RESEARCH ARTICLE / ARAŞTIRMA YAZISI

Readability of Online Patient Education Materials on Autism: An Invisible Barrier to Information Access

Otizmle İlgili Çevrimiçi Hasta Eğitimi Materyallerinin Okunabilirliği: Bilgiye Erişimde Görünmez Bir Engel

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Abstract:

This study aimed to evaluate the readability of online patient education materials related to Autism Spectrum Disorder (ASD) and determine how comprehensible these resources are for parents. On January 26, 2025, English-language materials were identified using the Google search engine with the keywords "autism," "atypical autism," "Asperger syndrome," "pervasive developmental disorder," and "autism spectrum disorder." According to predefined inclusion criteria, 132 websites were selected and categorized into three groups: Professional Society, Clinical Practice, and General Health Information. Readability was assessed using six standardized metrics: Flesch Reading Ease (FRE), Flesch–Kincaid Grade Level (FKGL), Gunning Fog Index (GFI), Simple Measure of Gobbledygook (SMOG), Coleman–Liau Index (CLI), and Automated Readability Index (ARI). Of the 132 analyzed materials, 67.4% were from General Health Information sources, 17.4% from Professional Societies, and 15.2% from Clinical Practices. The mean FRE score was 30.2 ± 16.2, FKGL was 14.3 ± 3.7, GFI was 17.0 ± 3.8, SMOG was 13.0 ± 2.6, CLI was 15.7 ± 2.4, and ARI was 14.3 ± 4.1. No statistically significant differences were found between the three website categories ($p > 0.05$). These findings indicate that online autism education materials are generally written at an academic level that exceeds the reading ability of the general public, creating a gap between available information and its practical usability. This gap may hinder parents from making informed decisions and accessing timely support for their children. Therefore, developing clearer, more accessible, and health-literacy-appropriate resources is essential to improve understanding, early diagnosis, and intervention outcomes for individuals with autism.

Keywords: Autism spectrum disorder; Readability, Patient education materials, Health literacy, Online health information.

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Öz:

Bu çalışma, Otizm Spektrum Bozukluğu (OSB) ile ilgili çevrimiçi hasta eğitimi materyallerinin okunabilirliğini değerlendirmeyi ve bu kaynakların ebeveynler tarafından ne ölçüde anlaşılabildiğini belirlemeyi amaçlamıştır. 26 Ocak 2025 tarihinde, Google arama motoru kullanılarak "otizm", "atipik otizm", "Asperger sendromu", "yaygın gelişimsel bozukluk" ve "otizm spektrum bozukluğu" anahtar kelimeleriyle İngilizce dilinde hasta eğitimi materyalleri belirlenmiştir. Önceden tanımlanmış dahil edilme kriterlerine göre 132 web sitesi seçilmiş ve Profesyonel Dernek, Klinik Uygulama ve Genel Sağlık Bilgisi olmak üzere üç gruba ayrılmıştır. Okunabilirlik, Flesch Okunabilirlik Kolaylığı (FRE), Flesch–Kincaid Sınıf Düzeyi (FKGL), Gunning Sis İndeksi (GFI), Gobbledygook Basit Ölçümü (SMOG), Coleman–Liau İndeksi (CLI) ve Otomatik Okunabilirlik İndeksi (ARI) olmak üzere altı standart ölçüt kullanılarak değerlendirilmiştir. Analiz edilen 132 materyalin %67,4'ü Genel Sağlık Bilgisi kaynaklarından, %17,4'ü Profesyonel Derneklerden ve %15,2'si Klinik Uygulamalardan elde edilmiştir. Ortalama FRE skoru 30,2 ± 16,2, FKGL 14,3 ± 3,7, GFI 17,0 ± 3,8, SMOG 13,0 ± 2,6, CLI 15,7 ± 2,4 ve ARI 14,3 ± 4,1 olarak bulunmuştur. Üç web sitesi kategorisi arasında istatistiksel olarak anlamlı fark saptanmamıştır (p > 0,05). Bu bulgular, otizmle ilgili çevrimiçi eğitim materyallerinin genel okuyucu kitlesinin okuma düzeyinin oldukça üzerinde bir akademik dilde yazıldığını ve bu durumun mevcut bilgiyle pratik kullanım arasında bir boşluk yarattığını göstermektedir. Bu boşluk, ebeveynlerin çocukları için bilinçli kararlar almasını ve zamanında destek kaynaklarına ulaşmasını zorlaştırabilir. Bu nedenle, daha açık, erişilebilir ve sağlık okuryazarlığına uygun materyallerin geliştirilmesi, otizmli bireylerde anlayışı, erken tanıyı ve müdahale süreçlerini iyileştirmek açısından büyük önem taşımaktadır.

