborations can lead to broader consensus guidelines [4], question prior beliefs held by individual specialties [5], draw attention to specific patient populations [6], provide insight into

differing research methodologies among specialties [7], and generally provide a much needed multiperspectival examination of gaps in knowledge and medical problems to be solved. As with the parable of the blind men and the elephant, multiple perspectives are needed to achieve the solution.

Seizures and epilepsy are primarily treated by and researched by neurologists and epileptologists, but a wide gamut of providers in numerous medical and surgical specialties come into contact with patients who have seizures and epilepsy. Seizures occur acutely and chronically, in inpatient and outpatient settings, triggered by a variety of etiologies such as toxic/metabolic states, autoimmune conditions, infection, and structural brain lesions. Epilepsy can occur in individuals of all ages. Psychogenic nonepileptic seizures intersect with psychiatric comorbidity. Despite the diversity of seizure and epilepsy presentation, there is little

Abbreviations: MeSH, medical subject headings; JCR, Journal Citation Reports.

* Corresponding author at: The Queen's Medical Center Neuroscience Institute, 1301 PUNCHBOWL ST., QET5, HONOLULU, HI 96813, UNITED STATES OF AMERICA.

E-mail address: wongvict@hawaii.edu (V.S.S. Wong).

known about whether nonneurologist clinicians are researching and publishing on seizures and epilepsy.

In 2012, The Institute of Medicine published a report titled “Epilepsy Across the Spectrum: Promoting Health and Understanding” [8]. Within epilepsy care, “co-management for patients with comorbid conditions whose care may cross specialty boundaries” was emphasized as a priority in the report. Additionally, among research priorities, there was mention of cross-specialty care including development of decision support tools for primary care and emergency room providers, improved coordination with providers caring for comorbid health conditions, and timely referral to surgery and mental health services. Although the 17-member committee that authored the report consisted of an interdisciplinary team of “members with expertise in epilepsy care, health services research, epidemiology, public health surveillance, mental health services, health care services and delivery, health literacy, public health, education, and communications,” [8] the presence of cross-specialty physician collaborators was notably absent.

Our study aimed to broadly characterize the prevalence of published research on seizures and epilepsy in nonneurology journals. Examination of this published research allows for insight into the relevance of seizures and epilepsy in other specialties and may increase opportunity for cross-specialty collaboration.

2. Materials and methods

We evaluated the top five journals within each of nine clinical specialties based on the number of total citations found in the 2016 InCites Journal Citation Reports (JCR) [9]. Specialties (as categorized by the JCR) included cardiac and cardiovascular systems; clinical neurology; critical care medicine; emergency medicine; medicine, general and internal; neuroimaging; obstetrics and gynecology; oncology; pediatrics; and psychiatry. We additionally included neurosurgery journals (separating them out from the clinical neurology category) out of interest though it was not a specifically defined JCR category. We chose to review only “clinically relevant” journals, defined by previously reported criteria [10]. Journals were also excluded if they were felt to be subspecialized in a way that was not clearly representative of their broad category (e.g., *Pain* journal under the category of clinical neurology, *Journal of Pediatric Surgery* under the category of pediatrics); encompassed several specialties (e.g., *Journal of Neurology, Neurosurgery, and Psychiatry*); or had a weak link to seizures (e.g., spine journals were excluded from the neurosurgery category). Journals reviewed are listed in Table 1.

For each journal, we performed a PubMed search for articles in which “seizures,” “epilepsy,” or “status epilepticus” was one of the main topics. The United States National Library of Medicine has created Medical Subject Headings (MeSH) that are assigned to journal articles by skilled subject analysts [11]. *MeSH Major Topic* identifies a MeSH term that is one of the main topics of an article. We collected 2013 to 2017 data on articles with *MeSH Major Topic* of “seizures,” “epilepsy,” or “status epilepticus.” For comparison, we ran a similar search for articles with *MeSH Major Topic* of “Alzheimer disease” (a condition with a higher prevalence than epilepsy) and “multiple sclerosis” (a condition with a lower prevalence than epilepsy) [12].

For each journal article on “seizures,” “epilepsy,” or “status epilepticus,” we retrieved first and last author medical specialty affiliations through PubMed. We manually analyzed whether each author’s self-identified department of affiliation was 1) concordant with the medical journal containing that article, 2) neurology or child neurology, or 3) a different medical specialty. We additionally recorded the country of affiliation for all first authors.

