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# Medical E-Reference: A Benchmark for E-Reference Publishing in Other Disciplines

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# E-Reference Context and Discoverability in Libraries: Issues and Concepts

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# Chapter 11

## Medical E–Reference: A Benchmark for E–Reference Publishing in Other Disciplines

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### ABSTRACT

*Electronic medical information retrieval systems and reference sources were some of the first discipline-specific e-resources to be developed, due to physicians' need to access the most current and relevant clinical information as quickly as possible. Many medical publishers and information aggregators have been incorporating the features their users demand for years. Thus, medical e-reference publishing could serve as a benchmark for e-reference publishing in other fields. Yet medical e-reference is not without its challenges. Today's physicians and medical students expect immediate and user-friendly electronic access to media rich and value added clinical references, particularly via their mobile devices. Publishers, librarians, and network administrators will need to ensure that mobile information sources users demand are discoverable and easy to access and use, even in healthcare environments where increased data security is necessary.*

### INTRODUCTION

Medical publishers and aggregators were among the first to begin developing electronic desktop and mobile publications, due to the obvious need of physicians and medical students to access authori-

tative reference sources quickly and conveniently, but with the current increasing adoption of mobile devices and smart phones among the general population as well as the physician population, user expectations for anytime, anywhere access to enhanced content is increasing as well. Therefore, medical publishers, aggregators, and access providers (like librarians and network analysts)

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must continue to meet these expectations as much as possible. Medical librarians and publishers take for granted that authoritative reference sources are critical for quality patient care, but today's physicians and medical students also expect a flexible and media rich experience, that is still quick and easy to discover and to access, even on a secured network. For decades, the medical field has been at the forefront of discovery of and access to scholarly resources. One reason for this may be because of the influence of the National Library of Medicine (NLM), which has long been a leader in Information Technology.

## **BACKGROUND**

The NLM published the first volume of *Index Medicus: A Monthly Classified Record of the Current Medical Literature of the World* in 1879. This index included books, medical articles, reports, and other literature (Miles & National Library of Medicine, 1982). NLM set high standards for information retrieval systems and vocabulary control in 1964 when it developed MEDLARS (Medical Literature Analysis and Retrieval System), which was based on *Index Medicus*. This database was too large for the remote access by computer systems in 1970 (McCarn, 1970), but by 1971, NLM had developed the first available online IRS, MEDLARS ON-LINE or MEDLINE, by using existing U.S. Department of Defense computer programs. DIALOG, the first well known, multidiscipline, and searchable database, was developed after MEDLINE in 1972 (Palmer, 1987). The NLM's impact can even be seen in current copyright practices. The 1976 Fair Use sections of the copyright law developed as a result of lengthy litigation between NLM and publishers who objected to NLM's photocopying practices (Miles & National Library of Medicine, 1982). During the 1980s, the NLM benefitted by having a director who was simultaneously the director of NLM and the National Coordination Office for

High Performance Computing and Communications (Groen, 2007). Under this director's leadership, NLM developed a computer program called Grateful Med, which was the precursor to PubMed (Hersh, 2003). PubMed became freely available on the Internet in 1997 and currently includes the full text to over 100 medical e-books (U.S. National Library of Medicine and the National Center for Biotechnology Information, 2010).

