

## Accuracy of online health information on amblyopia and strabismus

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**The internet is a major source of health information for patients and parents. The information found online influences patients' and caregivers' understanding of diagnoses and decision making regarding management. We report the results of a survey completed by 4 fellowship-trained pediatric ophthalmologists evaluating the accuracy and clarity of various websites that provide information on amblyopia and strabismus.**

Patients and families consult online health information resources with increasing frequency to understand conditions and facilitate decision making about treatments.<sup>1,2</sup> Many turn to the internet before consulting a medical professional, but the content and presentation of online information may be problematic. Prior studies have investigated the quality of medical information on Wikipedia and other online sources.<sup>3-7</sup> The DISCERN instrument ([www.discern.org.uk](http://www.discern.org.uk)) was developed and validated as a tool to help patients and providers assess the quality of written information.<sup>8</sup> The purpose of the present study was to assess the accuracy and clarity of online information on amblyopia and strabismus, common pediatric ocular conditions that can have serious long-term adverse effects if not treated appropriately.

### Methods

Four fellowship-trained pediatric ophthalmologists (BG, SP, JR, EW) independently evaluated 5 online sources: Wikipedia, the American Academy of Ophthalmology (AAO), WebMD, EyeWiki, and the American Association for Pediatric Ophthalmology and Strabismus (AAPOS) for information on amblyopia and strabismus between January 11, 2019, and February 12, 2019. An

11-question survey was used to evaluate each website about amblyopia, and a separate survey consisting of 14 questions was used for strabismus (Tables 1 and 2). Seven questions as established by the DISCERN instrument were used to evaluate the clarity of each site's content (Tables 3 and 4).

The survey questions were composed by the authors based on questions they had frequently encountered from patients and parents. Each question was scored from 0 to 3, depending on the completeness of information provided (0 = no information or incorrect information; 1 = some rudimentary information; 2 = additional but incomplete information; 3 = complete information sufficient for understanding). The authors scored each question independently. Mean scores (with standard deviation) were calculated for each question, and the differences among websites were tested using Friedman's test, which tests the difference in ordinal variables across multiple groups and accounts for each website being assessed by the same raters. Significant pairs were identified by post hoc analysis using the Nemenyi's multiple comparison test controlling for family-wise type 1 error rate ( $P < 0.05$ ). Benjamini and Hochberg's correction factor for multiple comparisons was then applied to account for any erroneous significant findings ( $P < 0.05$ ).

### Results

There was fair-to-good reproducibility between raters for both the amblyopia sites (intraclass correlation coefficient [ICC] = 0.608 [95% CI, 0.512 < ICC < 0.699]) and strabismus sites (ICC = 0.63 [95% CI, 0.544 < ICC < 0.711]). For amblyopia, EyeWiki, had the highest content score,  $2.6 \pm 0.3$ , and WebMD had the lowest content score,  $0.9 \pm 0.4$  (Table 1). For strabismus, EyeWiki and AAO scored equally high, with mean scores of  $2.2 \pm 0.4$  and  $2.2 \pm 0.3$  (Table 2). WebMD scored lowest for strabismus, with a mean score of  $0.6 \pm 0.3$ . In assessing the clarity of written content, EyeWiki scored highest for amblyopia, with a mean score of  $2.4 \pm 0.3$ , whereas Wikipedia and EyeWiki scored highest for strabismus, each with a mean score of  $2.1 \pm 0.4$  (Tables 3 and 4).

Overall, there was a statistically significant difference across all of the websites in content and clarity for both amblyopia and strabismus. EyeWiki scored significantly higher than WebMD ( $P = 0.007$ ) for amblyopia content as well as for clarity of presentation ( $P = 0.015$ ). Both EyeWiki and AAO scored higher than WebMD ( $P = 0.010$  and  $P = 0.021$ , resp) for strabismus content. EyeWiki and Wikipedia were both clearer than WebMD on strabismus, but only Wikipedia demonstrated a statistically significant difference compared with WebMD ( $P = 0.041$ ). Of note, Wikipedia scored relatively high with regard to content and clarity on both topics with no statistically significant difference compared with EyeWiki and AAO. AAPOS scored in the middle to bottom range on content and clarity on both amblyopia and strabismus.