Open source tools from the Rust programming language ecosystem were used to query the PubMed database via the ESearch and EFetch application program interfaces (APIs) [13]. EFetch results in Extensible Markup Language (XML) format were programmatically parsed to extract first and last author names, country, medical specialty, and institutional affiliation. Results were reviewed manually for accuracy

and edited where appropriate. Initial search for “seizures,” “epilepsy,” or “status epilepticus” articles was performed May 9, 2018 with subsequent search on “Alzheimer disease” and “multiple sclerosis” performed December 27, 2018 pursuant to peer reviewer request.

3. Results

A total of 1606 articles focused on “seizures,” “epilepsy,” or “status epilepticus” were identified out of 177,546 articles in 55 specialty journals. Journals are listed in Table 1 along with their 2016 JCR impact factor; total citations from 2013 to 2017 (from the May 9, 2018 search); and the number of articles per journal (and percentage) with *MeSH Major Topic* of “seizures,” “epilepsy,” or “status epilepticus.” The prevalence of articles with *MeSH Major Topic* of “seizures,” “epilepsy,” or “status epilepticus” by medical specialty are as follows: (number of articles [%]): cardiac and cardiovascular systems (2 [0.01%]); clinical neurology (749 [5.34%]); critical care medicine (29 [0.20%]); emergency medicine (57 [0.47%]); medicine, general and internal (190 [0.44%]); neuroimaging (227 [2.05%]); neurosurgery (218 [2.23%]); obstetrics and gynecology (20 [0.16%]); oncology (2 [0.01%]); pediatrics (88 [0.69%]); and psychiatry (24 [0.23%]).

Fig. 1 illustrates the availability of first-author data and last-author data for each medical specialty, along with whether each author’s self-identified medical department affiliation was 1) concordant with the medical journal containing that article [labeled as Concordant in the figure], 2) neurology or child neurology [labeled as Neurology in the figure], or 3) a different medical specialty [labeled as Other in the figure]. Within general and internal medicine; neuroimaging; and pediatrics; seizure-related articles were more likely to be first-authored by someone with a neurology-related affiliation. Within critical care medicine; emergency medicine; neurosurgery; and obstetrics and gynecology, seizure-related articles were more likely to be first-authored by someone whose affiliation is within the field.

For each first author, the country of their institutional affiliation was documented. These data were available for 1440 (89.7%) of first authors. The most common country of affiliation was the United States with 518 (36.0%) of first author institutions based there. Other common countries of affiliation included the United Kingdom (11.2%), Canada (6.2%), and Australia (4.8%). See Fig. 2 for institutional affiliations by continent.

For comparison, the number of articles per journal focused on “Alzheimer disease” and “multiple sclerosis” during the same period is also listed in Table 1. Total citations from 2013 to 2017 are listed from the second December 27, 2018 search. Total citations from the two different search dates vary slightly because of periodic reindexing of the PubMed database.

4. Discussion

The goal of this study was to establish the prevalence and characteristics of seizure and epilepsy research published in nonneurology journals. We found that such published research is severely lacking outside the neurology literature with prevalence ranging from 0.01% to 2.23% among different specialties. The paucity of research and educational material on seizures in the nonneurology literature is concerning because it is often nonneurology providers who are first- or second-line in diagnosing and managing seizures before a neurologist can assess the patient.

Although there is no correct answer for what proportion of the nonneurology medical literature should contain epilepsy and seizure research, it is fair to say that the current prevalence of such research is a far cry from the prevalence of patients with epilepsy within the specialties examined. For example, seizures account for approximately 1% of all emergency department visits in the United States [14], yet the prevalence of relevant articles in the emergency medicine literature is 0.47%. Between 0.3% and 0.5% of all pregnancies occur among women with epilepsy [15], yet only 0.16% of the obstetrics and gynecology

Table 1
Articles containing “seizures,” “Alzheimer disease,” or “multiple sclerosis” by journal.

