A Quality Assessment of Cardiac Auscultation Material on YouTube

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ABSTRACT

Background: YouTube is a highly utilized Web site that contains a large amount of medical educational material. Although some studies have assessed the education material contained on the Web site, little analysis of cardiology content has been made. This study aimed to assess the quality of videos relating to heart sounds and murmurs contained on YouTube.

Hypothesis: We hypothesized that the quality of video files purporting to provide education on heart auscultation would be highly variable.

Methods: Videos were searched for using the terms "heart sounds," "heart murmur," and "heart auscultation." A built-in educational filter was employed, and manual rejection of non-English language and nonrelated videos was undertaken. Remaining videos were analyzed for content, and suitable videos were scored using a purpose-built tool.

Results: YouTube search located 3350 videos in total, and of these, 22 were considered suitable for scoring. The average score was 4.07 out of 7 (standard deviation, 1.35). Six videos scored 5.5 or greater and 5 videos scoring 2.5 or less. There was no correlation between video score and YouTube indices of preference (hits, likes, dislikes, or search page). The quality of videos found in this study was highly variable. YouTube indications of preference were of no value in determining the value of video content. Therefore, teaching institutions or professional societies should endeavor to identify and highlight good online teaching resources.

Conclusions: YouTube contains many videos relating to cardiac auscultation, but very few are valuable education resources.

Introduction

The role of modern media in medical education is an expanding field.[1–4] Studies have previously examined the growing use of the Internet to obtain information regarding personal health issues.[3–6] YouTube is an online repository of video files that is popular due to ease of access and free content. Several articles have previously suggested the use of YouTube to aid in the education of health professionals.[7,8]

The auscultation of heart sounds and murmurs is central to the examination of any patient with potential heart disease.[9,10] However, crowding of the medical curriculum with an ever-expanding range of required subjects, and the shortage of patients with long-lasting physical signs, has led to reduced opportunities to teach physical examination of the cardiovascular system. To substitute this, some institutions are turning toward simulators to provide the necessary educational experience.[11] The nature of this information lends itself well to the prerecorded educational material utilizing both audio and visual components. As such, YouTube represents a platform that may be widely used by medical students and trainee doctors.

YouTube presents an opportunity for educational use.[7,8] Some studies have attempted to assess the quality of videos held on YouTube relating to medical procedures.[1] Despite this, little research has been conducted into the validity of files contained on YouTube that purport to contain medical education material, particularly in the field of cardiology. The unregulated nature of the information contained within YouTube is potentially dangerous to those seeking online information.[6] It was hypothesized that YouTube currently hosts videos of inadequate educational value. To this end, the contents of YouTube detailing educational information relating to heart sounds and murmurs was examined.

Methods

A list of 16 heart sounds/murmurs/conditions was compiled by examining current medical text books and selecting those thought to be common and important.[9,10] From these, 8 were chosen that are essential core information for medical practice and medical education (Table 1).

The YouTube Web site was queried on January 15, 2012, using 3 search terms; "heart murmur," "heart sound," and

The authors have no funding, financial relationships, or conflicts of interest to disclose.

Received: July 3, 2012
Accepted with revision: October 25, 2012

Published online in Wiley Online Library (wileyonlinelibrary.com)
DOI:10.1002/clc.22080

Table 1. Heart Sounds/Murmurs/Conditions Selected as Core and Extra

Core	Extra
S1	Pulmonary stenosis
S2	Prosthetic valves
S3	Opening snap
S4	Systolic click
Mitral stenosis	Pericardial rub
Mitral regurgitation	Gallop rhythm
Aortic stenosis	Atrial septal defect
Aortic regurgitation	Ventricular septal defect

Abbreviations: S, heart sound.

"heart auscultation." Quotation marks were used in place of a logic operator to specify that both terms must be present. A filter was subsequently placed on the search results using an built-in YouTube feature, which limited search results to those listing themselves as educational. All videos in a language other than English or without sound were excluded.

