Quality Assessment of Online Resources for Gender-affirming Surgery

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Background: As visibility of the transgender patient population and utilization of online resources increases, it is imperative that web-based gender-affirming surgery (GAS) materials for patients are readable, accessible, and of high quality.
Methods: A search trends analysis was performed to determine frequency of GAS-related searches over time. The top 100 most common results for GAS-related terms were analyzed using six readability formulas. Accessibility of patient-facing GAS sources was determined by categorizing types of search results. Frequency of article types was compared in low- and high-population dense areas. Quality was assigned to GAS web-based sources using the DISCERN score.
Results: Search engine trend data demonstrates increasing occurrence of searches related to GAS. Readability scores of the top 100 online sources for GAS were discovered to exceed recommended levels for patient proficiency. Availability of patient-facing online information related to GAS was found to be 60%, followed by information provided by insurance companies (17%). Differences in availability of online resources in varying dense cities were found to be minimal. The average quality of sources determined by the DISCERN score was found to be 3, indicating "potential important shortcomings."
Conclusions: Despite increasing demand for web-based GAS information, the readability of online resources related to GAS was found to be significantly greater than the grade level of proficiency recommended for patients. A high number of nonpatient-facing search results appear in response to GAS search terms. Quality sources are still difficult for patients to find, as search results have a high incidence of low-quality resources. *(Plast Reconstr Surg Glob Open 2023; 11:e5306; doi: 10.1097/GOX.0000000000005306; Published online 9 October 2023.)*

INTRODUCTION

Defined by a discrepancy between a person's sex assigned at birth and their experienced gender, gender dysphoria is a DSM-5 recognized diagnosis that is associated with clinically significant distress or impairment in function.[1] The population of transgender and gender diverse (TGD) Americans has been estimated to near 2 million, corresponding to a prevalence of 9.2 per 100,000 individuals.[2,3] These numbers may underrepresent the true number of Americans experiencing gender dysphoria, as underreporting is driven by the stigma associated with transgender populations.[4] A recent study indicated that the incidence of patients receiving gender-affirming surgery (GAS) has increased 152-fold from 2010 to 2018.[2]

GAS represents one type of gender-affirming care, which many transgender individuals choose to pursue. A recent study estimated that 42%–54% of transgender men, 28% of transgender women, and 9% of nonbinary people pursue GAS of any type, with the most common being chest/breast surgery (8-25%) and the second being genital surgery (4%–13%).[4] Colloquially, the former is often referred to as "top surgery" and the latter as "bottom surgery."

GAS options for transgender patients are diverse, technically complex, and are associated with a variety of complications. Current data strongly support the importance of speaking with a healthcare provider directly and seeking in-person consults to receive personalized, accurate, and specific GAS information.[5,6] For many Americans, however, GAS specialists may be difficult to locate or reach due to lack of information or geographic distance.[7,8] Studies have indicated that the internet acts as a source of health information for more than 80%

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of Americans, and many people use it as a first-line resource before speaking with physicians.[9,10] However, the value of the internet for patients is only as high as the sources it provides. A variety of validated tools exist that allow for the analysis and quantification of a text-based healthcare source's readability, accessibility, and quality.

Readability is a term used to describe the ease with which a written material can be understood.[11] The readability of resources available online, particularly those related to healthcare, can differ greatly and be written for an intended audience with a widely variable base of knowledge. A variety of scores have been developed and vetted to estimate and quantify the readability of written resources. These scores rely on a variety of parameters, such as words per sentence or syllables per word to quantify readability, typically in terms of grade level.

Availability of online sources of healthcare information, referring to the ease at which relevant sources can be located, constitutes another challenge for transgender patients. A 2017 article by Vargas et al demonstrated that of the top 97 available articles for the search term "transgender surgery," only 14.5% of search results contained patient information.[7] Additionally, due to impacts of geographical location on web-based search results, areas in which GAS information availability may already be sparse could be disproportionately affected by a lack of relevant online resources.

