



# Assessing comprehension of online information in the United States for third-line treatment of overactive bladder

Zachary Werner<sup>1</sup> · Tyler Trump<sup>1</sup> · Stanley Zaslau<sup>1</sup> · Robert Shapiro<sup>1</sup>

Received: 22 January 2022 / Accepted: 19 April 2022  
© The International Urogynecological Association 2022

## Abstract

**Introduction and hypothesis** Overactive bladder (OAB) affects up to 43% of women. Treatment ranges from lifestyle modification to invasive therapies. Nearly 75% of patients report using the internet to gain health information creating a need for interpretable, online resources. This study is aimed at evaluating the readability of online resources for OAB treatment in the US population.

**Methods** Google and Bing were queried regarding “sacral neuromodulation,” “peripheral tibial nerve stimulation (PTNS),” and “bladder botox.” The first 20 results from each search engine were assessed, representing over 90% of accessed search results. Websites were categorized as institutional/reference, commercial, nonprofit, or personal. The Gunning fog (GF), Simple Measure of Gobbledygook (SMOG), and Dale–Chall (DC) validated readability scores were used to assess results.

**Results** Sacral neuromodulation yielded 27 eligible results. The associated mean readability scores correlated with levels of college senior (GF), high school junior (SMOG), and college level (DC). PTNS yielded 31 eligible results. The associated mean readability scores correlated with levels of college senior (GF), high school senior (SMOG), and college level (DC). Bladder botox yielded 17 eligible results. The associated mean readability scores correlated with levels of college sophomore (GF), high school junior (SMOG), and college level (DC). There was no difference between the therapies regarding readability. Sixty-one percent of websites were institutional/reference, 24% were commercial, 13% were nonprofit, and 2% were personal.

**Conclusions** High levels of reading comprehension are required by the general US population to understand OAB information obtained through the internet. These findings highlight a need for simplification of online resources pertaining to OAB.

**Keywords** Overactive Bladder · Readability · Botox · Neuromodulation · Online

## Introduction

The American Urogynecological Society (AUGS) and the International Urogynecological Association (IUGA) define overactive bladder (OAB) as the presence of “urinary urgency, usually accompanied by frequency and nocturia, with or without urgency urinary incontinence, in the absence of urinary tract infection (UTI) or other obvious pathology” [1]. Similarly, the American Urological Association (AUA) notes that OAB primarily consists of four symptoms: urgency, urinary frequency, nocturia, and urge incontinence

[1]. Overactive bladder (OAB) is highly prevalent, affecting up to 43% of women during their lifetime [2–9]. In addition, the prevalence and severity of OAB increase with age [6, 7]. Treatment of OAB typically progresses in a step-wise fashion from behavioral therapy to pharmacotherapy and then to third-line treatments. The American Urological Association (AUA) wording of third-line therapies for OAB includes: intradetrusor onabotulinumtoxin A (“botox”) therapy, peripheral tibial nerve stimulation (PTNS), and sacral neuromodulation (SNS) [1]. Until recently, it has been common for medications, particularly anticholinergics, to be used in combination with behavioral therapy. In 2015, research from the National Institute on Aging showed that adults over the age of 65 are at a higher risk for developing cognitive impairment, dementia, and Alzheimer’s disease after taking anticholinergic medications [10]. In response to this, newly amended (AUA) guidelines on OAB asserted

✉ Zachary Werner  
zwerner@hsc.wvu.edu

<sup>1</sup> Department of Urology, West Virginia University, Suite 1400 Health Sciences Center, Morgantown, WV 26506, USA

that the previously held lines of therapy should not result in a strict progressive algorithm [1]. In 2019, approximately 30% of the female population in the US was over the age of 55 [11]. As age is a significant risk factor for dementia, the use of anticholinergic medications in this subset of patients is less appealing. Therefore, these patients are likely to seek out information on “third-line” treatment options for OAB.

As the ubiquity of the internet has grown, so too has the ability to access targeted medical information. In 2013, approximately 72% of internet users reported searching for health information [12]. This is likely to increase further in the era of the COVID-19 pandemic, as more people rely on technology to obtain medical information rather than in-person consultation. Despite the growing demand for online medical advice, there is little curation of information. Medical information often requires a high level of reading comprehension to be understood. The National Institutes of Health (NIH) recommend that medical information be written at a sixth to seventh-grade reading level (11 to 12 years of age) in order to provide plain and accurate medical information in a web-based format [13].

