

# Lifestyle Measures for Glaucoma Patients: An Objective Social Media Content Analysis

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## ABSTRACT

**Aim:** In this study, we analyze the content quality and characteristics of the most viewed search results on various internet platforms related to lifestyle measures for patients with glaucoma.

**Materials and methods:** In this internet-based cross-sectional study, we used search keywords “glaucoma,” “lifestyle,” “glaucoma,” and “exercise” on the most popular internet platforms—Google, Facebook, YouTube, and Reddit. The top 30 Google searches about each of the keyword combinations were identified. We also assessed the first 30 videos on YouTube and Facebook Watch, the first 30 Reddit posts and the first 30 Google images about each of the keyword combinations. The quality of content from the platforms was evaluated by three independent reviewers using the well-established Sandvik score, Health on Net (HON) code, and risk score for different uploaders. The quality of content regarding lifestyle measures in glaucoma uploaded by healthcare professionals (HCPs) was further evaluated.

**Results:** The established criteria resulted in 48 websites from the Google search engine, 22 videos from YouTube, 37 posts from Reddit, and 28 videos from Facebook Watch, which were included in the final analysis. The mean Sandvik scores were  $11.14 \pm 1.8$  (Google webpages),  $10.4 \pm 2.19$  (YouTube videos),  $10.54 \pm 2.21$  (Facebook Watch), and  $4.24 \pm 1.18$  (Reddit). The mean risk scores were  $0.22 \pm 0.68$  (YouTube videos),  $0.18 \pm 0.47$  (Facebook Watch), and  $0.11 \pm 0.31$  (Reddit). The mean HON code scores were  $5.45 \pm 1.62$  (YouTube),  $6.55 \pm 1.44$  (Google webpages),  $5.29 \pm 1.04$  (Facebook Watch), and  $8.27 \pm 3.05$  (Reddit). The content uploaded by HCPs was primarily from ophthalmologists and had significantly ( $p < 0.05$ ) higher content quality scores. The majority of the content recommended aerobic exercise as a lifestyle measure in patients with glaucoma as an adjuvant to medical and surgical management.

**Conclusion:** The majority of the content regarding lifestyle measures in glaucoma was uploaded by HCPs and had medically accurate and well-referenced information, especially on Google and YouTube.

**Clinical significance:** Primary care physicians and ophthalmologists can reliably use social media content to guide recently diagnosed patients about the requisite lifestyle measures.

**Keywords:** Glaucoma, Lifestyle changes, Patient education, Social media.

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## INTRODUCTION

Glaucoma is a leading cause of irreversible blindness, affecting >60.5 million people, globally.<sup>1</sup> It is estimated that by 2040, glaucoma will affect >110 million people. Glaucoma is a chronic disease that significantly affects the quality of life due to gradual and progressive vision loss.<sup>2–5</sup> Therefore, it is essential for ophthalmologists to provide clear and concise information addressing the patient’s concerns.<sup>6</sup> The ever-expanding access to the internet in the developed and developing world has made it the primary source of information. Several studies have shown that patients with glaucoma often turn to the internet as a source of information related to their conditions.<sup>7–9</sup> In a recently conducted survey, it was reported that 43% of glaucoma patients used the internet as a source of information.<sup>10</sup> The temporary closure of medical practices during the ongoing COVID-19 pandemic further increased the dependence on the internet as a potential source of health-related information.<sup>11,12</sup> However, the lack of regulation pertaining to the accuracy of information disseminated through the internet can have potentially negative effects on the patient’s health, typically when this information is published by people who are not healthcare professionals (HCPs).<sup>8,13</sup> The most widely used platforms to source medical information include Google, YouTube, Facebook, and various other social media platforms.<sup>14–16</sup> With 2.74 billion active users, Facebook is the topmost social media site,

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followed by YouTube with 2.291 billion active users, while Reddit ranks 15th with 450 million active users.<sup>17</sup>

The conventional treatment approach for glaucoma management is centered around lowering intraocular pressure

(IOP) using antiglaucoma medications, laser iridotomy, valve/shunt placement or microinvasive glaucoma surgery.<sup>18–21</sup> However, the evidence suggests the significant role of modifiable factors including lifestyle, exercise, and nutrition in lowering the risk of glaucoma.<sup>22–28</sup> Moreover, the patients are more compliant with these changes due to their easy adaptability and provide a greater sense of autonomy. The purpose of this study is to assess the quality of the most commonly assessed content related to lifestyle measures and glaucoma on popular internet-based platforms, using well-established objective metrics—Sandvik score, Health on Net (HON) code principle score, and previously reported risk score.