Following the initial search, the titles of videos produced by each of these searches were examined, and those appearing to contain heart sounds were flagged for further analysis. For any videos where the title was ambiguous, the videos were examined to ascertain if they met the inclusion criteria. Videos were excluded if they were non-English language, noneducational in nature, or where the topic of the video was not related to heart sounds, murmurs, or auscultation. An initial list of videos was compiled. All additional videos on YouTube made by authors found using our initial search were reviewed for any additional relevant material and added to the search results. All videos were fully viewed to confirm that they contained auditory representations of heart sounds and were intended as educational tools. Any videos that did not fulfill these criteria were subsequently excluded. The initial search, subsequent screening, analysis, and scoring of videos were performed independently by 2 of the authors (C.F.C., N.S.), and any discrepancies were solved by consensus.

YouTube publishes certain information on all videos. These built-in metrics were catalogued for each selected video on January 22, 2012. The metrics catalogued from the Web site were: hits (the number of times a video had been viewed), likes and dislikes (a crude scoring system that viewers can assign to videos), and the page number on which the video was located (each page of search results contained 20 videos). Number of hits were recorded, as they provide an indication of the popularity and potential influence of the video. Likes and dislikes were selected as they are considered a measure of the video quality. The page number was recorded, as the YouTube search algorithm is intended to order videos according to their relevance, and thus those found on the first page are more likely to be seen than those on lower pages.

Any video that, although issued as a separate file, contained the same video content was classified as a repeat. Repeats were treated as a single file for analysis; all hits, likes, and dislikes were summed together. The repeat file with the greatest number of hits was considered the original and used for analysis, with the summed metrics used in the analysis. Any videos that appeared to be part of a series were considered as a single file; all hits, likes, and dislikes were averaged between the files considered to be part of a series. The metrics were averaged between files in a series, as it was thought that the average viewer may watch many, if not all, of the videos in a series. As such, this would lead to a gross overestimation of unique viewings if the metrics were summed.

The videos were assessed for audiovisual quality, teaching quality, comprehensiveness, and file metrics. In an attempt to accurately compare the videos, a scoring system was developed. Although several scoring systems have been proposed in previous studies, none were appropriate for the video content that was being assessed.[2,6] The elements are outlined in Table 2. Given the importance of a comprehensive set of heart sounds, this was weighted more highly. However, given the arbitrary nature of the scoring system, the score was assessed using different weighting. A set of anchor statements was outlined to secure the maximum level of objectivity between the 2 scorers. Video accuracy was assessed by comparing the YouTube video with the auditory files provided on Heart Sounds 2, produced by the American College of Cardiology.[12] This program was considered to be the gold standard for audio teaching quality.

Statistical Analysis

Pearson product-moment correlation was used to assess the correlation between variables. Interobserver analysis was assessed by calculating the Cohen kappa score. Microsoft Excel 2010 (Microsoft Corp., Redmond, WA) was used as the software to calculate statistical values.

Results

A total of 3350 videos were found on initially searching YouTube; 2,370 using "heart sounds," 865 using "heart murmur," and 115 using "heart auscultation." On applying the educational filter, the number of videos in each category was reduced to 297 (12.5%), 135 (15.6%), and 31 (26.9%), respectively. After visual examination, 111, 56, and 12 videos, respectively, were selected from these searches. Concordance between the 2 observers in the initial search was 0.975 (95% confidence interval, 0.954-0.995).

When search results were combined and duplicated videos removed, 125 unique files were found. A further 14 videos were located when other videos from identified uploaders were examined. This created a total list of 139 videos. Those considered being part of a series or copies of the same file were combined to create 32 unique videos. Once fully viewed and assessed, 22 videos were taken for analysis; 10 were excluded because they contained no relevant educational content. Of those videos selected for final analysis, all 22 (100%) were found when searching "heart sounds," 16 (72.7%) on searching "heart murmur," and 4 (18.2%) on searching "heart auscultation." A flow chart explaining how the search process was carried out is shown in the Figure.

