

Medical Information and the Use of Emerging Technologies

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ABSTRACT

In this age of information technology, physicians are confronted daily with the dilemma of how to deal with an excess of medical information. To do this efficiently and effectively, it is important to be aware of new technologies and their application. This article introduces emerging technologies, highlighting some of the resources available and demonstrating how they can assist the physician with the daily flow of information.

INTRODUCTION

Doctor Smith is a primary care physician in a busy clinical practice who occasionally works with medical students. She has been in practice for almost 2 decades and began using an electronic health record 3 years ago. During a typical day she uses her computer to view her patient care schedule and to check patient care-related messages. She has voice mail on her office phone that needs to be checked and a stack of paper mail is left on her office desk daily. In addition, Dr Smith has 2 e-mail accounts, 1 for work and 1 that is personal; she checks both e-mails at least once a day. She is on several listservs that have multiple e-mails regarding discussion topics daily. In her e-mail, she receives the table of contents for the many journals to which she subscribes. Doctor Smith has created a bookmark system on her computer to assist her in answering clinical questions; however, her bookmarks are saved on her office computer, which means she has to leave the exam room to go use her office computer to use her bookmarks during patient care. Doctor Smith feels overwhelmed and wonders how she can keep up with all of her various "inboxes" and rapidly changing medical information.

As this example illustrates, physicians are bom-

barded daily with information from multiple sources including paper mail, e-mail, electronic health record inboxes, and phone message boxes, and must use various technologies to deal with the excess of information. The methods for seeking and organizing information have evolved exponentially in the past decade.

This time of information explosion has been referred to as "the decade of health information technology."¹ In 1996, the first generation of personal digital assistants (PDAs) containing 128 to 512 kB of random access memory (RAM) were manufactured.² These devices contained information that could be downloaded from other sources and remained the same until the user updated it. These devices could only be connected to the Internet through a direct cable connection to a desktop or laptop computer, which was itself connected to the Internet. Many physicians used this technology to keep track of their calendars and to keep medical resources that functioned much like electronic books. Smartphones, which today function as phones with complete personal organizers and often a direct connection to the Internet, were first introduced in 1993.³ The first Blackberry appeared in 2001 and the first iPhone in 2007. Today these devices have up to 16 GB storage space, which is often an internal flash drive; up to 128 MB RAM; and they can connect directly to the Internet. In addition to the variety of portable devices, desktop, laptop, and tablet computer usage has become commonplace in most medical settings. Wireless technology, known by the trade name Wi-Fi, enables many electronic devices to connect to the Internet eliminating cables, wiring, plugs, and connectors, making access to information easier than ever.

BACKGROUND

The World Wide Web was created in 1989 and released in 1992. Initially, information on the Web was primarily static, documents were created and posted but rarely updated and no one other than the author had access to modifying them. Information on the Web has changed

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since that time, and the term “Web 2.0” is often used to describe the current World Wide Web. The term Web 2.0 was first described in 2004,⁴ and refers to an interactive Web that allows sharing and collaboration, instead of a static location where we go only to view information (Table 1).⁵⁻⁶

Today physicians can use the Internet to gather general information, to answer specific clinical and research questions, to keep up on identified topics of interest, or to comment on the latest medical information. In a typical day, physicians may receive e-mail that includes messages from listservs, tables of content from a variety of medical journals, messages from colleagues, as well as personal messages and unwanted spam messages. The Internet is a great resource, but it also contributes to information overload. Somehow physicians need to find a way to wade through this information while moving through their busy day. There are several technologies that can assist with unclogging various electronic “inboxes.” These technologies can help organize information, minimizing the need to jump from Web site to Web site in search of answers to questions. In this article we discuss some of these available technologies and their application. All of the technologies and resources discussed in this article function best with a fast Internet connection.

Medical Information in Web 2.0

Wikis

The term wiki comes from the Hawaiian word for hurry or swift. A wiki is a collaborative Web site where users can add and edit content. The most famous wiki is an on-line free encyclopedia “Wikipedia,” which was launched in 2001.⁴ In medicine, wikis offer a way for people in many different locations to collaborate on a topic. Wikis can serve as sites to find medical information, ways to collaborate on a specific topic, and places for patients to focus on a specific topic. Some examples of wikis are noted in Table 2.