In this study we examine the readability of open-access online medical information regarding third-line treatment options for OAB in the US population. We hypothesize that the majority of online information regarding these therapies is not accessible at the recommended reading level according to NIH guidelines, indicating a need for plain and accurate patient information.

## Materials and methods

This cross-sectional study was performed at West Virginia University School of Medicine, Morgantown, WV, USA. The search engines Google ([google.com](http://google.com)) and Bing ([bing.com](http://bing.com)) were used to query online information regarding the third-line management options for OAB. The first 20 results from each search engine were evaluated. Results were excluded if they were paid advertisements, duplicate websites, videos, or if they had insufficient text to be analyzed. Terminology was derived from the 2019 joint AUA/SUFU guideline on the diagnosis and treatment of non-neurogenic adult OAB. Of note, rather than “intradetrusor onabotulinumtoxin A therapy,” the authors chose the phrase “bladder botox” for search engine use to better replicate the lay-person’s search attempt.

The three search terms used were: “sacral neuromodulation,” “peripheral tibial nerve stimulation,” and “bladder botox,” according to their appearance in the AUA/SUFU guideline statements [14–16]. Each website was classified into one of the following categories: institutional and reference, commercial, nonprofit, or personal.

A combination of readability formulae was used to approximate the prerequisite level of education for understanding. Three validated readability scores were used for assessment: the Gunning fog (GF), Simple Measure of Gobbledygook (SMOG), and Dale–Chall (DC). The GF index and SMOG formula calculate grade level and reader age based on complex word density, number of sentences, and mean length. For both the GF and SMOG the score indicates the grade level required to understand the content, with the score correlating with the grade level needed (a score of 12 is understandable to a 12th grade student). The DC score has an inverse relationship between score and readability, with a scale of 6–6.9 corresponding to a seventh- or eighth-grade level (age 12 or 13), 7–7.9 corresponding to a ninth- or tenth-grade level (age 14 or 15), 8–8.9 corresponding to 11th- or 12th-grade level (age 16 or 17), and 9.0 and above corresponding to college level and above.

An online tool ([readabilityformulas.com](http://readabilityformulas.com)) was used to score each text segment. For both the GF and SMOG scores a minimum of 150 words was required. The DC score required 200 words. Up to the first 20 sentences from each online resource were analyzed.

The above three formulae allowed for a comprehensive assessment of literacy in understanding OAB treatment. SPSS version 23 was used for statistical analysis.

Descriptive summary statistics (mean,  $\pm$  standard deviation [SD], as appropriate) were used to analyze parameters. Statistical analysis was performed using one-way analysis of variance (ANOVA) to compare mean readability scores among the three treatment modalities. When  $p$  values were  $< 0.05$ , an effect was considered statistically significant.

This study was exempt from Institutional Review Board (IRB) approval at our institution. Protected individual information was not requested or obtained. We used publicly available information for the entirety of the study.

## Results

The term “sacral neuromodulation” revealed 27 queries for analysis. The mean scores for GF, SMOG, and DC (with standard deviation) were 16.0 (3.14), 11.9 (2.10), and 9.7 (0.87) respectively. These correlated with levels of college senior (22 years of age), high school junior (17 years of age), and college level (18 years of age or more; Table 1).

The term “peripheral tibial nerve stimulation” resulted in 31 queries for analysis. The mean scores for GF, SMOG, and DC (with standard deviation) were 16.7 (3.38), 12.5 (2.42), and 9.7 (0.84) respectively. These correlate with levels of college senior (22 years of age), high school senior (18 years of age), and college level (18 years of age or more; Table 1).

