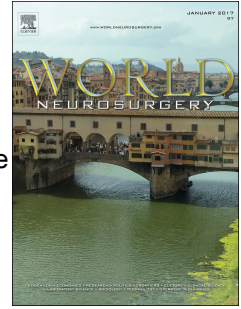


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The Most Cited Works in Severe Traumatic Brain Injury: A Bibliometric Analysis of the 100**Most Cited Articles**

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Key words:

Bibliometric analysis; Citation classics; Severe traumatic brain injury.

Abbreviations list:

sTBI: Severe traumatic brain injury

TBI: Traumatic brain injury (TBI)

WoS: Web of Science

Abstract

BACKGROUND: There is an abundance of works published on severe traumatic brain injury (sTBI). Bibliometric analyses are aiming to have a macroscopic view of research activities about sTBI and are helpful in determining the most impactful studies within this field.

METHODS: we performed a generalized search using the database of Web of Science (WoS), organized the references by the number of citations, and reviewed full length-articles for the top 100 cited papers. The articles were classified according to the focus of the paper.

RESULTS: The top 100 articles were cited on average 326.4 times per paper. The Journal of Neurosurgery published the greatest number of top cited articles (9 of 100). Authors from the United States published the majority (67%) of the top-cited articles. The most popular categories were “reviews and guidelines” and “etiology and epidemiology.”

CONCLUSIONS: The present study provides a cross-sectional summary of the 100 cited studies in sTBI, highlighting areas of research that require further investigation and development.

INTRODUCTION

Traumatic brain injury (TBI) is a major cause of death and disability worldwide without effective treatment, especially severe TBI (sTBI)¹. In Europe alone, a quarter to a third of patients with sTBI will die². As a result, the heavy burden of disability and mortality highlights the urgent need for further understanding of sTBI, decreasing the morbidity and improving the management of sTBI^{3,4}.

It is not easy to quantify the importance of a given published study. Recently, we often regard the number of published articles and citations as important indicators. And selected articles that have been cited more than 400 times generally are termed “Citation Classics”⁵. Bibliometric analysis is usually used to understand the changing landscape of a specific field over time, as well as describing the importance of published articles⁶.

Bibliometrics has become an established method to analyze scientific literature in information science, which is based on a number of laws quantitatively⁷. It has been conducted more and more widely in various clinical specialties, including cardiovascular⁸, hematology⁹, endocrinology¹⁰, neurology¹¹, gastroenterology¹², obstetrics and gynecology¹³, ophthalmology¹⁴, anesthesiology¹⁵, orthopedic surgery¹⁶ and radiology¹⁷. Recently, similar methods have been applied to subspecialties within neurosurgery^{18,19}.

However, as we know, bibliometric analysis has not yet been applied to the field of sTBI. Thus, in the present study, we aim to provide an insight into the most highly cited works in this field. To some degree, the bibliometrics about sTBI concerning the distributions of countries could help to promote generalized development worldwide in this field and the changing trends in highly cited publications could provide the investigators with a lot of information about essential Citation Classics in the field.

METHODS

Search Strategy

To identify highly cited works in sTBI, we performed a generalized search using the database of Web of Science (WoS) (Thomson Reuters, New York, USA), the world’s leading database collecting citation and other academic impact information. The search was performed in September 2017 with the restriction of publications in the last two decades. The database was searched using the keywords “severe traumatic brain injury” or “sTBI” or “severe TBI” for literatures. That is to say, the articles we identified were specific to sTBI. The document type is not limited. We obtained and reviewed the top 100 most-cited works in the field of sTBI.

Bibliometric analysis

We record the basic information such as publication titles, authors, countries and journals by using the analysis tool in the WoS. After collecting the top 100 cited articles, we collected all variables in our analysis, such as the number of citations, year of publication, name of first author, title of article, journal of publication, and specialty and country of the corresponding author at the time of publication etc. for each article. We also ranked the 100 most cited articles in descending order by citation numbers.

