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Information management for clinicians

ABSTRACT

Clinicians are bombarded with information daily by social media, mainstream television news, e-mail, and print and online reports. They usually do not have much control over these information streams and thus are passive recipients, which means they get more noise than signal. Accessing, absorbing, organizing, storing, and retrieving useful medical information can improve patient care. The authors outline how to create a personalized stream of relevant information that can be scanned regularly and saved so that it is readily accessible.

KEY POINTS

The first step in information management is to become aware of relevant new information in your area of practice and set up feeds of information from reliable and authentic sources. These feeds should be accessible from any computer or mobile device and scanned regularly.

Useful information you come across in various digital streams needs to be bookmarked for future search and retrieval. Social bookmarking lets you create bookmarks you can share across other devices and with other people and retrieve with an Internet search.

Cloud storage services have apps for most platforms and devices, providing search tools and the ability to share articles or "folders" with other users. The information is "synced" between all devices so that the most up-to-date version is always available, regardless of location and device.

ACCESSING, ABSORBING, ORGANIZING, storing, and retrieving potentially useful medical information is a challenge. Physicians used to try meet this challenge with personal libraries of journal articles in their file cabinet. Today, that is inadequate to combat the deluge of digital information. In 2013, the Institute of Medicine acknowledged this problem, stating, "The ever-increasing volume of evidence makes it difficult for clinicians to maintain a working knowledge of new clinical information."¹

The sheer volume of data has meant that, rather than try to maintain a regular diet of professional reading (proactive scanning²), many of us now seek information only when we need answers to specific clinical questions (reactive searching). This approach promotes lifelong problem-based learning but assumes that we are consciously aware of this need and are aware of the need to search for new information.

We need to constantly scan for new evidence in our area of practice to avoid becoming falsely assured of our knowledge. We also need to be able to find information we have seen before we need to use it. The following are examples of how using this approach could dramatically empower a busy clinician.

On a recent clinic day, a colleague pokes his head into your office and asks, "Have you heard anything about niacin in the news? I have a patient who is asking me if we should discontinue it." You respond: "Yes, there was something that just came out. I am not sure where I read it or heard about it. Give me a couple of seconds and I can find it." True to your word, a few seconds later you find and share the latest article on the HPS2-THRIVE trial and a commentary on the results.

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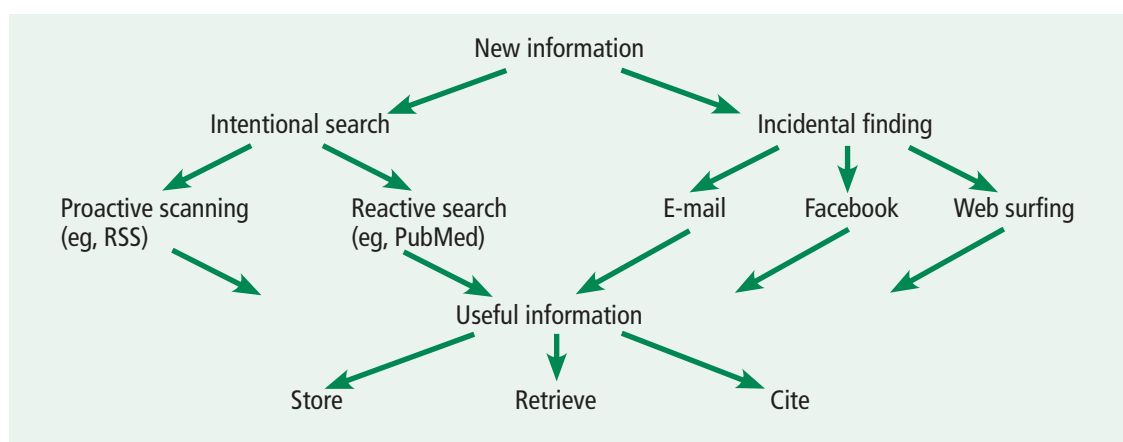


FIGURE 1. A strategy for managing medical information overload.

