

The effect of Web 2.0 on the future of medical practice and education: Darwokinian evolution or folksonomic revolution?

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Australian health care providers have increasingly been using the Internet to access information in documents linked by hypertext on the World Wide Web, a function now often referred to as “Web 1.0”. Many contemporary health professionals in Australia use the Internet to participate in continuing professional development (CPD) activities, for email communication, and to search for clinical information.¹

In using Web 1.0, clinicians are likely to have started with accessing the websites of reputable journals or by going to known trusted sites or databases like the National Institute of Clinical Studies (<http://nhmrc.gov.au/nics/asp/index.asp>) or PubMed (<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?DB=pubmed>).

Some clinicians may have talked with patients about using quality consumer sites like the Australian Government HealthInsite (<http://healthinsite.gov.au>) or the United States National Library of Medicine’s MedlinePlus (<http://www.nlm.nih.gov/medlineplus>) to find reliable information about their condition.

Some clinicians and their patients will have “Googled” health conditions and used newer specialised search engines such as the academic literature search engine Google Scholar (<http://scholar.google.com>), science-specific search engine Scirus (<http://scirus.com>), consumer health search engine Kosmix (<http://www.kosmix.com>) or vertical search engines such as Rollyo (<http://rollyo.com>) or Gigablast (<http://gigablast.com>) (which restrict searches to your choice of up to 20 sites).

However, fewer clinicians will probably know about or have used health-related podcasts, blogs or wikis. Even fewer will know about collabularies, folksonomies, and mashups. In short, most will not be aware of the emergence of “Web 2.0” (see Box 1 for development of the Web, and Box 2 for a glossary).

The concept of Web 2.0 was articulated in 2004, and the seminal publication is, not surprisingly, found on the Internet.² The term Web 2.0 does not refer to new technical standards, but to new ways of using the Internet as a platform for interactive applications. A distinguishing characteristic of Web 2.0 is the concept of online social networking — the use of Internet technologies to create value through mass user participation.

These technologies are characterised by constant development and enrichment (evolution) as a result of user interaction (the so-called perpetual beta). Those who use these services assist with their development and are part of the “collective intelligence” which is harnessed to make the services better and more responsive.

Web 2.0 phenomena that are particularly relevant to the dissemination of medical information include blogs, wikis and podcasts (or their visual equivalent, vodcasts).³

Blogs

Not necessarily replacing personal homepages and bulletin boards, blogs (a condensation of the term “web logs”) have become popular and influential manifestations of Web 2.0. Blogs bypass the need for authors to be able to program in hypertext markup language (HTML) and thus allow easy self-publishing of information, links or opinion on any subject.

ABSTRACT

- Web 2.0 is a term describing new collaborative Internet applications.
- The primary difference from the original World Wide Web is greater user participation in developing and managing content, which changes the nature and value of the information.
- Key elements of Web 2.0 include:
 - Really Simple Syndication (RSS) to rapidly disseminate awareness of new information;
 - blogs to describe new trends;
 - wikis to share knowledge; and
 - podcasts to make information available “on the move”.
- The medical community needs to be aware of these technologies and their increasing role in providing health information “any time, any place”.

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A blog is an informal online journal, usually reflecting the author’s personal thoughts. Generally published in reverse chronological order with the latest entry at the top, blogs can compensate for search engine inadequacies in publication date searching. A blog can be useful for those who wish to informally follow the progress of a topic more quickly than is possible within the rigorous expert review model of evidence gathering required by academic journals.

It is simple to set up your own blog (eg, using <http://www.blogger.com>), and you can search for blogs using the specialist search engine Technorati (<http://technorati.com>). Conversations spanning several blogs can be traced using trackback software.⁴ Once you find a relevant quality blog, you can use its blogrolls (lists of recommended sites) to find other relevant blogs — a process similar to following hypertext links from trusted websites.