The term “bladder botox” revealed 17 queries for analysis. The mean scores for GF, SMOG, and DC (with standard

**Table 1** Readability scores for third-line treatments of overactive bladder

Group		Gunning fog	SMOG	Dale–Chall
Sacral neuromodulation	Mean score	16.0 $\geq$ 3.14	11.9 $\geq$ 2.1	9.7 $\geq$ 0.87
	Corresponding age (years)	22	17	$\geq$ 18
	Number of websites	27	27	27
PTNS	Mean score	16.7 $\geq$ 3.38	12.5 $\geq$ 2.42	9.7 $\geq$ 0.84
	Corresponding age (years)	22	18	$\geq$ 18
	Number of websites	31	31	31
Botox	Mean score	13.9 $\geq$ 2.88	10.3 $\geq$ 2.07	9.2 $\geq$ 0.84
	Corresponding age (years)	20	17	$\geq$ 18
	Number of websites	17	17	17

PTNS peripheral tibial nerve stimulation, SMOG Simple Measure of Gobbledygook

deviation) were 13.9 (2.88), 10.3 (2.07), and 9.2 (0.84) respectively. These correlate with levels of college sophomore (20 years of age), high school junior (17 years of age), and college level (18 years of age or more; Table 1).

No difference was noted between DC scores ( $p=0.17$ ). Statistically significant differences were noted with regard to the GF and SMOG between the treatment modalities ( $p=0.01$  and  $p=0.01$  respectively). Post-hoc analysis revealed that differences existed for both GF and SMOG between PTNS and “bladder botox” groups ( $p=0.01$  and  $p=0.01$  respectively) with no effect on the sacral neuromodulation group.

The data were then analyzed based on the website type. Sixty-one percent of all websites identified (46 out of 75) were categorized as institutional or reference, 24% (18 out of 75) as commercial, 13% (10 out of 75) as nonprofit, and 2% as personal (1 out of 75). Readability scores trended higher among the institutional and reference websites than among the commercial and nonprofit websites, although ANOVA did not reveal any significant difference among GF, SMOG, and DC (Table 2).

Websites identified in our search as industry sponsored were also analyzed. Medtronic revealed GF of 20.8, SMOG of 15.3, and DC of 10.6. Cogentix Medical revealed GF of 13, SMOG of 9.7, and DC of 8.7. No industry-related websites were identified for intradetrusor onabotulinumtoxin A in this query. Of note, Axonics sacral neuromodulation appeared only outside of the top 20 search results on both Google and Bing searches. The Axonics website revealed GF of 10.7, SMOG of 8.1, and DC of 9.1. Information

regarding Axonics is included as it manufactures the only other sacral neuromodulator device and no preference was intended to be made toward Medtronic.

## Discussion

Previous authors have shown the readability of urogynecology pamphlets to be above recommended reading levels [17]. We showed that the readability of commonly used digital information regarding OAB treatment is provided at a level difficult to understand by the general population in the US. The index patient for web-based medical queries is a white middle-aged female [18]. Further, women tend to judge the usability of web-based medical information at a level higher than men and also report higher levels of enjoyment from it [19].

As utilization of the internet for healthcare information continues to increase, so does the importance of access to information that is easily comprehended. Each minute, 70,000 health-related inquiries are made on Google [20]. Studies indicate that most patients view the information they discover through their online searches as reliable information [14]. Prior studies from other specialties have raised concern regarding access to reliable and interpretable information from online resources [15, 20]. The results of our study reiterate that online information pertaining to OAB remains well above the reading level recommended by the NIH (sixth- to seventh-grade corresponding to 11–12 years

**Table 2** Average readability scores based on website classification

	Institutional/reference	Commercial	Nonprofit	Personal	<i>p</i> value
SMOG score (age)	12.16 (17)	11.24 (16)	10.66 (15)	14.8 (19)	0.11
GF score (age)	16.48 (21)	14.94 (19)	14.19 (19)	18.6 (23)	0.11
DC score (age)	9.71 (>18)	9.37 (>18)	9.41 (>18)	9.8 (>18)	0.51