Later, your first patient of the day asks you, “When we switched to dabigatran, you mentioned that, unlike warfarin, there was no specific reversal agent. I heard that there is one now?” Instead of being taken aback, you nod your head. “Yes, I saw that recent article showing that the medication rapidly and completely reverses the effect of dabigatran in the majority of patients. While I hope we don’t need it, this is good news, particularly as there did not seem to be any major adverse events.”

Sounds too good to be true? Can this really be you? In this article, we outline an information management strategy (Figure 1) and tools to help busy clinicians stay up to date with new medical evidence in their areas of interest or expertise. In addition, we provide a strategy for leveraging technology to easily retrieve previously viewed information. A future article will specifically show how to best access information at the point of patient care.

■ THE NEED TO MANAGE INFORMATION

Physicians are expected to practice evidence-based medicine. When faced with a clinical question, we should search for evidence using focused queries of primary and secondary sources such as PubMed or the Cochrane Library. This is an important skill and is appropriate when we take time to look for an evidence-based answer to a specific question. In many cases, it is appropriate to continue with a current practice until newer information has been reviewed and validated.

Unfortunately, indexing and adding new

recommendations to these information sources takes time. We may also be unaware that new information is available and may continue to practice as usual until faced with a situation like those outlined above or until we attend a continuing medical education activity, often quite by chance.

Today we can proactively update ourselves in a manner tailored to our own interests and focus and retrieve important information easily when we need it.

■ A STRATEGY FOR INFORMATION MANAGEMENT

In general, we come across new information in one of three ways:

- Proactive scanning of personalized sources of information—as discussed above, a habit of regular scanning is critical to information management
- Reactive searching for information to answer clinical problems or when doing research
- Incidentally—an e-mail from a colleague, information shared on a social network or encountered while surfing the Internet.

In each case, we may find information that is potentially useful, something we may need to find again in the future. But unless we use this information often, we will not remember the details or may even forget we had seen it. Thus, we need a strategy to store this information so we can retrieve it easily at any time with any device; neuroscientists call this the “externalization” of memory.³ Ideally, even if we forget that we ever saw this information or

We need to be able to find information we have seen before we need to use it

where we stored it, a search would retrieve the location and details of this formerly viewed information.

In the following sections, we outline steps and tools of a strategy for managing clinical information relevant to your practice.

■ STEP 1: SETTING UP INFORMATION FEEDS

The first step in this information management strategy is to become aware of relevant new information in your area of practice or research. To do this, you proactively set up feeds of information from reliable and authentic sources. These feeds can be browsed on any computer or smart mobile device.

There are several possibilities for creating these feeds. One option is to subscribe to the table of contents (TOC) of relevant journals via e-mail.

A more versatile and full-featured option is a research site summary (RSS) feed-reader. RSS is a standard for publishing summaries (feeds) of frequently updated content on the World Wide Web, such as journal TOCs and items from medical journal news sites (Table 1 shows what this looks like on screen), as well as aggregators like the American College of Physicians Journal Club. You can subscribe to these using feed-reader software from Feedly (www.feedly.com) or Inoreader (www.inoreader.com), which can be used with any browser on a desktop or laptop. They are also available as apps for mobile devices such as smartphones and tablets. The feed-reader periodically checks for new content and automatically downloads it to the device. Thus, you do not need to check multiple websites for updates or have e-mail inboxes fill with content; the content is delivered to your device for perusal at your convenience. (See online supplement “Information Management for the Clinician” at www.ccjm.org for step-by-step instructions on creating a free Inoreader account and subscribing to feeds.)

RSS feed-readers have several advantages over e-mailed TOCs:

- RSS feeds create a centralized searchable repository of all subscribed information.
- The software keeps track of what you have read and displays only unread items; after a journal TOC e-mail is opened, the entire

TABLE 1

Feeds from medical journals and news sources

Medical journal feeds

Annals of Internal Medicine Current Issue	Medicine Journals
Cleveland Clinic Journal of Medicine current issue	Medicine Journals
JAMA Current Issue	Medicine Journals
JAMA Internal Medicine Current Issue	Medicine Journals
Latest headlines from BMJ	Medicine Journals
Latest Results for Journal/ /of/ /General/ /Internal/ /Medicine	Medicine Journals
Massachusetts Medical Society: New England Journal of Medicine	Medicine Journals
The Lancet	Medicine Journals

Medical news feeds

Health & Medicine News -- ScienceDaily	Medical News
Health The Guardian	Medical News
MedPageToday.com - medical news plus CME for physicians	Medical News
Medscape Medical News Headlines	Medical News
NYT > Health	Medical News
WebMD Health	Medical News

TOC is marked as having been read.