Finally, the quality of a text is concerned with whether it is accurate, relevant, reliable, up to date, well cited, and unbiased. Although there are several methods to assess the quality of texts, a common and well-validated method that has previously been used to evaluate online sources is the DISCERN tool.[12–14]

The transgender population faces unique barriers to health literacy. Studies indicate that 24% of transgender patients have only completed elementary level education, and 60% have only secondary education.[15] Additionally, transgender patients are more likely to experience unemployment, financial hardship, and hesitance to disclose health information. Gender dysphoria is disproportionately associated with social stigmatization, discrimination, and victimization. Perhaps due to these factors, a high level of correlation exists between mental health diagnoses and TGD identities, estimated to be 69%–77%.[16,17] Additionally, rate of school dropout and economic marginalization is increased in the TGD population.[2] For these reasons, understanding the limitations of online GAS resources in terms of readability, availability, and quality is of unique importance. The following study aims to assess and quantify these parameters such that particular strengths and weaknesses of online patient-facing GAS offerings might be understood, and providers may have better insight into the role web-based information might have in their patients' care and their own practice.

METHODS

Assessing Search Trends

To determine the trends in online searches related to gender dysphoria and GAS, "gender dysphoria," "gender

Takeaways

Question: What is the current state of readability, quality, and accessibility associated with web-based patient-facing materials for gender-affirming surgery?

Findings: Incidence of gender affirming surgery–related internet searches has increased in the past two decades, and results have increasingly included patient-facing information, which now makes up the majority of search results regardless of geographical location. Search results are far above recommended patient reading level in terms of complexity, and quality assessment using the DISCERN score indicates "potentially important shortcomings."

Meaning: Although demand for web-based information on gender-affirming surgery is increasing, patient-facing information may be too complex, inaccessible, or low quality to adequately address patient needs.

affirming surgery," "transgender surgery," "top surgery," and "bottom surgery" were assessed for search trends in the United States using the Google Trends tool. Time frame was adjusted to the earliest possible date, January 1, 2005, until the day the analysis occurred in May 2023. Data were exported and visualized.

Analyzing Readability of Online Sources

Occurring in May 2023, searches were conducted from a VPN located in San Francisco, California. Using the search engines Google, Bing, and Yahoo, the first 100 online resources available from the search terms "gender affirming surgery (GAS)," "gender affirmation surgery," "gender confirming surgery," and "transgender surgery" were collected and recorded. Although search engines are known to use automatic stemming to include similar terms in search results, this function does not recognize the four terms of interest investigated to be synonymous.[18] Search results that were sponsored by the search engine, were duplicates, did not include text, were not accessible, or were irrelevant to the search query were excluded. Results in a language other than English were excluded as well, due to lack of comparability in metrics utilized by many of the analysis scores. Cookies and user account information were disabled to avoid bias in search results. The 400 results across the four terms were compiled in order of search appearance, and duplicates were removed. After removal of duplicates, the top 100 sources in order of appearance across the four terms did not require tie breaking. The top 100 sources from this list were used to estimate the most likely sources people access when seeking general information online regarding GAS.

From the top 100 sources, those determined to be patient-facing information (groups 4 and 5 below) were analyzed using the following six readability formulas: Flesch-Kincaid Grade Level, Flesch-Kincaid Readability Ease, Gunning Fog Index, Simple Measure of Gobbledygook Index, Coleman-Liau Index, Linsear Write Formula, and Automated Readability Index (Table 1).[19] Scores were averaged across the websites, and score-specific outcome measures were assigned. After determining

