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# How readable and reliable is online patient information on chronic rhinosinusitis?

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**Abstract**

**Objective.** This study aimed to assess the quality and readability of websites on chronic rhinosinusitis.

**Methods.** A total of 180 results from 3 different search engines regarding 'chronic rhinosinusitis', 'sinusitis' and 'sinus infections' were analysed for readability using the Flesch–Kincaid Grade Level, Flesch Reading Ease Score and Gunning Fog Index. The Discern tool was used to approximate information quality.

**Results.** From 180 total searches, 69 unique websites were identified. These had an average Flesch–Kincaid Grade Level of 9.75 (95 per cent confidence interval = 9.12–10.4), a Flesch Reading Ease Score of 45.0 (41.0–49.0) and a Gunning Fog Index of 13.7 (12.9–14.4), which equates to the average reading level of a college or university student. Discern scores were variable but consistently showed good-quality information.

**Conclusion.** Chronic rhinosinusitis information is of a high quality but is for a reading level higher than that of the average adult. Standardising patient information should ensure adequate comprehension and improve patient compliance.

## Main Article

Mr A Habeeb takes responsibility for the integrity of the content of the paper

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## Introduction

Since the invention of the internet and formal search engines, the amount of information available for easy access by patients has exponentially increased.

Chronic rhinosinusitis is a spectrum of conditions encompassing different pathophysiologies. It is a clinical diagnosis made on the basis of having two or more sinonasal symptoms, of which one should be either nasal congestion or nasal discharge, for more than three months. Other symptoms include facial pain or pressure, and reduction or loss of smell. Flexible nasendoscopic evidence of polyps distinguishes the two subgroups of the condition: with and without nasal polyps.[1] Nasal polyps are benign masses that are inflammatory, and arise from the mucosa of the nose or paranasal sinuses. When considering the group without nasal polyps, the main causes include immunodeficiency, vasculitis, autoimmune conditions or idiopathic aetiology. Superadded polyposis tends to be idiopathic, but may be part of a genetic, metabolic or even immunological condition. The vast majority of chronic rhinosinusitis patients suffer from a type II pattern of inflammation, meaning that they have eosinophilia, as well as elevated interleukin 4, 5 and 13 cytokines, although this tends to be skewed towards white patients.[2] There is an overlap with lower airway disease such as asthma in the subgroup with polyps.[3]

Patients are increasingly using the internet for medical issues, whether for a suspected or confirmed diagnosis. This becomes problematic when the sources used have issues with accuracy and quality, as well as readability. It can lead to mismanagement of existing diagnoses or preconceived thoughts that can impact a consultation. Complex medical terminology can confuse patients. In order to be effective, the information that patients have should be 'noticed, read, understood, believed and remembered'.[4] While oral information can be adjusted appropriately, written information is fixed, and this can pose issues when the general population has such a variety of educational backgrounds. Patient information in the USA is recommended to be at grade 6 level (11–12 years old), although the national reading age is higher at grade 8–9 level (13–14 years old).[5]

This study aimed to objectively assess the quality and readability of websites with information on chronic rhinosinusitis. In order to allow a more objective analysis of readability of website information, different well-recognised scoring tools were used. Readability was assessed using the Flesch–Kincaid Grade Level, Flesch Reading Ease Score and Gunning Fog Index, which all use formulae to indicate how difficult a passage of English is to understand.

The Flesch–Kincaid Grade Level is calculated using the formula $0.39\left(\frac{total\ words}{total\ sentences}\right) + 11.8\left(\frac{total\ syllables}{total\ words}\right) - 15.59$. The Flesch Reading Ease Score is calculated by $206.835 - 1.015\left(\frac{total\ words}{total\ sentences}\right) - 84.6\left(\frac{total\ syllables}{total\ words}\right)$. Despite these two tests having similar core measurements, they apply different weights to certain variables, allowing them to be used in conjunction. The results from these formulae should correlate inversely, meaning that a low Flesch–Kincaid Grade Level should correspond to a high