Anahtar Kelimeler: Otizm spektrum bozukluğu, Okunabilirlik, Hasta eğitimi materyalleri, Sağlık okuryazarlığı, Çevrimiçi sağlık bilgisi.

Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition that begins in early childhood and is marked by difficulties in social communication, repetitive behaviors, and restricted interests (Hodges et al., 2020). Approximately 1 in every 36 children worldwide is diagnosed with ASD, and the prevalence has been rising in recent years (Maenner et al., 2023). This rise is believed to result from heightened awareness, changes in diagnostic criteria, and environmental influences (Neggers, 2014). Early diagnosis and intervention can support language, cognitive, and social development in individuals with ASD. Yet, developmental progress is not limited to early intervention; individualized education programs and continuous support also play a crucial role. Intensive and long-term approaches may yield lasting benefits in language and cognition. For this reason, parents and caregivers need access to clear information not only during the diagnostic phase but also throughout the child's educational and therapeutic journey.

The Internet has increasingly become one of the main sources for accessing health-related information (Kummervold et al., 2008). Reliable information is crucial for individuals to adopt healthy lifestyles, prevent illnesses, and utilize healthcare services effectively. Parents and individuals seeking health information often use the Internet as a primary tool to learn about their medical conditions and available treatment options (Andreassen et al., 2007). After professional advice, the Internet ranks as the second most preferred source of health information (Couper et al., 2010). For conditions associated with stigma, people and their families are even more likely to rely on online resources (Berger et al., 2005). ASD is considered a neurodevelopmental disorder frequently misunderstood in society and linked with stigma (Turnock et al., 2022). This increases the probability that parents of children with ASD will seek online information as their primary source. In fact, studies have shown that online media can influence parental health-related decisions, such as childhood vaccination, highlighting the critical importance of evaluating both the accessibility and quality of such content (Yılmaz & Sezgin, 2023)**.** The rapid spread of digital technologies and easier Internet access has further broadened the availability of autism-related information, but also raised concerns about its quality. In recent years, the COVID-19 pandemic has accelerated the adoption of digital tools in healthcare, with physicians increasingly using online resources to inform patients, conduct initial assessments, and offer teleconsultations (Marinelli et al., 2022). The developmental progress of individuals with ASD depends not only on early diagnosis and intervention but also on individualized education programs and long-term support. Therefore, parents must obtain accurate, understandable, and accessible information about autism spectrum disorder. Although the Internet enables fast and wide access, the scientific reliability and readability of online content are not always sufficient. Expanding high-quality online educational materials can support earlier diagnosis and more effective planning for children with autism. Still, mere access is not enough; both the quality of the material and its suitability for the target audience are critical to how effectively the information is used.

When assessing the overall quality and usefulness of an online resource for patients and caregivers, a key factor is how easily the information can be read, understood, and processed by the intended audience. Therefore, the health literacy level of the target group must be considered. Several methods have been developed to evaluate the readability of texts and websites. In the U.S. academic context, readability refers to the level of education needed to comprehend a given text. The average American adult reads at approximately an 8th-grade level. The American Medical Association (AMA) and the National Institutes of

Health (NIH) recommend that patient education materials be written at about a 6th-grade level (Affairs, 1999; The National Library of Medicine (MedlinePlus), 2022). However, limited knowledge about diseases can impair health-related decision-making and lower adherence to treatment (Dempster et al., 2015). Thus, patient education resources should not only provide information but also be presented clearly and understandably to patients and their parents.

In the literature, six widely used readability tools are commonly applied to evaluate patient education materials. The Flesch Reading Ease (FRE), developed in 1948, measures the overall comprehensibility of a text. (Flesch, 1948). The Flesch–Kincaid Grade Level (FKGL) indicates the education level required to understand a text and converts it into a U.S. grade level. (Flesch, 1948). The Gunning–Fog Index (GFI) assesses readability based on sentence length and the number of polysyllabic words. (Gunning Ralph, 1952). The Simple Measure of Gobbledygook (SMOG) analyzes the entire text and is often used specifically for health-related information. (GH, 1969). The Coleman–Liau Index (CLI) focuses on word length and sentence structure. (Coleman & Liau, 1975), while the Automatic Readability Index (ARI) calculates readability from the number of characters, words, and sentences (Smith & Senter, 1967).