- You can organize news items into folders by tagging key words.
- Most journals and medical news sites like Medscape and the health section of the *New York Times* provide RSS feeds at no cost.
- An unlimited number of feed items, or articles, are stored in the cloud and do not affect e-mail storage capacity.
- The feed is automatically updated multiple times a day instead of once a week or once a month.
- In addition, one can create RSS feeds on PubMed for custom searches. Thus, a physician can get automatic regular updates of new articles indexed in MEDLINE in their area of interest.

Users can thus build their own personalized magazine of constantly updated information for access and can search from any web-enabled device. (Note: It is advisable to turn off notifications generated by these apps on mobile devices to reduce distraction.)

■ STEP 2: BOOKMARKING EVIDENCE

When you find something useful or interesting, bookmarks help you find the information again quickly when you need it. But while the browsers Firefox, Chrome, Internet Explorer, and Sa-

We can now tailor our updates to our interests, and retrieve information when we need it

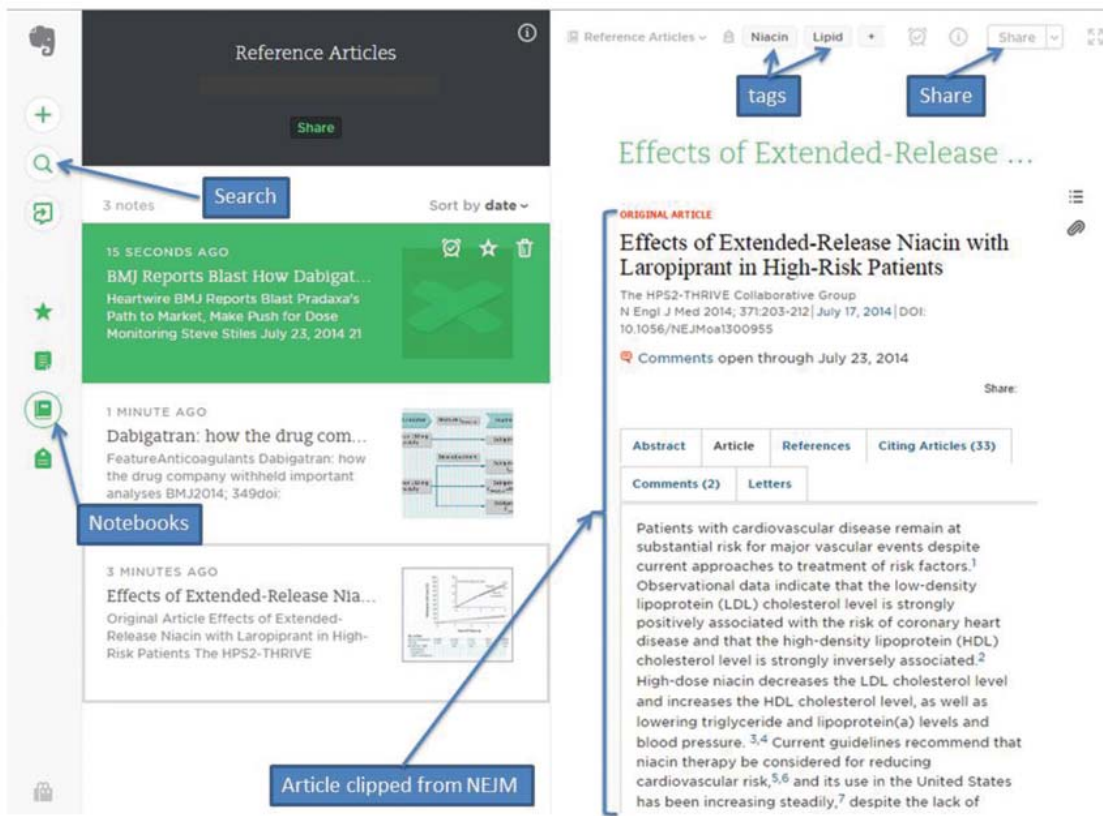


FIGURE 2. Screenshot of Evernote, highlighting the ability to clip web pages and then tag, share, and search.