Table 1. Readability Formulas

Test Name	Formula	Score Range	Interpretation of Score
Flesch-Kincaid Grade Level (FGL)	FGL = 206.835 − 1.015(words/sentences) − 84.6(syllables/words)	0–12	U.S. grade level needed to comprehend a text
Flesch-Kincaid Readability Ease (FRE)	FRE = 0.39(words/sentences) + 11.8(syllables/words) − 15.59	0–100	90–100: very easy; 80–90: easy; 70–80: fairly easy; 60–70: standard; 50–60: fairly difficult; 30–50: difficult; 0–30: very difficult
Gunning Fog Index (GFI)	GFI = 0.4[(words/sentences) + 100 (complex words/words)]	0–20	U.S. grade level needed to comprehend a text. Text with a Fog Index score of 17+ requires the reading proficiency of a college graduate.
Simple Measure of Gobbledygook (SMOG) Index	SMOG = 3+ polysyllable count	1–240	See polysyllabic word count / grade level table below
Coleman-Liau Index (CLI)	CLI = 0.0588L − 0.296S −15.8	1–	U.S. grade level needed to comprehend a text.
Linsear Write Formula (LWF)	1) Identify "easy" words (defined as two syllables or less) and place a number "1" over each word, even including a, an, the, and other simple words. 2) Identify "hard" words (defined as three syllables or more) and place a number "3" over each word as pronounced by the dictionary. 3A) Multiply the number of easy words times "1." 3B) Multiply the number of hard words times "3." 4) Add the two previous numbers together. 5) Divide that total by the number of sentences. 6A) If your answer is > 20, divide by "2" 6B) If your answer is < 20 or equal to 20, subtract "2," and then divide by "2"	0–100	U.S. grade level needed to comprehend a text.
Automated Readability Index (ARI)	ARI = 4.71(characters/words) + 0.5(words/sentences) − 21.43	1–14	See score / age / grade level table below
DISCERN instrument	16 questions evaluation	16–80	Section 3 score: Score 1: serious shortcomings; Score 2: partial serious shortcomings; Score 3: not serious shortcomings; Score 4: partial minimal shortcomings; Score 5: minimal shortcomings

SMOG interpretation:

Polysyllabic Word Count	Grade Level
1–6	5
7–12	6
13–20	7
21–30	8
31–42	9
43–56	10
57–72	11
73–90	12
91–110	13
111–132	14
133–156	15
133–156	16
183–210	17
211–240	18

ARI interpretation:

Score	Age	Grade Level
1	5–6	Kindergarten
2	6–7	First/second
3	7–9	Third
4	9–10	Fourth
5	10–11	Fifth
6	11–12	Sixth
7	12–13	Seventh
8	13–14	Eighth
9	14–15	Ninth
10	15–16	Tenth
11	16–17	Eleventh
12	17–18	Twelfth
13	18–24	College
14	24+	Professor

each, the mean and SD for each index among the sources was calculated.

Determining Availability of Patient-facing Information

The list of most popular online informational sources related to GAS derived above was used to determine the availability of patient-facing information in search results. To characterize different sources, websites were grouped accordingly: (1) provider-facing information; (2) insurance; (3) news media outlet; (4) patient-facing information: provider-affiliated; (5) patient-facing information: non-affiliated medical information source.

Group 1 included sources that are intended for healthcare providers to share information on evidenced-based medicine, standard of care, and academic journal articles related to GAS. Websites categorized here included Up to Date and PubMed. Articles and sources that share information regarding insurance coverage related to GAS were included in group 2. For example, Aetna shares information regarding plans and coverage related to facial GAS. Group 3 comprised news media outlet resources that provide journalistic stories and breaking news of interest to the general public relating to GAS. The final two groups included information directed towards gender diverse individuals seeking GAS. Sources associated with academic hospitals and private practice providers sharing general information about GAS and the offerings at their institution, such as the University of Illinois Hospital & Health Science System, were sorted into group 4, whereas online resources that were not affiliated with any healthcare institution, such as Healthline, were sorted into group 5. The number of sources in each category was calculated.

Determining Effects of Geography and Population Density on Availability of Patient-facing Online Sources

Using the Google search engine, online sources resulting from the term "gender affirming surgery" were collected from the most densely populated cities in the United States (Cambridge, Mass.; Peterson, N.J.; and East Los Angeles, Calif.) and the least densely populated cities in the United States (Norman, Okla.; Columbia, S.C.; and Athens, Ga.) using a VPN. The 100 most common online search results for this term were compiled from the most and least dense cities. The sources were categorized as above. The percentage of sources was compared between the most and least densely populated cities to gain a greater sense of changes in accessibility to patient-facing healthcare information regarding GAS, based on geography and population density.