### Discussion

Our study suggests that for those seeking information on amblyopia, EyeWiki is the most reliable source of those

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Table 1. Mean and total scores for questions evaluating information on amblyopia in freely available internet sources

Question	Points, mean $\pm$ SD <sup>a</sup>					P value across websites	FDR corrected P value
	Wikipedia	AAO	WebMD	EyeWiki	AAPOS		
What is amblyopia?	2.8 $\pm$ 0.5	2.5 $\pm$ 1	2.0 $\pm$ 0.8	2.8 $\pm$ 0.5	2.8 $\pm$ 0.5	0.176	0.205
What are the symptoms of amblyopia?	2.8 $\pm$ 0.5	1.5 $\pm$ 1.3	0.2 $\pm$ 0.5	2.8 $\pm$ 0.5	1.0 $\pm$ 1.2	0.015	0.035
What is the cause of amblyopia?	2.8 $\pm$ 0.5	3.0 $\pm$ 0	1.5 $\pm$ 0.6	2.8 $\pm$ 0.5	3.0 $\pm$ 0	0.019	0.039
What is the incidence of amblyopia?	2.5 $\pm$ 1.0	0.2 $\pm$ 0.5	0.2 $\pm$ 0.5	2.8 $\pm$ 0.5	0 $\pm$ 0	0.009	0.028
What are the risk factors of amblyopia?	2.0 $\pm$ 1.4	0.5 $\pm$ 0.6	1.2 $\pm$ 0.5	2.8 $\pm$ 0.5	1.2 $\pm$ 1.5	0.085	0.112
What age do children most commonly present with amblyopia?	1.2 $\pm$ 1.5	0.8 $\pm$ 1	0.8 $\pm$ 1.0	1.5 $\pm$ 1.7	1.0 $\pm$ 1.4	0.663	0.663
How is amblyopia diagnosed?	2.5 $\pm$ 0.6	2.5 $\pm$ 1.0	1.0 $\pm$ 0	3.0 $\pm$ 0	1.2 $\pm$ 1.3	0.048	0.072 <sup>c</sup>
How is amblyopia treated?	2.5 $\pm$ 0.6	2.0 $\pm$ 0	1.2 $\pm$ 0.5	3.0 $\pm$ 0	2.8 $\pm$ 0.5	0.012	0.031
What is the success rate of treatment for amblyopia?	0.5 $\pm$ 1.0	0 $\pm$ 0	0.2 $\pm$ 0.5	2.0 $\pm$ 0.8	1.0 $\pm$ 1.4	0.030	0.049
What age group can be treated for amblyopia?	2.0 $\pm$ 1.4	0.2 $\pm$ 0.5	1.2 $\pm$ 0.5	2.5 $\pm$ 0.6	1.8 $\pm$ 1.5	0.061	0.086
References for amblyopia	3.0 $\pm$ 0	0 $\pm$ 0	0.2 $\pm$ 0.5	3.0 $\pm$ 0	0.5 $\pm$ 0.6	0.006	0.025
Mean score	2.2 $\pm$ 0.3	1.2 $\pm$ 0.3	0.9 $\pm$ 0.5	2.6 $\pm$ 0.3	1.5 $\pm$ 0.6	0.008	0.028
Total score <sup>b</sup>	24.5 $\pm$ 3.8	13.2 $\pm$ 2.9	10.0 $\pm$ 4.2	28.8 $\pm$ 3.6	16.2 $\pm$ 6.8	0.008	0.028

AAO, American Academy of Ophthalmology; AAPOS, American Association for Pediatric Ophthalmology and Strabismus; FDR, false discovery rate; SD, standard deviation.

<sup>a</sup>Scores of individual questions on a scale of 0-3.

<sup>b</sup>Total scores are on a scale of 33.

<sup>c</sup>Benjamini and Hochberg false discovery rate correction factor applied and found not to have a statistically significant difference across multiple sites.