## MATERIALS AND METHODS

For this cross-sectional study, two reviewers independently queried the Google search engine, YouTube, Facebook Watch, and Reddit using the Safari browser on 26<sup>th</sup> April 2022. The queries consisted of two keyword combinations—"glaucoma," "lifestyle," "glaucoma," and "exercise". The search entries yielded the same results on using either upper or lower case of alphabets. Assuming that most users rarely go beyond the first three pages of the search results, we included the content from the first three pages of search results in the analysis. We identified 32 Google searches, 20 Google images, 30 YouTube videos, 30 Facebook Watch videos, and the first 30 Reddit posts for both the keyword combinations, thus including 64 Google searches, 40 Google images, 60 YouTube videos, 60 Facebook Watch videos, and 60 Reddit posts in the final analysis. Since all these platforms use algorithms based on the users' search history to curate the feed with the intent of providing information most likely used by the user, it would have introduced a bias in this study. Hence, the acquisition of content for analysis was performed after clearing the browser cache and without a user log on.

### Inclusion Criteria

All the websites, videos, and posts from the above-mentioned sources, that were in English language and mentioned the combination of keywords were included in the study. The non-English-language content ( $n = 1$  for YouTube,  $n = 11$  for Facebook Watch) and nonkeyword related content ( $n = 3$  for Google websites,  $n = 2$  for Google images,  $n = 33$  for YouTube videos,  $n = 17$  for Facebook Watch Videos, and  $n = 7$  for Reddit posts) were excluded (Fig. 1). We also excluded the overlapping content within the same platform and between different platforms ( $n = 11$  for Google weblinks,  $n = 3$  for YouTube, and  $n = 4$  for Facebook Watch). We also excluded content from YouTube shorts and dysfunctional links ( $n = 1$ , YouTube short,  $n = 2$ , Google weblinks). The data included in the final analysis consisted of 48 websites from the Google search engine, 38 Google images, 22 videos from YouTube, 37 posts from Reddit, and 28 videos from Facebook Watch.

### Content Categorization

The content on YouTube and Facebook Watch uploaders was categorized based on source, that is, HCPs and non-HCPs (NHCPs). The content from HCPs was further classified into ophthalmologist/optometrist content or noneyecare professional content (any other specialty physician). The view count, time since upload (from 04/26/2022), number of likes, comments, and length of video were recorded. The videos were characterized as information sharing, general discussion, personal stories, questions and answers, and interviews. Additionally, the daily view count and viewer interaction

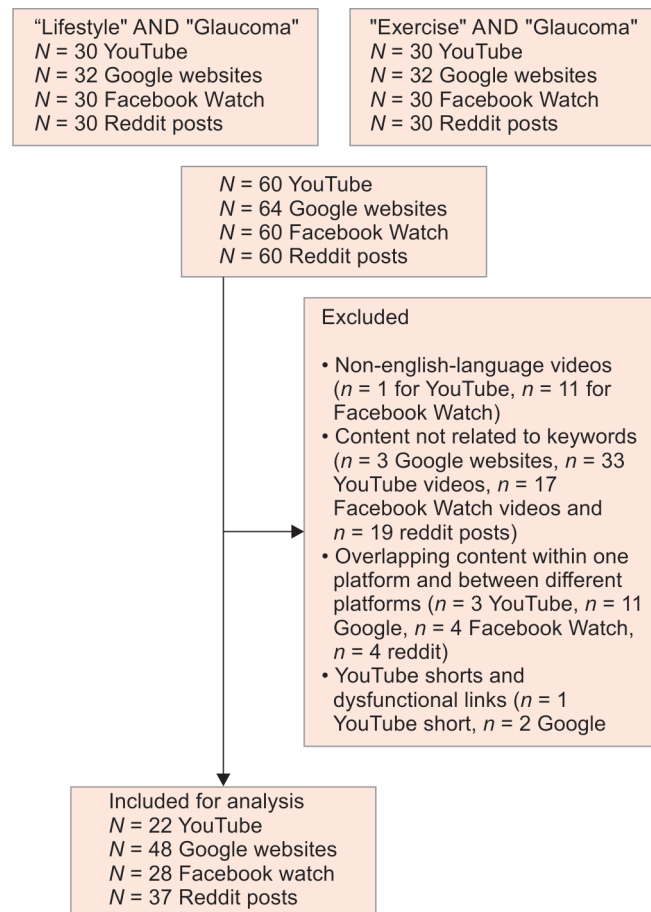


Fig. 1: Consort diagram of the social media content included in the analysis

were also calculated. The viewer interaction was calculated based on the interaction index, that is, number of likes/total views  $\times$  100.

