

Modern medicine comes online

How putting Wikipedia articles through a medical journal's traditional process can put free, reliable information into as many hands as possible.

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➤ **IF YOU GRADUATED FROM A MEDICAL OR NURSING** school before the turn of the millennium, a single glance in a teaching hospital can tell you how things have changed. Resident and student physicians no longer huddle in groups, listening to their seniors: they lean alone over smartphones or computers, searching for diagnoses and doses. With an Internet connection, you don't need to talk to the brightest people in the room to get the information you need. With the right access, you are one of them.

Of course, making a sound clinical decision requires more than Wi-Fi. One must accumulate and contextualize disparate bits of knowledge and integrate them into a larger impression shaped by clinical experience, the patient's evolving clinical trajectory, current evidence, and the limitations of the immediate health care environment. After a consensus has been gathered from other professionals involved in a person's care about available options, an informed and compassionate discussion makes the process clear and creates the solid ground necessary for a patient's informed decision.

If the latter points are the "art" of medicine, then the former are its science, and that science moves quickly. New evidence pours in to the tune of 12 systematic reviews per day,¹ and accumulating the information and then deciding how to incorporate it into one's practice

is an almost impossible task. A study published in *BMJ* showed that if one hoped to take account of all that has been published in the relatively small discipline of echocardiography, it would take 5 years of constant reading—by which point the reader would be a year behind.²

Thirty-five years ago, Archie Cochrane remarked that the medical profession could use a critical summary of available evidence to aid in decision-making³ so the echocardiographer could stop reading and do some echocardiography. The Cochrane Collaboration, launched in 1994,⁴ has led to a better synthesis, but it's far from convenient or complete. More than half of the articles are out of date, and this situation is getting worse all the time:⁵ having busy academics decide on what topics are important, reach a consensus about new studies that merit practice change, and then publish a distillation of their analysis, is a losing battle. In 2012, hundreds of thousands of new citations were added to MEDLINE, and the number is increasing each year.⁶ There have been repeated calls for new ways to aggregate information and translate it to the bedside, including making research articles "living" documents that exist only online and evolve constantly at the hands of many authors⁷—an approach we have explored in this journal.⁸ In the age of Wikipedia, even the Cochrane Collaboration admits it needs to change with the times.⁹

If you type "Archie Cochrane" into a search engine, the first link will be to a Wikipedia article. The same is true if you type in "pneumonia," "azithromycin," or "life after death." Wikipedia is the most heavily used health resource on the Internet—even more than MEDLINE—and is the sixth most popular website in the world.¹⁰ In printed form, it would consist of more than a million pages,¹¹ and it grows each day. Anyone with Internet access can connect, provide content, and correct mistakes.

Or make them. Despite its popularity,^{12,13} in medical circles Wikipedia's constant evolution has been viewed with skepticism. Although often used to gather information, it is rarely considered accurate or complete enough to guide treatment decisions.¹⁴ In the face of this, clinicians and trainees turn to medical resources such as UpToDate with greater frequency¹⁵ and confidence,¹⁶ because in clinical medicine a small error can make a big difference.

It pays to be certain. Some institutions pay UpToDate hundreds of thousands of dollars per year for that

sense of security.¹⁷ This has allowed Wolters Kluwer, the owners of UpToDate, to accrue annual revenues of hundreds of millions of dollars and to forecast continued double-digit growth as “market conditions for print journals and books ... remain soft.”¹⁸ In contrast, the Wikimedia Foundation, the non-profit that operates Wikipedia, a resource with 20 times the numbers of views and wide-ranging articles in 287 languages,^{19,20} has forecasted revenues of \$50 million in the upcoming year.²¹

As a source of clinical information, how does Wikipedia differ from UpToDate or, for that matter, a textbook or scholarly journal? Wikipedia lacks three main things. First, a single responsible author, typically with a recognized academic affiliation, who acts as guarantor of the integrity of the work. Second, the careful eye of a trained editorial team, attuned to publication ethics, who ensure consistency and accuracy through the many iterations of an article from submission to publication. Third, formal peer review by at least one, and often many, experts who point out conflicts, errors, redundancies, or gaps. These form an accepted ground from which publication decisions can be made with confidence.