The articles were subsequently divided into five categories: 1) etiology and epidemiology of sTBI; 2) review articles or guidelines on sTBI; 3) sTBI treatment; 4) sequelae and prognosis of sTBI; and 5) the diagnosis of sTBI. The first category included articles describing the mechanisms of sTBI, as well as epidemiologic studies for prevalence, clinical characteristics, and risk factors. The second encompassed studies highly cited reviews and published guidelines. The third included papers studying surgical, endovascular and other treatments for sTBI. The fourth encompassed studies investigating the influence factors of prognosis or complications of sTBI, such as cognitive dysfunction, disability, psychiatric disability, loss of consciousness, anterograde amnesia, confusion etc. Finally, the last category included studies investigating the role of transcranial Doppler, computed tomography, magnetic resonance imaging as well as other clinical and radiological assessment instruments. Two reviewers (Xiaoye Ma and Sajan Pandey) independently read the title and abstract of the articles (full text, if necessary), conducted journal selection, article identification, and analyses of articles. Any disagreements between reviewers were resolved by a third reviewer (Lei Li).

RESULTS

General information

The total number of literature extracted from the WoS was 11618, among which 8987 were original articles and the others were papers without original data such as review, editorial, comments etc. The world map revealed that the articles were focused on the Western Europe, Eastern Asia and America (Fig. 1).

The Most Cited Works in sTBI

The top 10 most-cited articles in sTBI are presented in Table 1. The top 100 most cited articles were cited on average 326.4 times on average per paper (range, 206-843). The most frequently cited article (843 citations) was published by Marion et al. in 1997 in the NEW ENGLAND JOURNAL OF MEDICINE (“Treatment of traumatic brain injury with moderate hypothermia”) followed by Thurman et al. (“Traumatic brain injury in the United States: A public health perspective”), which was published in the JOURNAL OF HEAD TRAUMA REHABILITATION in 1999.

Sixty-seven of the 100 articles were from the USA and 10 from Germany, followed by ENGLAND (n=9, 9.00%) (Table 2).

These highly cited works were published in 18 unique journals. The journal publishing the greatest number of the top 100 highly cited articles was the Journal of Neurosurgery, which published 9 papers with an average of 265.78 citations per paper. Journals publishing more than 4 highly-cited works are presented in Table 3. Hovda DA and Maas AIR were the most prolific author in the top 100 cited articles (Table 4).

Of the top 100 cited articles, 20 were considered Citation Classics, accruing more than 400 citations.

Articles by Category

The categories in which of the 100 highly-cited articles are outlined in Table 5, and the trends in publication according to dates is shown in Figure 2. Most articles in our study were review articles or guidelines on sTBI (33 articles), followed by etiology and epidemiology of sTBI (27 articles), sTBI treatment (19 articles) or sequelae and prognosis of sTBI (16 papers). There were only 5 highly-cited studies published about the diagnosis of sTBI. In 2008 there was a surge in the publication of highly cited articles in sTBI (Figure 3). Articles with a focus on Etiology and epidemiology were the most common in 1999, and the situation has remained stable since the 2000s. Interestingly, the most common category in 1998 was sequelae and prognosis of sTBI, and after 2003 it has begun

to show a tendency to decline. However, the trends of treatment were not pronounced. Lastly, there has been a steady increase in highly cited systematic reviews/guidelines, especially in 2008.

Discussion

In this study, we identified and reviewed the top 100 most-cited articles associated with sTBI. Bibliometric studies can provide a historical account of research and can reflect the changing landscape within a given field. With citation, an index to evaluate the value of a literature, it is possible to identify which articles have had great influence in sTBI, and which articles are discussed, referenced recently. Therefore, we provided a general discussion of our findings, as well as a category-specific commentary.

Our bibliometric analysis demonstrated the average citation of all top 100 cited works in the last twenty years was 326.4 times and 20 works were considered Citation Classics, which suggested they were of high quality with an active research activity.