The advantage to using a wiki is its ease of use and availability to anyone with Internet access. One disadvantage to this technology is uncertainty about the quality of information provided. Because anyone can contribute information to the site, it can be vandalized. However, there is evidence of a socially Darwinian process that has been named “darwinkinism” where unfit content is culled and edited to reflect valid information by the core users.^{4,6} A recent study comparing Wikipedia to Encyclopedia Britannica on-line found a similar number of errors between the 2 resources.⁷ One way to improve the validity of medical wikis is to limit who can contribute to the wiki. For example on

Table 1. Web 1.0 vs. Web 2.0⁶

Web 1.0	Web 2.0
Static	Dynamic
Posting of fixed document to Web site	Interactive document where users alter content
Encyclopedia	Wikipedia
Personal Web sites	Blog where readers can comment on what they are reviewing

Ganfyd, only licensed medical professionals can contribute to the wiki.

How could a wiki save busy physicians time during their day? A wiki could be used as an interactive site that could replace mass e-mails that get sent out to large groups and then clog up individuals’ e-mail as all of the many group members respond to the e-mail. If a group practice is working on creating a policy or document, they could have it posted on a restricted wiki site where members have to sign in to see the document and they could collaborate on-line regarding the document. In this scenario, members of the group could participate at the time convenient for them, eliminating the need to try to find a meeting time that fit into everyone’s schedule.

Blogs

Blog, which stands for “Web log,” was coined in 1997 and abbreviated to “blog” in 1999.⁴ Blogs are Web diaries or on-line journals that appear in chronological order. The author of a blog may be an individual or a group. The blog entries often include commentary and links to other Web sites. The software for creating blogs is free and easy to use. Many different types of blogs exist; they can be used in place of a listserv so that a topic can be discussed and replied to on the same Web site instead of through e-mail. They can function as journals or diaries where people discuss their opinions on topics. They can serve as locations to review medical cases with comments from any users. A blog can also be a site where patients discuss their health care. Some examples of blogs are noted in Table 3. Similar to wikis, the disadvantage is the quality of the information on a blog. Blogs can be open to the public or limited by password to members only. There are health insurance portability and accountability act (HIPPA) concerns if patient information is being posted on the Internet.

How could a blog save busy physicians time during their day? A blog could be used as an interactive site that would replace listservs and reduce daily e-mail messages. Clinicians would go to the blog site at their convenience and view all of the messages regarding a particular topic all at once, and comment on it if neces-

Table 2. Wikis

Name	Site	Purpose
Fluwiki	www.fluwiki.com	An international public health site for public health officials to keep track of influenza epidemics
Ganfyd	www.ganfyd.org	On-line encyclopedia of medical topics
Efficient MD	wiki.efficientmd.com	A site for medical students, residents, and physicians to provide pearls, strategies, and useful resources to improve health care

Table 3. Blogs

Blog	Focus
http://digutmb.blogspot.com/	A dermatology site that reviews information relevant to medical students, residents, physicians, and the general public
http://efficientmd.blogspot.com/	Technology and medical practice
http://casesblog.blogspot.com/	A medical education blogs that includes cases and medical images
http://www.diabetesmine.com/	A discussion about diabetes and related issues for patients

sary. Blogs can also be very useful references to give to patients with chronic illnesses and their caregivers. It is possible that patients and their families will have fewer questions for their clinician and feel more support when connected to these types of resources.

