ORIGINAL RESEARCH

Laryngoscope
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The World's consumption of free web-based Otolaryngology-Head and Neck Surgery educational resources: A global assessment of video usage trends

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Abstract

Objectives: Online educational platforms with open access have seen a growing adoption in the field of medical education. However, the extent of their global usage is still unclear. To fill this knowledge gap, our objective is to examine the usage patterns of two renowned open-access resources in Otolaryngology. This includes identifying the most sought-after topics and understanding the demographics of their users.

Methods: Retrospective study of web analytics data between 2016 and 2021 extracted from the Headmirror.com and Mayo Clinic Otolaryngology YouTube channel platforms analyzing demographic and education topic trends via descriptive, geospatial, time-series, t-tests, and ANOVA analyses.

Results: Viewership spanned 124 countries in 7 different geographic regions, with 72 countries comprising low- to middle-income countries, mostly represented ages of 25–34 years old, came from high-income countries rather than low-income ($p < .001$), and used mobile phones followed by computers for device access. Video-educational material comprised of subspecialty topics on Rhinology and Sinus Surgery (25%) at the highest end and Facial Trauma (1%) at the lowest. Controlling for the age of the video content, the most-accessed videos comprised of subspecialty topics on Head and Neck Surgery at the highest end and Laryngology at the lowest with significant differentiation across topics of interest ($p < .044$).

Amelia S. Lawrence and David J. Fei-Zhang contributed equally to the work.

Due to international privacy data laws, the data analyzed in this study only comprised of summarized, deidentified statistics per country and demographic category, which would not be considered human research.

Conclusions: This assessment of web-analytics platforms from two widely used otolaryngology free, online-access materials showed increasing global usage trends with significant differentiating factors along viewership demographics, as well as sought-after subspecialty topics of interest. In turn, our results not only lay the groundwork for characterizing the global otolaryngology audience but also for future development of targeted educational materials and accessibility initiatives aimed at ameliorating global educational disparities in the field.

KEYWORDS

demography, developed countries, developing countries, global surgery, open-access, social media

1 | INTRODUCTION

As the world becomes increasingly interconnected, free web-based educational platforms have become more important to the core learning style of the recent generation of otolaryngologists. Open-access educational resources, defined as online materials that are free and available to the public, have seen increasing usage globally through various forms of video podcasts, audio podcasts, e-textbooks, websites, applications, and software.[1] Compared with traditional textbooks and pay-to-view journals, these resources connect providers and trainees in developing countries who have internet access to consume such resources freely,[2] with most of these free open-access material (FOAM) being created in high-income countries (HICs).[3,4]

Coinciding with advances in technology and web access alongside the COVID-19 pandemic, educators have sought to increase web-based information available to students, health care providers, and patients to promote and develop these resources.[5–8] However, there are disproportionately fewer open-access educational resources specifically targeted for global accessibility and consumption, such as free online videos and various surgical atlas texts.[9–12] Even with modern advances in technology improving access to medical information worldwide, the readability and quality can be variable.[13] This is in spite of how prior investigation has shown that increased access to education information globally can promote a higher standard of care among the global health sector.[14]

Since the 2015 Lancet Commission on Global Surgery, there has been a call to increase access to safe and affordable surgery worldwide. In countries that lack persistent experienced surgical teachers, access to meaningful open-access education could be utilized to help bridge this gap.[15] Established in 2016, Headmirror.com is one of the premier, otolaryngology resources that has aimed to address this shortcoming by providing a centralized open-access information hub on specialty-career advising and medical and surgical education through an established podcast channel and physician-curated educational video-content. Closely tied with this resource, the Mayo Clinic Otolaryngology YouTube channel was established in 2018 as another freely accessible otolaryngology hub that has since provided numerous in-depth procedural and medical knowledge videos for global audiences.