Quality of Web-based Information

DISCERN is an information quality assessment instrument created by a panel of health journalists, clinicians, researchers, and consumers.[20] The DISCERN instrument provides 16 questions to evaluate the content, comprehensibility, and balance of a publication, and each question is rated on a scale of 1 to 5 (1 = definite no, 2–4 = partial, 5 = definite yes). The instrument's questions are divided into three sections. Section one (questions 1–8) evaluates the publication's reliability by analyzing if the article

achieves its goals, has relevance to the reader, and is unbiased. Section two (questions 9–15) addresses the quality of the source and is used to look at how well the source describes a treatment plan, the positives of care plans, the risks of recovery procedures, and the quality of life after treatment. Section three (question 16) helps determine the overall rating of the publication on a scale of 1–5 after rating the previous 15 questions.[12]

Using the same list of 100 most popular search results for the common GAS-related search terms as described above, the quality of these online sources was determined using the DISERN score. Two researchers (A. Z.F and A. A. C.) independently rated each of the 100 online sources, according to the DISCERN score criteria. In the case of a one-point disagreement, the scores were averaged. In the case of a two-or-more point disagreement, a plastic and reconstructive surgery fellow with significant experience in transgender care and the DISCERN score (D. B. A.) would assign a score to the source. Overall scores were then averaged and evaluated to estimate the quality of the online sources for GAS.

RESULTS

Search Trends

For all search terms investigated ("gender dysphoria," "gender affirming surgery," "transgender surgery," "top surgery," and "bottom surgery"), trends indicated a striking increasing incidence of search occurrence on the Google platform from 2005 to the present (Fig. 1).

Readability

For patient-facing GAS online sources, the mean readability across six metrics is shown in Table 2. All metrics demonstrated necessary reading levels in the college/postgraduate level for GAS materials.

Availability

The 100 most available online sources resulting from the search terms "gender affirming surgery (GAS)," "gender affirmation surgery," "gender confirming surgery," and "transgender surgery" were found to be primarily patient facing (60%). Although 51% of patient-facing online information related to GAS was affiliated with surgical providers, 9% was not affiliated. Pages related to insurance companies, claims, and coverage made up 17% of results. Sites directed at physicians and healthcare providers made up 12% of the results, whereas news sources accounted for the remaining 11%. These results can be viewed in Figure 2.

Figure 3 depicts the categorical percentage of online material related to GAS in low-density and high-density population areas, respectively. Search results were found to be highly similar, with no more than a 4% difference in categorical allocation between the two locations.

Quality

Rating correlation between the two DISCERN score evaluators was high ($P = 0.95$). The average DISCERN score was determined to be 3 ($\mu = 3.2 \pm 1.35$), which correlates
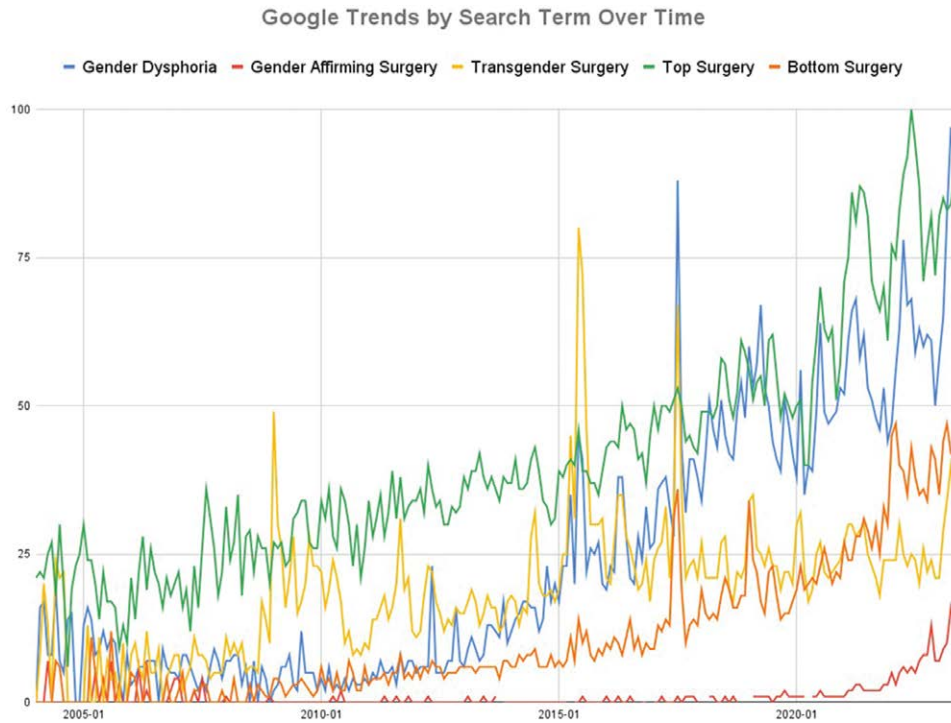
Google Trends by Search Term Over Time

— Gender Dysphoria — Gender Affirming Surgery — Transgender Surgery — Top Surgery — Bottom Surgery

Fig. 1. Google Trends by search term over time.