Blogs may be tracked with RSS (Really Simple Syndication, or Rich Site Summary, or RDF Site Summary), which is a Web 2.0 syntax for syndicating content. Searchers can use RSS to be alerted to relevant news headlines, blog postings, podcasts from radio, tables of contents of published electronic journals, and updates on results from a previous search on PubMed. Because RSS sends “feeds” to a website aggregator, the user does not need to be bombarded with emails, and can restrict the time period for prompts (eg, past 2 weeks). Examples of RSS feeds include New Scientist — Health (http://pheedo.com/f/newscientist_health/rss10) and BBC News Health (http://newsrss.bbc.co.uk/rss/newsonline_uk_edition/health/rss.xml).

In the business world, blogs are becoming increasingly important and are starting to be used quite extensively in the law. The so-called blogosphere is now doubling in size every 6 months, with more than 50 million blogs currently online. A good introduction to these concepts is found in a series of articles by Barsky.^{5–7}

1 Timeline: weaving the World Wide Web**1960s**

- Multiple computer terminals let many people share the use of one mainframe computer processor: predecessor of personal computers
- The term “personal computer” appeared in a *New York Times* article (1962)
- ARPANET (predecessor of the Internet) developed in the United States (1969)

1970s

- MEDLINE (“Medlars online”) initiated (1971)
- Development of the single-chip microprocessor: a key catalyst to the popularisation of cheap, easy-to-use personal computers (1974)
- Apple Computers started (1976)

1980s

- National Science Foundation Net (which became the Internet) using TCP/IP protocols (1983)
- Australasian Medical Index started (1985)
- AARNET implemented in Australia (1989)

1990s

- World Wide Web elements (HTTP; URL; HTML) developed
- LI (Librarians Index to the Internet) Web subject directory began in the US (1994)
- PubMed (free MEDLINE) established at the US National Library of Medicine (1997)
- The term “weblog” coined (1997) and abbreviated to “blog” (1999)
- Google started (1998)
- MedlinePlus for consumer health information started (1998)

2000s

- The Apple iPod released (2001)
- Wikipedia launched (2001)
- Apple iTunes Music Store (2003) launched
- Google Scholar launched (2004)
- Web 2.0 described (2004)
- Rupert Murdoch’s News Corporation buys MySpace (2005)
- Google buys YouTube (2006)
- Google raises profile of e-books, video, blogs, images, maps by implementing Universal Search (2007)
- Wikipedia claims more coverage than BBC and CNN combined (2007)

Medical blogs include discussions about clinical cases, images and special clinical interest topics. Examples include Clinical Cases and Images — Blog (<http://casesblog.blogspot.com>), Dean Giustini’s UBC Academic Search — Google Scholar Blog (<http://weblogs.elearning.ubc.ca/googlescholar>), David Rothman (<http://davidrothman.net>) (lists of medical wikis), and Science Roll (<http://scienceroll.com>).

Wikis

A wiki (from the Hawaiian word for “hurry”) is an expandable collection of interlinked web pages that allows any user to quickly and easily add, remove, or edit content. Wikis are freely accessible, incremental, observable, and organic. The “success” of the user engagement or collective response principle of Web 2.0 can be

2 Glossary

Blog: abbreviation of weblog, a simple web page of opinion, information or personal diary with links called posts arranged chronologically, with the most recent first.

Citizendium: a “citizens’ compendium of everything” is an open wiki project aimed at creating a comprehensive, free, and reliable encyclopedia.

Collabulary: a collective vocabulary, an example of social bookmarking.

Darwinkinism: a neologism that describes the socially Darwinian process of “survival of the fittest”, to which wiki pages are subject through repeated editing by users.

Folksonomy: a collection of categorising tags created by an individual for their personal use but which is shared with other users.

Mashups: a derivative work consisting of two pieces of (generally digital) media conjoined in some interesting way, such as a video clip with a different soundtrack applied for humorous effect, or a digital map overlaid with user-supplied data.

Podcasts: audio recordings of interviews and lectures which can be played either on a desktop computer or handheld MP3 devices.

Social bookmarking: using software to share bookmarks of sites or reference lists.

RSS: a service that allows users to be automatically notified of new content on a website of interest.

Tagging: adding keywords to digital objects to describe them, but not as part of a formal classification system.