**Table 1.** Quality and readability data for three different search terms on popular search engines

| Search term | Search engine | Flesch–Kincaid Grade Level average (95% CI) for $n = 20$ | Flesch Reading Ease Score average (95% CI) for $n = 20$ | Gunning Fog Index average (95% CI) for $n = 20$ | Discern tool score average (95% CI) for $n = 20$ |
|---|---|---|---|---|---|
| Chronic rhinosinusitis ($n = 60$ websites) | Google | 12.7 (11.4–14.1) | 26.6 (19.8–33.4) | 17.7 (15.1–20.2) | 4.2 (3.76–4.64) |
| | Bing | 10.7 (9.59–11.7) | 37.1 (30.3–43.9) | 14.7 (13.4–16.1) | 4.2 (3.74–4.66) |
| | Yahoo | 10.8 (9.89–11.8) | 36.8 (31.0–42.6) | 14.8 (13.8–15.8) | 3.8 (3.26–4.34) |
| | Unique websites $n = 36$ | 11.4 (10.5–12.4) | 33.8 (28.3–39.3) | 16.2 (14.5–17.8) | 4.1 (3.70–4.41) |
| Sinusitis ($n = 60$ websites) | Google | 8.89 (7.93–9.85) | 51.6 (46.4–56.8) | 12.5 (11.4–13.5) | 3.9 (3.50–4.20) |
| | Bing | 9.19 (8.18–10.2) | 49.6 (43.9–55.3) | 13.5 (12.4–14.5) | 3.9 (3.63–4.27) |
| | Yahoo | 9.22 (8.21–10.2) | 49.3 (43.6–55.0) | 13.3 (12.2–14.4) | 4.0 (3.69–4.31) |
| | Unique websites $n = 34$ | 8.88 (8.15–9.60) | 51.4 (47.6–55.3) | 12.7 (11.9–13.5) | 3.8 (3.57–4.07) |
| Sinus infections ($n = 60$ websites) | Google | 8.37 (7.87–8.86) | 54.2 (51.1–57.3) | 11.9 (11.3–12.6) | 3.9 (3.66–4.24) |
| | Bing | 9.17 (8.29–10.05) | 50.2 (44.8–55.7) | 13.3 (12.4–14.1) | 3.6 (3.04–4.06) |
| | Yahoo | 9.13 (8.29–9.97) | 49.5 (44.6–54.4) | 13.3 (12.4–14.2) | 3.9 (3.66–4.24) |
| | Unique websites $n = 37$ | 8.68 (8.09–9.27) | 52.5 (49.0–56.0) | 12.4 (11.8–13.1) | 3.7 (3.34–4.00) |
| Total ($n = 180$ websites (unique websites $n = 69$)) | | 9.75 (9.12–10.4) | 45.0 (41.0–49.0) | 13.7 (12.9–14.4) | 3.9 (3.64–4.10) |

A Flesh–Kincaid Grade Level approximates the reading level. A Flesch Reading Ease Score between 0 and 30 equates to a reading level of a college or university graduate, while 90 to 100 equates to that of a fifth grade student. A Gunning Fog Index score ranges from 6 (equates to a reading level of sixth grade) to 17 (equates to a reading level of a college or university graduate). The table also shows the unique websites generated amongst the three different search engines for each search term.[6–8] CI = confidence interval

Flesch Reading Ease Score. The Gunning Fog Index allows estimation of the years of formal education a person requires to understand the text on websites when reading it for the first time. The formula for this is $0.4\left[\left(\frac{words}{sentences}\right) - 100\left(\frac{complex\ words}{words}\right)\right]$, where complex words are those that consist of three or more syllables and do not include proper nouns or compound words. Common suffixes are not included in syllable count here.[6,7]

The Discern tool is a well-recognised but subjective measure that can be used to approximate the quality of website information. A short 15-item questionnaire is completed for each website with a final question that gives an overall rating of the publication on a scale from 1 to 5, where 1 represents serious or extensive shortcomings and 5 reflects minimal shortcomings.[8]

## Materials and methods

Information online concerning the search terms 'chronic rhinosinusitis', 'sinusitis' and 'sinus infections' was assessed. These terms were searched using Google, Bing and Yahoo search engines, which are the top three utilised. The terms were searched, and the top 20 results from each search engine were assessed for both readability and quality of information, giving 180 total data points.