From Landray MJ, Haynes R, Hopewell JC, et al. Effects of extended-release niacin with laropirant in high-risk patients. HPS2-THRIVE Collaborative Group. *N Engl J Med* 2014; 371:203-212. Copyright 2014, Massachusetts Medical Society. Reprinted with permission from Massachusetts Medical Society.

With these tools you can create a customized, constantly updated medical news 'magazine,' accessible from any web-enabled device

fari allow bookmarking, they have significant limitations. Bookmarks may be available only on the device they were created on, and because people use more than one device to go online, they may not remember which device they used to bookmark or view the web page.

Browser bookmarks generally store the address (URL) of the web page and a label that you create, but they do not do much else. Sharing bookmarks with others is also difficult or impossible.

Social bookmarking

Social bookmarking lets you create bookmarks you can share across other devices and with other people. Diigo (www.diigo.com) and Delicious (www.delicious.com) are two social bookmarking services that let you integrate with all popular browsers through a button or toolbar. They allow you to save displayed web pages with labels, descriptions, and tags.

Diigo offers two additional features. It al-

lows web pages to be annotated with highlights and notes. And during a Google search, relevant results from the Diigo library are simultaneously displayed.

If you forget you bookmarked something and saved it in your Diigo library, when you search for the information again on Google, Diigo will automatically display any results from your Diigo library next to the Google search results. This is very helpful as it is much easier to review information you have already read, marked up, and saved than it is to start over.

Bookmarks and annotations are stored in the cloud and can be accessed by any device. (See "Information Management for Clinicians" at www.ccjm.org to learn how to sign up for a free Diigo account, and how to use it.)

STEP 3: STORING YOUR INFORMATION

You may want the option to store full-text information in your personal library. This informa-



FIGURE 3. Screenshot showing example of research site summary (RSS) medical news feed item as seen on feed-reader and tagged “cardiology” and “vascular” (in blue).

tion was once stored in file cabinets and, more recently, on hard drives and USB flash drives. But information stored with these methods is not available or searchable on multiple devices from any location.

Cloud storage

Cloud storage services meet the need for access to stored information at any time and with any device. Options include Dropbox (www.dropbox.com), Box (www.box.com), Google Drive (drive.google.com), OneDrive (onedrive.live.com), and Evernote (www.evernote.com). Each provides different amounts of free storage and has apps available for most platforms and devices. They provide search tools and the ability to share articles or “folders” with other users. The information on these online drives is “synced” between all devices so that the most up-to-date version is always available to the user regardless of location and device.

Evernote offers multiple folders called notebooks to store and segregate data. The open notebook shown in **Figure 2** is named “reference articles.” It has the HPS2-Thrive article from the *New England Journal of Medicine* (*N Engl J Med*) tagged with the terms “niacin” and “lipid” to facilitate retrieval. The article was saved from that journal’s website using an Evernote browser extension that allows entire web pages or selections to be saved

to Evernote with a single click. Evernote also has a powerful search feature that can find text in images or in PDF documents. In addition, it allows easy sharing of a note or an entire notebook. Once a note or notebook is shared, all parties can add to it. In The Evernote app also allows tablet and smartphone access to the shareable content.

The other services listed here have similar feature sets. Dropbox is perhaps the easiest to adopt, but it offers the least amount of free storage. If you use Microsoft Office software, OneDrive lets you edit documents online, and an Office 365 subscription includes 1 terabyte of storage. Google Drive is probably the best solution for online collaboration, such as coauthoring a paper. Box is one of the few online storage solutions that complies with the Health Insurance Portability and Accountability privacy rules.