Table 2. Mean and total scores for questions evaluating information on strabismus in freely available internet sources

Question	Points, mean $\pm$ SD <sup>a</sup>					P value across websites	FDR corrected P value
	Wikipedia	AAO	WebMD	EyeWiki	AAPOS		
What is strabismus?	2.8 $\pm$ 0.5	3.0 $\pm$ 0	2.0 $\pm$ 1.4	2.8 $\pm$ 0.5	3.0 $\pm$ 0	0.336	0.351
What are the symptoms of strabismus?	2.8 $\pm$ 0.5	2.2 $\pm$ 0.5	1.0 $\pm$ 0.8	2.0 $\pm$ 1.4	0.8 $\pm$ 1.0	0.019	0.036
What is the cause of strabismus?	2.5 $\pm$ 0.6	2.5 $\pm$ 0.6	1.2 $\pm$ 0.5	2.2 $\pm$ 1.0	1.8 $\pm$ 1.0	0.049	0.059 <sup>c</sup>
What is the incidence of strabismus?	2.0 $\pm$ 1.2	2.8 $\pm$ 0.5	0 $\pm$ 0	1.0 $\pm$ 1.4	2.2 $\pm$ 1.0	0.026	0.039
What are the risk factors of strabismus?	1.8 $\pm$ 1.0	2.5 $\pm$ 0.6	0 $\pm$ 0	2.8 $\pm$ 0.5	1.5 $\pm$ 0.6	0.014	0.034
What age do children most commonly present with strabismus?	1.0 $\pm$ 0.8	1.8 $\pm$ 1.5	0.2 $\pm$ 0.5	2.8 $\pm$ 0.5	0 $\pm$ 0	0.010	0.029
How is strabismus diagnosed?	1.2 $\pm$ 0.5	1.5 $\pm$ 1.0	0.5 $\pm$ 1.0	3.0 $\pm$ 0	0.2 $\pm$ 0.5	0.005	0.020
How is strabismus treated?	2.2 $\pm$ 0.5	2.8 $\pm$ 0.5	1.2 $\pm$ 0.5	3.0 $\pm$ 0	1.8 $\pm$ 1.0	0.024	0.039
What is the success rate of treatment for strabismus?	0.5 $\pm$ 1.0	1.8 $\pm$ 0.5	0 $\pm$ 0	1.5 $\pm$ 1.3	0 $\pm$ 0	0.018	0.036
What age group can be treated for strabismus?	1.0 $\pm$ 0.8	2.0 $\pm$ 1.4	1.0 $\pm$ 0.8	1.5 $\pm$ 1.3	0.2 $\pm$ 0.5	0.206	0.235
When is surgery indicated for strabismus?	0.5 $\pm$ 1.0	2.5 $\pm$ 0.6	0.8 $\pm$ 1.0	1.8 $\pm$ 0.5	0.8 $\pm$ 1.0	0.008	0.027
What are the complications of surgery for strabismus?	0.8 $\pm$ 0.5	3.0 $\pm$ 0	0 $\pm$ 0	3.0 $\pm$ 0	0 $\pm$ 0	0.004	0.020
Pictures of strabismus	1.5 $\pm$ 0.6	2.5 $\pm$ 0.6	0 $\pm$ 0	0.5 $\pm$ 1.0	2.2 $\pm$ 1.0	0.021	0.036
References for strabismus	2.8 $\pm$ 0.5	0 $\pm$ 0	0 $\pm$ 0	3.0 $\pm$ 0	0 $\pm$ 0	0.003	0.020
Mean score	1.7 $\pm$ 0.4	2.2 $\pm$ 0.3	0.6 $\pm$ 0.3	2.2 $\pm$ 0.4	1.0 $\pm$ 0.4	0.004	0.020
Total score <sup>b</sup>	23.2 $\pm$ 6.2	30.8 $\pm$ 4.4	8 $\pm$ 4.2	30.8 $\pm$ 5.1	14.5 $\pm$ 5.2	0.004	0.020

AAO, American Academy of Ophthalmology; AAPOS, American Association for Pediatric Ophthalmology and Strabismus; FDR, false discovery rate; SD, standard deviation.

<sup>a</sup>Scores of individual questions on a scale of 0 to 3.

<sup>b</sup>Total scores are on a scale of 42.

<sup>c</sup>Benjamini and Hochberg false discovery rate correction factor applied and found not to have a statistically significant difference across multiple sites.