This was an objective assessment using the Flesch–Kincaid Grade Level, the Flesch Reading Ease Score and the Gunning Fog Index to determine readability.[6,7] The Discern tool was used to approximate the quality of website information. A two-tailed statistical *t*-test was conducted to compare the results of different search engines and gauge statistical significance.[8]

## Results and analysis

In total, 180 websites were obtained for all 3 search terms, which generated 69 unique websites. These had an average Flesch–Kincaid Grade Level of 9.75 (95 per cent confidence interval (CI) = 9.12–10.4), an average Flesch Reading Ease Score of 45.0 (95 per cent CI = 41.0–49.0) and an average Gunning Fog Index of 13.7 (95 per cent CI = 12.9–14.4), which equates to the average reading level of a college or university student. They had an average Discern score of 3.9 (95 per cent CI = 3.64–4.10), which equates to moderate–high quality on a scale of 1–5, where 5 represents minimal shortcomings and 3 reflects potentially important but not serious shortcomings (Table 1). Only seven websites (10 per cent) had a readability level that was appropriate for the average adult.

Regarding the search term 'chronic rhinosinusitis', 60 websites were obtained from the 3 different search engines, yielding 36 unique websites for patient information on chronic rhinosinusitis. The unique websites revealed an average Flesch–Kincaid Grade Level of 11.4 (95 per cent CI = 10.5–12.4), an average Flesch Reading Ease Score of 33.8 (95 per cent CI = 28.3–39.3) and an average Gunning Fog Index of 16.2 (95 per cent CI = 14.5–17.8). These equate to the reading level of a college or university student. The average Discern score was 4.1 (95 per cent CI = 3.70–4.41), which equates to moderate–high quality. Only seven websites (19 per cent) had a readability level that was appropriate for the average adult. The content of websites found on Google, Bing and Yahoo had the average reading level of a college or university graduate. There were minimal shortcomings on the Discern tool assessment (Table 1).

For the search term 'sinusitis', 60 websites were obtained from the 3 different search engines, yielding 34 unique websites for patient information on sinusitis. The unique websites revealed an average Flesch–Kincaid Grade Level of 8.88 (95 per cent CI = 8.15–9.60), an average Flesch Reading Ease Score of 51.4 (95 per cent CI = 47.6–55.3) and an average Gunning Fog Index of 12.7 (95 per cent CI = 11.9–13.5). These equate to the reading level of a high school senior. The average Discern score was 3.8 (95 per cent CI = 3.57–4.07), which equates to moderate–high quality on a scale of 1–5, where 5 means

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minimal shortcomings and 3 means potentially important but not serious shortcomings. Only six websites (18 per cent) had a readability level that was appropriate for the average adult. The websites found on Google had the average reading level of a high school senior, with moderate–high quality on Discern assessment; the websites found on Bing and Yahoo had the average reading level of a college or university student, with moderate–high quality on Discern assessment (Table 1).

In relation to the search term 'sinus infections', 60 websites were obtained from the 3 different search engines, yielding 37 unique websites with patient information on sinus infections. The unique websites revealed an average Flesch–Kincaid Grade Level of 8.68 (95 per cent CI = 8.09–9.27), an average Flesch Reading Ease Score of 52.5 (95 per cent CI = 49.0–56.0) and an average Gunning Fog Index of 12.4 (95 per cent CI = 11.8–13.1). These equate to the reading level of a college or university student. The average Discern score was 3.7 (95 per cent CI = 3.34–4.00), which equates to moderate–high quality on a scale of 1–5, where 5 means minimal shortcomings and 3 means potentially important but not serious shortcomings. Only five websites (14 per cent) had a readability level that was appropriate for the average adult. The websites found on Google had the average reading level of a high school senior, with moderate–high quality on Discern assessment; the websites found on Bing and Yahoo had the average reading level of a college or university student, with moderate–high quality on Discern assessment (Table 1).

## Discussion

There is an extensive list of resources about chronic rhinosinusitis available to patients. When analysing the unique websites generated, it is clear that the average reading level is very high, which can make understanding the information presented very difficult. This results in an unfortunate situation whereby the condition is very common, but in order to read about it on the internet, the patient must sieve through what are seemingly complex articles. Although this is paired with high quality as per the Discern scoring, it is important that this is balanced against readability. In an ideal world, an article will have the highest quality but be as readable as possible.