Podcasts

Podcasts are digital-media files that are available over the Internet. They include audio or both audio and video content. The term podcast began to appear regularly in 2004 and was Word of the Year in the 2005 New Oxford American Dictionary.^{4,8-9} Podcasts allow information to be shared with anyone at any time. They can be played on your computer or downloaded onto MPEG audio layer 3 (mp3) players, personal digital assistants (PDAs), or smart phones. Podcasts are often syndicated and subscribed to so that when new content is added the information will download automatically. There are podcasts of lectures on the Web that include entire presentations or summaries that review the major teaching points of presentations. Podcasts have become very popular teaching tools in medical schools and resident training. There are libraries of podcast content available through many medical schools and residencies. One example is the University of Wisconsin School of Medicine and Public Health Department of Family Medicine digital media library at <http://www.fammed.wisc.edu/our-department/media>. Podcasts provide a way to keep up with medical information. Clinicians can access podcasts by downloading content from digital libraries, by subscribing to specific presentations such as grand rounds at hospitals and medical schools, or through weekly podcasts offered by medical journals such as the *New England Journal of Medicine*.

One example of how a clinician could use a podcast

to save time during a busy day can be seen with the use of the Family Medicine Digital Media Library previously mentioned. If a clinician has a question regarding a specific orthopedic test such as the crank test, hawkin's test, or speed's test, a quick video demonstration including audio explanation can be viewed in 12 to 20 seconds on this Web site. The clinician can quickly review the podcast, do the testing at that time on the patient, and help answer their clinical question.

Using Technology to Manage the Information

RSS (Really Simple Syndication)

RSS is a method for "pushing" new Web content to users or allowing for continuous instant "alerting" of users to new Web content.⁵ By using a Web-based portal, the user subscribes to RSS content by requesting it to be "delivered" to them. This type of delivery is referred to as a feed. The benefit of RSS is that it saves time by allowing users to view content from multiple Web sources all in 1 place. In addition, users do not have to "revisit" Web sites to check for updated information as it is delivered automatically. It is a direct, permanent connection to continually updated sources. For example, with the use of RSS technology, physicians can subscribe to table of contents for electronic journals, news headlines, blog postings, and podcasts. To access RSS feeds, the user needs an RSS feed reader. These feed readers do the work of checking for new content and retrieving the updates on the sites subscribed to. Web-based examples include My Yahoo, Bloglines, and Google reader. The benefit of Web-based feed readers is that users can access personalized information from any Internet connected computer. Feed readers are also built into the latest browsers (Windows Internet Explorer, Mozilla Firefox, and Apple Safari); however, to access

feeds with these readers users must be using the 1 specific computer on which they created their personalized feeds. RSS is a key component to the concept of Web 2.0; it is the method commonly used to disseminate new information quickly and efficiently.⁴

RSS technology can help busy clinicians save time by giving them the ability to access their favored Web sites from any computer and updating the information from selected Web sites automatically. This eliminates the need to run back to 1 main computer to access favorites or bookmarks. In addition, it can help eliminate outdated static resources that are found in paper files. For example, a busy clinician is seeing a patient with chronic back pain and wants to give that patient a handout on back care and back exercises. Rather than stepping out of the exam room and trying to sift through a file cabinet, the physician pulls up their bookmarks on the exam room computer, goes directly to the link for back pain resources, and prints the handout for the patient. The extra time saved is then used to go over the handouts to make sure the patient understands them.

Web Content Management

In this section, what is often referred to as a startpage is described. It can be thought of as a personalized homepage or desktop that provides users access to all their information from any computer with an Internet connection. A startpage is a Web portal connecting the user to useful bookmarks/favorites, RSS feeds, podcasts, wikis, and blogs and other gadgets available on the Internet. The benefit is that all their RSS feeds, bookmarks, and gadgets can be viewed in 1 place and easily accessed with minimal effort. An example of a Web management system or startpage is iGoogle (<http://www.google.com/ig>), launched in 2005 and currently supporting 42 languages with more than 70 country domains supported.¹⁰ iGoogle can function like a mobile computer desktop accessible from any computer with Internet access. It can coordinate calendars, documents, bookmarks, RSS feeds (including links to desired podcasts), blogs, and wikis. An example of how to create a personalized medical iGoogle page can be found on a public blog, <http://casesblog.blogspot.com/2006/06/make-your-own-medical-journal-with.html>. Other examples of startpages are Netvibes, Pageflakes, GloTouch, MyYahoo, and Windows Live Personalized Experience.