During the last 20 years, we found that the number of the most cited articles originated from the United States was far more than any other country, indicating that the articles in America were of high quality and of great quantity. Besides, the distribution map of published articles showed that the worldwide productivity in sTBI was concentrated in the Western Europe, Eastern Asia and America. What's more, JOURNAL OF NEUROSURGERY published the largest number of sTBI research in the world followed by JAMA JOURNAL OF THE AMERICAN, indicating the importance of these two journals in this field.

Our findings show that studies on sTBI are currently accumulating the most cited works per year (Figure 2). This suggests that severe TBI is a predominant topic of discussion in the field of brain injury, perhaps because rates of severe morbidity and mortality have not improved over the last 20 years²⁰, which highlights the urgent need for researchers to improve the knowledge of sTBI³.

We also found most works were associated with reviews, guidelines, etiology and epidemiology, given the mechanism of severe traumatic brain injury is complex and it covers a wide range of people²¹. Therefore, the

discovery of new biomarkers and risk factors will contribute to deeper understanding of TBI²². In view of the effectiveness of many currently available treatments and management programs for sTBI²³, the discussion of new sTBI treatment methods is necessary in the future. Moreover, a sustained research effort into predictors of outcome is required to inform clinicians as to which patients are at greatest risk of poor long-term outcome, and, therefore, should be targeted for a particular management strategy or therapeutic intervention²⁴.

Although only five works are associated with sTBI diagnosis, it may also be reasonable to expect an increase in research activity on identification and evaluation for sTBI, given the push to identify brain injury accurately and immediately²⁵.

We noted that additional research activities in one sub-area might affect activities in another sub-area. For example, more attention to treatment and diagnosis may lead to updated guidelines or consensus statements, which is consistent with our results.

Limitations

Some limitations should be noted in this study. First, articles not published in WoS-cited journals are not included. Furthermore, the citation metrics that were computed in the present study have likely changed since we completed our analyses, given that the sTBI literature is being continually cited. At the same time, self-reference bias is not considered in our study. However, given its broad nature and vast citations, we believe that this study can still be used to describe the general trend of the most cited works in this field. Besides, we have not excluded reviews and guidelines for reviews and guidelines tend to portray the articles with widespread acknowledgement in scientific community and represent the highest quality or scientific merit in literature. They all represented the latest achievements of sTBI development in their period and have played a profound influence around the world^{6,26}.

Conclusion

The present study provides a cross-sectional summary of the 100 cited studies in sTBI, highlighting areas of research that require further investigation and development.

Conflict of interest

The authors declare that they have no conflict of interest.

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References:

1. Lin C, He H, Li Z, Liu Y, Chao H, Ji J, et al. Efficacy of progesterone for moderate to severe traumatic brain injury: a meta-analysis of randomized clinical trials. *Sci Rep*. 2015;5:13442.
2. Stein SC, Georgoff P, Meghan S, Mizra K, Sonnad SS. 150 years of treating severe traumatic brain injury: a systematic review of progress in mortality. *J Neurotrauma*. 2010;27:1343-1353.
3. Adams H, Donnelly J, Czosnyka M, Koliass AG, Helmy A, Menon DK, et al. Temporal profile of intracranial pressure and cerebrovascular reactivity in severe traumatic brain injury and association with fatal outcome: An observational study. *PLoS Med*. 2017;14:e1002353.
4. Maas AI, Menon DK. Traumatic brain injury: rethinking ideas and approaches. *Lancet Neurol*. 2012;11:12-13.
5. Garfield E. 100 citation classics from the Journal of the American Medical Association. *Jama*. 1987;257:52-59.
6. Alotaibi NM, Nassiri F, Badhiwala JH, Witiw CD, Ibrahim GM, Macdonald RL, et al. The Most Cited Works in Aneurysmal Subarachnoid Hemorrhage: A Bibliometric Analysis of the 100 Most Cited Articles. *World Neurosurg*. 2016;89:587-592.e6.
7. Leng Z, He X, Li H, Wang D, Cao K. Olfactory ensheathing cell transplantation for spinal cord injury: An 18-year bibliometric analysis based on the Web of Science. *Neural regeneration research*. 2013;8:1286.
8. Gal D, Glänzel W, Sipido KR. Mapping cross-border collaboration and communication in cardiovascular

research from 1992 to 2012. *European heart journal*. 2016;38:1249-1258.