■ PUTTING IT ALL INTO PRACTICE

Once you have become familiar with Inoreader and Diigo (visit www.ccjm.org for step-by-step instructions), the following scenario shows how to adapt them into an efficient workflow.

Dr. Smith has a smartphone, a tablet, a laptop at home, and a desktop at work. She signs onto Google Chrome as her preferred browser on all devices. This seamlessly loads

These tools can transform the Internet into a searchable notebook of personally selected, annotated information



FIGURE 4. Screenshot showing news-feed item with annotation using Diigo.



FIGURE 5. Screenshot showing original article with annotation using Diigo.

From Landray MJ, Haynes R, Hopewell JC, et al. Effects of extended-release niacin with laropirant in high-risk patients. HPS2-THRIVE Collaborative Group. *N Engl J Med* 2014; 371:203-212. Copyright 2014, Massachusetts Medical Society. Reprinted with permission from Massachusetts Medical Society.

her Diigo extension when she is using a laptop or desktop. She has set her RSS feeds for her preferred journal TOCs and medical news sites to be downloaded to Inoreader. (For details on how to add a medical journals feed bundle and a medical news feed bundle, visit the information supplement at www.ccmj.org.)

Instead of reading paper journals, Dr. Smith browses her customized up-to-date “magazine” on Inoreader. When she comes across a relevant article, she marks it as “favorite.” If she has more time, she visits the web page, reviews the information, and saves it to her Diigo library with annotations if appropriate.

When searching for information on the web, she uses Google—without having to remember if she bookmarked information related to the search term. The Diigo extension in her browser automatically searches and displays information from her Diigo library next to her Google search results, and she can instantly see her notes from the last time she read the article.

Relating this workflow to the example of the dabigatran story above, Dr. Smith sees an article about dabigatran reversal while viewing her *N Engl J Med* medical news feed on her feed-reader. She marks it as a favorite and tags it with the key terms “cardiology” and “vascular” (Figure 3).

Dr. Smith later returns to look at her favorite feed items and visits the article on the *N Engl J Med* website. She annotates the article and saves it to her Diigo library (Figure 4).

Since this information is highly relevant to her practice, she also visits the *N Engl J Med* website to read the full article and the accompanying editorial (Figure 5). She annotates these and also saves them to her Diigo library.

Later, if she searches Google for dabigatran (using her default Google Chrome browser with Diigo extension), she will see the usual Google search results and twinned Diigo bookmarks (Figure 6).

If she clicks on one of the links, the browser will load the web page with all the annotations that she made when she first visited.

CONCLUSION

The strategies and tools we describe here let you create a personalized and constantly updated medical news “magazine,” accessible from any of your web-enabled devices. They can transform the Internet into a searchable notebook of personally selected, annotated information, helping you to more easily stay up to date with advances in your field of practice, and to more easily manage the modern information overload.

The screenshot shows a Google search for "dabigatran". The search bar at the top contains the word "dabigatran". Below the search bar, there are tabs for "All", "News", "Images", "Books", "Shopping", and "More". The search results on the left include links to Pradaxa's website, healthcare professionals' resources, Wikipedia, and Drugs.com. On the right, a Diigo bookmarked page titled "Dabigatran" is displayed, showing information about the drug as a blood thinner, its side effects, interactions, warnings, and related medications.

FIGURE 6. Searching for “dabigatran” on Google automatically retrieves results of previously viewed information bookmarked in Diigo (on right).

REFERENCES

1. **Institute of Medicine (IOM).** Best Care at Lower Cost: The Path to Continuously Learning Health Care in America. Washington, DC: National Academies Press; 2013. www.nap.edu/openbook.php?record_id=13444&page=R1. Accessed May 17, 2016.
2. **Slotnick HB.** Physicians' learning strategies. *Chest* 2000; 118(suppl 2):185–235.
3. **Levitin DJ.** The Organized Mind: Thinking Straight in the Age of Information Overload. New York, NY: Dutton; 2014:528.

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