In this issue of *Open Medicine*, we are pleased to publish the first formally peer-reviewed and edited Wikipedia article. The clinical topic is dengue fever.²² It has been submitted by the author who has made the most changes, and who has designated 3 others who contributed most meaningfully. It has been peer reviewed by international experts in infectious disease, and by a series of editors at *Open Medicine*. It has been copy-edited and proofread; once published, it will be indexed in MEDLINE. Although by the time this editorial is read the Wikipedia article will have changed many times, there will be a link on the Wikipedia page that can take the viewer back to the peer-reviewed and published piece on the *Open Medicine* website.²² In a year's time, the most responsible author will submit the changed piece to an indexed journal so it can move through the same editorial process and continue to function as a valid, reliable, and evolving free and complete reference for everyone in the world. Although there may be a need for shorter, more focused clinical articles published elsewhere as this one expands, it is anticipated that the Wikipedia page on dengue will be a reference against which all others can be compared. While it might be decades before we see an end to dengue, perhaps the time and money saved on exhaustive, expensive, and redundant

searches about what yet needs to be done will let us see that end sooner.

There were challenges with this article, as there will be with others. A lack of a single, authorial voice in the Wiki process means not only that strong personal recommendations are unlikely, but also that the style can be inconsistent, and the sentences and transitions between them less smooth, resulting in a paper that might be challenging to read. Some “Wikipedians” have little traditional experience in publishing and the editorial process that accompanies it, which can lead to frustrations about content or format that might fit a journal's preference. (In *Open Medicine*'s case, we would have preferred a different structure for the article, but deferred to Wikipedia's standard flow.) Medical articles that originate from Wikipedia might also lack the traditional “senior” author typical of many clinical reviews, whose role is to provide guidance on when a piece is ready for submission, what editorial changes should be accepted or challenged, which journal's readership might be the best audience for a clinical topic, and who might write accompanying editorials to contextualize new information or frame controversy. Should the example of the dengue article be copied, this may lead to a number of rejected submissions to formally peer-reviewed journals. Also, as time goes by, the Wikipedia-based articles will lose their brevity as they become truly encyclopedic.

The issue of authorship is particularly controversial. We talked about many possibilities, including listing an author even if she made only a single change, or setting a threshold based on the percentage of total changes contributed, and finally settled on letting the most responsible author, the one who had made the most changes, decide who should share authorship according to widely accepted authorship criteria.²³ A single change, though, may be an important contribution, depending on what it is, and a case can be made to include all those who contributed: in this case, 1373 people.²⁴ Since the number of changes made to an article are freely available for everyone to see, what of the “senior” authors mentioned in the previous paragraph, who may suggest small but important revisions, or—too common in traditional academia—are added honorifically, without having changed a comma? If a decision is made by a journal to include every person who made a minor change, or only those who made substantial ones, how will a university determine whom to reward with merit? Will medical journals be as tuned to potential conflicts of interest when there

are hundreds of authors? Will pharma companies be keen to exploit this weakness?

The line between editors and authors will become more blurred. In the case of the dengue article, we deliberated over whether editorial changes should be made publicly on the “wiki” or “suggested” to the primary author. If journals were truly “open,” recording every change an editor advised, we might see that some publications require more than a careful eye and attention to conflicts of interest. Some require editors to do research of their own, find relevant citations, communicate with experts in the field, and even interpret data. In this case, we opted for a more traditional, invisible role, although a compelling case could be made that disambiguation, in all spheres, brings valuable change.

A trend toward improvement is not just typical of a Wikipedia page, but so too of medicine. Its progress is determined, and marked, by what appears on the pages of medical journals and textbooks—or, these days, on computer screens. It is our hope, and that of the Wiki Project Med Foundation, that this endeavour will encourage other scholars to refine and improve Wikipedia articles so they might become the world’s most accurate and trusted reference, in addition to the most well read (the Wikipedia page on dengue was accessed more than 10 000 times yesterday).²⁴ Freely open and accessible, Wikipedia can improve clinical care at the bedside for physicians around the world by allowing them access to the latest information, regardless of their ability to pay high fees. Already, Wikipedia’s Zero Project is working with mobile communications providers in developing countries to minimize, or even remove, data costs associated with using the site.²⁵ This might encourage greater numbers of clinicians and scholars to contribute their experience and research to our shared, global knowledge, and begin to repair the enormous publishing bias that exists between the high- and low-income world.²⁶ Further, in a time when newspapers and traditional publishers struggle to explain their relevance, medical journals can more easily describe what we deliver: content you can trust.

At least temporarily. Medicine and science, like the diseases they attend to, move fast—much faster than the systems that are responsible for making medical science known. As this editorial is being written, Ebola continues its surge in West Africa. Since the 2014 epidemic started, there have been 1549 changes to Wikipedia’s Ebola disease page, 10 times as many as the year before.²⁷ Which ones are accurate? Given Wikipedia’s history, one would suspect that most of them are. All

of them? Without the attention of dedicated, capable, and responsible eyes, one can’t be sure. What we can be certain of is that the story of the 2014 Ebola epidemic, like the recent dengue outbreak in Japan,²⁸ will be told on Wikipedia and that a determining factor for its final sentences will be how much relevant information about how to treat and control the disease makes its way into capable hands.

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