Despite this plethora of FOAM, quantitative assessments of their global usage trends regarding who their audiences are and what otolaryngology topics are of most interest have yet to be done. Thus, this study aims to explore the usage of these two free, open-access resources by characterizing the demographics of their international viewership and their specific usage trends. We hypothesise that vast differences varying by income status of represented countries and regions would be observed across usage patterns in device type, subject content consumed, and the number of views and amount of time consumed.

2 | METHODS

2.1 | Web-based analytic data and category definitions

Web traffic data spanning from 2016 to 2021 were extracted from Headmirror.com and the Mayo Clinic Otolaryngology YouTube channel. Parameters included age of audience, location, consumed FOAM/content (i.e. individual video), and device type. Along these parameters, specific values of number of total views, average views, cumulative watchtime, average watchtime, and average percentage of video watched across the full timeline and for selective chronological periods (e.g., values from 2018 to 2019, or 2020 to 2021) were extracted directly from the analytics platforms. Web traffic data for video materials were of primary focus due to the availability of data values from the analytics platforms.

Due to current data restriction policies and international data privacy laws, data on the level of individuals were not accessible. Instead, the summary descriptive statistic values as described above were available for extraction and were delineated along set categories for each parameter: for age, descriptive values were extracted by set analytic-platform categories of "13–17 years," "18–24 years," "25–34 years," "35–44 years," "45–54 years," "55–64 years," and "65+ years"; for location, descriptive values were extracted based on country; for consumed content, values were extracted per "content" (i.e., for YouTube, each individual video uploaded); for device type, values were extracted by set analytic-platform categories of "Computer," "Mobile phone," "Tablet," and "TV."

Content subspecialty was based on extracted content relevance (i.e., neck dissection videos were under "Head and Neck Surgery") for certain analyses. Low- and middle-income country (LMIC) and HIC categories were based on extracted locations and their delineations based on World Bank Indicators. Region of audience (i.e., "North America," "Middle East and North Africa," etc.) were also based on extracted locations.

2.2 | Statistical methods

Extracted parameters of age, location, consumed content, and device type, as well as regrouped parameters of content subspecialty, country income level, and region of audience were analyzed by descriptive statistics. Regrouped parameters were also assessed by repeated t-test and univariate ANOVA analyses when appropriate. Location was also assessed by descriptive geospatial analyses.

The "Number of Views [...]" and "Cumulative Watch Time over Video Age in Days" metrics were calculated by taking the total view count and watch time divided by the age of the video in days to control for the varying time when content was originally uploaded to the platforms.

Log-based measures of views and clicks for descriptive geospatial analyses were used to balance the wide spread of values observed while still showing differentiation. Significance was set to $p < .05$ and all p-values were two-tailed.

