

RESEARCH LETTERS

Temporal Trends in Accessing Online Medical Information

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Online publication of medical research continues to grow at a rapid pace, with approximately 2,000 to 4,000 new citations indexed daily by the National Library of Medicine.¹ Prior studies suggest use of web-based applications such as Google and electronic databases may improve accuracy and efficiency in clinical decision-making compared to accessing primary sources of medical information.^{2–4} To date, however, no analyses have examined longitudinal patterns of utilization associated with these online resources. Accordingly, we sought to describe temporal trends in the online use of select sources of primary medical literature and drug information compared to UpToDate (<http://www.uptodate.com>), a database of evidence-based clinical knowledge.

METHODS

We obtained data from Google Trends (Google Inc., Menlo Park, CA; <http://www.google.com/trends>), an online resource for tracking Google search queries, from January 2004 to December 2013. We obtained weekly estimates of the relative search query interest for the *New England Journal of Medicine* (NEJM), the *Journal of the American Medical Association* (JAMA), the *Physicians' Desk Reference* (PDR), PubMed, and UpToDate. Use of relative search query interest values in research and their calculation have been described previously.⁵ We used the Google Trends “topic” search feature, which captures all related search terms for a limited number of queries, for data pertaining to NEJM and JAMA. The search terms “PDR,” “PubMed,” and “UpToDate” were used to obtain data for those sources, respectively. All searches were restricted to the “health” category and “United States” geography using the corresponding Google Trends filters.

Ordinary least-squares linear regression was used to calculate coefficients of trend for each source of online medical information, and postestimation differences

across all pair-wise combinations of coefficients were assessed using the generalized Hausman specification test. We performed locally weighted least squares regression to produce smoothed curves of each search query for graphical visualization. All analyses were performed using Stata SE 13.1 (StataCorp, College Station, TX), and all statistical tests were 2-tailed with α equal to 0.05.

RESULTS

Since January 2004, relative search interest associated with UpToDate has increased steadily, whereas web-based queries for other sources of online medical information have declined (Figure 1). Relative search interest in UpToDate has, on average, exceeded that of JAMA, NEJM, and PDR since approximately July 2011 (Figure 1), whereas PubMed has been associated with the greatest, albeit diminishing, relative search interest. Linear regression yielded the following significant ($P < 0.001$) coefficients of trend for UpToDate (coefficient = 0.010), JAMA (coefficient = -0.012), NEJM (coefficient = -0.030), PDR (coefficient = -0.020), and PubMed (coefficient = -0.011). Every coefficient differed significantly from each other ($P < 0.001$).

DISCUSSION

Proliferation of medical research—in concert with expanding access to the Internet—has dramatically magnified the amount and availability of medical information.¹ Our results support prior research indicating that medical information may be increasingly accessed by providers via interaction with online summary databases, rather than through electronic sources of primary medical literature or digital textbooks.^{3,6,7}

Our study has implications for the practice of hospital-based medicine. Our findings may reflect evolving provider preferences for synthesized medical information that can be translated efficiently to clinical practice.^{8,9} Use of summary databases may potentially lead to improved inpatient outcomes¹⁰ by enhancing knowledge of current medical evidence, adherence to clinical guidelines, and subsequent consistency of care across providers. However, increased reliance on these resources necessitates that such databases are subject to ongoing evaluation and integration of novel research according to standardized criteria, such as those employed by the Cochrane Collaboration or the United States Preventive Services Task Force, to ensure the quality of the medical information they purport to deliver.

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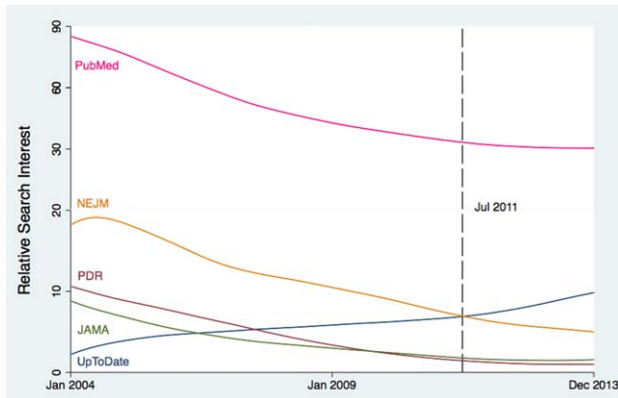


FIG. 1. Google Search trends for online medical information. Temporal trends in relative Google search query interest by online medical resource, 2004 to 2013. Abbreviations: JAMA, *Journal of the American Medical Association*; NEJM, *New England Journal of Medicine*; PDR, *Physicians' Desk Reference*.

These results are also relevant to inpatient medical education. As summary databases are used more frequently, trainees may elect to memorize fewer medical facts and algorithms. Ideally, this transition would foster more opportunities to hone clinical reasoning skills and concentrate on delivering patient-centered care. However, it may also create unwanted dependency on externalized expertise, which could impede the ability to critically evaluate primary medical literature, appropriately contextualize care options, and engage in real-time problem solving.

Our study has several limitations. It is ecologic by design and cannot account for unknown secular trends. This analysis does not capture actual use or direct access of online medical resources, although we believe our observed results most likely mirror in-person patterns of use. Additionally, because UpTo-

Date is frequently incorporated into existing health information technology platforms (unlike journals), our results are biased conservatively. Finally, this study compares online medical information resources only, and we cannot account for concomitant use of printed/nondigital publications.

Our results signal an emergent—and perhaps permanent—shift in the utilization of online medical information in the United States. These trends may inform future efforts to optimize medical education and evidence-based patient care as knowledge-seeking behaviors continue to adapt to changes in technology and clinical demands.

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