Journal name abbreviation	Journal clinical topic	2016 impact factor	Total citations (2013–17) ^a	Seizure articles ^b	% of seizure articles ^b	Total citations (2013–17) ^c	Alzheimer disease (AD) articles	% of AD articles	Multiple sclerosis (MS) articles	% of MS articles
Circulation	Cardiac & cardiovascular systems	19.309	4432	0	0.000%	4442	2	0.045%	0	0.000%
J Am Coll Cardiol	Cardiac & cardiovascular systems	19.896	5241	0	0.000%	5240	2	0.038%	1	0.019%
Eur Heart J	Cardiac & cardiovascular systems	20.212	3650	1	0.027%	3596	6	0.167%	0	0.000%
Circ Res	Cardiac & cardiovascular systems	13.965	2019	0	0.000%	2019	2	0.099%	1	0.050%
Am J Cardiol	Cardiac & cardiovascular systems	3.398	3649	1	0.027%	3649	0	0.000%	0	0.000%
Neurology	Clinical neurology	8.32	5945	409	6.880%	5925	193	3.257%	339	5.722%
Stroke	Clinical neurology	6.032	3643	11	0.302%	3639	4	0.110%	0	0.000%
Brain	Clinical neurology	10.292	1859	133	7.154%	1858	152	8.181%	72	3.875%
Ann Neurol	Clinical neurology	9.89	1209	123	10.174%	1210	59	4.876%	89	7.355%
Lancet Neurol	Clinical neurology	26.284	1366	73	5.344%	1366	73	5.344%	81	5.930%
Am J Respir Crit Care Med	Critical care medicine	13.204	3242	0	0.000%	3241	0	0.000%	1	0.031%
Chest	Critical care medicine	6.147	3331	4	0.120%	3314	2	0.060%	0	0.000%
Crit Care Med	Critical care medicine	7.05	3500	10	0.286%	3496	0	0.000%	0	0.000%
Intensive Care Med	Critical care medicine	12.015	2241	8	0.357%	2241	0	0.000%	0	0.000%
Crit Care	Critical care medicine	5.358	2406	7	0.291%	2406	0	0.000%	0	0.000%
Ann Emerg Med	Emergency medicine	5.352	2055	10	0.487%	2056	0	0.000%	0	0.000%
Resuscitation	Emergency medicine	5.23	2112	9	0.426%	2107	0	0.000%	0	0.000%
Injury	Emergency medicine	1.894	2742	1	0.036%	2742	0	0.000%	0	0.000%
Acad Emerg Med	Emergency medicine	2.925	1113	8	0.719%	1103	0	0.000%	0	0.000%
Am J Emerg Med	Emergency medicine	1.494	4000	29	0.725%	4001	2	0.050%	4	0.100%
N Engl J Med	Medicine, general & internal	72.406	7776	21	0.270%	7776	34	0.437%	26	0.334%
Lancet	Medicine, general & internal	47.831	8374	22	0.263%	8380	14	0.167%	30	0.358%
JAMA	Medicine, general & internal	44.405	6976	18	0.258%	6960	25	0.359%	4	0.057%
BMJ	Medicine, general & internal	20.785	15,706	31	0.197%	15,706	36	0.229%	18	0.115%
Cochrane Database Syst Rev	Medicine, general & internal	6.264	4656	98	2.105%	4659	17	0.365%	26	0.558%
NeuroImage	Neuroimaging	5.835	4852	61	1.257%	4860	102	2.099%	30	0.617%
AJNR Am J Neuroradiol	Neuroimaging	3.55	2274	32	1.407%	2275	34	1.495%	78	3.429%
Hum Brain Mapp	Neuroimaging	4.53	1957	58	2.964%	1957	66	3.373%	38	1.942%
Neuroradiology	Neuroimaging	2.093	779	9	1.155%	779	9	1.155%	13	1.669%
Neuroimage Clin	Neuroimaging	4.348	1202	67	5.574%	1212	66	5.446%	62	5.116%
J Neurosurg	Neurosurgery	4.059	2994	74	2.472%	2994	2	0.067%	4	0.134%
Neurosurgery	Neurosurgery	4.889	2528	70	2.769%	2191	3	0.137%	1	0.046%
J Neurotrauma	Neurosurgery	4.19	1300	11	0.846%	1298	3	0.231%	1	0.077%
Acta Neurochir (Wien)	Neurosurgery	1.881	1879	40	2.129%	1877	0	0.000%	3	0.160%
Neurosurg Focus	Neurosurgery	3.139	1067	23	2.156%	1067	1	0.094%	0	0.000%
Am J Obstet Gynecol	Obstetrics & gynecology	5.226	2852	10	0.351%	2853	0	0.000%	0	0.000%
Fertil Steril	Obstetrics & gynecology	4.447	2698	0	0.000%	2697	0	0.000%	1	0.037%
Obstet Gynecol	Obstetrics & gynecology	5.215	2716	10	0.368%	2715	0	0.000%	1	0.037%
Hum Reprod	Obstetrics & gynecology	5.02	1792	0	0.000%	1790	0	0.000%	0	0.000%
Gynecol Oncol	Obstetrics & gynecology	4.959	2199	0	0.000%	2201	0	0.000%	0	0.000%
J Clin Oncol	Oncology	24.008	4473	2	0.045%	4473	8	0.179%	0	0.000%
Cancer Res	Oncology	9.122	3452	0	0.000%	3452	0	0.000%	0	0.000%
Clin Cancer Res	Oncology	9.619	3790	0	0.000%	3790	0	0.000%	0	0.000%
Cancer	Oncology	6.072	3185	0	0.000%	3186	0	0.000%	0	0.000%
Oncogene	Oncology	7.519	3159	0	0.000%	3159	0	0.000%	0	0.000%
Pediatrics	Pediatrics	5.705	4157	34	0.818%	4158	2	0.048%	2	0.048%
J Pediatr	Pediatrics	3.874	4100	31	0.756%	4099	0	0.000%	2	0.049%
Arch Dis Child	Pediatrics	3.265	1773	18	1.015%	1769	0	0.000%	1	0.057%
J Adolesc Health	Pediatrics	3.974	1473	0	0.000%	1473	0	0.000%	0	0.000%
Pediatr Res	Pediatrics	2.882	1296	5	0.386%	1290	0	0.000%	0	0.000%
Biol Psychiatry	Psychiatry	11.412	1687	5	0.296%	1687	38	2.253%	2	0.119%
Am J Psychiatry	Psychiatry	14.176	1213	1	0.082%	1213	17	1.401%	0	0.000%
Neuropsychopharmacology	Psychiatry	6.403	1692	3	0.177%	1687	15	0.889%	0	0.000%
J Affect Disord	Psychiatry	3.432	3785	8	0.211%	3797	7	0.184%	4	0.105%
Psychopharmacology	Psychiatry	3.308	1979	7	0.354%	1979	7	0.354%	1	0.051%