The content on the Google Search engine and Reddit was categorized as HCPs, NHCPs, academic institutions, and National Library of Medicine (PubMed) indexed journal articles. The websites and posts were characterized as information sharing, general discussion, research study, personal story, question and answer, or news articles. Additionally, the number of comments and upvotes under the Reddit posts was also recorded. For the Google images content, the uploaders were categorized as academic institutions, research portals (PubMed, ResearchGate, ARVO, etc.), patient support groups, Healthcare workers (HCW), and a few companies. The purpose of the image was characterized as information sharing, advertisements, questions, related images of lifestyle and exercise, and images about glaucoma in general. The links or captions under the Google images were also characterized as information sharing, general discussion, research study, personal story, or question answers.

### Quality Assessment

For assessing the content quality we used the well-established Sandvik score, HON code principle score and previously reported risk score.<sup>8,29–35</sup> The scoring parameters of these scales are outlined in Figure 2. The Sandvik score ranges from 0 to 14 points and is graded into optimal quality (14 points), excellent (11–14 points), medium (6–10 points), and poor quality (0–5 points). The HON code has been specifically designed for quality assessment of medical and health-related information available on the internet and consists of eight principles that evaluate the reliability and credibility of health

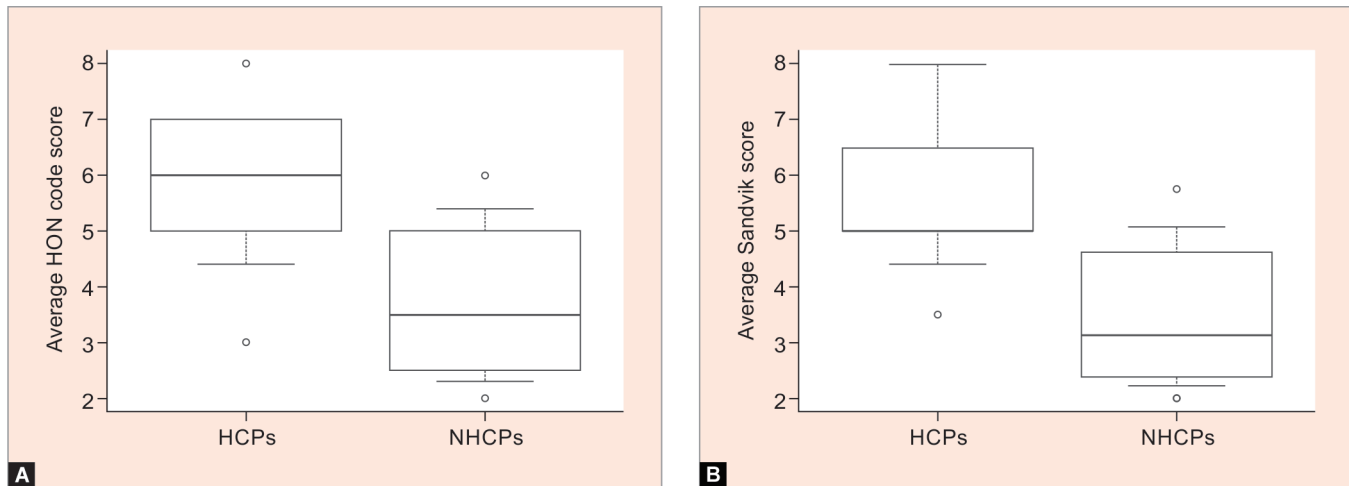


Fig. 2: Box and Whisker plots comparing HON code and total Sandvik score for HCPs and NHCPs for YouTube videos

information. The videos are rated with a score of 1 (adherent) or 0 (nonadherent) for each of the eight principles. The risk score assesses the potential risk posed to patients with the following four questions:

- Does the site discourage the use of conventional medicine?
- Does the site discourage adherence to the clinician's advice?
- Does the site provide opinions and experiences rather than factual data?
- Does the site provide commercial details?

