Evaluating the Effectiveness of a Wiki Internet Site for Medical Topics

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Abstract To evaluate the iterative process of a collaborative public database (a Wiki) as a reference for information on hand illnesses we tested the null hypothesis that the number and type of edits are comparable for web pages covering different topics. The history of 4 hand surgery related web pages on the English language Wikipedia (Trigger finger, Complex Regional Pain Syndrome (CRPS), Ganglion cyst, and de Quervain Syndrome) were analyzed from inception to July 2011. Each edit was classified as one of six types: an *addition* is an edit that adds material; a *deletion* removes material; a *modification* is a combination of addition and deletion, or any rearrangement; a *minor edit* is a correction of spelling, grammar, or formatting errors; *vandalism* is any edit that is intended to harm the page; a *vandalism fixed* is an edit that addresses harm. The edits were also rated as possibly controversial or not (defined as edits that present information with a clear bias or do not list reliable sources). For both the Ganglion cyst and Trigger Finger pages, readability was measured at 1 year increments. Our primary null hypothesis was that the proportion of constructive edits (addition, deletion or modification) did not differ between the 4 web pages. The percentage of constructive edits (additions, deletions, and modifications) was significantly different for each page: 121/234 (52 %) for de Quervain, 258/448 (58 %) for CRPS, 103/156

(66 %) for Trigger Finger, and 160/389 (41 %) for Ganglion cyst. The percentage of edits related to vandalism was also significantly different: 28/234 (12 %) for de Quervain, 33/156 (7 %) for CRPS, 21/156 (14 %) for Trigger Finger, and 135/389 (35 %) for Ganglion cyst. Vandalism was quickly identified and addressed. Twenty-six percent of all edits were classified as potentially controversial. Forty percent of possibly controversial edits were deletions. The topic of a Wiki web page for information on hand illness influences the degree to which edits are constructive. A Wiki for hand illness could be a very useful resource for patients with hand illness, but it requires careful moderation because only about half the edits are constructive. Cohort Study.

Keywords Internet · Moderation · Medical information as topic · Wikipedia · Medical informatics · Hand · Disease · Hand illness

The internet has reshaped every day life in many ways. With search engines and the ability for anyone to make a website, it is a substantial source of information. The fact that anyone can add information to the Internet allows almost the entirety of human knowledge and opinion to be archived and shared. A Wiki—a web site that can be edited by multiple users—tries to develop this into a balanced and complete web page on a given topic [1]. Wikipedia takes this idea and attempts something very ambitious: an online encyclopedia edited by everyone with articles on everything, while still remaining well moderated and quality controlled [2, 3]. The English version of the website has almost four million pages [4].

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On the other hand allowing anyone to edit a page accepts the possibility of misconceptions, ignorance, and vandalism. Pages are susceptible to bias or confrontation, adding and deleting differing opinions back and forth with no real addition to the article. Many dismiss Wikipedia as a credible source because of this, without looking further into it. Wikipedia attempts to remedy these potential problems by giving guidelines and thoughtful policies on article editing. One measure of the degree to which the Wiki format is effective would be a count of the proportion of edits that are constructive. Furthermore, evidence that the proportion of edits that are constructive differs between pages with different topics would demonstrate the influence of page topic or content, which would help inform the guidelines and moderator policies of a Wiki.

In this study, we analyzed the history of 4 hand illness related Wikis from inception to July 2011 [5–8] to address the primary null hypothesis that the proportion of constructive edits does not vary by page topic.

Materials and Methods

Four Wikipedia pages addressing hand illness were analyzed by one of us: Trigger finger, Complex Regional Pain Syndrome, Ganglion cyst, and de Quervain Syndrome [5–8]. The history of all edits made to any Wikipedia article can be viewed by clicking on the “view history” tab on the top right. Every edit for each of the four pages was viewed and classified as one of six types as follows: an *addition* is an edit that adds material to the article; a *deletion* is an edit that removes material; a *modification* is a combination of addition and deletion, or any rearrangement; a *minor edit* is any minor edit, usually when spelling or grammatical errors, mistakes and typos are addressed; a *vandalism* is any edit that vandalizes the page; a *vandalism fixed* is an edit that fixes any vandalism done.