Wiki: a set of web pages that can be easily edited by anyone who is allowed access. ◆

seen in the online encyclopaedia Wikipedia (<http://wikipedia.org>), which has more than a million articles which any user can edit. This democratic wiki model has resulted in Wikipedia having articles that collectively generate more “hits” and are more responsive to changes in knowledge than conventional online encyclopaedias (such as the Encyclopædia Britannica). A recent comparison of Wikipedia and the online Encyclopædia Britannica showed the accuracy to be very similar.^{8,9}

As with blogs, a user does not need knowledge of HTML to contribute. Wikis are now being developed in many fields from academic institutions, companies, the military, and specific health communities. Many conferences now offer a wiki or blog to facilitate pre-conference networking.

Wikis are already in existence and expanding in medicine and medical information,⁴ including the Flu Wiki (<http://flu-wiki.com>), which helps communities prepare for and cope with an avian influenza pandemic. The World Health Organization has announced that the revision of the International Classification of Diseases will be opened up via wiki to more than expert panels.¹⁰ Other wikis for doctors and researchers include Wiki Surgery (<http://wikisurgery.com>), Healthva (<http://www.healthva.com>), Ganfyd (<http://www.ganfyd.org>) (a free medical knowledge base that anyone can read but only registered medical practitioners may edit) and Sermo (<http://sermo.com>) (only accessible by those who can prove their medical credentials).

The disadvantage of wikis and blogs is that they are vulnerable because of lack of authoritative control over their content. The openness of wikis has given rise to the concept of “Darwinkinism”³ — the socially Darwinian process that wiki pages undergo in an evolutionary selection process in which “unfit” sentences or sections are ruthlessly and speedily edited and replaced by other users.

The time between notification of an error and cleanup has recently been debated by health bloggers as a window of possible harm, and other problems of governance, liability and accuracy have been raised in rapid responses to Dean Giustini's recent *BMJ* article on Web 2.0.¹¹ Jimmy Wales, the founder of Wikipedia, argues the value of the philosophy of trust, proposing an analogy of a restaurant where tables are in cages because knives are dangerous.¹²

Quality assurance of wikis can occur by monitoring of changes using RSS feeds, through the use of read-only content in certain areas, and using "rollback" to easily revert to a previous version. The closed environment of Ganfyd (and some sections of Wikipedia), in which only selected and verifiable interest groups or individuals can edit text, is one way of addressing these quality issues.

Podcasting

Podcasting and its visual equivalent, vodcasting, allow audio and video downloads from websites to MP3 and MP4 players (including iPods). Yahoo has a specific podcast search engine (<http://podcasts.yahoo.com>). The popularity of the podcast is evidenced by its fame as the Word of the Year in the 2005 *New Oxford American Dictionary*.

Podcasting is being used widely in medical school curricula for student lectures, chapters from text books, and even for downloadable libraries of high resolution respiratory sounds. Mainstream examples include the *New England Journal of Medicine* podcasts, Johns Hopkins Medicine podcasts and the ABC Radio's podcasts. Health care podcasts are even beginning to be used by seniors in the US, and a YouTube video (vodcast) has been used for a children's antismoking campaign.⁴

Other Web 2.0 applications

An increasing number of medical journals have RSS feeds available, so that readers can have a "persistent search" waiting in cyberspace to send an alert when new information of interest is published, but many clinicians who already use podcasts, RSS, blogs or wikis may not be aware of the potential of lesser known Web 2.0 options, including the hybrid potential of mashup websites, tagging or social bookmarking (collaboratories and folksonomies), and the concept of social networking, which has major implications for consumers of health care.

A mashup is a web application that presents information integrated from a variety of sources. An example of a health mashup (remix of Web 2.0 technologies) is HealthMap (<http://healthmap.org>), the global disease alerting site which uses "geo-feed" mapping services overlaid with RSS news markers.