Each positive answer received one point, giving a total risk score of 0–4, with a higher score indicating greater risk. The content was assessed by two independent reviewers and their reported mean scores were recorded for statistical analysis. Additionally, random videos were rechecked by one observer to ensure the accuracy of the data collected. Any divergence between the assessors was solved by reconsideration and consensus. The higher scores on the Sandvik and HON code scoring scales and lower scores on the risk scoring scale indicated the good quality of information.

### Statistical Analysis

The recorded data were analyzed using IBM Statistical Package for the Social Sciences Statistics for Windows version 28 (IBM Corp., Armonk, New York, United States of America) and R Studio (R Foundation for Statistical Computing, Vienna, Austria). The values were stated at a 95% confidence interval (CI). The descriptive statistics were recorded as percentages, mean  $\pm$  standard deviation (SD), median, and range. The Wilcoxon test was used for the analysis of continuous data and Spearman correlation analysis was used to correlate the scores of the quality assessment parameters. Linear regression analysis was performed to assess the correlation between video parameters and video quality. The Boxplot whisker range was set as 10–90 percentile. All the  $p$ -values  $\leq 0.05$  were considered statistically significant.

## RESULTS

A total of 48 websites from the Google search engine, 38 Google images, 22 videos from YouTube, 37 posts from Reddit, and 28 videos from Facebook Watch were reviewed and subjected to quality assessment and statistical analysis (Table 1). The content from the Google searches was primarily information sharing ( $n = 30/48$ ; 62.5%), research papers ( $n = 11/48$ ; 22.9%), news updates ( $n = 3/48$ ; 6.2%), questions and answers (2/48; 2%), and patient discussion forum (1/48; 2%). The character of the Google

Images was primarily related pictures of lifestyle and exercise ( $n = 27/38$ ; 71%), advertisement for events ( $n = 6/38$ ; 15.7%), information sharing ( $n = 4/38$ ; 10.5%), and general images about glaucoma ( $n = 1/38$ ; 2.6%). The captions/website links under the images were primarily information sharing ( $n = 23/38$ ; 60.5%), general discussion ( $n = 14/38$ ; 36.8%), and research study ( $n = 1/38$ ; 2.6%).

The YouTube videos were primarily general information ( $n = 15/27$ ; 55.5%), questions and answers ( $n = 4/27$ ; 14.8%), interviews ( $n = 2/27$ ; 7.4%), personal stories ( $n = 2/27$ ; 7.4%), and general discussion ( $n = 1/27$ ; 3.7%). The Facebook Watch content included general information ( $n = 25/28$ ; 89.3%) followed by discussions ( $n = 2/28$ ; 7.1%) and personal stories ( $n = 1/23$ ; 3.6%). The Reddit posts were primarily questions and answers ( $n = 15/37$ ; 40.5%), general information sharing ( $n = 14/37$ ; 37.8%), personal stories ( $n = 5/37$ ; 13.5%), and discussion ( $n = 3/23$ ; 8.1%).

The YouTube videos were primarily uploaded by HCP groups and associations ( $n = 18/22$ ; 81.8%), followed by NHCPs ( $n = 4/22$ ; 18.1%) (Table 2). Most HCP uploaders were ophthalmologists ( $n = 16/18$ ; 88.8%) and only a few uploads were from nonophthalmologists ( $n = 2/18$ ; 11.1%). The sixteen videos for "glaucoma," "lifestyle," exercise/yoga, and diet/nutrition were the most commonly occurring themes ( $n = 5/16$ ; 31%). The other videos included alternative health care measures (acupuncture, marijuana etc.), habits like wearing a tight tie knot, hobbies (playing trumpet, sleep, etc.), and systematic illnesses like hypertension and diabetes. The Facebook Watch videos were primarily uploaded by academic institutions ( $n = 13/28$ ; 46.4%) followed by HCPs ( $n = 9/28$ ; 32.1%), and NHCPs ( $n = 6/28$ ; 21.4%). Out of the 23 videos chosen for "glaucoma," "lifestyle," and exercise was again the most common keyword, with 12 out of 23 videos (52.1%) suggesting exercise as a means to prevent an increase in IOP. The other popular keywords included dietary modifications ( $n = 9/23$ ; 39.1%), regular check-ups ( $n = 7/23$ ; 30.4%), avoiding stress ( $n = 4/23$ ; 17.3%), and smoking.