9. Collier BS. Blood at 70: its roots in the history of hematology and its birth. *Blood*. 2015;126:2548-2560.
10. Sweileh WM, Al-Jabi SW, AbuTaha AS, Zyoud SH, Anayah FMA, Sawalha AF. Bibliometric analysis of worldwide scientific literature in mobile - health: 2006-2016. *BMC Med Inform Decis Mak*. 2017;17:72.
11. Carter CS. Expanding the Reach of Biological Psychiatry with Biological Psychiatry: Cognitive Neuroscience and Neuroimaging. *Biological psychiatry*. 2015;78:434-435.
12. Loomes DE, van Zanten SV. Bibliometrics of the top 100 clinical articles in digestive disease. *Gastroenterology*. 2013;144:673-676.e5.
13. Parikh LI, Benner RS, Riggs TW, Hazen N, Chescheir NC. Subspecialty Influence on Scientific Peer Review for an Obstetrics and Gynecology Journal With a High Impact Factor. *Obstet Gynecol*. 2017;129:243-248.
14. Mimouni M, Zayit-Soudry S, Segal O, Barak Y, Nemet AY, Shulman S, et al. Trends in Authorship of Articles in Major Ophthalmology Journals by Gender, 2002-2014. *Ophthalmology*. 2016;123:1824-1828.
15. Pagel PS, Hudetz JA. Scholarly productivity and national institutes of health funding of foundation for anesthesia education and research grant recipients: insights from a bibliometric analysis. *Anesthesiology*. 2015;123:683-691.
16. Hannafin JA, Leopold SS. Editor's spotlight/take 5: sex-specific analysis of data in high-impact orthopaedic journals: how are we doing? *Clin Orthop Relat Res*. 2015;473:3695-3699.
17. Sardanelli F, Bashir H, Berzaczy D, Cannella G, Espeland A, Flor N, et al. The role of imaging specialists as authors of systematic reviews on diagnostic and interventional imaging and its impact on scientific quality: report from the EuroAIM Evidence-based Radiology Working Group. *Radiology*. 2014;272:533-540.
18. Hirshman BR, Tang JA, Jones LA, Proudfoot JA, Carley KM, Marshall L, et al. Impact of medical academic genealogy on publication patterns: An analysis of the literature for surgical resection in brain tumor patients. *Anna Neurol*. 2016;79:169-177.
19. Arunachalam L, Hunter IA, Killeen S. Reporting of Randomized Controlled Trials With Statistically Nonsignificant Primary Outcomes Published in High-impact Surgical Journals. *Ann Surg*. 2017;265:1141-1145.

20. Roozenbeek B, Maas AI, Menon DK. Changing patterns in the epidemiology of traumatic brain injury. *Nat Rev Neurol*. 2013;9:231-236.
21. Jassam YN, Izzy S, Whalen M, McGavern DB, El Khoury J. Neuroimmunology of Traumatic Brain Injury: Time for a Paradigm Shift. *Neuron*. 2017;95:1246-1265.
22. Raheja A, Sinha S, Samson N, Bhoi S, Subramanian A, Sharma P, et al. Serum biomarkers as predictors of long-term outcome in severe traumatic brain injury: analysis from a randomized placebo-controlled Phase II clinical trial. *J Neurosurg*. 2016;125:631-641.
23. Ponsford J, Bayley M, Wiseman-Hakes C, Togher L, Velikonja D, McIntyre A, et al. INCOG recommendations for management of cognition following traumatic brain injury, part II: attention and information processing speed. *J Head Trauma Rehabil*. 2014;29:321-337.
24. Sharma B, Lawrence DW. Top-cited articles in traumatic brain injury. *Front Hum Neurosci*. 2014;8:879.
25. Charleswell C, Ross B, Tran T, Walsh E. Traumatic brain injury: considering collaborative strategies for early detection and interventional research. *J Epidemiol Community Health*. 2015;69:290-292.
26. Hye K, Dae Y, Eun K, Kwanseop L, Jong B, Ju-Hun L. The 100 most-cited articles in neuroimaging: A bibliometric analysis. *NeuroImage*. 2016; 139:149-156.