Folksonomy is a term describing the collaborative categorisation of content such as web pages, links and images by allowing users to spontaneously assign "tags" to specific items. A picture of a young dog might be given the tags of "puppy" and "cute". Other users can then "subscribe" to the nominated tags to "crawl the net" at regular intervals to find new examples of the use of these tags and notify them when there are either more "cute" or more "puppy" items (or both). However, to professionals accustomed to taxonomy (epitomised by the MEDLINE MEDical SubHeading terms or MESH terms), the lack of standardised hierarchy and synonym control in folksonomy tags may provoke criticism for not

allowing historical tracking of terms, and for permitting polysemy, synonyms and plurals.⁴

Tim Berners-Lee, who developed the basic tools to allow Web 1.0 to come into existence (uniform resource locators [URLs], HTML, and the hypertext transfer protocol [HTTP]), has been critical of the concept of Web 2.0 and has proposed the concept of the "Semantic Web",¹³ where machine-readable information is exchanged and acted upon on our behalf, although this concept has not yet been fully realised. Debate about controlled vocabularies and ontologies suitable for different user groups has focused on issues relating to problems with free tagging in folksonomies. Research using wikis for consensus "cataloguing" (where "see also" references are extracted from tags and bookmarks) is still in the early stages, and there are concerns over sustainability of some promising tools, many of which are not open source.^{4,14} However, social bookmarking sites, such as CiteULike (<http://www.citeulike.org>) and Connotea (<http://www.connotea.org>), facilitate sharing of academic papers by networks of users with common interests.

Social networking examples in the medical arena include patient and support groups such as the MySpace Cure Diabetes Group. Other social networking sites help patients to choose a doctor or health service, for example by allowing consumers to comment on health services, such as Vimo (<http://www.vimo.com>) and Patient Opinion (<http://patientopinion.org.uk>). Health care providers are also initiating services like CarePages (<http://www.carepages.com>), a website used by University of Pennsylvania Hospital to connect patients to family members and which plans to share information between carer and nursing home staff for patients in long-term care. A recent editorial¹⁵ cites a systematic review that found that interactive health communication applications have positive effects for people with chronic illness.¹⁶

Web 2.0 is having a major effect on a range of information services, and the concept of Library 2.0 has been invented — "the application of interactive, collaborative, and multimedia web based technologies to web based library services and collections".³ Microsoft now plans to include blog and wiki capabilities within MS Office, and IBM is developing a product called Dogear (for tagging and social bookmarking) that will be made available this year as part of Lotus Connections.^{14,17}

Web 2.0 is also accommodating new communication modes such as instant messaging, mobile phone connectivity and online social gaming.¹⁸ A recent *Archives of Surgery* article noted that doctors who have previously played video games at least 3 hours per week worked 27% faster and made 37% less errors on surgical tasks (suturing and laparoscopic surgery).¹⁹ Virtual reality applications using avatars (digital representations of participants) have been used in surgical training and health education.¹⁴

From the point of view of underpinning pedagogy, the notion of "any time, any place" learning is more achievable using Web 2.0 applications than traditional teaching methods,³ and the use of Web 2.0 applications as "mind tools" to stimulate reflection and actively involve learners in their own construction of knowledge may yield powerful learning experiences.

It has been stated that students of all ages learn best when immersed within a culturally and socially rich environment in which learners and peers are committed to achieving the same goals and can regulate each others' performance,²⁰ and therefore the use of Web 2.0 tools has potential to both liberate and tie learners together in dynamic learning communities. Furthermore,

Anderson has noted the revolutionary challenge to education with the rise of the amateur challenging conventional thinking on who has knowledge¹⁴ — a debate epitomised by views on the value of Wikipedia as a research tool.¹²

Conclusion

A recent article about the role of Web 2.0 in health and health care education describes Web 2.0 as a “revolutionary way of managing” and concludes on a cautious note:

careful thinking, testing and evaluation research are still needed in order to establish “best practice models” for leveraging these emerging technologies to boost our teaching and learning productivity, foster stronger “communities of practice”, and support continuing medical education/professional development (CME/CPD) and patient education.⁴

Whether these technologies will (r)evolutionise medical education and information distribution will only be known in hindsight. More evaluation of their use in clinical practice and medical education is required,⁴ but medical practitioners and educators cannot afford to ignore these developments.

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