The Google search engine results primarily included uploads by HCPs ( $n = 30/48$ ; 62.5%), PubMed-indexed articles ( $n = 14/48$ ; 29.1%), academic institutions ( $n = 2/48$ ; 4.1%), and NHCPs ( $n = 2/48$ ; 4.1%). Almost all the search results included in the analysis were associated with ophthalmologists or optometrists (93.7%). Out of 30 web pages by HCPs, 10 were by clinics and physician associations (33%), and two were by medical companies (6%).

An analysis of the 24 results for "glaucoma," "lifestyle," exercise, and body postures/yoga were the most common keywords

**Table 1:** The general characteristics of the content uploaded on YouTube, Facebook Watch, and Reddit pertaining to lifestyle measures for glaucoma patients

Parameters	Mean	SD	Median	Range	
<b>YouTube</b>					
Number of views	18,261	18,997	10,625	38	59,313
Daily view rate	24.86	37.86	9.39	137.67	0.08
Time since upload (days)	1218.63	948.94	983.5	4,066	300
Time since upload (years)	3.33	2.59	2.69	11.13	0.82
Number of likes	327.59	440.51	111	1,700	1
Number of comments	21.5	45.15	0.5	177	0
Viewer interaction index	1.65	0.86	1.52	3.62	0.33
<b>Facebook Watch</b>					
Length (in seconds)	281.10	601.24	88.5	12	3,207
Number of views	1074.42	2714.15	223	4	14,000
Daily view rate	2.81	6.41	0.67	0.02	31.09
Time since upload (days)	843.14	1106.16	590.5	18	4,220
Time since upload (years)	2.31	3.03	1.62	0.05	11.51
Number of likes	19.75	32.21	10	0	141
Number of comments	3.57	9.61	0	0	46
Viewer interaction index	5.50	7.55	2.88	0	35.64
<b>Reddit</b>					
Comments	7.08	9.50	4	0	46
Upvotes	4.41	9.50	2	0	58

**Table 2:** Comparison of online content pertaining to glaucoma and lifestyle measures across social media platforms

Scoring	YouTube			p-value*
	Total (n = 22)	HCPs (n = 18)	NHCPs (n = 4)	
Sandvik	10.4 ± 2.19	10.94 ± 1.86	8 ± 2.16	<0.0001
Risk score	0.22 ± 0.68	0.05 ± 0.23	1 ± 1.41	<0.0001
HON code	5.45 ± 1.62	5.83 ± 1.38	3.75 ± 1.7	<0.0001
Scoring	Facebook Watch			p-value*
	Total (n = 28)	HCPs (n = 21)	NHCPs (n = 7)	
Sandvik	10.54 ± 2.21	11.19 ± 1.77	8.57 ± 2.37	<0.0001
Risk score	0.18 ± 0.47	0.05 ± 0.21	0.57 ± 0.78	<0.0001
HON code	5.29 ± 1.04	5.62 ± 0.66	4.29 ± 1.38	<0.0001
Scoring	Reddit			p-value*
	Total (n = 37)	HCPs (n = 13)	NHCPs (n = 24)	
Sandvik	4.24 ± 1.18	5.23 ± 0.72	3.71 ± 1.04	<0.0001
Risk score	0.11 ± 0.31	0 ± 0	0.17 ± 0.38	<0.0001
HON code	8.27 ± 3.05	9.62 ± 3.40	7.54 ± 2.63	<0.0001

\*Wilcoxon test

(n = 21/24, 87%). The other commonly occurring keywords were smoking (n = 13/24; 54%), alcohol (n = 10/24; 41.6%), supplements (n = 2/24; 8.3%), and marijuana (n = 2/24; 8.3%).