Table 2. Readability Results

Index	Average (SD)	Qualitative Wording
Fleisch Reading Ease	26.5 (±13.2)	College graduate—best understood by university graduates
Fleisch-Kincaid Grade Level	13.9 (±2.7)	College freshman
Gunning Fog	15.4 (±3.8)	College junior
SMOG	14.1 (±2.4)	College sophomore
Coleman-Liau	13.6 (±2.1)	College freshman
Linsear Write	16.4 (±4.2)	College senior—too hard to read for the majority of readers
Automated Readability Index	14.7 (±4.3)	College

Categorization of 100 Most Common Online Resources

- 1. Physician-facing information
- 2. Insurance
- 3. News outlet / Media
- 4. Patient-facing information: Provider-affiliated
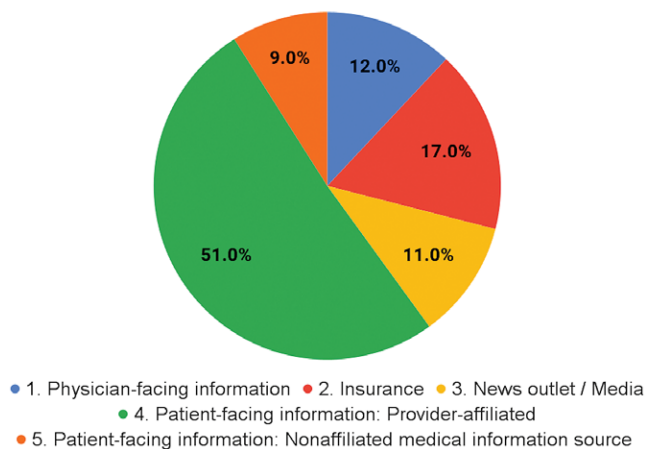- 5. Patient-facing information: Nonaffiliated medical information source

Fig. 2. Categorization of 100 most common online resources.

to the description "potentially important shortcomings" (Fig. 4). Approximately 20% of online GAS sources had "serious shortcomings," whereas approximately 17% had "minimal shortcomings" in quality as estimated by the DISCERN score.

DISCUSSION

GAS represents an important healthcare offering in the holistic treatment of patients with gender dysphoria.[21] Specific offerings within the world of GAS are both challenging to understand and associated with serious complications. Additionally, GAS providers are often not available in certain geographical locations, and not all primary care providers are trained in educating patients on current care options in GAS. The importance of accurate information regarding realistic expectations for surgical results and the associated risks is paramount, and the internet has become a
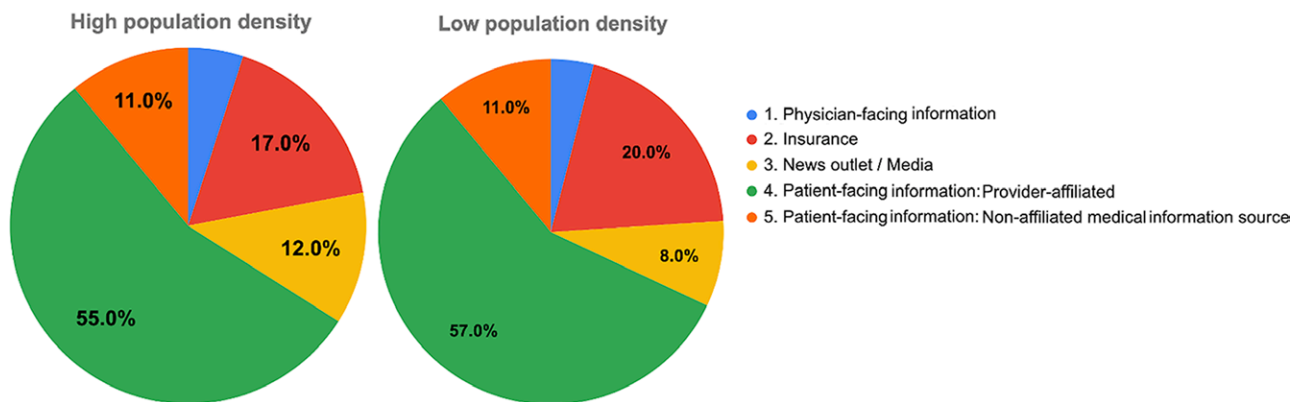
Categorization of 100 Most Common Online Resources