Very early medical e-reference books published include the Physician's Desk Reference and the Merck Manual (Hersh, 2003). STAT!Ref was a very early medical e-book aggregator, with its first version published in the early 1990s (Heyd, 2010). Another early medical e-book aggregator is Unbound Medicine which now partners with many e-book publishers: American Academy of Pediatrics, The American Public Health Association, The American Society of Health-System Pharmacists (ASHP), BMJ Group, Consumers Union and ConsumerReportsHealth.org, F. A. Davis, McGraw-Hill Professional, Merck & Co., Inc., Oxford University Press, Wiley-Blackwell, and Wolters Kluwer Health (Unbound Medicine Inc., 2011). Many medical e-books are available through these platforms: STAT!Ref and American College of Physicians (ACP), McGraw-Hill's Access products (including AccessMedicine, AccessSurgery, and AccessEmergencyMedicine), Elsevier's MDConsult, NetLibrary, Books@Ovid, and R2 Digital Library. Because of their relatively early development compared with those of publishers in non-medical disciplines, current medical e-reference book interfaces are very robust when compared to their general academic counterparts. Most medical e-book aggregators have allowed the functions that current e-books users complain are lacking in many other subject area e-book offerings: the options to download (to computers or to mobile devices), print, and email sections or whole chapters (e.g. AccessMedicine, MDConsult, and Psychiatry Online); the ability to personalize the experience with bookmarks, saved information, and annotations; the inclusion of hyperlinks to

more information and to multimedia; and the availability of interactive tools and continuing education opportunities (Lorbeer & Mitchell, 2008), (PRNewswire, 2009), (Newman, 2010). In late 2009, the American Medical Association (AMA) announced that it had launched an e-book portal in order to provide more frequent updates to their published content without the expense of reprinting. The publisher that the AMA chose, Impelsys.com, provides the user-desired features previously described (PRNewswire, 2009).

## **IMPACT OF CURRENT MEDICAL E-REFERENCE USE**

An important concept to remember is that most medical books and almost all medical textbooks can be considered reference books based on the usual criteria for reference books. Users of medical books do not typically read the material in a “linear fashion” but are “typically searching for an answer” (White, 2008). This is also true of the way that medical e-books are used (Lorbeer & Mitchell, 2008). Several studies have shown that medical e-book use far surpasses the print version of the same title, and that medical e-books are often the most accessed e-books within library collections (Heyd, 2010), (Raynor & Iggulden, 2008), (Ugaz & Resnick, 2008), (Prgomet, Georgiou, & Westbrook, 2009), (Fischer, Barton, Wright, & Clatanoff, 2010).

### **Electronic Access Correlates to More Use and Improved Patient Care**

The medical use of e-books is so high compared to that of other disciplines because medical students, residents, and faculty need remote access to information, since they are likely to be in several clinical locations in a single day and they are limited in the paper resources they can carry on their person (Ugaz & Resnick, 2008). A systematic review of the literature has shown that physicians

much prefer mobile electronic access to reference resources and consult them more often than if they had to use the print version of the same resource (Prgomet et al., 2009). Physicians were the early adopters of portable data assistants when they were introduced in the 1990s (Prgomet et al., 2009), and this is possibly due to the convenience of carrying just one device to manage their schedules, communicate, and access clinical decision support systems like medical e-reference books, drug reference sources, and medical calculators (Ugaz & Resnick, 2008). Estimates of physician use of mobile devices in clinical settings are high. In Feb 2010, one market research firm found that 94% of physicians were using smartphones for personal and professional use (Dolan, 2010b). As of July 2010, Pew Research Center reports that 82% of American adults own a device that “is also a cell phone” (Smith, 2010).

The combination of increased mobile device use and preference for e-reference has been shown to improve patient care in several statistically significant ways, especially when time is a critical factor: faster physician response times, fewer prescription drug errors, and fewer medical documentation errors. Patients whose doctors use a mobile device get more prompt treatment, have decreased antibiotic use, and have decreased length of stay in hospitals (Prgomet et al., 2009). Physicians are already able to view radiology scans on their smartphones screens with the same diagnostic accuracy as they achieve on full-sized work stations (Dolan, 2009). More improvements may come as continuous patient monitoring (like real time EKG) by mobile device becomes more widespread and patient electronic medical records (EMRs) become accessible by mobile devices (Prgomet et al., 2009).