2.3 | Institutional review board

No Institutional review board was needed given the level of data not being for individuals and was anonymized based on analytics-platform restrictions and in accordance with international data privacy law.
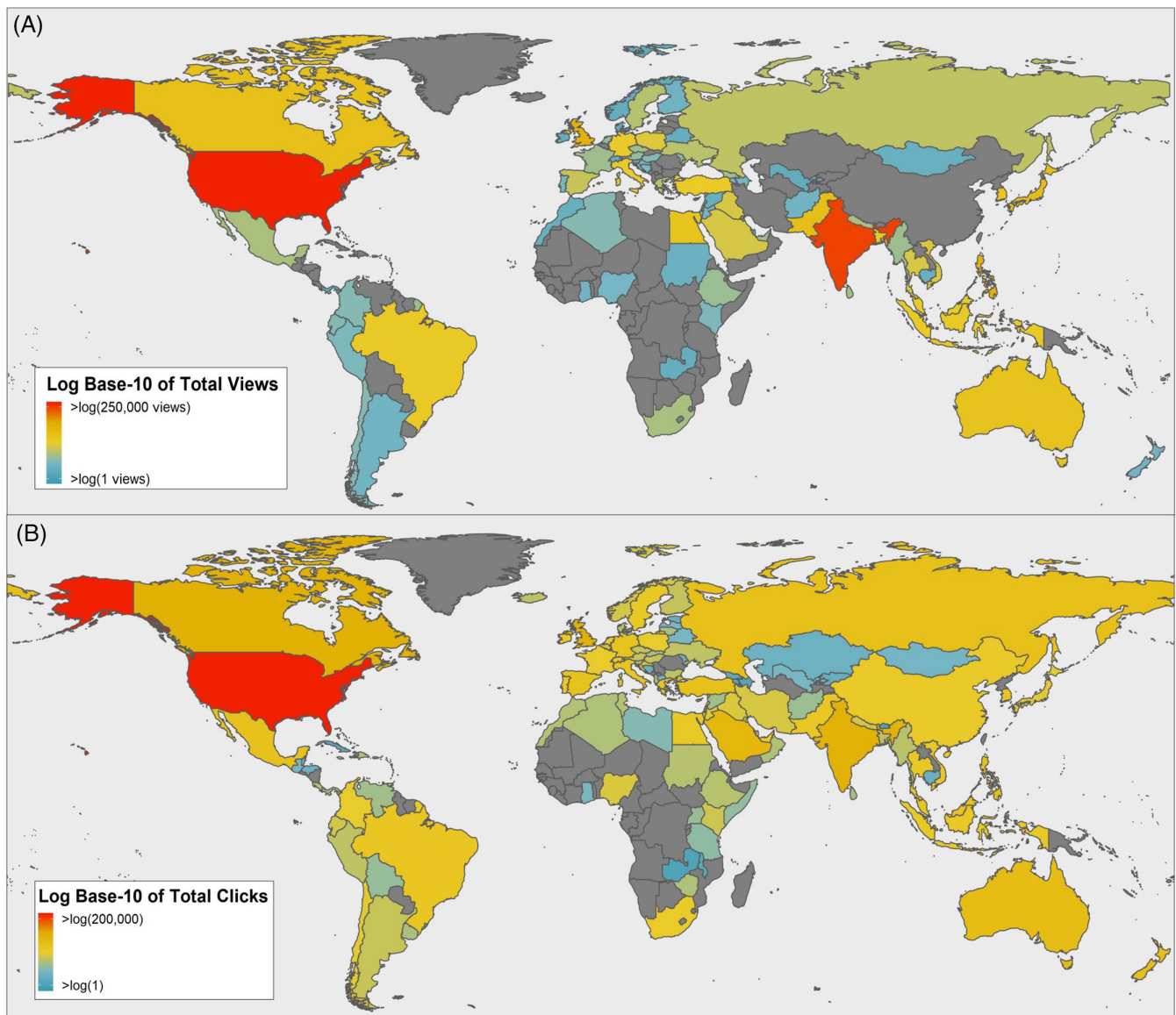
FIGURE 1 Geospatial analysis of log-base 10 of (A) YouTube Views and (B) Headmirror.com web traffic.

3 | RESULTS

Across Headmirror.com and the Mayo Clinic Otolaryngology You-Tube channel from 2016 to 2021, data analytic parameters were extracted for web traffic spanning 124 countries in 7 different geographic regions, with 72 countries (58.06%) comprising LMICs. Throughout the video materials, the total number of views was 2,530,799 views while the total cumulative watchtime was 164,159 h. Viewership ages ranged from 13 to 65+ years, with most of the views and cumulative watch time found in the 18- to 24-year (47.92% of total views; 35.27% of cumulative watchtime) and 25- to 34-year (45.66%; 60.61%) audiences. The video content viewed consisted of 100 videos total, with videos representing subspecialty topics on Rhinology and Sinus Surgery (25% or 25/100 videos), Otology and Neurotology (23%), Head and Neck (19%), Laryngology (13%), Pediatric Otolaryngology (10%), Sleep Surgery (5%), Facial Plastic Surgery (4%), and Facial Trauma (1%). Among device types, mobile phones comprised most of the views and watchtime (55.90%; 46.77%) followed by computers (35.58%; 41.76%), tablets (6.06%; 7.35%), and television (2.45%; 4.12%). Further descriptive values regarding average view duration and percentage of video watched across these parameters can be found in the Figures S1–S4.