Table 3. Mean and total scores for questions evaluating clarity of written information on amblyopia

Question	Points, mean ± SD <sup>a</sup>					P value across websites	FDR corrected P value
	Wikipedia	AAO	WebMD	EyeWiki	AAPOS		
Are the aims of this article clear?	0.8 ± 1.5	0.5 ± 1.0	0.5 ± 1.0	0.8 ± 1.5	0.8 ± 1.5	0.406	0.426
Is this article relevant to its readers?	2.5 ± 0.6	2.5 ± 1.0	2.5 ± 0.6	3.0 ± 0	3.0 ± 0	0.266	0.294
Is it clear what sources of information were used to compile the publication, other than the author or producer?	3.0 ± 0	0 ± 0	0.2 ± 0.5	3.0 ± 0	0 ± 0	0.004	0.023
Is it clear when the information used or reported in the publication was produced?	3.0 ± 0	0 ± 0	0 ± 0	3.0 ± 0	0 ± 0	0.003	0.023
Is it balanced and unbiased?	2.5 ± 0.6	2.2 ± 0.5	2.0 ± 0.8	2.8 ± 0.5	2.5 ± 0.6	0.165	0.204
Does it provide details of additional sources of support and information?	1.8 ± 1.3	0.2 ± 0.5	0.2 ± 0.5	2.8 ± 0.5	1.2 ± 1.0	0.028	0.049
Does it refer to areas of uncertainty?	1.8 ± 1.5	0.2 ± 0.5	0 ± 0	1.5 ± 1.3	1.5 ± 1.3	0.023	0.044
Mean score	2.2 ± 0.5	0.8 ± 0.1	0.8 ± 0.1	2.4 ± 0.3	1.3 ± 0.5	0.003	0.023
Total score <sup>b</sup>	15.2 ± 3.2	5.8 ± 1.0	5.5 ± 0.6	16.8 ± 2.1	9.0 ± 3.6	0.003	0.023

AAO, American Academy of Ophthalmology; AAPOS, American Association for Pediatric Ophthalmology and Strabismus; FDR, false discovery rate; SD, standard deviation.

<sup>a</sup>Scores of individual questions on a scale of 0-3.

<sup>b</sup>Total scores are on a scale of 21.

evaluated. It does particularly well in providing information on how amblyopia is diagnosed and treated as well as providing references. EyeWiki on amblyopia was also superior to the other websites in terms of clarity. EyeWiki and AAO are generally the most reliable sources compared to Wikipedia, WebMD, and AAPOS. It seems to provide more complete information than AAO on age of presentation of strabismus, how strabismus is diagnosed, and references for strabismus; AAO seems to provide more complete information on the incidence of strabismus and indications for strabismus surgery, and it includes illustrations. EyeWiki and Wikipedia were determined to have equally high clarity of information on strabismus of the websites evaluated. Wikipedia also did relatively well

with regard to content for both topics as well as clarity on amblyopia.

The inherent limitation of this study is that the authors participated in both writing the questions and evaluating the online resources using those questions.

Google search results at the time of submission for the terms *amblyopia* and *strabismus* list the websites evaluated here in the following order for both topics: AAO, Wikipedia, WebMD, AAPOS, and EyeWiki. This ranking suggests that patients and parents are more likely to use AAO and Wikipedia as their source of information. Based on our findings, patients and parents seeking information on amblyopia can be directed to EyeWiki, and those seeking information on strabismus can be directed to

Table 4. Mean and total scores for questions evaluating clarity of written information on strabismus

Question	Points, mean ± SD <sup>a</sup>					P value across websites	FDR corrected P value
	Wikipedia	AAO	WebMD	EyeWiki	AAPOS		
Are the aims of this article clear?	0.5 ± 1.0	0.8 ± 1.5	0.5 ± 1.0	0.5 ± 1.0	0.8 ± 1.5	0.406	0.406
Is this article relevant to its readers?	2.5 ± 0.6	3.0 ± 0	2.2 ± 0.5	3.0 ± 0	3.0 ± 0	0.040	0.054 <sup>c</sup>
Is it clear what sources of information were used to compile the publication, other than the author or producer?	3.0 ± 0	0 ± 0	0.5 ± 1.0	2.8 ± 0.5	0 ± 0	0.004	0.020
Is it clear when the information used or reported in the publication was produced?	3.0 ± 0	0 ± 0	0 ± 0	2.2 ± 1.5	0.8 ± 1.5	0.017	0.036
Is it balanced and unbiased?	2.5 ± 0.6	2.5 ± 0.6	2.2 ± 0.5	2.0 ± 0.8	2.2 ± 0.5	0.323	0.351
Does it provide details of additional sources of support and information?	2.2 ± 1.5	0 ± 0	0.2 ± 0.5	2.5 ± 1.0	0.8 ± 1.0	0.043	0.054 <sup>c</sup>
Does it refer to areas of uncertainty?	1.2 ± 1.3	0.5 ± 0.6	0 ± 0	1.5 ± 1.3	0 ± 0	0.028	0.039
Mean score	2.1 ± 0.4	1.0 ± 0.2	0.8 ± 0.2	2.1 ± 0.4	1.1 ± 0.3	0.011	0.030
Total score <sup>b</sup>	15.0 ± 2.9	6.8 ± 1.7	5.8 ± 1.3	14.5 ± 2.9	7.5 ± 1.9	0.011	0.030

