Google Search Queries About Neurosurgical Topics: Are They a Suitable Guide for Neurosurgeons?

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■ OBJECTIVE: **Google is the most popular search engine, with about 100 billion searches per month. Google Trends is an integrated tool that allows users to obtain Google's search popularity statistics from the last decade. Our aim was to evaluate whether Google Trends is a useful tool to assess the public's interest in specific neurosurgical topics.**

■ METHODS: **We evaluated Google Trends statistics for the neurosurgical search topic areas "hydrocephalus," "spinal stenosis," "concussion," "vestibular schwannoma," and "cerebral arteriovenous malformation." We compared these with bibliometric data from PubMed and epidemiologic data from the German Federal Monitoring Agency. In addition, we assessed Google users' search behavior for the search terms "glioblastoma" and "meningioma."**

■ RESULTS: **Over the last 10 years, there has been an increasing interest in the topic "concussion" from Internet users in general and scientists. "Spinal stenosis," "concussion," and "vestibular schwannoma" are topics that are of special interest in high-income countries (eg, Germany), whereas "hydrocephalus" is a popular topic in low- and middle-income countries. The Google-defined top searches within these topic areas revealed more detail about people's interests (eg, "normal pressure hydrocephalus" or "football concussion" ranked among the most popular search queries within the corresponding topics). There was a similar volume of queries for "glioblastoma" and "meningioma."**

■ CONCLUSIONS: **Google Trends is a useful source to elicit information about general trends in peoples' health interests and the role of different diseases across the world. The Internet presence of neurosurgical units and surgeons can be guided by online users' interests to achieve high-quality, professional-endorsed patient education.**

INTRODUCTION

Increasing numbers of patients make use of the Internet to find information about certain disorders or to share their experiences with other users. By analyzing the Internet users' searching behavior, physicians may be able to learn which neurosurgical topics the public are interested in. This information could help to 1) gain a better understanding of the average patient's background knowledge, 2) improve the physician–patient interaction, and 3) develop strategies for well-coordinated public relations work.

The most widely used search engine, with over 1 billion users and 100 billion searches per month,[1,2] Google offers a freely accessible implemented statistical tool called Google Trends, which depicts the amount of search queries over a period of time.

In 2009, Google Trends received public attention when scientists discovered that searching behavior of Google users could be used to identify general trends in the spreading of influenza in the United States.[3] Increasing rates of infection as reported by the Centers for Disease Control and Prevention correlated with increasing search queries. Recently, there have been several suggestions to improve the accuracy of Google Flu Trends[4,5] and there have been attempts to correlate Google Trends to other pandemic infectious diseases.[6]

The aim of this study was to evaluate whether Google Trends could also be a useful tool for neurosurgeons to assess the public's interest in different neurosurgical conditions.

METHODS

Google Trends depicts the amount of certain search queries per week based on a relative scale. The week with the overall highest

Key words
- Google trends
- Internet
- Neurosurgery
- Patient guidance
- Search queries

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Citation: World Neurosurg. (2016) 90:179-185.
http://dx.doi.org/10.1016/j.wneu.2016.02.045

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

number of search queries receives 100 points and all other weeks are viewed in relation to that week. There are 2 methods available from Google Trends to assess the users' search behavior: search terms include only queries including the exact term, whereas search topics include all queries within the field of interest. As of 2015, search topics was in beta mode and not all keywords are implemented into topics. Therefore, in this study both methods were assessed.

We obtained Google Trends data from the last 10 years for the following search topics: "hydrocephalus," "concussion," "vestibular schwannoma," "spinal stenosis," and "cerebral arteriovenous malformation." This choice of topics was selected from the limited range of topics within the current, beta version of Google Trends. Despite the limited range, we sought to include 1 topic from each of the main fields of neurosurgery: spinal surgery, tumor surgery, vascular surgery, trauma surgery, and cerebrospinal fluid disorders. Google Trends data were evaluated with respect to the amount of search queries, both worldwide and within Germany, so-called top searches (ie, most common expressions related to the search topic), and worldwide distributions of search queries.