The readability of online patient education materials on ASD is crucial, since many parents use the Internet to learn about their children's diagnosis and treatment. However, some health-related websites contain medical terminology that makes the information more complicated to understand. In particular, when discussing complex and multidimensional neurodevelopmental disorders such as ASD, topics like genetic and environmental factors, the diagnostic process, early intervention, individualized education plans, and behavioral therapies are frequently included. This range of content can affect readability and make comprehension difficult for some parents. Materials that are difficult to read and understand may lead parents toward unscientific sources or prevent them from accessing adequate support. As a result, missed opportunities for early intervention might arise, leading to delays in children's language, cognitive, and social development. Therefore, patient education materials on autism should be both accessible and easy to understand.

This research aimed to evaluate the readability standards of online educational materials about autism and to assess how comprehensible these resources are to both parents and patients. In doing so, it seeks to contribute to the development of more accessible and comprehensible resources for these audiences.

Methods

On January 26, 2025, online patient education materials related to autism were identified using the Google search engine. The search terms used were "autism," "atypical autism," "Asperger syndrome," "pervasive developmental disorder," and "autism spectrum disorder." During the refined search process, only results set to 'full sentence' and 'English language' were included. For each keyword, the first 50 eligible websites were systematically gathered, yielding a total sample of 250 sites for evaluation. Any repeated entries, scholarly journals, multimedia content (such as videos), or sites that display solely tables or images were deliberately excluded. The final set of websites was organized into three distinct categories: (1) Professional Society, (2) Clinical Practice, and (3) General Health Information websites. A Professional Society refers to professional associations, research foundations, and advocacy groups aiming to advance knowledge, research, and practice in the field of autism. "Clinical Practice" included healthcare institutions such as hospitals, private clinics, genetic laboratories, and imaging centers that provide diagnostic, treatment, or medical services for individuals with ASD. "General Health Information Website" referred to non-clinical and non-professional organizations providing general public health information about autism.

All selected autism-related texts were individually transferred into separate Microsoft Word documents (version 2010; Microsoft, Redmond, WA, USA). To prevent any distortion of the readability assessments, non-instructional components such as navigation menus, copyright details, disclaimers, author credits, feedback sections, hyperlinks, web addresses, citations, images, tables, footnotes, contact details, and phone numbers were carefully excluded. After this cleaning process, the readability metrics were automatically determined by entering the cleaned texts into the online tool at https://www.webfx.com/tools/read-able/. As this study analyzed only publicly available online materials and did not involve human participants or personal data, ethics committee approval was not required.

Statistical Methods

Descriptive statistical analyses included calculations of mean, standard deviation, median, minimum and maximum values, frequencies, and percentages. To assess the distribution characteristics of the variables, the Kolmogorov-Smirnov and Shapiro-Wilk tests were applied. For normally distributed independent quantitative data, ANOVA accompanied by Tukey's post-hoc test was conducted, whereas the Kruskal-Wallis and Mann-Whitney U tests were employed for non-normally distributed data. Qualitative data comparisons were performed using the Chi-Square test. All statistical evaluations were executed using SPSS software, version 28.0.

Results

A total of 132 online patient education materials related to ASD were evaluated. Of these, 89 (67.4%) were obtained from General Health Information websites, 23 (17.4%) from Professional Society websites, and 20 (15.2%) from Clinical Practice websites (Table 1).

Table 1. *Readability Metrics and Difficulty Classification of ASD-Related Online Patient Education Material*