^a Total citations from first search on “seizures,” “epilepsy,” or “status epilepticus,” performed May 9, 2018.

^b “Seizure articles” includes articles with *MeSH Major Topic* of “seizures,” “epilepsy,” or “status epilepticus.”

^c Total citations from second search on “Alzheimer disease” and “multiple sclerosis,” performed December 27, 2018.

literature focuses on seizures and epilepsy; this does not even take into account provoked seizures (e.g., eclampsia). That said, disease prevalence alone does not dictate prevalence in the neurology or cross-specialty literature. For example, multiple sclerosis research is better represented than Alzheimer disease in some neurology journals despite its significantly lower prevalence among patients.

Neurologists who research seizures and epilepsy, even in contexts with relevance to other medical specialties, may prefer to publish this research in journals relating to their primary specialty because of familiarity, name-recognition, and possibly because of relevance for promotion. Thus, a study that may be relevant for publication in an

emergency medicine journal – for example, the acute presentation of seizures in the emergency department – may end up in a neurology journal rather than an emergency medicine journal. Conversely, one wonders whether there are recurrent concerns from nonneurologist providers about patients with epilepsy that do not make it into the neurology literature.

Beyond cross-specialty publication, it is also possible that cross-specialty research collaborations on seizures are rare. The lack of cross-specialty research collaborations may contribute to the development of divergent beliefs among providers of different specialties. One example is the differing opinions of neurologists and psychiatrists in



Fig. 1. Concordance of author medical specialty with journal medical specialty.

the accuracy of video-EEG monitoring in diagnosing psychogenic nonepileptic seizures [16]. Our study, however, does point towards some limited cross-specialty collaboration. As compared with the 5.34% of published seizure-related articles in clinical neurology journals, neurosurgery and neuroimaging journals published 2.23% and 2.05% articles respectively. Also, the majority of first authors of such articles in neuroradiology journals were not neuroradiologists. It is possible that specialized seizure and epilepsy journals such as *Epilepsia*, which were not included in our study, may act as cross-specialty platforms.