Possibly controversial edits were defined as edits that present information with a clear bias or do not list reliable sources. These edits often went back and forth between different opinions until they were removed by a moderator.

Others were advertisements for product related to the disease. Some rearranged the information already in the article to make sure readers saw certain information first. We classify these as possibly controversial because the rating is not based on evidence or expertise, but rather by the editing process and etiquette on Wikipedia. The classifications were performed by one of us and we did not test reliability.

For both Ganglion cyst and Trigger Finger, readability was tested with a Flesch-Kincaid grade at one-year intervals. The number of edits per year were also recorded. (Tables 3 and 4)

Statistical Analysis

The numbers of each type of edit in each web page were counted. We used chi-square tests to compare the proportions of edits types within each web page. The proportion of each type of controversial edit were compared using chi-square tests. The mean number of edits per month for each web page were compared with one sample Z test. P values less than 0.05 were considered significant.

Results

A total of 1,227 edits were noted in the four articles over a period varying from 7 to 9 years (Table 1). We rejected the primary null hypothesis, finding that the proportion of constructive edits was significantly different for each of the four web pages ($p < 0.05$ for all comparisons). The average number of edits per month were significantly different for each website ($p < 0.001$). (Table 1) Additions and Minor edits are consistently the most common types of edits, followed by Modifications. (Table 1) The ganglion cyst page attracted substantial vandalism (including crude jokes, personal tags, and mass deletions of information with no stated reason). (Table 1)

Twenty-six percent of edits were rated as possibly controversial. (Table 2), Deletions and modifications were more than twice as likely as additions to be possibly controversial and

Table 1 Type of edits for each of four Wikipedia pages

Type of edit	Dequervain	CRPS	Trigger	Ganglion cyst	Total
Addition	74 (31.6 %)	159 (35.5 %)	51 (32.7 %)	77 (19.8 %)	361
Deletion	15 (6.4 %)	57 (12.7 %)	19 (12.2 %)	32 (8.2 %)	123
Modification	32 (13.7 %)	42 (9.4 %)	33 (21.2 %)	51 (13.1 %)	158
Small edit	85 (36.3 %)	157 (35.0 %)	32 (20.5 %)	94 (24.2 %)	368
Vandalism	16 (6.8 %)	18 (4.0 %)	11 (7.1 %)	72 (18.5 %)	117
Fixed vandalism	12 (5.1 %)	15 (3.3 %)	10 (6.4 %)	63 (16.2 %)	100
Total	234	448	156	389	1227
Avg edits per month	2.4	4.1	1.6	4.3	

CRPS Complex Regional Pain Syndrome

Table 2 Potentially controversial edits

Type of edit	No	Yes	Total
Addition	301 (83 %)	60 (17 %)	361
Deletion	74 (60 %)	49 (40 %)	123
Modifications	99 (63 %)	59 (37 %)	158
Total	474 (74 %)	168 (26 %)	642

this difference was statistically significant (Additions vs. Deletions: $p=0.010$, Additions vs. Modifications: $p=0.018$).

The readability for both the Ganglion cyst and Trigger Finger pages were approximately 10 and 12 respectively with little change over time. (Tables 3 and 4)

Discussion

Our finding that the proportion and rate of constructive edits varies between web pages demonstrates the need for careful moderating of a Wiki, more so for certain topics. For instance, there was a substantially greater amount of vandalism in the ganglion cyst page. Between 7.3 % (DeQuervain's) and 34.7 % (Ganglion cyst) of all the edits on a given page were vandalism or repair of vandalism depending on the page, but it was all fixed very quickly. Many were fixed almost immediately by Wikipedia's bots (a program that scans articles and makes changes to the web page automatically; Wikipedia's vandalism bots are programmed to detect and delete vandalism, one of the most successful of which is ClueBot [9]). We cannot say for certain why Ganglion cyst had the largest percentage of vandalism, but it seems to be a more commonly known condition that lends itself easily to crude humor.