High population density

11.0%
17.0%
12.0%
55.0%

Low population density

11.0%
20.0%
8.0%
57.0%

- 1. Physician-facing information
- 2. Insurance
- 3. News outlet / Media
- 4. Patient-facing information: Provider-affiliated
- 5. Patient-facing information: Non-affiliated medical information source

Fig. 3. Categorization of 100 most common online resources by population density.
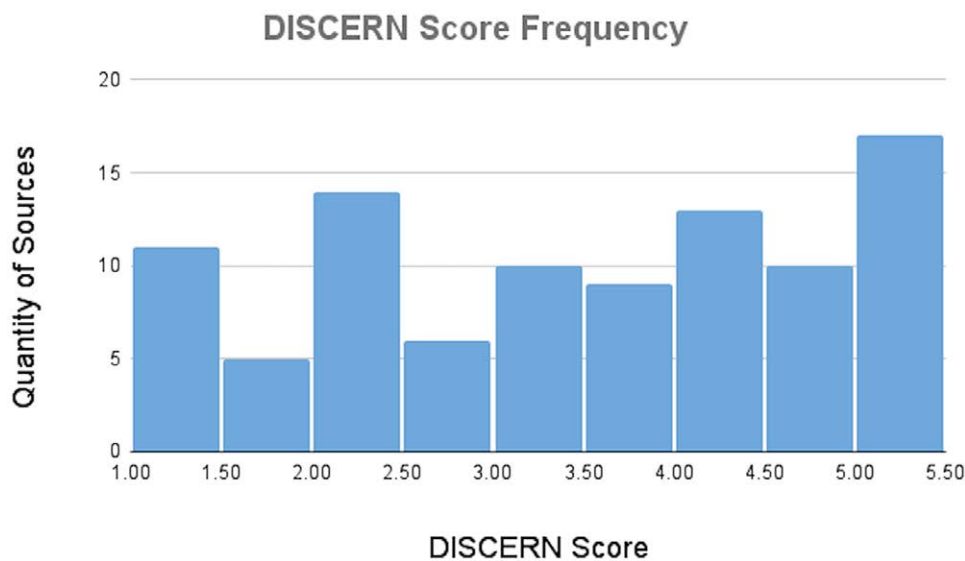
DISCERN Score Frequency

Fig. 4. DISCERN score frequency.

primary source for providing patients this information. Therefore, the quality, accessibility, and readability of web-based GAS informational sources is of significance as we continue to strive for high-quality care for transgender patients. This study aimed to assess the current state of these attributes.

Search Trends Demonstrate Increasing Interest in Gender Dysphoria and GAS

As visibility of the transgender population increases, so too does the incidence of individuals seeking online information regarding gender dysphoria and GAS. This increasing interest in online sources is reflected in the search engine trend data reported here; searches for GAS-related terms have increased over the past 18 years. These trends represent a growing demand for high-quality GAS patient-facing information on the internet.

Average Readability of GAS Online Resources Is College Level

Health literacy is defined as the ability of an individual to read, comprehend, and apply information to their own healthcare-related decisions. Previous studies have demonstrated that health literacy is more predictive of health status than race, education level, income status, employment, or age.[11,22,23] For this reason, health literacy can be improved for the transgender patient population by increasing readability of online resources. Although patient-facing health information is recommended to be written at the sixth-grade level, our analysis indicates that readability of current online information for GAS is at the college to postgraduate level across six separate formulas. Previous analyses from 2017 of similar search terms indicate that online sources at that time were at a college reading level.[7,24] Therefore, the readability of these resources has historically been prohibitive, and is becoming increasingly so.