To compare Google search queries with the volume of scientific publications during this period, PubMed publication data were acquired for the Medical Subject Headings terms corresponding to the above-mentioned search topics: "hydrocephalus," "brain concussion," "neuroma, acoustic," "spinal stenosis," and "intracranial arteriovenous malformation." PubMed publication data present the total number of publications per year.

For comparison of public interest as determined from Google Trends with disease prevalence, the total number of diagnoses per year according to the *International Classification of Diseases Version 10, German Modification* was obtained from the Federal Health Monitoring Agency of Germany.

In addition, we assessed Google Trends data for the following search terms: "neurosurgery," "glioblastoma," and "meningioma."

All data were obtained on 11 January 2015. The data on the number of PubMed publications were updated on 23 October 2015 to include publications from 2014 that were listed with a delay.

RESULTS

Overall Search Topic and PubMed Results

Over the last 10 years, there has been an increasing interest in the topic "concussion." This trend is reflected both in worldwide Google search queries (Figure 1) and in the number of publications in medical journals (Figure 2). Within search results from Germany, there was an exceptionally high peak for this search topic in the week of 29 December 2013 until 4 January 2014, correlating with a significant national news event. The worldwide amount of search queries mostly remained stable for the topics "hydrocephalus," "spinal stenosis," and "cerebral arteriovenous malformation" and shows a slight decrease for the topic "vestibular schwannoma." The number of publications on PubMed, on the other hand, has continuously increased over the last decade for all of the subjects mentioned except "hydrocephalus." The Medical Subject Headings term "brain concussion" reveals the steepest curve over the last 8 years.

Number of Diagnoses According to *International Classification of Diseases Version 10, German Modification*

From 2004 until 2014, there was a dramatic increase in the number of diagnoses of spinal stenosis within Germany (with a percentage increase of 134% over this period). There have also been increases in the number of cases of concussion, intracranial arteriovenous malformation, and hydrocephalus over this period (+31.9%, +26.9%, and +28.8%, respectively). The number of diagnosed benign cranial nerve tumors remained largely stable (−9.11%; Figure 3).

Top Searches

The so-called top searches on Google Trends show the most frequent search queries that contain words associated with the search topics. "Concussions in football," "concussions in sports," and "Crosby concussion" (which relates to the brain concussion of an American ice hockey player) were among the top searches within the topic "concussion." Google users appeared to be especially interested in congenital forms of hydrocephalus (top searches were "hydrocephalus baby," "spina bifida") and treatment ("hydrocephalus shunt," "hydrocephalus treatment," "VP shunt").

Within the topic "spinal stenosis," Google users were mostly interested in treatment ("spinal stenosis surgery," "spinal stenosis treatment," "laminectomy," "spondylolisthesis"). The interest in cervical spinal stenosis ("stenosis cervical," "cervical spinal stenosis," "stenosis neck," "cervical spine," "cervical stenosis symptoms," "cervical stenosis neck") was similar to that of lumbar spinal stenosis ("lumbar stenosis," "lumbar spinal stenosis," "canal lombaire etroit," "lumbar spine," "lumbar canal stenosis").

The top searches within "vestibular schwannoma" were mainly therapy-related ("acoustic neuroma surgery," "acoustic neuroma treatment," "gamma knife," "vestibular schwannoma surgery," "akustikusneurinom operation").

There were no sublevel terms within the top-level topic "cerebral arteriovenous malformations."

Geographic Aspects

Next, we looked at the worldwide distribution of the 5 search topics. The maps in Figure 4 indicate the top 10 countries for each one of them. Apparently, "spinal stenosis," "concussion," and "vestibular schwannoma" are mainly searched for in high-income countries, such as the United States, parts of western and northern Europe, and Australia, whereas "hydrocephalus" appears to be of most concern in low- and middle-income countries like Colombia, Kazakhstan, and Kenya. "Cerebral arteriovenous malformation" mostly raises interest in Japan and the United States.

Search Term Results

The search terms "glioblastoma" and "meningioma" have shown similar search rates over the last 10 years (Figure 5). There was a peak of the search term "glioblastoma" in October–November 2014.

In regard to the search term "neurosurgery," we found that there has been decreasing interest over the last decade. Alongside "journal neurosurgery" and "best neurosurgeons," Google users were frequently interested in "neurosurgery salary."