### **E-Resource Use Trends in Medical Education**

Just as physicians provide faster and more accurate care to the patient when they combine the

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use of mobile devices with medical e-reference resources, so do medical students (Kho, Henderson, Dressler, & Kripalani, 2006). Wright State University's Boonshoft School of Medicine might be viewed as a single case study example of medical students' mirroring the physicians' trend of adopting mobile devices and electronic reference sources. For the first two years, all of the students' class materials are made available through course management software. It is standard practice in medical education to use course management software. Even in 2006, 97% of medical schools used course management software to augment classroom instruction (Kamin et al., 2006). These materials can include lecture notes, lecture videos and audio recordings, journal articles, and e-book content. According to an Academic Technology Analyst in the Medical Education Technology Group at WSU's BSOM in an interview on October 25, 2010, medical students at WSU all download e-books for medical board test preparation and a free drug e-reference called ePocrates Rx. (A more comprehensive version of ePocrates is available for purchase from <http://www.epocrates.com/>). By their third year clerkships, all students also download a program called Diagnosaurus, a full text differential diagnosis tool made available through the WSU Libraries' subscription to McGraw Hill's AccessMedicine. An informal poll of WSU BSOM students in October and November 2010 revealed these e-reference sources as favorites: USMLE question books, ePocrates, Diagnosaurus, Medscape (<http://www.medscape.com/>), a free product intended for medical professionals and produced by WebMD LLC, the company that also produces the consumer health website called WebMD at <http://www.webmd.com/>), and UpToDate. UpToDate (<http://www.uptodate.com/>) is a subscription medical e-reference produced by Wolters Kluwer Health, a well-known health sciences publisher. UpToDate is supported by a number of medical specialty professional associations and is "recommended" by the American Academy of Family Physicians

(Wolters Kluwer Health, 2010). The information included is constantly updated and summarized by physicians who are considered experts in their area of specialty. The quality of a one stop place to go for all current medical reference makes this product very appealing to medical students and physicians. Another reason this product may be so popular is that it allows users to earn Continuing Medical Education (CME) credits automatically by simply searching UpToDate. According to the American Medical Association, "Physicians may be required to demonstrate that they have obtained CME credit by state licensing boards, medical specialty societies, ABMS specialty boards, hospital medical staffs, the Joint Commission, insurance groups, and others" (American Medical Association, 2011). The UpToDate CME program keeps track of and reports CME progress without any additional effort on the part of the user.

## **Mobile Applications in Medical Education**

While most medical students and faculty seem to carry a smartphone voluntarily for its multipurpose qualities, some medical schools are requiring all students to purchase or are issuing to them mobile devices, smartphones, or tablet PCs (Bhanoo & Post, 2009), (Boudreau, 2010), (Feeman & Wilson, 2010). Medical professionals prefer not to carry more than one device (Bhanoo & Post, 2009), and so they seem to prefer devices that serve more than one purpose. Tablet PCs may provide an easier user experience for physicians when they consult medical e-reference sources, since not all e-reference material is optimized for small screens like those on smartphones. It is too early to tell how many medical schools are or will be integrating iPads or similar devices into their curriculum, but some are predicting that this will soon become standard practice for all medical schools (Vasich, 2010), (Thomas & Sun-Times, 2010). WSU BSOM seems to be considering integrating the use of iPads into medical education

in the future, as it hosted a public presentation called “Apple Seminar: iPad in Health Science Education” on November 12, 2010 (Feeman & Wilson, 2010). A number of faculty members brought along their new iPads to the presentation, and the presenters, an Apple account specialist and a system engineer, discussed bulk purchase discounts. Free or inexpensive medical e-reference applications available from iTunes the presenters described included:

- Pages allows anyone to e-publish and store material on Apple’s servers
- Papers can search PubMed, and download and organize articles
- “Goodreader,” a way to annotate articles using your finger or a stylus to write on the touch screen
- “Instapaper” has a “read later” button than downloads a mobile optimized version of articles for reading later
- “Inkling” allows social reading, see free Biology version at [http://www.inkling.com/mh\\_raven\\_biology/](http://www.inkling.com/mh_raven_biology/)
- iMeds XL (drug reference)
- modalityBODY, (interactive anatomy and medical imaging)
- Blausen Human Atlas HD (3D animated atlas)
- Medical Spanish (with audio) by Batoul Apps (canned Spanish medical phrases and questions)
- ePocrates
- Medscape
- Airstrip OB (“delivers vital patient waveform data — including fetal heartbeat and maternal contraction patterns — in virtual real-time”)
- Netter’s Anatomy
- Allscripts Remote (access to a medical practice’s patient health records)
- STAT ICD-9 (diagnostic code reference)
- Dragon Dictation (records dictations and transcribes them into text)