		Min-Max	Median	Mean±sd/n-%	
Flesch Reading Ease		0,0-73,8	29,2	30,2 ±	16,2
Flesch Reading Ease	Fairly Easy			2	1,5%
	Standard			3	2,3%
	Average Diffucult			11	8,3%
	Fairly Diffucult			17	12,9%
	Diffucult			31	23,5%
	Very Diffucult			68	51,5%
Flesch-Kincaid Grade Level		6,6-35,5	14,3	14,3 ±	3,7
Flesch–Kincaid Grade Level	East To Read			3	2,3%
	Fairly Easy			2	1,5%
	Standard			8	6,1%
	Fairly Diffucult			28	21,2%
	Diffucult			71	53,8%
	Very Diffucult			20	15,2%
Gunning-Fog Index		9,1-37,7	17,0	17,0 ±	3,8
Gunning- Fog Index	Standard			2	1,5%
	Fairly Diffucult			15	11,4%
	Diffucult			49	37,1%
	Very Diffucult			66	50,0%
SMOG Grading		7,3-27,3	13,0	13,0 ±	2,6
SMOG Grading	Fairly Easy			5	3,8%
	Standard			10	7,6%
	Fairly Diffucult			51	38,6%
	Diffucult			64	48,5%
	Very Diffucult			2	1,5%
Coleman-Liau Index		10,0-21,1	15,4	15,7 ±	2,4
Coleman-Liau Index	Fairly Diffucult			12	9,1%
	Diffucult			81	61,4%
	Very Diffucult			39	29,5%
Automated Readability Index		5,3-39,8	14,1	14,3 ±	4,1
Automated Readability Index	East To Read			3	2,3%
	Fairly Easy			2	1,5%
	Standard			10	7,6%
	Fairly Diffucult			29	22,0%
	Diffucult			67	50,8%
	Very Diffucult			21	15,9%
Group	Professional			23	17,4%
	General			89	67,4%
	Clinical Practice			20	15,2%

The FRE scores ranged from 0.0 to 73.8, with a mean of 30.2 ± 16.2 and a median of 29.2. According to the FRE classification, 2 materials (1.5%) were rated as fairly easy, 3 (2.3%) as standard, 11 (8.3%) as average difficult, 17 (12.9%) as fairly difficult, 31 (23.5%) as difficult, and 68 (51.5%) as very difficult.

The FKGL values ranged between 6.6 and 35.5, with a mean of 14.3 ± 3.7 and a median of 14.3. Based on the FKGL classification, 3 materials (2.3%) were rated as easy to read, 2 (1.5%) as fairly easy, 8 (6.1%) as standard, 28 (21.2%) as fairly difficult, 71 (53.8%) as difficult, and 20 (15.2%) as very difficult.

The GFI ranged from 9.1 to 37.7, with a mean of 17.0 ± 3.8 and a median of 17.0. According to GFI categorization, 2 materials (1.5%) were classified as standard, 15 (11.4%) as fairly difficult, 49 (37.1%) as difficult, and 66 (50.0%) as very difficult.

The SMOG results ranged between 7.3 and 27.3, with a mean of 13.0 ± 2.6 and a median of 13.0. In this classification, 5 materials (3.8%) were identified as fairly easy, 10 (7.6%) as standard, 51 (38.6%) as fairly difficult, 64 (48.5%) as difficult, and 2 (1.5%) as very difficult.

The CLI values varied between 10.0 and 21.1, with a mean of 15.7 ± 2.4 and a median of 15.4. According to CLI categories, 12 materials (9.1%) were categorized as fairly difficult, 81 (61.4%) as difficult, and 39 (29.5%) as very difficult.

The ARI ranged between 5.3 and 39.8, with a mean of 14.3 ± 4.1 and a median of 14.1. According to ARI classification, 3 materials (2.3%) were easy to read, 2 (1.5%) fairly easy, 10 (7.6%) standard, 29 (22.0%) fairly difficult, 67 (50.8%) difficult, and 21 (15.9%) very difficult (Table 1).

In the FRE comparison, 9 materials (39.1%) from Professional Society websites, 49 materials (55.1%) from General Health Information websites, and 10 materials (50.0%) from Clinical Practice websites were classified as very difficult. Materials rated as difficult included 4 (17.4%) in the Professional Society group, 21 (23.6%) in the General Health Information group, and 6 (30.0%) in the Clinical Practice group. The proportion of fairly difficult texts was 6 (26.1%), 8 (9.0%), and 3 (15.0%) in the respective categories, while average difficult texts were identified in 2 (8.7%) Professional, 9 (10.1%) General, and none in Clinical Practice websites. "Standard" texts were observed in 2 (8.7%) Professional Society and 1 (5.0%) Clinical Practice materials, whereas "fairly easy" materials were present only in 2 (2.2%) General Health Information websites. There was no statistically significant difference in FRE scores among the three website categories (p = 0.079).