The Google images were primarily uploaded by HCPs (n = 22/38; 57.8%) followed by research portals (n = 10/38; 26.3%), patient or patient support groups (n = 3/38; 7.8%), and pharmaceutical companies (n = 3/38; 7.8%). The Reddit posts were primarily uploaded by NHCPs (n = 27/37; 73%) followed by academic institutions (n = 6/37; 16.2%), ophthalmologists (n = 3/37; 8.1%),

and journals (n = 1/23; 2.7%). "Exercise" was the most common keyword in the Reddit posts for "glaucoma" and "lifestyle" keywords. A total of 14 out of 23 posts (60.8%) suggested exercise as one of the lifestyle modifications to prevent glaucoma progression. These 14 posts were uploaded by HCPs (n = 7/14, 50%), and non-HCPs (n = 7/14, 50%). The other lifestyle modifications suggested in these posts were dietary changes (n = 9/23, 39.1%), regular check-ups (n = 7/23, 30.4%), quitting smoking (n = 6/23, 26%), avoiding coffee (n = 5/23, 21.7%), and smoking marijuana (n = 2/23, 8.6%).



**Table 3:** Correlation between Sandvik, risk score, and HON code scores for the content on the social media platforms

Facebook Watch					
Score	Sandvik	Risk score	HON code		
Sandvik	1	$R = -0.700$ $p = <0.001$	$R = 0.743$ $p = <0.001$		
Risk score	$R = -0.700$ $p = <0.001$	1	$R = -0.375$ $p = 0.049$		
HON code	$R = 0.743$ $p = <0.001$	$R = -0.375$ $p = 0.049$	1		
Reddit					
	Comments	Upvotes	HON code	Risk score	Sandvik
Comments	1	$R = 0.334$ $p = 0.043$	$R = -0.415$ $p = 0.011$	$R = -0.068$ $p = 0.689$	$R = -0.258$ $p = 0.123$
Upvotes	$R = 0.334$ $p = 0.043$	1	$R = -0.048$ $p = 0.776$	$R = -0.006$ $p = 0.973$	$R = -0.003$ $p = 0.986$
HON code	$R = -0.415$ $p = 0.011$	$R = -0.048$ $p = 0.776$	1	$R = -0.221$ $p = 0.189$	$R = -0.740$ $p = <0.001$
Risk score	$R = -0.068$ $p = 0.689$	$R = -0.006$ $p = 0.973$	$R = -0.221$ $p = 0.189$	1	$R = -0.147$ $p = 0.386$
Sandvik	$R = -0.258$ $p = 0.123$	$R = -0.003$ $p = 0.986$	$R = -0.740$ $p = <0.001$	$R = -0.147$ $p = 0.386$	1
YouTube					
	Sandvik	Risk score	HON code		
Sandvik	1	$R = -0.410$ $p = 0.115$	$R = 0.910$ $p = <0.001$		
Risk score	$R = -0.410$ $p = 0.115$	1	$R = -0.481$ $p = 0.059$		
HON code	$R = 0.910$ $p = <0.001$	$R = -0.481$ $p = 0.059$	1		
Google					
	Sandvik	Risk score	HON code		
Sandvik	1		$R = 0.702$ $p \leq 0.001$		
Risk score					
HON code	$R = 0.702$ $p = <0.001$		1		

**Table 4:** Linear regression analysis between countable parameters of the content shared by HCPs and NHCPs

Uploader	Parameters	Sandvik		Risk score		HON code	
		p-value	R	p-value	R	p-value	R
HCP	Video length	0.01	0.39	0.28	0.17	0.04	0.32
	View count	0.003	0.45	0.93	0.01	<0.001	0.52
	Daily view count	0.004	0.44	0.90	0.01	0.004	0.43
	Comments	0.006	0.42	0.12	0.24	0.05	0.30
NHCP	Video length	0.06	0.57	0.77	0.09	0.29	0.34
	View count	0.83	0.06	0.47	0.24	0.34	0.31
	Daily view count	0.72	0.11	0.15	0.46	0.51	0.22
	Comments	0.65	0.15	0.41	0.27	0.12	0.48

**Quality Assessment Scores**

The mean Sandvik scores for YouTube videos were  $10.4 \pm 2.1$ , Google search engine results were  $11.14 \pm 1.89$ , Facebook Watch was  $10.54 \pm 2.21$ , and Reddit posts were  $8.27 \pm 3.05$ . The mean

risk scores were  $0.22 \pm 0.68$ ,  $0 \pm 0$ ,  $0.18 \pm 0.47$ , and  $0.11 \pm 0.31$  for YouTube videos, Google search engine, Facebook Watch, and Reddit posts, respectively. The mean HON code scores for YouTube videos, Google search engine, Facebook Watch, and Reddit posts were

5.45 ± 1.62, 6.55 ± 1.44, 5.29 ± 1.04, and 4.24 ± 1.18, respectively. We observed a significant correlation between the HON code and Sandvik scores for all platforms (Table 3). A significant correlation was found between comments and upvotes on Reddit. A significant negative correlation was found between risk score with HON code and Sandvik score on Facebook Watch. The content uploaded by HCPs had a significantly better HON code, relative risk scores, and Sandvik scores on YouTube, Facebook Watch, and Reddit ( $p < 0.05$ ).