Figure legends

Figure 1. The distribution map of published articles in the world (GoPubMed).

Figure 2. The time trends in severe traumatic brain injury (sTBI) articles according to their categories.

Figure 3. Most cited works about severe traumatic brain injury (sTBI) on Web of Science distributing in each year (by September 2017)

Table 1. The Top 10 Cited Articles on sTBI.

Title	First Author	Journals (IF[*] 2016)	Year	Country	Citations
Treatment of traumatic brain injury with moderate hypothermia	Marion, DW	NEW ENGLAND JOURNAL OF MEDICINE (72.406)	1997	USA	843
Traumatic brain injury in the United States: A public health perspective	Thurman, DJ	JOURNAL OF HEAD TRAUMA REHABILITATION (3.214)	1999	USA	760
Structured interviews for the Glasgow Outcome Scale and the extended Glasgow Outcome Scale: Guidelines for their use	Wilson, JTL	JOURNAL OF NEUROTRAUMA (5.19)	1998	Scotland	759
Acute effects and recovery time following concussion in collegiate football players - The NCAA Concussion Study	McCrea, M	JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION (44.405)	2003	USA	680
The Patient Health	Kroenke, Kurt	GENERAL	2010	USA	670

Questionnaire Somatic, Anxiety, and Depressive Symptom Scales: a systematic review		HOSPITAL PSYCHIATRY (2.279)			
Moderate and severe traumatic brain injury in adults	Maas, Andrew I. R.	LANCET NEUROLOGY(26.28 4)	2008	Belgium	631
The spectrum of disease in chronic traumatic encephalopathy	McKee, Ann C.	BRAIN (10.292)	2013	USA	498
Immune modulation of learning, memory, neural plasticity and neurogenesis	Yirmiya, Raz	BRAIN BEHAVIOR AND IMMUNITY (5.964)	2011	Israel	498
White matter integrity and cognition in chronic traumatic brain injury: a diffusion tensor imaging study	Kraus, Marilyn F.	BRAIN(10.292)	2007	USA	494
A systematic review of brain injury epidemiology in Europe	Tagliaferri, F	ACTA NEUROCHIRURGIC A (1.881)	2006	USA	490

*IF: impact factor.

Table 2. Countries of the Top 100 Cited Articles on sTBI

Countries/territories	Record count
USA	67
GERMANY	10
ENGLAND	9
CANADA	8
NETHERLANDS	8
SCOTLAND	8
AUSTRALIA	7
ISRAEL	5
ITALY	5
SWEDEN	5
FRANCE	4
BELGIUM	2
DENMARK	2
SWITZERLAND	2

Table 3. Journals (With More Than 4 Articles) in Which the Top 100 Cited Articles on sTBI Were Published

Journals	Number of Articles
JOURNAL OF NEUROSURGERY	9
JAMA JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION	8
BRAIN	7
JOURNAL OF NEUROTRAUMA	6
NEW ENGLAND JOURNAL OF MEDICINE	6