For these two platforms, varying numbers of clicks and views across the globe were observed by geospatial assessments (Figure 1A,B). When country viewership was grouped by income level, viewers from HICs showed higher proportions of views (66.73%) and watch time (71.82%) in comparison to LMICs (33.27%; 28.18%, respectively). Average view durations across the countries comprising the country-income levels were significantly higher ($p < .001$) in HICs (3.56 ± 1.91 h) than LMICs (2.22 ± 1.30 h) but not for average percentage of video watched ($p = .540$; Figure 2). Specific regional and per-country comparisons can be found in the Figures S5 and S6.

These differences also held true across chronological assessments of web traffic. From 2018 to early 2020, global usage of this FOAM increased, with higher traffic rates observed across YouTube and Headmirror.com users from both HICs and LMICs. From early 2020 to late 2020/early 2021, YouTube usage had decreased but still maintained significant differences between HICs and LMICs (Figure 3A), whereas annual Headmirror.com usage continued to increase substantially while maintaining significant differences between income groups (Figure 3B).

Among this global userbase, subspecialty topics of interest for video content presented in the YouTube channel and Headmirror.com showcased significant differences across all topics after adjusting for video age/upload date. For both number of views and watchtime, Head and Neck subspecialty topics saw the most usage while Laryngology saw the least while varying degrees of usage for other topics were observed (Figure 4). Specific per-video assessments can be found in the Figures S1– S6.

