2.0

The World of Evidence 2.0™

Writing in the prestigious peer-reviewed journal *Science*, the President of the National Federation of Science Abstracting and Indexing Services, John Green, called for the development of a rational system to deal with the explosion of scientific literature. [1]

This eminently reasonable call to action is remarkable only because it was published half a century ago, in 1964, when the volume of literature was a fraction of what it is today. The need for such a system has become far more acute since then, as the volume of published literature has increased exponentially, as illustrated in the accompanying chart. [2]

ARTICLES INDEXED ON PUBMED PER YEAR
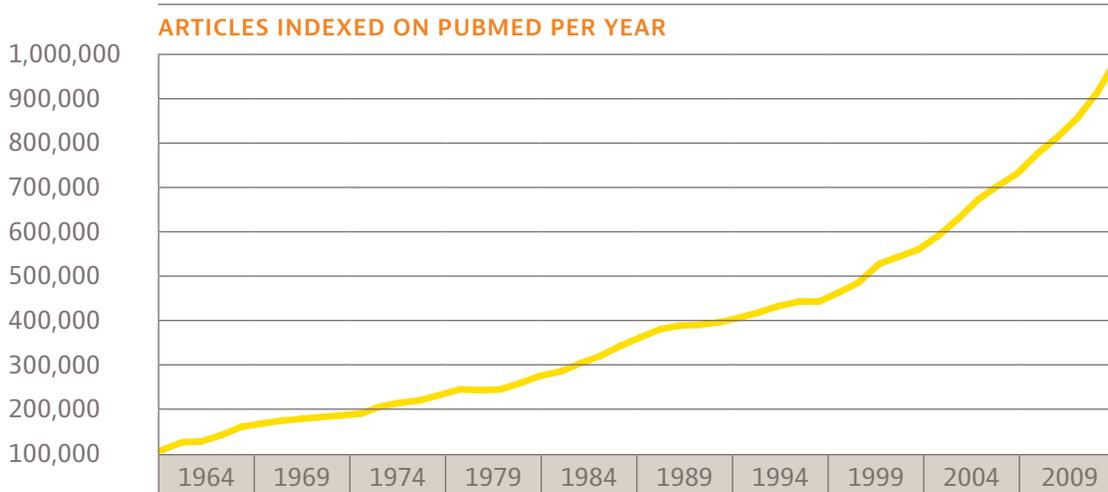
The First Generation: Evidence 1.0
The first system for managing the information explosion in the scientific and clinical literature arrived with the identification of the discipline of evidence-based medicine in 1992. The application of the principles of evidence-based medicine led to evidence-based practice. This practice necessitated the formalization of the rules for the critical appraisal of the medical literature on which practice is based.

These rules established the preeminence of meta-analyses, systematic reviews, and randomized controlled trials over nonsystematic clinical observations and anecdotes. They provided the quality metrics for categorizing and sorting scientific and clinical literature. Technology, in the form of searchable databases and continuous access to new literature through the Internet, supported this new system for appraisal and consumption of the literature. These literature evaluation systems and the tools created to support those systems are what we call *Evidence 1.0*.

The New Evidence Challenge

While Evidence 1.0 systems and tools have been effective in supporting the establishment of evidence-based medicine as the clinical practice standard, they have not succeeded in making the evidence available to clinicians and other caregivers, when and where the need it. In fact, some studies indicate that no more than one-fifth of clinical decisions today are informed by evidence from clinical research. [3] Despite the advances of Evidence 1.0, the latest scientific research and innovations in medical treatment and management are often not applied in clinical practice. Two factors have contributed to the lack of accessibility of evidence in the clinical workflow. The first is that Evidence 1.0 systems and tools were built around the traditional view of evidence as reference, rather than evidence as real-time clinical decision support. In fact, this view informed the design of the evidence systems, including the methods of dissemination—and ultimately the very definition of what evidence is.

The second factor contributing to the lack of accessibility of clinical evidence is another wave of the knowledge and information explosion that motivated John Green's original call to action. Large new sources of evidence are emerging, driven by the widespread use of electronic health record (EHR) systems and the availability of heath care data from a variety of new sources, such as registries for diseases and treatment of specific populations, claims databases from insurers and payers, and mobile devices and sensors that capture local patient data.

It is clear that the traditional reference-based systems of disseminating new scientific and clinical information are not sufficient. New methods are needed to move evidence from reference to actionable medical intelligence in the clinical workflow.

Evidence 1.0 + Data + Analytics = Evidence 2.0

It is time for Evidence 2.0: the application of data and analytics to the practice of evidence-based medicine. Evidence 2.0 leverages advances in technology—as well as innovations in the fields of scientometrics and bibliometrics—to expand evidence sources, and to analyze that evidence against patient-specific clinical needs, to make new knowledge actionable and available in the clinical workflow.

EHRs provide additional evidence sources that enable the patient-specific application of evidence-based medicine. These include qualitative data, such as abstract data type (ADT) feeds and problem lists; quantitative data, such as laboratory results and costs; and transactional data, such as medication administration records and claims data. The application of real-time analytics to these evidence sources drives outcomes-based care and leads to improved quality and lower cost.

The use of Evidence 2.0 techniques not only provides efficiency and scalability, its data-driven design enforces greater objectivity in the evaluation of new scientific information than was possible using Evidence 1.0 systems and tools. By enhancing evidence-based medicine through the application of big data and quantitative analytic techniques, we will be able to ensure that evidence-based practice is the only practice in health care.

1   Green JC. The information explosion—real or imaginary? *Science*. 1964;144:646-648.

2   Data extracted from PubMed, a service of the National Center for Biotechnology Information, U.S. National Library of Medicine, 8600 Rockville Pike, Bethesda, MD 20894.

3   Smith M, Saunders R, Stuckhardt L, McGinnis JM, eds; Committee on the Learning Health Care System in America. Best Care at Lower Cost: The Path to Continuously Learning Health Care in America. Washington, DC: National Academies Press; 2013.