An added benefit to iPad use is that they can be made accessible with Braille readers and keyboards, simplified touch screen menu for those with limited hand motion, text readers, and low visibility screen viewing options (Feeman & Wilson, 2010). With all of these features, it is no wonder that more than 50% of physicians are now considering purchasing a tablet PC (Dolan, 2010a). Even physicians who used only print medical reference sources during their own education seem to be enthusiastic about the shift from print to electronic reference. When asked what he thought of this shift, a WSU BSOM faculty member who used only print resources during his medical education replied that electronic resources are “more convenient and up to date. I only use books or paper versions when I can’t get what I want electronically. In the past, I bought e-books for use on a PDA or PC, but I mostly use Internet based versions now.” This faculty member also said these habits are typical for his students and colleagues as well.

## **CHALLENGES TO MOBILE AND E-REFERENCE USE IN HEALTHCARE**

### **Balancing Access and Security**

Despite the appeal and ever-increasing prevalence of mobile devices, both inside and outside the medical arena, balancing security with ease of use and appropriate levels of access continues to be the most obvious challenge. Traditionally, hospital IT departments have made demands of physicians to accommodate hospital IT resources and policies, but physician demand for mobile access to medical resources is beginning to reverse these traditional roles (Gamble, 2010), (Dolan, 2010b). Nevertheless, some current hospital security policies interfere with the convenience of using mobile technologies (Dolan, 2010b). In 2008, Pharow and Blobel stated:

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*Quite often, especially in the mobile domain, proprietary solutions, outdated approaches, and traditional principles are still in routine use for communicating sensitive information. The awareness level of principals is not significantly high, so real and potential threats and risks are often not addressed. (p. 699)*

As it stands currently, the security issues surrounding access to EMR systems via mobile devices prevent about two-thirds of mobile-device-using-physicians from connecting to these systems (Dolan, 2010)

There is definitely a lack of consistency in the data access and security measures at healthcare institutions. Medical librarian blogger Michelle Kraft has bemoaned the fact that her hospital system's IT department will not allow iPads on the hospital network because they are "consumer device[s]" rather than "medical device[s]" while other esteemed healthcare institutions, such as Beth Israel Medical Center, have managed to integrate the device into their daily activities (Kraft, 2010c). It also seems that the hospitals and medical centers affiliated with WSU are quite liberal concerning physician use of mobile devices. When asked if he has ever experienced any IT issues like firewalls or restrictive hospital policies, the same faculty member mentioned above responded that the only problems he has encountered while accessing electronic resources are "some dead spots in hospitals and other medical buildings for mobile devices, but no firewall issues. Occasionally I have to get 'permission' to visit a blocked site." Information Security Officer for the Albany Medical Center Kristopher P. Kusche, in describing his academic medical center's implementation of a mobile encryption suite, acknowledges the challenges in balancing academic freedom and the need to protect confidential information (such as patient records):

*Special considerations for implementing encryption in a blended healthcare and academic environment include the regulatory requirements for each component of the organization, the need to maintain sufficient flexibility in functionality and performance of the mobile device for sometimes divergent clinical, research, and educational purposes, and the need to balance desired security with an anticipated and fostered level of business and academic freedom (2009, p. 25).*