Subspecialty topics of interest for video content were also assessed overtime and showcased varying degrees of interest from viewership after adjusting for video age/upload date (Figure 5).
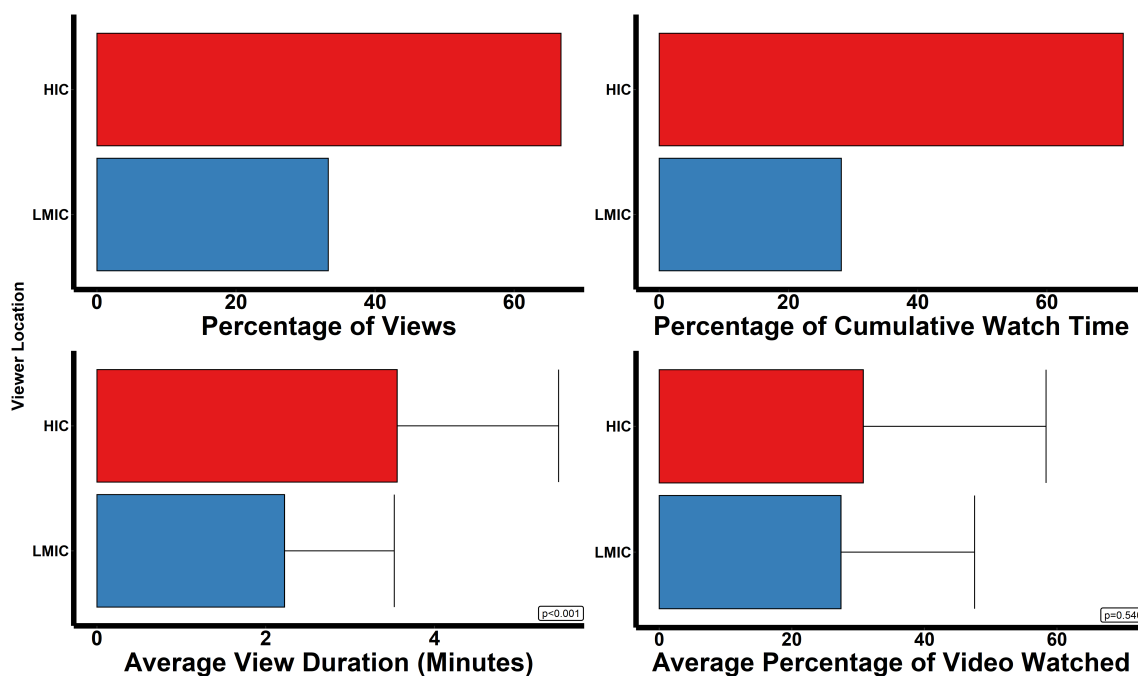
FIGURE 2 Average percentage of views, percentage of cumulative watch time, average view duration (min) and average percentage video watched by viewer location through grouping of high-income countries (HICs) versus low- to middle-income countries (LMICs) as defined by the World Bank Data. Figure shows that the average view durations across the countries comprising the country-income levels were significantly higher ($p < .001$) in HICs (3.56 ± 1.91 h) than LMICs (2.22 ± 1.30 h) but not for average percentage of video watched ($p = .540$).
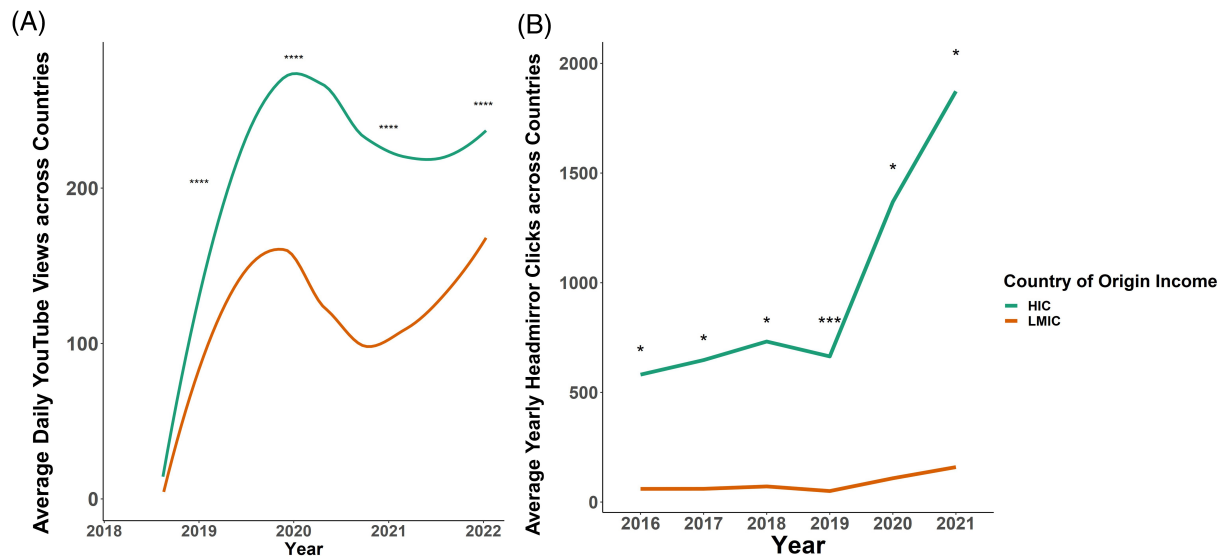
FIGURE 3 Timeseries analysis of average (A) YouTube daily views and (B) Headmirror.com yearly clicks by country-of-origin income groups. Repeated measures *t*-test were performed, *$p < .05$, ***$p < .001$, ****$p < .0001$. HIC, high-income country; LMIC, low- to middle-income country.

4 | DISCUSSION

Our web analyses showed that FOAM-consumption of Headmirror. com and the Mayo Clinic Otolaryngology YouTube channel reached global audiences of 18–24 and 25–34 years. This demographic information provides invaluable quantitative assessments of how the age ranges imply that medical trainees and younger practitioners would likely be the majority audience. Given that the FOAM evaluated from these resources were intended to cater toward health professionals (see per-video titles denoted in Figures S1– S6), these demographic findings suggest how future content created for these otolaryngology platforms should continue relaying information at a level of detail necessary for practicing physicians and trainees. At the same time, given the vast scope of audiences to a popular platform such as YouTube, these results also provide context for further investigations of currently available FOAM quality and complexity to define the landscape of professional and laymen-directed content.[13]