Availability of Patient-facing GAS Information from Online Searches

The analyses conducted indicated that 61% of search results for GAS-related terms are patient-facing sources. Although the authors predict that this number is lower than that of other surgery types, previous analyses from 2017 indicate that this number has increased substantially over the past five years. Vargas et al previously reported this number at a mere 14.4%, indicating that the search result landscape has improved for patients substantially in past years. Notably, results from news outlets were previously the most common result. Now, patient-facing information from providers leads in the top 100 sources.[7] Although much progress has been made, the online results of searches for GAS are still uniquely plagued by news articles reporting on policy changes around the surgical recommendations and academic journals reporting likelihood of regret compared with other surgical topics that have been studied such as breast reconstruction, orthognathic surgery, and abdominal aortic aneurysm.[25–27] Although policy changes and surgical regret are not unique to GAS, over-exposure to these concerns push useful sources for patients down the page of search results.

Population Density Does Not Have Significant Impact in GAS Search Results

Although a geography-based investigation of this type has not previously been conducted on online sources for GAS, it has been well established in the literature that online search results are heavily influenced by a user's location.[28–30] Considering the stigma surrounding and politicization of GAS, the authors hypothesized that accessibility of patient-facing information might be affected by factors such as population density. However, the results of the analysis demonstrated that only negligible differences exist in Google searches on this topic based on the population density. Although this finding is surprising, it is also reassuring that increasing accessibility of patient-facing resources exists outside of urban centers such as San Francisco, where the original analysis was conducted. The researchers noted significant overlap in the sources between location-based searches, indicating that similar readability and quality metrics might be expected in these areas as well.

Quality

Although the quality of GAS online resources varied widely based on the DISCERN score, the average score indicated that significant concerns may exist. Researchers noted that many of the top search results from hospitals and providers included only information about booking consultations and available providers rather than substantive information regarding GAS surgery. Additionally, many articles were not related to GAS information relevant to patients. These results suggest that quality of online GAS sources may be similar to those available 5 years ago, when a similar analysis was conducted. The researchers noted that although high-quality resources

describing GAS in a patient-facing manner are available online, they are difficult to find due to the high incidence of low-quality resources.

The authors acknowledge several limitations of this study. First, our analyses include a maximum of 100 analyzed sources, whereas the internet provides nearly endless content, which patients may be accessing in their search for informative GAS material. The sources analyzed were estimated to the best of our ability to reflect the most likely sources a patient may find in their online investigations of GAS, though patients may be using other search terms, search engines, or search styles that were not investigated here. Experts in the field note that the TGD community is highly connected through closed Facebook pages, Reddit groups, and shared materials that may not be captured by initial Google searches. Finally, the authors acknowledge the challenges of implementing the changes called upon by the results of the analyses presented.

The concerns identified in this study related to patient-facing online resources have also recently been identified in other facets of GAS care, such as patient-reported outcome measures. A systematic review of patient-reported outcome measures in gender-affirming care demonstrated that the primary barriers to implementing these important patient-facing tools were issues regarding quality and complexity.[31] Writing accurate content in a readable fashion is difficult, and altering the availability of online sources is a complicated issue for any one institution to tackle. However, the importance of this issue, particularly for the transgender patient population, is of clear significance in improving patient satisfaction and outcomes. Health organizations providing online information on GAS should work to improve the readability of their materials. Providers of GAS capable of offering high-quality information should include patient-facing materials on their sites in addition to booking and provider information and strive to make these materials readable for their patient population. Until online resources are more consistently of high readability, accessibility, and quality, providers may choose to direct patients toward vetted sources. The authors feel the findings presented can positively impact patient care by drawing attention to and quantifying the shortcomings of current online patient-facing offerings for GAS as well as allowing providers to better understand the readability, accessibility, and quality of these sources and tailor their practice accordingly.

CONCLUSIONS

This study simulated how patients might use the internet to search for materials on GAS and identified the sources they are mostly likely to come across in this process. The identified sources were then examined through a multi-faceted approach to assess for readability, accessibility, and quality. Although accessibility of these materials seems to have improved in recent years, readability remains prohibitive, and quality is variable. These findings indicate a continued need for effort on behalf of

transgender patients from providers, healthcare institutions, and online sources of medical information.

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DISCLOSURE

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