

## Documents

Zhang, P., Cheng, R.

**Interdisciplinary influences in headache literature: A network citation analysis of PubMed Central articles** (2021) *Headache*, 61 (1), pp. 143-148.

**DOI:** 10.1111/head.14022

Department of Neurology, Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ, United States

### Abstract

**Background:** Non-headache literature inevitably influences headache research, but the way this interdisciplinary interaction occurs has seldom been evaluated. **Objective:** Utilizing network analysis techniques within the PubMed Central (PMC) database, we illustrate a novel method by which to identify and characterize the important non-headache literature with significant impact within the headache world. **Methods:** Using the National Center for Biotechnology Information E-utilities application programming interface and custom backend software, all PMC articles containing the words "headache(s)" and/or "migraine(s)" in the title were identified. This generated a list of "seed articles" to represent the body of primary headache literature. Articles referenced by the seeds were then found, generating the list of articles with one degree of separation from the seeds (first-degree neighbors). This was iterated twice more to find the second- and third-degree neighbors. A directed network graph was generated for each level of separation using these articles and their referential connections. The hyperlink-induced topic search (HITS) and PageRank algorithms were used on these graphs to find the top 50 articles in the network (hub and authority rank via HITS, general rank via PageRank). Removing seed articles from the ranked lists left the influential non-headache articles at each level of separation. **Results:** We extracted 6890 seed articles. The first-, second-, and third-degree models contained 16,451, 105,496, and 431,748 articles, respectively. As expected, most first-degree neighbors were part of the seed group (headache literature). Using HITS, at the second degree, only two seed articles were found in the top 50 hubs (none in the authorities); the majority of non-seed articles were basic neuroscience, involving ion channel function or cell signaling. At the third degree, there were no seeds and all articles involved imaging/structure of brain connectivity networks. PageRank gave more varied results, with 35/50 second-degree articles being seeds, and the remainder a mixture of articles describing rating scales (3), epidemiology/disease burden (3), basic statistical/trial methods (3), and mixed basic science (6). At the third degree, five were seeds; non-seed articles were represented heavily by genomic mapping studies, brain connectivity networks, and ion channel/neurotransmitter studies. **Conclusion:** This work demonstrates the value of network citation analysis in the identification of interdisciplinary influences on headache medicine. Articles found with this technique via HITS identified and grouped basic science applicable to headache medicine at the molecular scale (ion channels/transmitters), and whole-brain scale (connectivity networks). Both groups have direct clinical correlates, with the former implicating pharmacological targets, and the latter implicating functional neuroanatomy and pathophysiology of various headache disorders. Likely, in-depth analysis of the whole network (rather than the top 50) would reveal further clusters where the relationship to headache may not be as immediately obvious. This may not only help to guide ongoing work, but also identify new targets where seemingly unrelated work may have future applications in headache management. © 2020 American Headache Society

### Author Keywords

citation analysis; headache literature; network analysis; PubMed Central

### Index Keywords

ion channel, neurotransmitter; algorithm, Article, citation analysis, functional connectivity, headache, human, interdisciplinary research, migraine, primary headache, priority journal, rating scale, signal transduction, systematic review, bibliometrics, headache and facial pain, interdisciplinary research, medical research, Medline; Algorithms, Bibliometrics, Biomedical Research, Headache, Headache Disorders, Humans, Interdisciplinary Research, PubMed

### References

- Park, K.M., Park, B.S., Park, S., Yoon, D.Y., Bae, J.S.  
**Top-100 cited articles on headache disorders: a bibliometric analysis** (2017) *Clin Neurol Neurosurg*, 157, pp. 40-45.
- Robert, C., Wilson, C.S., Lipton, R.B., Arreto, C.D.  
**Growth of headache research: a 1983-2014 bibliometric study**

(2017) *Cephalalgia*, 37 (13), pp. 1299-1309.

- Gupta, R., Gupta, B.M., Bansal, J., Kumar, A.  
**Scientometric assessment of India's migraine research publications during 2006-15**  
(2016) *J Young Pharm*, 8 (4), pp. 294-301.
- Ma, N., Guan, J., Zhao, Y.  
**Bringing PageRank to the citation analysis**  
(2008) *Inf Process Manage*, 44 (2), pp. 800-810.
- Zeng, A., Shen, Z., Zhou, J.  
**The science of science: from the perspective of complex systems**  
(2017) *Phys Rep*, 714-715, pp. 1-73.
- Kleinberg, J.M.  
**Hubs, authorities, and communities**  
(1999) *ACM Comput Surv*, 31 (4), pp. 5-es.
- Girvan, M., Newman, M.E.J.  
**Community structure in social and biological networks**  
(2002) *Proc Natl Acad Sci USA*, 99 (12), pp. 7821-7826.
- (2010) *Entrez Programming Utilities Help*,  
Bethesda, MD, National Center for Biotechnology Information (US), Accessed October 13, 2019
- Kleinberg, J.M.  
**Authoritative sources in a hyperlinked environment**  
(1999) *J Assoc Comput Mach*, 46 (5), pp. 604-632.
- Hagberg, A.A., Schult, D.A., Swart, P.J.  
**Exploring network structure, dynamics, and function using NetworkX**  
(2008) *Proceedings of the 7th Python in Science Conference (SciPy 2008)*, pp. 11-15.  
G Varoquaux, T Vaught, J Millman, eds., Pasadena, CA
- Zhang, P.  
**Network analysis of headache literature citations**  
(2019) *Cephalalgia*, 39 (5), pp. 370-371.
- Selby, G., Lance, J.  
**Observations on 500 cases of migraine and allied vascular headache**  
(1960) *J Neurol Neurosurg Psychiatry*, 23 (1), pp. 23-32.
- Maslov, S., Redner, S.  
**Promise and pitfalls of extending Google's PageRank algorithm to citation networks**  
(2008) *J Neurosci*, 28 (44), pp. 11103-11105.

**Correspondence Address**

Zhang P.; Department of Neurology, United States; email: phil.p.zhang@gmail.com

**Publisher:** Blackwell Publishing Inc.

**ISSN:** 00178748

**CODEN:** HEADA

**PubMed ID:** 33616997

**Language of Original Document:** English

**Abbreviated Source Title:** Headache

2-s2.0-85097318508

**Document Type:** Article

**Publication Stage:** Final  
**Source:** Scopus

---

**ELSEVIER**

Copyright © 2022 Elsevier B.V. All rights reserved. Scopus® is a registered trademark of Elsevier B.V.

 **RELX Group™**