This study also identified that these FOAM were accessed through primarily mobile phone closely followed by computer-technological means. This could imply that global access to mobile phones in LMICs, as well as usage trends in HICs are increasing with the progression of technological advancements and distribution, namely expected viewership trends of lesser duration for single session viewings but increasing number of viewings.[16,17]

Across their respective countries, audiences were observed to have significantly varied levels of engagement based on geographical location and country-income level (Figures S1 and S2). These results indicate that FOAM in otolaryngology is accessible and increasingly used worldwide, even in places where training and resources are limited. However, the significant differences among LMIC and HIC usage quantitatively confirm suspicions of how deficient otolaryngology

FOAM-accessibility is for LMICs. These results highlight the need for future discourse surrounding the global representation in other prominent FOAM platforms in otolaryngology and other fields, as well as on initiatives for expansion of FOAM accessibility and utilization in LMICs.[1,18]

Our data also indicated that many otolaryngology subspecialty topics are being accessed, with the highest consumption being Head and Neck subspecialty topics (Figure 4). Despite the highest number of video content being represented among Rhinology and Sinus Surgery at 25/100 videos, Head and Neck topics with only 19/100 videos were still the most viewed among global audiences. These results align with the need to address otolaryngologic disease burden among developing countries, which accounts for 67% of head and neck cancers and 82% of head and neck cancer-related deaths.[2]

As a further consideration, such interest in these subspecialty topics has not stayed constant, as they have varied drastically over time (Figure 5). These results not only provide insight into what educational resources and training HICs and LMICs require for their respective ENT practices but also inform how FOAM developers and educators need to stay current on the everchanging priorities of these global audiences.