The optimal measure of the degree to which the Wiki format is effective would be a measure of 'improvement' over time. It's difficult to define and quantify "improvement"; however, our thought was that a count of the proportion of edits that are constructive may correlate with improvement.

Table 3 Ganglion cyst

Date (MDY)	Number of edits (total)	Number of edits (in past year)	Readability (Flesch–Kincaid score)	Length (in words)
10/9/2003	2	2	10.7	78
10/9/2004	8	6	9.8	151
10/9/2005	15	7	8.7	196
10/9/2006	33	18	9.8	349
10/9/2007	108	75	9.5	444
10/9/2008	205	97	11.2	526
10/9/2009	274	69	10.4	423
10/9/2010	354	80	10.6	482
10/9/2011	415	61	10.2	409

Table 4 Trigger finger

Date (MDY)	Number of edits (total)	Number of edits (in past year)	Readability (Flesch–Kincaid score)	Length (in words)
7/19/2003	1	1	8.8	47
7/19/2004	4	3	9.1	62
7/19/2005	14	10	8.8	72
7/19/2006	33	19	10	178
7/19/2007	64	31	12.2	704
7/19/2008	106	42	13.8	371
7/19/2009	127	21	12.3	447
7/19/2010	159	32	12.4	736
7/19/2011	192	33	12.1	729

The need for careful moderation was also manifest in other types of non-constructive edits that were removed (e.g. advertisements). A lot of edits were from users who were new to Wikipedia and did not understand the guidelines, but the pages were consistently repaired by moderators and long time users. Wikipedia's guidelines for medical and scientific articles specify that only widely accepted tertiary source information, such as from textbooks and encyclopedias, is acceptable. When this was not respected, there was a back and forth addition and deletion of opinions.

Consistent with prior work, we found that Wikipedia pages had a relatively high Flesh-Kincaid grade level. A study comparing information on various types of cancer from Wikipedia versus a professional database found that Wikipedia articles generally had a higher reading grade than professionally produced pages [10]. A lower Flesch-Kincaid grade makes the material accessible to individuals with lower literacy [11]. Sixth to eighth is recommended, but we found reading levels between 9th and 12th grades. In contrast an upper limit of 1,400 words was suggested for patient information material and the Wikipedia articles we examined were shorter.

This study should be interpreted in light of several shortcomings. This study addresses four articles on hand disease topics and does not provide a wider scope of this category or give insight into the other sections of Wikipedia. We did not formally test the reliability of the classifications we used for various page edits. Finally, one of the authors made a few edits while exploring how Wikipedia works.

We have some opinions based on our work. Wikipedia is built on collective moderation, and this seems quite effective. There are more additions made than deletions, but most additions are not from reliable sources. Wikipedia's policy is to include only information "based on reliable, third-party, published sources and accurately reflect current medical knowledge" in medical articles [12], but this seems to be an uncommon source of edits. There are a lot of original research and primary source studies that do not get removed,

or are not removed for a long period of time, because they are overlooked or perhaps none of the editors of these pages are sufficiently familiar with these guidelines. Wikipedia contributors should become familiar with the policies and help those less familiar to adhere to them.

The issues addressed in this study are relevant given that search engines often offer a Wikipedia page at the top of the list for a given search [13]. Patients and providers are using these pages to understand these hand illnesses. We agree with others that the factor that would most improve publicly editable Wikis for information on hand illness is a greater number of hand experts writing and moderating pages [14]. Alternatively, some changes to how moderators organize and run the pages may help. One study found that an increase of editors improves article quality, but only if proper coordination is implemented [15]. It's important to maintain the standard of only providing information supported by evidence or at least based on established tradition, wisdom, and expertise. There are other Wiki projects such as Citizendium that are attempting to improve on Wikipedia's shortcomings by having experts review and contribute to pages [16]. Rather than dividing our efforts, we hope that hand surgeons see the potential of Wikis to improve the quality, balance, and completeness of information available to patients and providers and volunteer to build on the Hand Wiki task force of the American Society for Surgery of the Hand [17] by offering their knowledge, time and effort to improve Wiki web pages.

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