This study investigated the 180 top search results that will be encountered by patients when they search for different terms relating to sinusitis on the internet. There may be plenty of websites that would satisfy adequate readability and provide high-quality information, but this is unlikely to be read by patients if they are beyond the first two pages of results. Furthermore, this study has not accounted for videos, which have become a fount of knowledge for patients wishing to understand a condition, and may offer a more holistic understanding of available patient information.

When looking at the separate search engines for 'chronic rhinosinusitis', it is worrying that the content of websites found on the most popular search engine, Google, has the average readability of a college or university graduate. In comparison, the websites found on Bing and Yahoo have the average readability of college or university student, although this difference was statistically insignificant ($p > 0.05$) when compared with Google. However, when 'sinusitis' and 'sinus infections' were used as search terms, the websites found on Google had a lower average reading level than those found on other search engines ($p > 0.05$). Using more common search terms such as 'sinusitis' or 'sinus infections' generated websites that were of a lower reading level, albeit with a slightly lower quality of information; however, they still failed to meet adequate reading levels which ensure that the population understands the condition.

- Online information can be useful when a common condition such as chronic rhinosinusitis is suspected or diagnosed
- This study aimed to assess the quality and readability of websites on chronic rhinosinusitis
- Objective scoring systems can be used to assess readability, including Flesch–Kincaid Grade Level, Flesch Reading Ease Score and Gunning Fog Index
- The Discern tool can be used to approximate the quality of information available
- The overall readability of websites on chronic rhinosinusitis was at college or university student level, with moderate–high quality
- Information should be high quality with low readability, to increase awareness surrounding chronic ENT conditions, although this can be hard to achieve

Similar studies have been performed on other otorhinological conditions. For example, in 2017, Spiers *et al.* examined online information on vestibular schwannoma. These authors showed again that this specialty is well represented on the internet. However, the difficulty arises when readability is analysed, as the information given was very complex.[9] This is also the case with other specialties; Koo *et al.* (2017) showed that online information about overactive bladder treatment exceeds the reading ability of most adults.[10]

It is therefore apparent that medical terminology can be confusing for patients, regardless of the specialty. These terms inadvertently decrease the readability of information. However, styles that are too simplistic can be perceived as patronising and cause the patient to lose interest. Presenting scientific information clearly in a manner that is readable and still of high quality is a difficult skill, and, unfortunately, scientific text readability has been shown to decrease over time.[11] The reading level of the population is varied, so that even if information is at an appropriate reading level for the majority of the population, there will still be a select group who are unable to benefit from reading it. These patients need to be targeted to encourage understanding, through repeated consultations, information videos and tailored oral input. This will ensure their understanding of their diagnosis, which will ultimately lead to better outcomes for these patients in terms of managing their own chronic conditions.

Fortunately, within the National Health Service, there is guidance on how to improve patient information. This involves encouraging plain everyday English that is written in short sentences. The guidance also advises that font, style, layout and format be targeted, as these are all likely to affect readability.[12,13] Images, diagrams and spacing can all help the patient to clearly see the information presented and assist with readability.[12,13] However, little information is present in their guidelines regarding reading age; the guidelines should be developed to provide a baseline for people producing information. Patients and carers should be involved in the construction of information, to optimise readability. Test readers could prove beneficial in proofreading the information to be given to our patients. In addition, a more centralised way of producing information, such as through a governing body, will enable information to be more readable but also of a high quality.

## Conclusion

Patient information on the internet is a crucial source for patients to better understand and deal with their chronic

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conditions, such as chronic rhinosinusitis. When a patient better understands their diagnosis, they are more likely to comply with treatment. This improves the chance of symptom relief and allows the patient to be involved in their own care.

The extensive volume of information on the internet can be a pitfall when it comes to comprehension. Medical terminology dominates patient information and can negatively skew the reading scores. Limiting the use of medical terminology, and applying measures that focus on font, style, layout, format and images, and the use of shortened sentences, can help to make information more readable. Information is usually of high quality, but the balance between quality and readability can be difficult. The presence of a centralised governing body to provide a hub of information for patients, and to identify those who may require more guidance in the form of multimedia, oral input and repeated consultations, should be beneficial in terms of improving patient comprehension.

**Competing interests.** None declared

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