## **Lack of Interoperability/Cross Platform Searching and Discovery**

Another ongoing challenge to the use of e-reference sources is that in general, there are no tools that allow quick easy searching across multiple platforms. As previously stated, one reason Up to Date is such a popular e-resource among physicians and medical students is its appeal as a "one-stop shop" for reference, CE, and CE tracking. This desire to use one platform to meet a variety of needs underscores the need to have easy to use discovery tools that search across platforms. Medical e-reference aggregators (e.g., MD Consult and Access Medicine) allow users to search and access full text across their entire platform, yet, due to proprietary content and interfaces, they are not generally interoperable, unless the subscribing institution has developed its own federated search system to search across these silos of information, as is the case with the Health Sciences Library System at the University of Pittsburgh (Medical Library Association, 2010). Many librarians would likely agree with Michelle Kraft's observation that "we need a federated e-book search system" because "patrons do not use the catalog" (2010), and also because catalog records are limited in what they retrieve because they are missing chapter headings and full text, even if they do include the tables of contents (Kraft, 2010b).

## **Overcoming the Barriers: Everyone's Responsibility**

Network administrators and IT professionals have an obvious responsibility to resolve these security and access issues, but the responsibility is not solely theirs. All parties must be involved in overcoming these barriers. Indeed, some hospital CIOs are already working with their network vendors to make hospital network access “device-neutral” (Gardner, 2011). IT professionals also need to keep current on standards and best practices in order to implement networks with the most secure yet flexible access available within their “regulatory requirements,” HIPAA and Payment Card Industry Data Security Standard (PCI DSS), for example (Krusche, 2009). However, public services librarians and end users of mobile and e-reference need to continue to insist upon secure access to networked sources that is still quick and easy to use. Librarians should be broadly aware of IT research directions and trends and should harness that knowledge to use and encourage patron use of platform and device-agnostic reference sources and mobile applications. Finally, third party developers, publishers, and aggregators must find ways to de-emphasize platform dependent-content in favor of interoperability in order to allow easy discovery of their unique content through a platform neutral single search that goes beyond the basic catalog record. An ideal level of access for physicians may be through links within the appropriate context of their patients’ electronic medical records. Indeed, ePocrates is developing an electronic medical record system that will do just that (When your carpet calls your doctor, 2010).

## **FUTURE RESEARCH DIRECTIONS**

Toninelli et al. indicate that because today’s healthcare consumers and professionals expect “anywhere anytime mobile healthcare,” the

service discovery/discoverability tools currently being developed should ensure both flexible and personalized access, and user-specific visibility and retrieval, including on mobile devices. In other words, not only would the material be accessible only to authorized users, but services would only be discoverable by people with the appropriate authorization. They have developed and tested a “secure discovery framework” for patient discovery of available healthcare services. (Toninelli et al., 2009). Although their framework emphasizes appropriate credentials for accessing patient records and physician availability data, this type of framework also has obvious implications for flexible, “on the go” discovery of subscription e-reference sources. Such a system could allow appropriately authorized users to access the reference sources seamlessly.

## **CONCLUSION**

As the earliest type of electronic reference content to be developed and widely used, medical e-reference publications and user adoption could serve as a benchmark for e-reference publishing in other academic areas. Nevertheless, if medical e-reference sources are to be the best they can be in terms discoverability, ease of access, and ease of use, all parties concerned have a role. The need for security must consistently be balanced with the need for quick and easy use. In order to achieve this balance, librarians and end users of mobile and e-reference should continue to insist upon easy access, search functionality, and interoperability of secure networks and platforms. Furthermore, IT professionals should implement the most user-friendly and most flexible network access possible while complying with the security standards required for their type of institution. Last but not least, content producers and providers need to optimize interoperability and/or cross platform discoverability of their content. No one disputes the value of medical e-reference sources.

As says Meredith Ressi with Manhattan Research (a health-care market research firm that studies doctors' use of technology): "You've got a whole medical library right in the palm of your hand" (Boudreau, 2010). Imagine how much more efficient it would be if all the content in that library were easily accessed through an EMR system or a single search tool, regardless of the EMR, publishers', or mobile device's platforms.

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