The mean score for all of the videos assessed was 4.07 out of 7 (58.1%; standard deviation, 1.35). Not a single

Published online in Wiley Online Library (wileyonlinelibrary.com)
DOI:10.1002/clc.22080

Table 2. Outline of the Scoring System Used to Analyze YouTube Videos for Content and Quality

Aspect	Definition	Description	Score
Title and/or description		Uninformative Outlined Comprehensive	0 0.5 1
File accuracy	Refers to whether the video or audio accurately represents the heart sound or murmur indicated	Inaccurate Accurate	0 1
File comprehensiveness	The proportion of heart sounds and murmurs provided in the file when compared to those outlined in Table 1	Incomplete Basic Extended	0 0.5 1
Like/dislike ratio		Likes <0.9 of total Likes >0.9 of total	0 1
File quality	Refers to the technical quality of the video and audio material provided	Unclear or background music Clear	0 1
Audio teaching quality	The quality of additional educational audio material, in combination with any heart sounds or murmurs	Unclear or none Clear and relevant	0 1
Video teaching	The quality of any additional educational video material, such as animation	No use of video to aid teaching Video teaching provided	0 1
Total			n/7

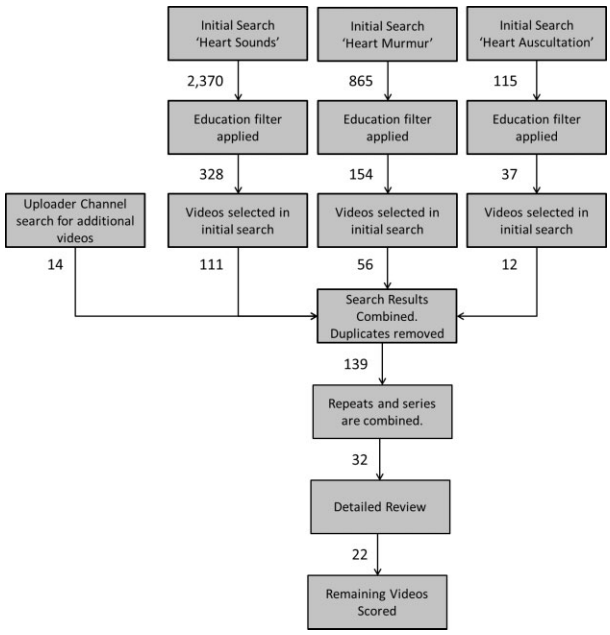

Figure 1. Flow diagram of search result refinement.

video scored full marks; the highest scoring video had a score of 6 (85.7%). The highest scoring item was video accuracy (86.4%). The lowest scoring items were video comprehensiveness and audio teaching quality (18.2% and 31.8%, respectively). Only 4 of 22 videos were considered comprehensive. A complete breakdown of items is found in Table 3. The total concordance between authors scoring subjective items was 0.86. Of the score items that were subjective in nature, all had a kappa score >0.75, with the exception of audio quality with a score of 0.37.

Table 3. Breakdown of Each Item Scored in the Analysis

Score Item	Percentage
Title	65.9% (14.5/22)
Video accuracy	86.4% (19/22)
Video comprehensiveness	18.2% (4/22)
Like/dislike ratio	86.4% (19/22)
Video/audio quality	68.2% (7/22)
Audio teaching quality	31.8% (15/22)
Video teaching	50.0% (11/22)

Table 4. Correlation Coefficients Comparing Search Page and Video Score

Search	Correlation Coefficient (*P* Value)
Heart sounds	−0.075 (0.74)
Heart auscultation	0.221 (0.32)
Heart murmur	−0.059 (0.79)

The correlation of the video score with the number of hits attributed to that video was not significant (0.195, $P = 0.38$). Similarly, no correlation was seen between likes or dislikes and the remainder of the score (0.269, $P = 0.23$ and −0.124, $P = 0.58$, respectively). No significant correlation was found between video score and the first page on which that the video was found during individual searches (Table 4).

Discussion

Created in 2005, YouTube is the third most visited Web site on the internet.[13] The high level of use combined with the ubiquitous presence of health information on the internet

Published online in Wiley Online Library (wileyonlinelibrary.com)
DOI:10.1002/clc.22080

has given YouTube a substantial potential for education. However, little research has been carried out to assess the validity of information aimed at health professionals contained on this Web site. Such videos can be used for private study or integrated into classroom teaching, especially when no clinical specialist is available. Some studies have, however, assessed YouTube as a source of patient information on a range of topics.[3–6]

The scoring system used in this study, although novel in origin, shows a high level of interobserver correlation while covering a wide range of potentially subjective elements. Although the field of audio quality was dramatically lower than the other subjective analyses, this is the aspect that is most likely to be affected by the listening environment.

