standards developed by the Health on the Internet (HON) Foundation

How complete, accurate, and reliable is the drug information that Americans retrieve from Wikipedia? The question is important because 74% of American adults look online for health information [1], and Wikipedia is the 7th-most visited site on the web [2]. Consumers using general search engines like Google or Yahoo often arrive at Wikipedia. A study using keywords from 3 health indexes found that Wikipedia “ranked among the first ten results in 71–85% of search engines and keywords tested,” with its articles viewed more frequently than the corresponding MedlinePlus topic page [3]. Practitioners also go regularly to Wikipedia for health information. A 2009 study of 1,900 physicians found that 50% used Wikipedia to answer health questions, twice the percentage of the year before [4]. Other studies found that Wikipedia was used by 70% of 35 “junior physicians” who graduated from a major London medical school [5] and by 28% of pharmacists seeking drug information, in most cases to identify medication indications [6].

Because Wikipedia contributors have various levels of subject expertise, there are bound to be questions about the accuracy of its health information. Indeed, ever since the web became freely available for public usage in 1993 [7], there have been concerns about health information on the Internet. Several studies have evaluated Wikipedia’s general medical content. Petersen recently examined whether Wikipedia met standards developed by the Health on the Internet (HON) Foundation <http://www.hon.ch> and re-
viewed several earlier studies that evaluated Wikipedia information, concluding that although Wikipedia did not adhere to some of the HON standards: “expert conducted studies have concluded that the site’s accuracy level is comparable to those of more traditional sources of information” [8]. A 2011 review of earlier studies published in the Journal of Medical Internet Research found that while Wikipedia information was accurate and easy to use, it often lacked depth and had content omissions [9]. Another study found Wikipedia’s pathology information to be high quality, comprehensive, current, and useful for both beginner and advanced students [10]. Clauson et al. evaluated drug information in Wikipedia and found “that Wikipedia fared poorly with regard to completeness, but that 100% of the information elements covered by Wikipedia were deemed to be mostly or entirely correct” [11].

Do drug entries now contain more complete information than in 2008? Is Wikipedia’s information still mostly or entirely correct? This study examined Wikipedia content for the class of HMG-CoA reductase inhibitors (statins), indicated for treatment of dyslipidemias. Statins were chosen because they are some of the most prescribed medications worldwide. Statins also pose risks for food interactions and other adverse effects and should be used in conjunction with lifestyle modifications.

METHODOLOGY

Review of Wikipedia’s entries on statin medications using the generic names took place over several days in 2010, with screen captures made of each entry to allow for offline, in-depth review and comparison with a standardized drug information database. The five statins selected were those listed in the “Top 200 Products in the US Market by Dispensed Prescriptions, 2009” published in the May 2010 issue of Pharmacy Times. Medications studied were atorvastatin (Lipitor), lovastatin (Mevacor), pravastatin (Pravachol), rosuvastatin (Crestor), and simvastatin (Zocor).

Each Wikipedia entry was reviewed to determine if five components (adverse effects, contraindications, indications or drug category, tips for lifestyle modification, and drug interactions) were discussed. While drug monographs do not include detailed information on lifestyle modification, patients taking a cholesterol-lowering medication should be given recommendations on diet and exercise. To assess accuracy and completeness of information, the Wikipedia article was compared to that in the database LexiComp Online for each statin.

RESULTS

For four of the five statins reviewed in Wikipedia (all but atorvastatin), some components of information were incomplete. While indications were always stated and four entries provided some information on adverse effects, only one listed contraindications to use. Drug interactions were included for three of the five statins. All statin entries included some references (Table 1).

| Generic (brand) | Adverse effects profile provided? | Contraindications provided? | Medication category or indication provided? | Tips for lifestyle modifications? | Drug interactions noted? | References cited? |
|----------------|----------------------------------|-----------------------------|-------------------------------------------|----------------------------------|------------------------|------------------|
| Atorvastatin (Lipitor) | Yes | Yes | Yes | No | Yes | Yes |
| Lovastatin (Mevacor) | Limited | No | Yes | No | Yes | Yes |
| Pravastatin (Pravachol) | No | No | Yes | No | No | Yes |
| Rosuvastatin (Crestor) | Limited | No | Yes | No | No | Yes |
| Simvastatin (Zocor) | Yes | Yes | Yes | Yes | Yes | Yes |