SMOG Simple Measure of Gobbledygook, GF Gunning fog, DC Dale–Chall

*p* values are based on ANOVA. Less than 0.05 is considered significant

# Grade Equivalents

## Age and Grade Comparison by Country

Age	USA Canada Australia India		Italy	UK	Korea	Japan
3	EC1	Early Childhood	asilo	Nursery	Play House	
4	EC2		asilo	Reception	Kindergarten	
5	Kindergarten		asilo	Year 1	Kindergarten	
6	Grade 1	Elementary	1a elem	Year 2	Grade 1	Grade 1
7	Grade 2		2a elem	Year 3	Grade 2	Grade 2
8	Grade 3		3a elem	Year 4	Grade 3	Grade 3
9	Grade 4		4a elem	Year 5	Grade 4	Grade 4
10	Grade 5		5a elem	Year 6	Grade 5	Grade 5
11	Grade 6	Middle School	1a media	Year 7	Grade 6	Grade 6
12	Grade 7		2a media	Year 8	Grade 7	Grade 7
13	Grade 8		3a media	Year 9	Grade 8	Grade 8
14	Grade 9	High School	1 liceo	Year 10	Grade 9	Grade 9
15	Grade 10		2 liceo	Year 11	Grade 10	Grade 10
16	Grade 11		3 liceo	Year 12	Grade 11	Grade 11
17	Grade 12		4 liceo	Year 13	Grade 12	Grade 12
18			5 liceo			

Fig. 1 International Grade and Age Equivalencies

of age) [13]. A comparative chart for age and associated grade amongst various countries is provided in Fig. 1a [21].

Overactive active bladder represents a highly prevalent, chronic syndrome, where the goal of care remains symptom management rather than cure. In 2007, healthcare utilization in the US for OAB was significant, with a reported national cost of nearly USD 66 billion. This is expected to increase to roughly USD 83 billion dollars at the present time [22]. Several cost analyses have been performed that illustrate the superiority of the third-line OAB treatment options versus traditional pharmacotherapy and behavioral modification. It is becoming more common for patients to be presented with options for the third-line therapies earlier in their treatment course. As these “third-line” treatment options become more common, the demand for understandable educational material pertaining to these treatment options will grow. The low readability raises concerns that information can be easily misinterpreted leading to inappropriate healthcare decisions.

Interestingly, analysis of the industry-sponsored websites (Medtronic, Axonics, and Cogentix) revealed similar findings to information provided from other sources and remained above the recommended reading level. This finding provides a target for improving the information available

as these resources are the most accessible to both providers and patients.

Our study is not without its limitations. First, search engines are sensitive to specific syntax and wording, and although our search terms are those likely used by patients, slight alterations may produce different results. We utilized two search engines, Google and Bing, which comprise >90% of daily searches, but cannot account for all results that may be received by queries through different search engines. Additionally, our results are limited to the online resources available to the public and may not be completely representative of the resources companies may provide to patients in the form of handouts, brochures, etc. By taking the first 20 search engine results we may be missing out on very good or very bad articles. One can also pay to get articles/information at the top of the search, especially the commercial ones. This may have altered the results of the study.

## Conclusion

High levels of reading comprehension are required by the general US population to understand OAB information obtained through the internet. These findings highlight a need for simplification of online health resources pertaining to OAB. It is our hope that these findings will lead to modifying patient education material through the use of simpler, shorter words and sentences, with greater use of illustrations.

**Author contributions** Zachary Werner: project development, data collection, manuscript writing and editing; Tyler Trump: project development, data collection and analysis, manuscript writing and editing; Stanley Zaslau: project development, manuscript writing and editing; Robert Shapiro: project development, manuscript writing and editing.

## Declarations

**Conflicts of interest** Tyler Trump and Zachary Werner have no conflicts of interest to declare. Stanley Zaslau receives support in the form of a grant from Medtronic and Avation Medical. Robert Shapiro is a consultant for Boston Scientific.

## References

1. Lightner DJ, Gomelsky A, Souter L, et al. Diagnosis and treatment of overactive bladder (non-neurogenic) in adults: AUA/SUFU Guideline amendment 2019. *J Urol.* 2019;202:558–63.
2. Choo MS, Ku JH, Lee JB, et al. Cross-cultural differences for adapting overactive bladder symptoms: results of an epidemiologic survey in Korea. *World J Urol.* 2007;25:505–11.
3. Corcos J, Schick E. Prevalence of overactive bladder and incontinence in Canada. *Can J Urol.* 2004;11:2278–84.