Despite these quantitative findings of global usage trends, solely having freely available online resources cannot alone promote increased education in LMICs. Challenges posing LMICs, including language barriers, literary understanding, quality of the information, practicality/topic relevance (i.e., modern robotic techniques not being utilized in low-resource areas), having internet or electronic device access, cannot be ascertained in quantitative assessments such as ours and require further contextual inquiry to fully characterize the impact of these findings.[2]
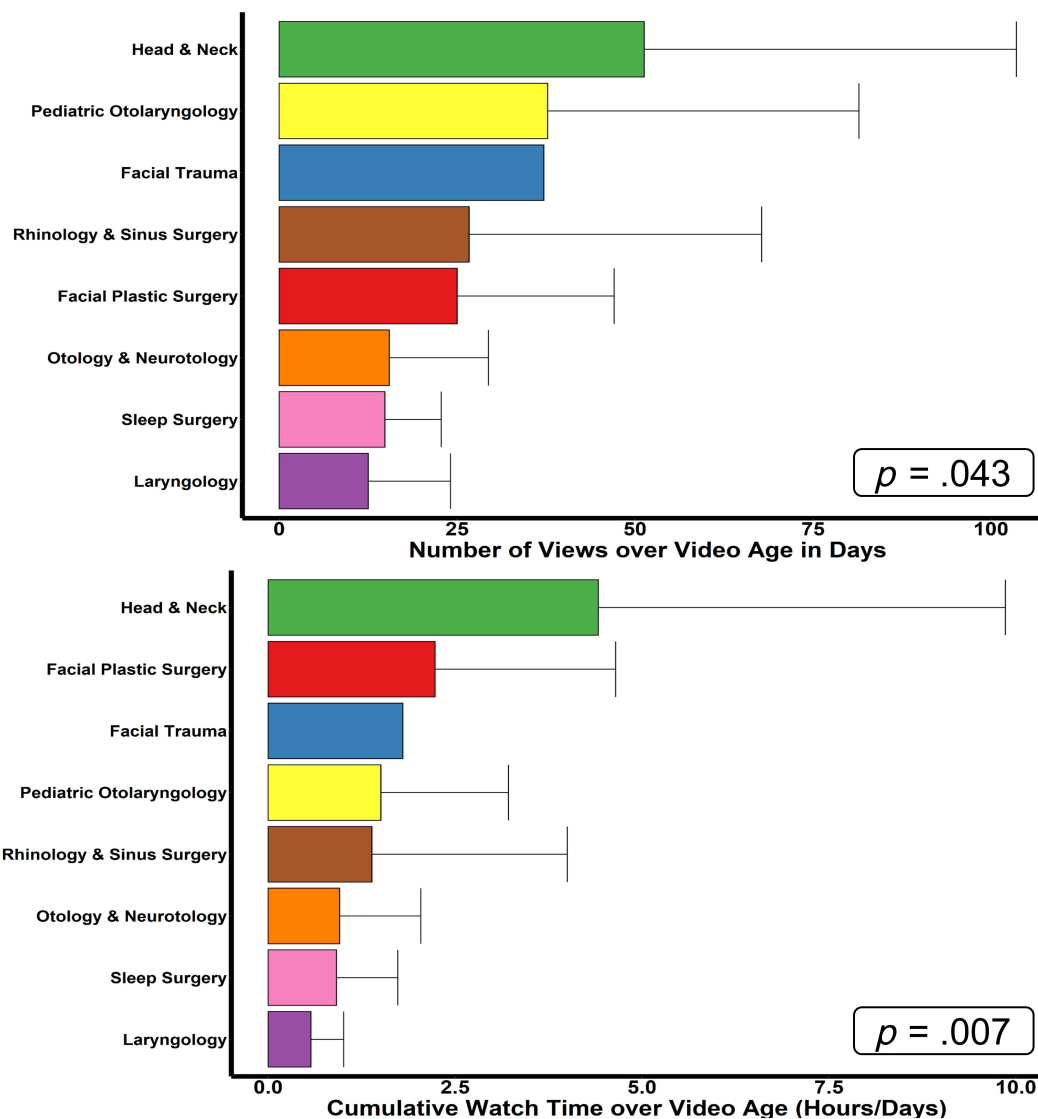
FIGURE 4 Cumulative number of YouTube views and watch time by subspecialty topic. One-way ANOVA was performed.

In addition, quantitative assessments such as ours cannot directly address the existing disparities in patients seeking care in LMICs compared with HICs. However, such data can be used in the context of global initiatives that have recently increased their focus on both immediately aiding in the performance of surgical procedures on short-term surgical trips and ushering long-term benefits through visiting providers extending education and surgical training. These efforts include the implementation of surgical curriculums, collaboration with government and nongovernmental agencies, and the development of residency programs.[19–25] Within this educational context of longitudinal surgical program growth in LMICs, these global partnerships provide ample opportunities for the inquiry, execution, and development of FOAM, especially in regard to the resource limitations of LMICs accessing traditional textbook or other paid educational media. Open-access resources in otolaryngology, such as those analyzed in our study, can enhance this ability for sustained growth of LMIC-otolaryngological care.

4.1 | Strengths and limitations

Strengths of this study include being one of the largest data assessments of otolaryngology FOAM usage across a global sample size; providing multi-level parameter analyses delineated by audience age, location, device type, and topics of content; implementing multiple types of statistical analyses with descriptive, geospatial, time-series, t-tests, and ANOVA alongside several statistical balancing considerations; and utilizing modern analytics platforms with powerful, accurate datasets.