In the FKGL results, 12 materials (52.2%) from Professional Society websites, 46 (51.7%) from General Health Information websites, and 13 (65.0%) from Clinical Practice websites were classified as difficult. "Very difficult" materials were recorded in 0 (0.0%) Professional, 18 (20.2%) General, and 2 (10.0%) Clinical websites. "Fairly difficult" texts included 6 (26.1%) in Professional, 19 (21.3%) in General, and 3 (15.0%) in Clinical Practice groups. "Standard" readability was

observed in 3 (13.0%), 4 (4.5%), and 1 (5.0%) of the same categories, while "fairly easy" texts were present only in 2 (8.7%) Professional Society materials, and "easy to read" materials were found in 2 (2.2%) General and 1 (5.0%) Clinical Practice websites. No statistically significant difference was found between website categories for the FKGL index (p = 0.155).

For the GFI, 8 materials (34.8%) from Professional Society websites, 49 (55.1%) from General Health Information websites, and 9 (45.0%) from Clinical Practice websites were categorized as very difficult. The number of difficult materials was 9 (39.1%) in Professional Society, 30 (33.7%) in General Health Information, and 10 (50.0%) in Clinical Practice groups. "Fairly difficult" texts included 6 (26.1%) in Professional, 8 (9.0%) in General, and 1 (5.0%) in Clinical websites, while "standard" readability was identified in 2 (2.2%) General Health Information materials only. Statistical analysis revealed no significant difference in GFI values across the three website categories (p = 0.086).

In the SMOG results, 9 materials (39.1%) from Professional Society websites, 47 (52.8%) from General Health Information websites, and 8 (40.0%) from Clinical Practice websites were classified as difficult. The proportion of fairly difficult materials was 8 (34.8%), 33 (37.1%), and 10 (50.0%) in the respective groups. Standard readability was recorded in 4 (17.4%) Professional Society, 5 (5.6%) General Health Information, and 1 (5.0%) Clinical Practice materials. Fairly easy materials were found in 2 (8.7%) Professional, 2 (2.2%) General, and 1 (5.0%) Clinical websites, and very difficult materials were observed only in 2 (2.2%) General Health Information sources. No statistically significant difference was observed in SMOG scores among website categories (p = 0.247).

In the CLI comparison, 14 materials (60.9%) from Professional Society websites, 52 (58.4%) from General Health Information websites, and 15 (75.0%) from Clinical Practice websites were classified as difficult. "Very difficult" materials were recorded in 6 (26.1%), 29 (32.6%), and 4 (20.0%) of the same groups, respectively. "Fairly difficult" materials accounted for 3 (13.0%) in Professional, 8 (9.0%) in General, and 1 (5.0%) in Clinical Practice websites. There was no statistically significant difference between the three categories for CLI values (p > 0.05).

For the ARI, 12 materials (52.2%) from Professional Society websites, 45 (50.6%) from General Health Information websites, and 10 (50.0%) from Clinical Practice websites were categorized as difficult. "Very difficult" texts were found in 0 (0.0%), 19 (21.3%), and 2 (10.0%) of the respective groups. "Fairly difficult" materials were identified in 6 (26.1%) Professional, 17 (19.1%) General, and 6 (30.0%) Clinical websites. "Standard" readability was observed in 3 (13.0%), 6 (6.7%), and 1 (5.0%) of the same groups, while "fairly easy" materials were present in 2 (8.7%) Professional Society websites, and "easy to read" materials in 2 (2.2%) General and 1 (5.0%) Clinical Practice websites. No statistically significant difference in ARI scores was found among the website categories (p = 0.159) (Table 2)