In this study, a large number of videos containing educational information relating to heart sounds and murmurs were located. The quality of the videos located was widely divergent when scored using our criteria. Not a single video or series of videos obtained the full score. This indicates a serious lack of quality content relating to heart sounds on the YouTube Web site. Although it would be ideal if YouTube could institute a moderating service for educational videos, this is not practical given the volume of new content added to the system daily.[13] However, organizations with a vested interest in educating medical students and other healthcare professionals should make increased efforts to identify and highlight good teaching resources online. Although this could be achieved informally by individual institutions, some form of Kitemark for approved videos, perhaps issued by the appropriate professional society (for example the American College of Cardiology in this instance), should be developed in cooperation with YouTube and other file-sharing Web sites.

The scoring metric used in this study creates an overall score. The top scoring videos were all valuable educational tools, but they clearly had strengths and weaknesses. The top scoring video series (http://www.youtube.com/watch?v=OQ9xrxDg3uc) scoring 6.0, encompassed a range of murmurs with good audio quality and video animation. However, of note are 2 further video series that did not score as highly but deserve particular mention. The first (http://www.youtube.com/watch?v=V5kSBrSA-sA), scoring 5.5, was a video series containing lectures on heart murmurs, which was particularly comprehensive but contained fewer auscultation examples. The second (http://www.youtube.com/watch?v=xS3jX1FYG-M), scoring 5.0, contained a broad range of high-quality heart sounds and murmurs but lacked educational content to supplement this.

The ability to filter videos for educational content is a useful feature found on YouTube. However, its effectiveness was limited. Despite employing this filter, a large number of videos that were not considered to be educational were found. The administrators of YouTube should, therefore, consider employing stricter criteria regarding the labeling of a video as educational.

The lack of correlation between video score and page location of the video when searched is an important observation. It highlights that the YouTube search algorithm is not best calibrated for searching for educational content. Viewers are inherently likely to select a video from earlier pages; however, this is no more likely to locate the best video. Additionally, the lack of correlation between score and video hits, highlights that the videos being viewed most are not those that scored highly. This suggests that many viewers are using substandard material in their education

The search strategy aimed to encompass as many videos as possible to ensure a high level of sensitivity. Unlike many professionally oriented databases, such as those used for peer-reviewed publications, the search engine utilized by YouTube is simplistic and allows for only a limited degree of search control. As such, this may explain the large number of video files found, especially when searching for "heart sounds." Checking the other video files of any uploader located using the initial search, would have identified any additional videos relating to the original searches. Although it is not certain that all videos were located using this search method, most users are likely to enter popular or common terms to locate videos.

The small number of search terms used is a limitation to the study. Similarly, restricting the video content language to English limits the content reviewed; however, given that the majority of videos stored on YouTube are English-language videos, this effect may be small.[13] The use of the educational filter built into YouTube may mean that some educational videos that were not labeled as such may have been missed. By only searching YouTube, and not including other video-storing Web sites, some videos may have been missed. The number of videos stored on other Web sites is difficult to assess, but the popularity of YouTube makes it the likely first port of call for those seeking educational material.

Conclusion

The generalizability of these findings to educational videos on other topics is not clear. It is possible that videos in other fields are of better quality compared to the sample located in this study. However, given the lack of regulation of such videos, it is likely that a proportion of online resources are still of poor quality with substantial educational flaws. The scoring system utilized in this article could be easily adapted to videos on other topics. With the rapid advances in file-sharing utilization for education, continued assessment of content is required. Others are encouraged to assess and improve on the system described in this article.

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Published online in Wiley Online Library (wileyonlinelibrary.com)
DOI:10.1002/clc.22080

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Published online in Wiley Online Library (wileyonlinelibrary.com)
DOI:10.1002/clc.22080