The linear regression analysis for the video content uploaded by HCPs showed a significant difference between the video length, total views, daily view count, comments, and Sandvik score ( $p < 0.05$ ) (Table 4). A similar difference was also observed between video length, total views, daily view count, and HON code ( $p < 0.05$ ). On the contrary, we did not find a significant difference in the video content uploaded by NHCPs (Table 4). Google search engine results had very few web pages by NHCPs, thus HCPs vs NHCPs analysis was not performed. As The Google images results offered very limited textual information, hence they were excluded from the quality assessment.

## CONCLUSION

The physician–patient interaction is often primarily focused on diagnosis and medical interventions. Ophthalmologists are often unable to discuss lifestyle modifications in ophthalmic disorders such as glaucoma, causing patients to turn to social media platforms for obtaining information.<sup>8,36</sup> Although, organizations such as the National Eye Institute, the American Academy of Ophthalmology, and the American Glaucoma Society publish well-researched and thorough patient education materials, the widely used social media platforms are commonly used by patients to obtain information regarding the disorder.<sup>37–39</sup> These sources often influence decisions pertaining to lifestyle modifications in a significant proportion of patients diagnosed with glaucoma.<sup>10</sup> Therefore, it is important to assess the quality of content shared on these platforms, specifically the videos, articles, and images shared by non-HCPs. Moreover, the “viral” nature of social media and low digital health literacy can lead to the rampant spread of misinformation as seen during the COVID-19 pandemic.<sup>40</sup>

We performed this study to evaluate the quality of information online on lifestyle and glaucoma. On performing the analysis of the content using “glaucoma” and “lifestyle,” 62% of the content included the keyword “exercise,” and we deemed it necessary to perform a secondary analysis of the content associated with the keywords “glaucoma” and “exercise.” In this cross-sectional study, we assessed the content, accuracy, navigability, readability, overall quality, and graphic content of the most commonly assessed information regarding glaucoma available on various popular platforms. A recent study by Jia et al. evaluated the online content for marijuana use for glaucoma, thus it was excluded from the keyword search and analysis.<sup>8</sup>

The majority of the commonly accessed content pertaining to lifestyle measures associated with glaucoma on YouTube was uploaded by ophthalmologists (81%) and included medical information, patient experience, and exercise tutorials for patients. Most of the content on YouTube was <5 years old and had a playback time of 5 minutes. However, the video with maximum comments (177) and highest daily view rate (137.6) was uploaded by an NHCP describing techniques involving pressing different parts of the face to lower IOP. The highest viewer interaction (3.6) was seen on the video of patient experience (NHCP) with

the highest risk score and lowest HON code and Sandvik score. Conversely, the highest number of likes (1,700) was on a video by HCP, which had the second-highest viewer index and scored highly on the HON code, Sandvik score, and low-risk score. Four out of the five most-watched videos on YouTube were uploaded by HCPs, and the other one was by a patient. Among the HCPs, two were by an individual ophthalmologist and two from the glaucoma research foundation.

All the sources on Google search engine results recommended medically appropriate lifestyle changes and these were sourced from 46 HCPs and two NHCPs. Nearly all uploaders (93%) underline the positive impact of exercise on glaucoma patients. These sources often explained the role of greater physical activity in reducing the average rate of visual field loss due to decreased IOP and increased blood supply to the eye and brain.<sup>41</sup> Most of the content by HCPs mentioned the positive effects of aerobic exercise, including a moderate-intensity run for 20–30 minutes for glaucoma patients. The emphasis laid on the frequency of exercise is important since vigorous daily exercise has been associated with a higher prevalence of glaucoma compared to when performed 3 days a week.<sup>42</sup> Although all the sites recommended consulting the ophthalmologist before starting an exercise regime, only 43% of the content pertained to special conditions (pigmentary dispersion syndrome or pigmentary glaucoma) where exercise may cause deterioration of a patient’s disease.<sup>43</sup> A third of the content by HCPs highlighted the harmful impact of strength training and a few explained the underlying physiology of Valsalva that raises the IOP. Only half of the HCPs outline the effect of yoga on glaucoma and cautioned against certain poses where the head is below heart level, such as downward dog, handstand etc., as these lead to an increase in IOP.<sup>44,45</sup>