Table 2. *Distribution of Readability Score Categories Across Website Types*

			[1] Professional (n:23)		[2] General (n:89)		[3] Clinical Practice (n:20)		p	
Flesch Reading Ease	Fairly Easy	n-%	0	0,0%	2	2,2%	0	0,0%	0,079	X^2
	Standard	n-%	2	8,7%	0	0,0%	1	5,0%		
	Average Diffucult	n-%	2	8,7%	9	10,1%	0	0,0%		
	Fairly Diffucult	n-%	6	26,1%	8	9,0%	3	15,0%		
	Diffucult	n-%	4	17,4%	21	23,6%	6	30,0%		
	Very Diffucult	n-%	9	39,1%	49	55,1%	10	50,0%		
Flesch–Kincaid Grade Level	East To Read	n-%	0	0,0%	2	2,2%	1	5,0%	0,155	X^2
	Fairly Easy	n-%	2	8,7%	0	0,0%	0	0,0%		
	Standard	n-%	3	13,0%	4	4,5%	1	5,0%		
	Fairly Diffucult	n-%	6	26,1%	19	21,3%	3	15,0%		
	Diffucult	n-%	12	52,2%	46	51,7%	13	65,0%		
	Very Diffucult	n-%	0	0,0%	18	20,2%	2	10,0%		
Gunning- Fog Index	Standard	n-%	0	0,0%	2	2,2%	0	0,0%	0,086	X^2
	Fairly Diffucult	n-%	6	26,1%	8	9,0%	1	5,0%		
	Diffucult	n-%	9	39,1%	30	33,7%	10	50,0%		
	Very Diffucult	n-%	8	34,8%	49	55,1%	9	45,0%		
SMOG Grading	Fairly Easy	n-%	2	8,7%	2	2,2%	1	5,0%	0,247	X^2
	Standard	n-%	4	17,4%	5	5,6%	1	5,0%		
	Fairly Diffucult	n-%	8	34,8%	33	37,1%	10	50,0%		
	Diffucult	n-%	9	39,1%	47	52,8%	8	40,0%		
	Very Diffucult	n-%	0	0,0%	2	2,2%	0	0,0%		
Coleman-Liau Index	Fairly Diffucult	n-%	3	13,0%	8	9,0%	1	5,0%	p>0.05	X^2
	Diffucult	n-%	14	60,9%	52	58,4%	15	75,0%		
	Very Diffucult	n-%	6	26,1%	29	32,6%	4	20,0%		
Automated Readability Index	East To Read	n-%	0	0,0%	2	2,2%	1	5,0%	0,159	X^2
	Fairly Easy	n-%	2	8,7%	0	0,0%	0	0,0%		
	Standard	n-%	3	13,0%	6	6,7%	1	5,0%		
	Fairly Diffucult	n-%	6	26,1%	17	19,1%	6	30,0%		
	Diffucult	n-%	12	52,2%	45	50,6%	10	50,0%		
	Very Diffucult	n-%	0	0,0%	19	21,3%	2	10,0%		

[K] Kruskal-wallis (Mann-whitney u test) / [X²] Chi-square test (Fischer test), Difference with [2] General Group p<0.05

Discussion

The readability level of PEMs should be adjusted so that patients and parents can easily understand them. Just as clinical experts carefully choose the language they use in communication, these materials should likewise be presented in a way that is easy for parents to grasp. The AMA recommends that patient education texts be written at a sixth-grade reading level. (Affairs, 1999).

Parents who suspect health problems in their children often turn to the Internet for information. (Kubb & Foran, 2020). However, most of these parents' lack experience with scientific databases, such as PubMed, and instead prefer more accessible platforms like Google. Therefore, we

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assessed the readability of the most frequently accessed patient education resources using Google search results (Pehora et al., 2015). The analyzed texts were divided into three categories: Professional Society, Clinical Practice, and General Health Information websites. The findings showed that most of these websites were written at a level above the sixth-grade level recommended by the AMA.

The results of our study showed that most of the analyzed patient education materials required high reading levels and clearly exceeded the recommended sixth-grade level. No significant differences in readability were found among the Professional Society, Clinical Practice, and General Health Information categories. The literature review reveals a similar trend. King and colleagues assessed seven mental health brochures on cognitive, emotional, and behavioral disorders in children from the website http://www.mentalhealth.org and found that all were written well above the recommended level (King et al., 2003). Singh et al. reported that materials for parents of children with ADHD also exceeded the recommended level, concluding that healthcare materials should be written in a way that the target audience can easily read and understand (Singh, 1995). A study of 74 patient education materials by the American Academy of Pediatrics found that more than half were above the recommended readability level. The authors suggested that professional organizations should conduct readability assessments and publish readability levels for each material, enabling healthcare providers to determine whether the material is suitable for their patients (Freda, 2005). Ballonoff Suleiman et al. evaluated materials designed to support parents in sexual health communication with their children and adolescents, finding that most had scores exceeding the comprehension levels of many parents, which emphasizes the need for improvement (Ballonoff Suleiman et al., 2016). Similarly, Dickerson and Sajeesh Kumar showed that online resources on childhood depression exceeded the recommended readability level by a wide margin (Dickerson & Sajeesh Kumar, 2016). Together, these studies suggest that patient education materials in child and adolescent psychiatry frequently exceed recommended readability standards, consistent with our findings.