Several limitations in this study existed and should be acknowledged. One of which is the fact that many Otolaryngologic resources are available online and we only analyzed two of them in this study. Both resources analyzed were from the same institution and both are based in the United States. Thus, their analysis may not be representative of global usage. Additionally, internet access globally and language barriers may potentially lead to decreased usage of these
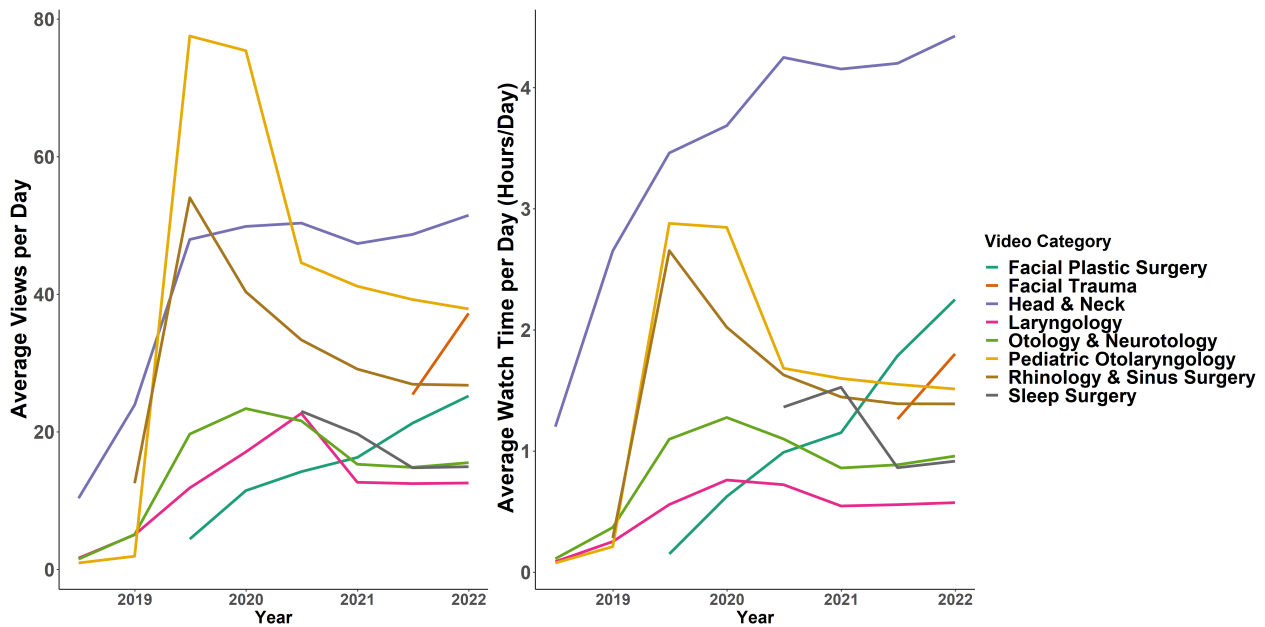
FIGURE 5 Average views per day and average watch time per day (h/day) for each video category from 2018 to 2021. Video categories are labeled according to color.

resources worldwide, specifically in LMIC and non-English speaking countries, respectively. No translation of the material on either website analyzed in this study is available at this time. As previously discussed, some studies have looked at the quality of YouTube videos, but none at Headmirror.com or Mayo Clinic YouTube quality specifically. Future studies should incorporate additional otolaryngology FOAM resources and evaluate the reliability of FOAM in otolaryngology. Research on the potential limitations of FOAM use globally should be further investigated as broadband access may play an important role in global usage of otolaryngologic resources available on the internet. Additionally, the effects of language barrier of usage of free-open access otolaryngologic materials should be evaluated as this may be limiting the ability of other countries from utilizing the available information.

Through analyses of two widely used open-access medical education platforms in otolaryngology, our study found that viewership of these FOAM have reached audiences worldwide, with selective demographic representation among age ranges coinciding with medical trainees and young practitioners through primarily mobile electronic means. These audiences preferred to view Head and Neck subspecialty topics among these two platforms. In addition, global comparisons showcased significant differences in usage trends for both HIC and LMICs, with LMICs showing disproportionately lower levels of engagement. These findings not only reveal the current scope of FOAM and significant utilization trends of their use among LMIC–HICs in the sources analyzed but also lay important groundwork for cultivating further investigations into the use and development of medical education resources in otolaryngology. As such, this may provide insight into the potential usage of FOAM integration into global surgery training and education.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.