The public application programming interface (API) on Reddit allowed us to evaluate the contextual information better, however, the support for throwaway accounts on the platform allows easier content sharing on Reddit; therefore, we included this platform in our content analysis. Among the 37 posts evaluated from Reddit, 13 were from HCPs and 24 from NHCPs. Most of the posts highlighted the role of exercise in lowering IOP while also outlining the importance of a healthy diet, vitamins, carotenoids, cannabis, sleep posture, sleep habits, strict monitoring of blood glucose and blood pressure levels, and smoking in glaucoma. Additionally, many posts advocated regular checkups in glaucoma patients. Among the top five posts on this platform, three were posted by NHCPs and two by HCPs. The post with maximum upvotes ( $n = 54$ ) was about the role of the keto diet in preventing glaucoma and was shared by an NHCP. Two posts suggested smoking cannabis to decrease glaucoma, one of which was shared by an HCP.

Among the 28 Facebook Watch videos selected for analysis, 21 were from HCPs, while seven were from NHCPs. The most commonly highlighted subject was the role of aerobic exercises and dietary modifications in decreasing IOP. Multiple videos on this platform outlined the role of modifiable life changes such as smoking, excessive coffee/tea intake, diabetes, hypertension, trauma, stress, and incorrect sleeping posture, to prevent glaucoma. Among the five most viewed videos on Facebook Watch, two videos were posted by non-HCPs and three by HCPs. The video with the highest number of views was posted by a non-HCP and focused on “natural body methods” to control high IOP, showing various facial massages to relax muscles around your eye area to release the pressure of the eyes. Table 5 gives a summary of favorable lifestyle interventions needed for glaucoma management.



**Table 5:** Summary of lifestyle interventions favorable for glaucoma management<sup>46–56</sup>

Intervention	Reference
Diet	
A ketogenic diet (high in fat, low in carbohydrates) provided significant neuroprotection and improved retinal ganglion function	46
Long-term oral supplementation with pyruvate reduced axon transport disruption and optic nerve degeneration and improved retinal ganglion cell visual function	47
Daily nicotinamide supplementation has been shown to improve inner retinal function in glaucoma	48
Coffee (caffeine) consumption correlated with a higher IOP in a cohort of primary open-angle glaucoma patients	49
Daily hot tea consumption was associated with a lesser incidence of glaucoma, potentially owing to the beneficial effects of flavonoids	50
The Framingham eye study demonstrated a potential positive correlation between heavy alcohol consumption and glaucoma	51
Exercise	
Long-term aerobic exercises like running were associated with a lesser incidence of glaucoma in a dose-dependent way while studying a cohort of 27,000 male runners	52
Exercise lowers baseline IOP for a prolonged period of time	53
Brain-derived neurotrophic factor levels were maintained in the retina in those who were subjected to aerobic exercise, offering long-term neuroprotection	54
Meditation and Yoga	
Yogic pranayama and diaphragmatic breathing decreased the IOP in glaucoma subjects	55
A short-term (6-week) meditation course was effective in decreasing IOP and improving brain oxygenation	56
Yoga exercises with head-down positions (sirsasna, adhomukha svasana, uttanasana) were associated with a rapid transient increase in IOP especially in previously diagnosed glaucoma patients	45

Future studies with an alternative approach by using a browser such as DuckDuckGo along with incognito mode or Onion browser to limit the impact of ad listing and browser preferences can also be explored. Additionally, Artificial intelligence platforms such as ChatGPT and Google Bard can also be explored.

### Clinical Significance

The analysis of the social media content on popular platforms shows that the information provided by HCPs is medically accurate compared to that shared by NHCPs. Both Google and YouTube had reliable information uploaded by HCPs. Most HCPs provided well-detailed, accurate, and reference information about lifestyle measures associated with glaucoma. This was objectively verified by

significantly higher HON code and Sandvik scores and significantly lower risk scores for HCPs compared to NHCPs.

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