In the comparison search for “Alzheimer disease” and “multiple sclerosis” research published in nonneurology journals, it was apparent that there was an even greater paucity of such research compared with the search for seizure-related articles. Published research on these two topics in the critical care medicine, emergency medicine, obstetrics and gynecology, and pediatrics literature were nearly nonexistent. This may in part be due to typical patient demographics; for example,

Alzheimer disease research would not be present in the pediatric literature. It also highlights the unique multispecialty nature of seizure and epilepsy care.

Our article had a few weaknesses. The use of *MeSH Major Topic* was a nonperfect method to identify relevant articles. Though we felt it was superior to using more general MeSH terms, *MeSH Major Topic* is still subjective to human error. Type I or Type II errors may also have been present in compiling relevant articles. We did not exclude specific article types such as narratives or editorials that may have been redundant or irrelevant. Also, departmental affiliation does not necessarily represent the specialty of the researcher, since some nonneurology medical departments employ neurologists and vice versa. Lastly, because of PubMed database queries on different dates, the total citations used as the denominator were different between the search for seizure-related articles and the search for “Alzheimer disease” and “multiple sclerosis” articles.

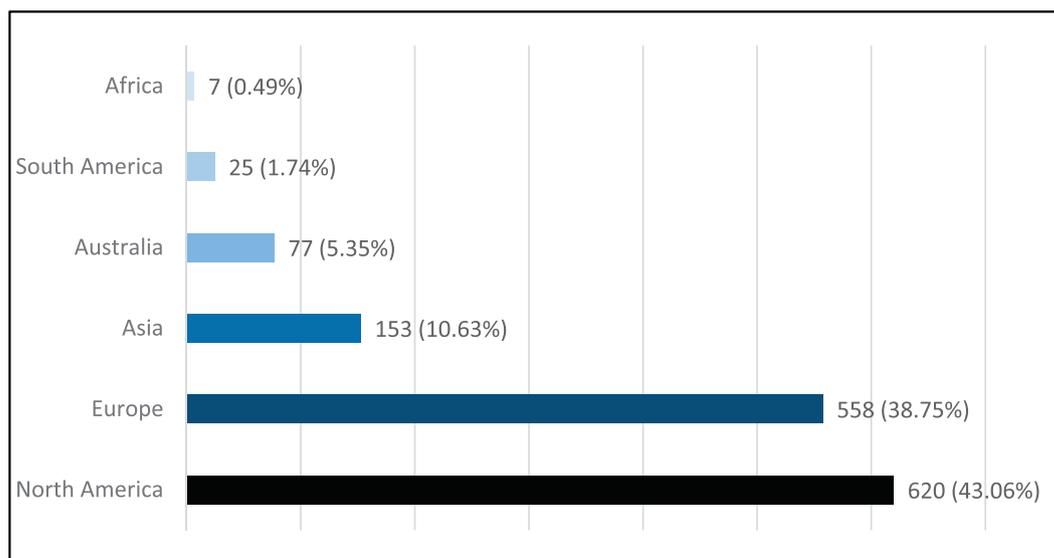


Fig. 2. Institutional affiliations of first authors by continent (number of articles [%]).

5. Conclusions

At the very least, this study suggests that there is room for further cross-specialty collaboration in clinical research on seizures and epilepsy. This may be particularly important for seizure-related research compared with other neurologic conditions because of its wide multispecialty scope. Such collaboration would potentially bring to light any gaps in knowledge and result in wider dissemination of seizure-related knowledge since nonneurologists are often first-line providers for recognizing, diagnosing, or managing seizures prior to assessment by a neurologist. This may result in a more well-rounded perspective of the field, thus improving the multidisciplinary care of patients with seizures and epilepsy.

Declaration of interest

None.