4. Coyne KS, Sexton CC, Vats V, et al. National community prevalence of overactive bladder in the United States stratified by sex and age. *Urology*. 2011;77:1081–7.
5. Tikkinen KA, Auvinen A, Tiitinen A, et al. Reproductive factors associated with nocturia and urinary urgency in women: a population-based study in Finland. *Am J Obstet Gynecol*. 2008;199:153.e1–12.
6. Irwin DE, Milsom I, Hunskaar S, et al. Population-based survey of urinary incontinence, overactive bladder, and other lower urinary tract symptoms in five countries: results of the EPIC study. *Eur Urol*. 2006;50:1306–14.
7. Stewart WF, Van Rooyen JB, Cundiff GW, et al. Prevalence and burden of overactive bladder in the United States. *World J Urol*. 2003;20:327–36.
8. Herschorn S, Gajewski J, Schulz J, et al. A population-based study of urinary symptoms and incontinence: the Canadian Urinary Bladder Survey. *BJU Int*. 2008;101:52–8.
9. Milsom I, Abrams P, Cardozo L, et al. How widespread are the symptoms of an overactive bladder and how are they managed? A population-based prevalence study. *BJU Intl*. 2001;87:760–6.
10. Gray SL, Anderson ML, Dublin S, et al. Cumulative use of strong anticholinergics and incident dementia: a prospective cohort study. *JAMA Intern Med*. 2015;175(3):401–7. <https://doi.org/10.1001/jamainternmed.2014.7663>.
11. United States Census Bureau. Profile of general population and housing characteristics: 2010. <https://data.census.gov/cedsci/table?q=ACSDP1Y2019.DP05%20United%20States&tid=ACSDP1Y2019.DP05&hidePreview=true>. Accessed 18 July 2021.
12. Fox S, Duggan M. January 15, 2013. Health Online 2013. Pew Research Center. Accessed 18 July 2021. <http://www.pewinternet.org/2013/01/15/health-online-2013>.
13. National Institutes of Health. MedlinePlus: how to write easy to read health materials. 2007. <http://www.nlm.nih.gov/medlineplus/etr.html>. Accessed 12 December 2021
14. Pehora C, Gajaria N, Stoute M, Fracassa S, Serebale-O'Sullivan R, Matava CT. Are parents getting it right? A survey of parents' internet use for children's health care information. *Interact J Med Res*. 2015;4(2):e12.
15. Huang G, Fang CH, Agarwal N, Bhagat N, Eloy JA, Langer PD. Assessment of online patient education materials from major ophthalmologic associations. *JAMA Ophthalmol*. 2015;133(4):449–54. <https://doi.org/10.1001/jamaophthalmol.2014.6104>.
16. Van Ballegooie C, Hoang P. Assessment of the readability of online patient education material from major geriatric associations. *J Am Geriatr Soc*. 2021;69(4):1051–6. <https://doi.org/10.1111/jgs.16960>.
17. Reagan KM, O'Sullivan DM, Harvey DP, Lasala CA. Readability of patient information pamphlets in urogynecology. *Female Pelvic Med Reconstr Surg*. 2015;21(2):63–5. <https://doi.org/10.1097/SPV.0000000000000152>.
18. Chung JE. Patient-provider discussion of online health information: results from the 2007 Health Information National Trends Survey (HINTS). *J Health Commun*. 2013;18(6):627–48. <https://doi.org/10.1080/10810730.2012.743628>.
19. Bidmon S, Terlutter R. Gender differences in searching for health information on the internet and the virtual patient-physician relationship in Germany: exploratory results on how men and women differ and why. *J Med Internet Res*. 2015;17(6):e156. <https://doi.org/10.2196/jmir.4127>.
20. Murphy M. Dr Google will see you now: search giant wants to cash in on your medical queries. *The Telegraph*, 10 March 2019. <https://www.telegraph.co.uk/technology/2019/03/10/google-siftng-one-billion-health-questions-day/>. Accessed 5 Dec 2021.
21. American School of Milan. Grade equivalent chart. Retrieved 6 March 2022, from <https://www.asmilan.org/admissions/grade-equivalents>. Accessed 12 December 2021
22. Murray B, Hessami SH, Gultyaev D, et al. Cost-effectiveness of overactive bladder treatments: from the US payer perspective. *J Comp Eff Res*. 2019;8(1):61–71. <https://doi.org/10.2217/cer-2018-0079>.

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.