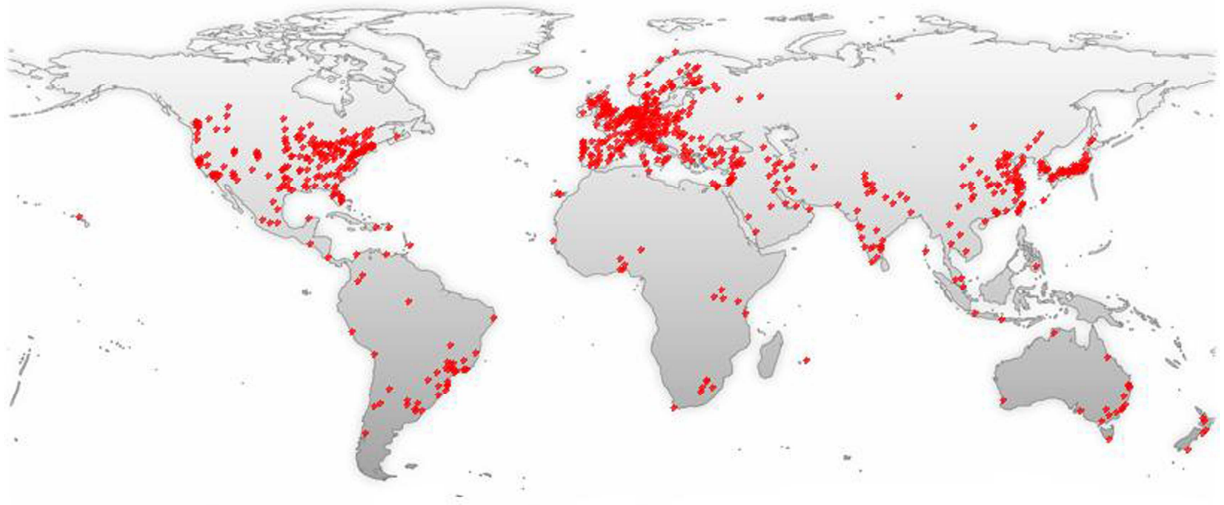
Table 4. The Most Common Authors (With More Than 3 Articles) of Top 100 Cited Articles on sTBI

Field: Authors	Record count
HOVDA DA	6
MAAS AIR	6
MAURRAY GD	5
MARMAROU A	4
MCINTOSH TK	4
STEYERBERG EW	4