Indications or medication category

Except for the pravastatin entry, each of Wikipedia’s entries referred users to Wikipedia’s general article on statins. The Wikipedia statin article had a section on indications and uses that, besides discussing statins’ use in treating cardiovascular disease, included the sentence, “research continues into other areas where statins also appear to have a favorable effect: colon cancer, inflammation, dementia, lung cancer, nuclear cataracts, and hypertension.” There were references to scholarly articles for all of these uses.

All the individual drug articles also discussed the drug’s purpose, but as with adverse effects (discussed below), there was a wide variety in the presentation and amount of information. The article on atorvastatin provided the most complete listing of all Food and Drug Administration (FDA)-approved indications, and the article on simvastatin discussed uses besides cholesterol management. There was less information about rosuvastatin, pravastatin, and lovastatin.

Adverse effects

As a class, the statins are usually well tolerated. However, gastrointestinal side effects such as nausea, diarrhea, constipation, and dyspepsia are common, especially on initiation of a statin. Arthralgia, myalgia, and elevations of liver enzymes can also occur and should be reported to the patient’s prescriber. While Wikipedia provided information on adverse effects for four of the five statins, the amount of information
varied widely. Only atorvastatin had a comprehensive adverse effects section comparable to LexiComp Online. The entry for rosuvastatin had no adverse effect section, although a paragraph titled “Myopathy” noted the risk of rhabdomyolysis, referencing an FDA alert. The rosuvastatin entry also included an advisory statement for patients of Asian descent. The entry on lovastatin stated the drug was usually well tolerated, but rhabdomyolysis was a rare occurrence. The entry on pravastatin included no mention of adverse effects. The two statins with the most comprehensive information were the two most prescribed: atorvastatin and simvastatin.

For consumers, a notable benefit of Wikipedia is its hypertext links to additional definitions and information, which are helpful to consumers who may not know what terms such as rhabdomyolysis or myopathy mean. Most medical texts and websites do not explain such terms or provide ready access to such definitions.

Contraindications

All statins had contraindications documented in LexiComp Online: hypersensitivity to the medication or other HMG-CoA reductase inhibitors, pregnancy, breast-feeding, active liver disease, and persistent elevations of serum transaminases. Only the Wikipedia entry on atorvastatin included a section labeled “Contraindications.” Lack of awareness of contraindications risks serious harm, making the omissions in Wikipedia articles a serious concern.

Lifestyle modification

None of the Wikipedia entries had information on lifestyle modification such as suggested dietary changes or increased exercise. The monographs in LexiComp Online, with the exception of the one on Lipitor (atorvastatin), all stated the purpose of the drug as an adjunct to diet therapy to lower cholesterol. All drug monographs in LexiComp Online included patient education sections recommending adherence to prescribers’ recommendations for diet modifications and exercise.

Drug interactions

Wikipedia’s article on atorvastatin had the most complete information on drug interactions, listing the names of drugs and including information on taking the drug with grapefruit juice and vitamin D. The Wikipedia article on simvastatin also discussed grapefruit juice but only mentioned a possible interaction with one drug, amiodarone. The LexiComp Online simvastatin monograph listed possible interactions with more than thirty medications. The lovastatin Wikipedia entry listed some drug interactions but no identification of the severity or risk associated with those interactions. There were no drug interactions provided in the entries for rosuvastatin and pravastatin.

References

All the entries listed references and/or source notes. Wikipedia’s policy calls for articles “based on reliable, third-party, published sources with a reputation for fact-checking and accuracy” [12]. Almost 65% of the references or notes in the statin entries were from peer-reviewed journals. The atorvastatin entry also listed articles from three reputable newspapers (New York Times, Times of London, and Wall Street Journal), while the entry on simvastatin listed a scholarly book. Remaining entries referred to government Internet sites (FDA or MedlinePlus) and to the medications’ package inserts.