AAO, American Academy of Ophthalmology; AAPOS, American Association for Pediatric Ophthalmology and Strabismus; FDR, false discovery rate; SD, standard deviation.

<sup>a</sup>Scores of individual questions on a scale of 0-3.

<sup>b</sup>Total scores are on a scale of 21.

<sup>c</sup>Benjamini and Hochberg false discovery rate correction factor applied and found not to have a statistically significant difference across multiple sites.

both EyeWiki and AAO. Given the highly technical nature of the content published by EyeWiki and AAO, however, Wikipedia may be a more approachable yet still reliable source of information for patients and parents. Finally, the higher-scoring online sources could serve as a guide for further content development of other sources.

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## Orbital conjunctival epithelial cyst mimicking cyst with microphthalmos

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**Orbitopalpebral cysts are most commonly associated with microphthalmic eyes (microphthalmos with cyst). We report a 15-year-old girl with a large orbitopalpebral cyst in the absence of associated microphthalmos. The patient presented with a massive swelling involving the left lower eyelid overhanging the**

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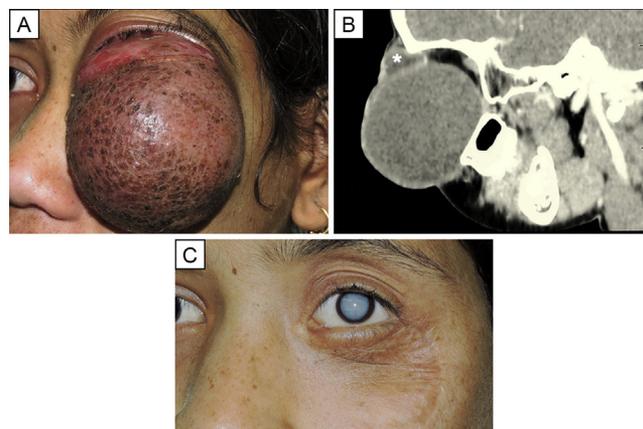
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**left cheek and occupying much of the left orbital cavity. The globe was not visible on clinical examination. No history of trauma or surgery preceding the development of the cyst was reported by the patient or her father. Imaging showed a small eyeball displaced superiorly along the anterior part of the orbital roof. On excision of the cyst, a normal-sized globe with a cataractous lens was noted. Histopathological examination revealed the cyst to be of conjunctival origin.**

### Case Report

A 15-year-old girl presented to the outpatient clinic at the LV Prasad Eye Institute, Bhubaneswar, Odisha, with a massive swelling involving the left lower eyelid. There was no other ocular complaint. The eyelid swelling had been noted by her parents since the girl was about 2 years of age but was initially very small. There was no definite history of birth trauma. Major developmental milestones had been achieved normally and no other ocular or systemic developmental anomalies were detected on clinical examination. Progressive increase in the size of the swelling had been noted from around 4 years of age. No medical advice had been sought until the swelling had progressed to massive dimensions.

On clinical examination, the right eye had an unaided visual acuity of 20/20, and the anterior and posterior segments were unremarkable. On the left side, the swelling involved the left lower eyelid and overhung the left cheek, extending to the lateral edge of the ala of the nose (Figure 1A). The inferior fornix was stretched and completely exposed, showing signs of early keratinization. The swelling felt tense but was appreciated to be cystic. The overlying skin was indurated and covered with multiple superficial crusts giving it a leopard-spotted appearance. The left globe was not visible clinically. Computed tomography (CT) revealed a massive orbitopalpebral cyst



**FIG 1.** A, Clinical photograph showing a massive cystic swelling of the left lower eyelid overhanging the cheek. B, Computed tomography showing a large orbitopalpebral cyst with a superiorly compressed eyeball (asterisk). C, At 1-year's follow-up there was no recurrence of the cyst.