Acknowledgments

None.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

- [1] Mutz R, Bornmann L, Daniel H-D. Cross-disciplinary research: what configurations of fields of science are found in grant proposals today? *Res Eval* 2015;24(1):30–6. <https://doi.org/10.1093/reseval/rvu023>.
- [2] Knapp B, Bardenet R, Bernabeu MO, Bordas R, Bruna M, Calderhead B, et al. Ten simple rules for a successful cross-disciplinary collaboration. *PLoS Comput Biol* 2015;11(4):e1004214. <https://doi.org/10.1371/journal.pcbi.1004214>.
- [3] Urquhart R, Grunfeld E, Jackson L, Sargeant J, Porter GA. Cross-disciplinary research in cancer: an opportunity to narrow the knowledge-practice gap. *Curr Oncol* 2013;20(6):e512–21. <https://doi.org/10.3747/co.20.1487>.
- [4] Tolsgaard MG, Todsén T, Sørensen JL, Ringsted C, Lorentzen T, Ottesen B, et al. International multispecialty consensus on how to evaluate ultrasound competence: a Delphi consensus survey. Milanese S, ed *PLoS One* 2013;8(2):e57687. doi:<https://doi.org/10.1371/journal.pone.0057687>.
- [5] Abbott AL, Adelman MA, Alexandrov AV, Barber PA, Barnett HJ, Beard J, et al. Why calls for more routine carotid stenting are currently inappropriate: an international, multispecialty, expert review and position statement. *Stroke* 2013;44(4):1186–90. <https://doi.org/10.1161/STROKEAHA.111.000261>.
- [6] Lee AG, Burton JA, Lundebjerg NE. Geriatrics-for-specialists initiative: an eleven-specialty collaboration to improve care of older adults. *J Am Geriatr Soc* 2017;65(10):2140–5. <https://doi.org/10.1111/jgs.14963>.
- [7] Michaelis LC, Ratain MJ. Phase II trials published in 2002: a cross-specialty comparison showing significant design differences between oncology trials and other medical specialties. *Clin Cancer Res* 2007;13(8):2400–5. <https://doi.org/10.1158/1078-0432.CCR-06-1488>.
- [8] IOM (Institute of Medicine). *Epilepsy across the Spectrum: promoting health and understanding*. Washington, DC: The National Academies Press; 2012.
- [9] 2016 Journal Citation Reports Science Edition (Clarivate Analytics, 2017).
- [10] Wong VSS, Callahan ML. Medical journal editors lacked familiarity with scientific publication issues despite training and regular exposure. *J Clin Epidemiol* 2012;65(3):247–52. <https://doi.org/10.1016/j.jclinepi.2011.08.003>.
- [11] Bethesda (MD): National Center for Biotechnology Information (US). PubMed Help [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK3827/>. Accessed November 11, 2018.
- [12] GBD 2015 Neurological Disorders Collaborator Group VLABajobir AA, Abate KH, Abd-Allah F, Abdulle AM, Abera SF, et al. Global, regional, and national burden of neurological disorders during 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet Neurol* 2017;16(11):877–97. [https://doi.org/10.1016/S1474-4422\(17\)30299-5](https://doi.org/10.1016/S1474-4422(17)30299-5).
- [13] U.S. National Library of Medicine. The 9 E-utilities and associated parameters. <https://dataguide.nlm.nih.gov/eutilities/utilities.html>, Accessed date: 15 January 2019.
- [14] Pallin DJ, Goldstein JN, Moussally JS, Pelletier AJ, Green AR, Camargo CA. Seizure visits in US emergency departments: epidemiology and potential disparities in care. *Int J Emerg Med* 2008;1(2):97–105. <https://doi.org/10.1007/s12245-008-0024-4>.
- [15] MacDonald SC, Bateman BT, McElrath TF, Hernández-Díaz S. Mortality and morbidity during delivery hospitalization among pregnant women with epilepsy in the United States. *JAMA Neurol* 2015;72(9):981. <https://doi.org/10.1001/jamaneurol.2015.1017>.
- [16] Harden CL, Burgut FT, Kanner AM. The diagnostic significance of video-EEG monitoring findings on pseudoseizure patients differs between neurologists and psychiatrists. *Epilepsia* 2003;44(3):453–6. <https://doi.org/10.1046/j.1528-1157.2003.33002.x>.