Although only one article, that about atorvastatin, had a section called “Further Reading” providing links to websites, all but one of the statin articles included some hyperlinks to other sources. The most common type, in three of the entries, was to the package insert. The next most common was to government sites, while one article had a link to the commercial site, eMedicineHealth.

DISCUSSION

Like earlier studies, this study suggests that Wikipedia’s information about commonly prescribed drugs is generally accurate but should not be used as the sole source of information by health care consumers or providers. While neither this study nor earlier studies show whether consumers and providers who turned to Wikipedia also looked to other sources, it is reasonable to assume that some users accepted Wikipedia’s seemingly encyclopedic information as sufficient. Although this study found no incorrect or inherently misleading information in Wikipedia’s articles, much of the information was incomplete in ways that might cause harm to the consumer, particularly the lack of information on drug interactions and contraindications to use.

CONCLUSION

The quality of drug information in Wikipedia continues to be inconsistent, increasing the risk that consumers and practitioners may inappropriately rely on it. Although the entry on atorvastatin did contain sufficient information with a complete list of FDA-approved indications, contraindications, and food and drug interactions, this was not the case for the four other statins examined. Because the entries on the five most commonly prescribed statins lacked important information, the authors recommend that consumers should seek other sources and not rely solely on Wikipedia.

Encouraging consumers, students, and health care professionals to evaluate the quality of drug information is an important step in improving health literacy, empowering patients, and ultimately improving health care in our country. While Wikipedia provides some basic drug information, users should be
encouraged to supplement that information with traditionally edited sources. Quality drug information is freely available from US government–provided sites such as the National Library of Medicine’s Drug Information Portal <http://druginfo.nlm.nih.gov> or MedlinePlus: Drugs, Supplements, and Herbal Information <http://www.nlm.nih.gov/medlineplus/druginformation.html> and commercial consumer sites such as WebMD’s RxList <http://www.rxlist.com>. Health care professionals—including physicians, pharmacists, and nurses—usually have access through a health care institution to subscription services like Lexi-Comp and Micromedex. If not, several free sources, including Medscape: Pharmacists <http://www.medscape.com/pharmacists/> and DailyMed <http://www.dailymed.nlm.nih.gov>, are available.

Patrons will undoubtedly continue to turn to Wikipedia for drug information, just as they do for information on other topics. What is problematic—far more so than with other topics researched in Wikipedia—is the possibility that users fail to recognize its limitations. If librarians encourage users to seek additional information and evaluate the information provided, we will be making an important contribution to health care and our patrons’ health.

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AUTHORS’ AFFILIATIONS

Natalie Kupferberg, MLS, MA, AHIP, kupferberg .1@osu.edu, Pharmacy Librarian and Associate Professor, Biological Sciences/Pharmacy Library, Ohio State University, 100F Riffe Building, 496 West 12th Avenue, Columbus, OH 43210; Bridget McCrate Protus, PharmD, RPh, CGP, MLIS, bprotus@hospiscript.com, Director of Drug Information Services and Clinical Assistant Professor, HospiScrip Services, College of Pharmacy, Ohio State University, 555 Metro Place North, Dublin, OH, 43017

Received January 2011; accepted March 2011

Preferred book formats in an academic medical center*  

Lynda J. Hartel, MLS, AHIP; Fern M. Cheek, AMLS, AHIP

See end of article for authors’ affiliations.

DOI: 10.3163/1536-5050.99.4.011

Learning more about when and why medical students, faculty, and clinical staff use e-books, as opposed to print books, is an expanding area of research for health sciences librarians. Several studies have highlighted the heavy use of health sciences titles in campus e-book collections [1–5] and the book format preferences of medical and other health sciences students [2, 6, 7]. A recent case study by Shurtle and von Isenburg is one of the first to explore e-book use in both health sciences educational and clinical settings [8].

* This study was supported by a 2007 Medical Library Association Research, Development, and Project Demonstration Grant.

Supplemental Table 1 and Appendices A, B, C, and D are available with the online version of this journal.
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