A personalized startpage can save busy physicians time. By centralizing all computer-related resources to 1 Web site, physicians can link to all of their other favor-

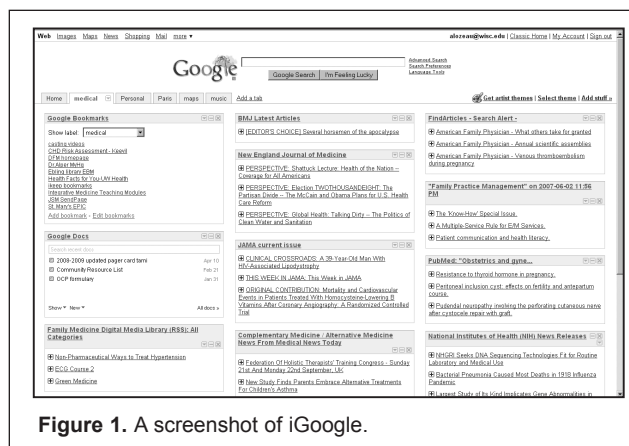


Figure 1. A screenshot of iGoogle.

ite resources easily. They can see their daily calendar; all of the top journal headlines, news headlines, blogs, or wikis they have chosen; and have access to documents such as pager lists and call schedules. All of these resources will be displayed on 1 Web site, which allows the user to separate work-related information from personal information by using various tabs (an example can be seen in Figure 1).

Example: Clinical Use of the Technology

Having gone to a hands-on computer workshop focused on emerging technologies, Dr Smith has created her own personalized startpage using iGoogle. Doctor Smith has changed her routine so that she arrives at her office 30 minutes before her first patient is scheduled to arrive. She logs on to her computer, goes directly to the Internet and opens her personal iGoogle start page. She reviews her Google calendar for her daily schedule and realizes that she has a medical student shadowing her for the morning. She looks at her Google reader for any updated medical resources, quickly scans the latest journal headlines, and reviews the journal articles in which she has interest (Figure 1). Today, while scanning the journal headlines, she chooses to read a recent article on atrial fibrillation and one on bisphosphonates.

Her student arrives and they review her morning schedule together. The first patient is coming in for an evaluation of shoulder pain. The medical student has never performed a shoulder exam before. Doctor Smith uses her link to a digital media library on her iGoogle site and pulls up a podcast on the shoulder exam; the student watches this while Dr Smith completes some paperwork. During the morning, 1 of her patients has a cyclospora infection. Doctor Smith is not sure how to treat this. She pulls up her iGoogle page, reviews her bookmarks and quickly finds her bookmark for the Centers for Disease Control and Prevention (CDC) Web site. On the CDC site, she quickly finds treatment

recommendations for this infection. Still connected to her iGoogle page, she then goes to her bookmark for the Epocrates drug database Web site and pulls up information on the medication used to treat this infection. Doctor Smith continues to use her iGoogle page throughout the day to review the latest journal information, monitor her schedule, and answer pertinent clinical questions.

SUMMARY

When used effectively, technology can assist physicians in organizing their daily information flow. As discussed, certain technologies such as wikis, blogs, and podcasts also offer a way to enhance clinicians' digital learning experiences. An essential component to using these resources efficiently is creation of a Web-based RSS feed reader or going 1 step further and creating a personalized startpage. The key is finding a way to organize the technologies and resources a physician uses on a daily basis so that they are quickly available where and when they are needed. Medical librarians today are well versed in most of the technology presented in this article, and they can be great resources for physicians interested in getting started using any of these technologies or applications. Some physicians may have access to information technology staff—another resource to turn to when looking for assistance with use of technology and its application. On the video sharing Web site YouTube there are countless videos on Web 2.0 and how to create wikis, blogs, podcasts, and iGoogle pages.

Overall, it remains to be seen if these technologies and their application will revolutionize medical information distribution and education; however, in the meantime clinicians and educators cannot afford to ignore them.^{4,6}

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