Similar to findings in child and adolescent psychiatry, studies in otolaryngology, orthopedics, neurology, ophthalmology, and radiology have also shown that the readability of patient education materials is above the recommended standards (Duymaz et al., 2023; Ghanem et al., 2024; Hansberry et al., 2014; Huang et al., 2015; Sharma et al., 2014).

Parents of children with autism spectrum disorder (ASD) need to have access to accurate and understandable information about their child's condition to make informed decisions and seek appropriate resources. However, both our study and previous research show that online patient education materials often exceed the recommended sixth-grade level. Since many parents are not familiar with medical terminology, they may struggle with texts written in complex academic language. This can lead to misinterpretation, misinformation, and poor decision-making. For parents searching for information on complex developmental disorders such as autism, access to reliable and clear resources is even more critical. Therefore, the readability of online patient education materials must

match the comprehension levels of patients and their caregivers. In this regard, healthcare professionals carry significant responsibility.

Relying solely on readability scores is insufficient when evaluating the suitability of a website for patient education. These scores are not exact measures of comprehension; instead, they provide approximate estimates of comprehension. Shorter sentences and simpler words do not necessarily guarantee that patients will understand or remember the content better. Other factors, such as grammar, syntax, page layout, graphics, videos, and audio elements, strongly influence the reading experience and information processing. For example, analyses of health-related videos on platforms such as YouTube have shown that the emotional framing of messages significantly shapes how audiences perceive and react to the content (Duğan, 2024). Readability scores also do not reflect the scientific accuracy or overall quality of the content. Moreover, analyses of health-related news reports have demonstrated that biased or unbalanced presentation can shape public perception, further emphasizing the need for both linguistic simplicity and content accuracy in patient education materials. (Yegen et al., 2025). Therefore, a high readability score alone does not ensure that the material provides reliable and accurate information. In addition, individual differences such as attention level and reading speed in children can substantially influence how texts are actually processed and understood, indicating that readability scores should always be interpreted with caution. (Kumrulu & Bal, 2024).

Limitations

This study had several limitations. First, only readability scores were assessed, and the scientific accuracy, quality, and timeliness of the websites were not evaluated. Second, the search terms, such as 'autism,' 'atypical autism,' 'Asperger syndrome,' 'pervasive developmental disorder,' and 'autism spectrum disorder,' included medical terminology. The frequent use of these technical terms may have inflated readability scores and exaggerated the difficulty of the texts. Third, the evaluation did not consider the overall quality of the websites, and only the top 50 sites per search term that met the inclusion criteria were analyzed. Fourth, the study was limited to materials published in English, so that no conclusions can be drawn about resources in other languages. Fifth, only the Google search engine was used, and materials from other search engines or social media platforms were not included. In addition, although readability tools provide objective metrics based solely on text, this study did not evaluate the potential impact of graphics, visuals, videos, interactive features, or page layout on readability. Finally, the research was conducted within a specific timeframe. Since website content can change over time, future studies should adopt a more dynamic design that accounts for long-term variations.

Conclusion

This study found that the readability levels of online patient education materials on autism exceed the recommended standards. To help parents better understand these resources, the content should be simplified and made more accessible. Healthcare professionals and content developers are encouraged to use more precise language and apply strategies that promote health literacy, thereby

improving the comprehensibility of patient education materials.

Future research should not only evaluate readability but also examine the accuracy and scientific reliability of the content, including resources published in other languages, and explore their impact on health literacy. Producing more accessible and comprehensible patient education materials will enable individuals with autism and their families to engage more effectively and with greater confidence with healthcare services.

Declaration

Ethical Approval and Consent to Participate
As this study analyzed only publicly available online materials and did not involve human participants or personal data, ethics committee approval was not required.

Publication Permission
Not applicable.

Availability of Data and Materials
Not applicable.

Conflict of Interest
The authors declare that they have no conflict of interest.

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Author Contributions
PA made substantial contributions to the writing of the introduction, methods, discussion sections, and abstract. She also contributed to the overall writing and proofreading of the manuscript. OK contributed to the analysis and interpretation of the research data, as well as to the overall writing and proofreading of the manuscript. All authors have read and approved the final version of the manuscript.

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