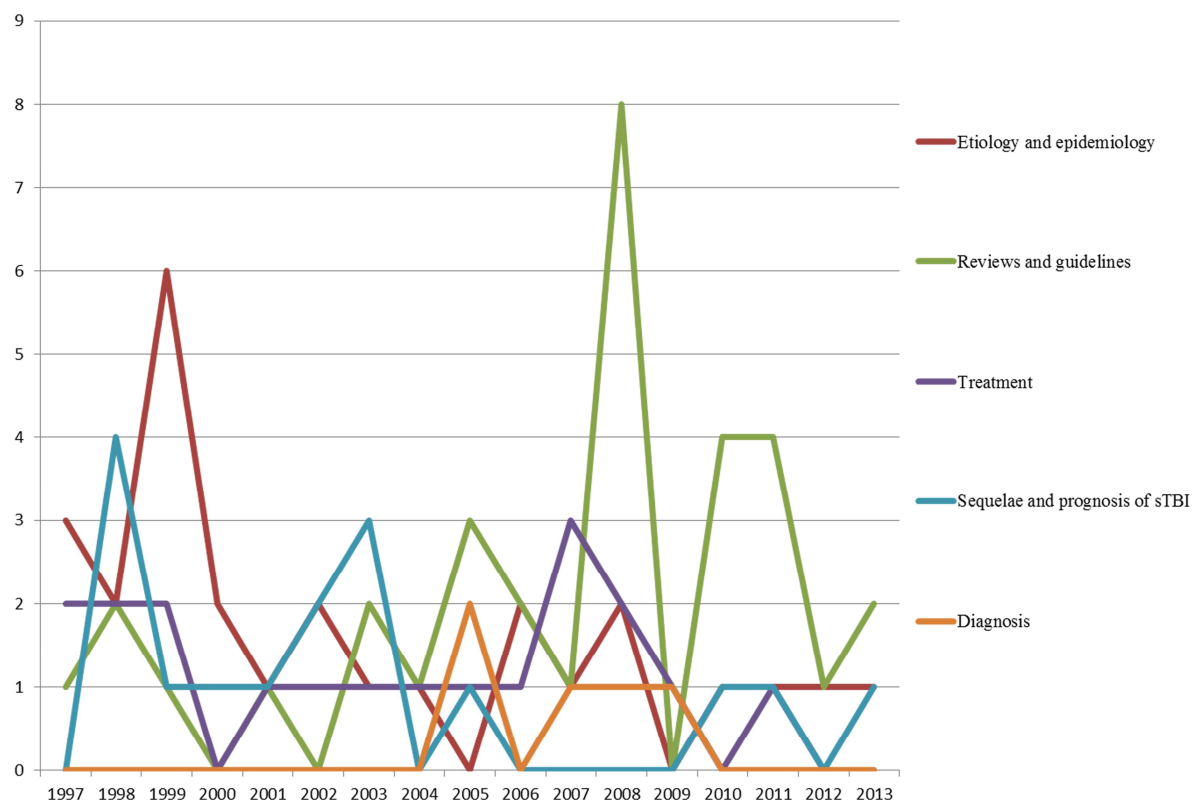
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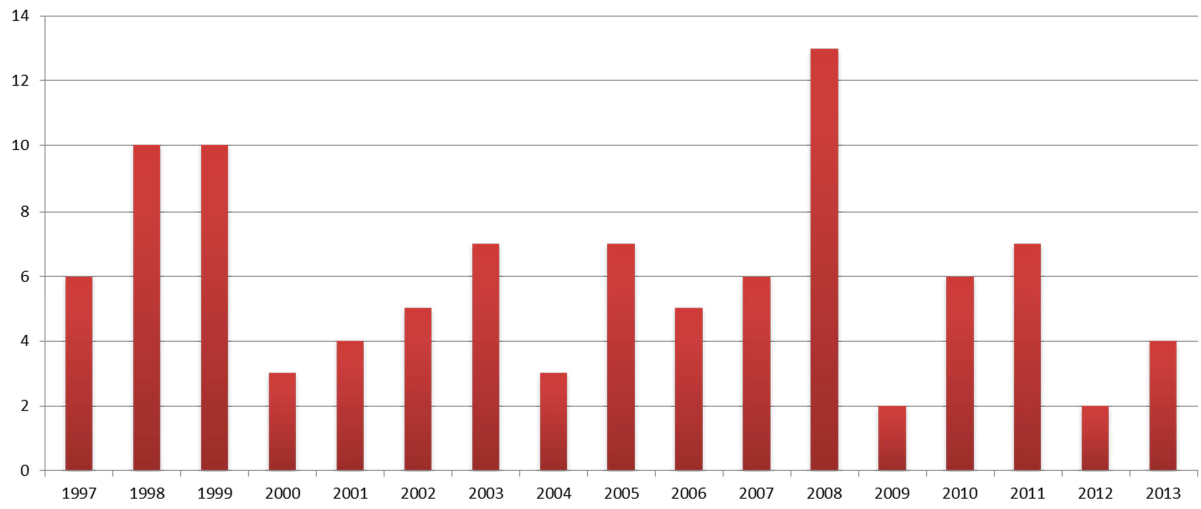
Table 5. Articles Categories for the Top 100 Cited Works

Category	Number of Articles
Etiology and epidemiology	27
Reviews and guidelines	33
Treatment	19
Sequelae and prognosis of sTBI	16
Diagnosis	5



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Highlights :

This was the first bibliometric analysis within the field of severe traumatic brain injury (sTBI).

The most popular categories were “reviews and guidelines” and “etiology and epidemiology.”

In 2008 there was a surge in the publication of highly cited articles in severe traumatic brain injury (sTBI).

Disclosure-Conflict of Interest

We confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

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