



## ARAŞTIRMA / RESEARCH

# Assessment of the readability of internet-based patient educational materials on acute rheumatic fever

Akut romatizmal ateşte internet tabanlı hasta eğitim materyallerinin okunabilirliğinin değerlendirilmesi

Derya Arslan<sup>1</sup>, Betül Kozanhan<sup>2</sup>, Mahmut Sami Tutar<sup>3</sup>

<sup>1</sup>University of Health Sciences, Konya Training and Research Hospital, Department of Pediatric Cardiology, <sup>2</sup>Department of Anesthesiology and Reanimation Clinic, Konya, Turkey

<sup>3</sup>Konya Numune Hospital, Department of Anesthesiology and Reanimation Clinic, Konya, Turkey

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### Abstract

**Purpose:** The purpose of this study is to assess the readability of acute rheumatic fever-related Internet-based patient education materials.

**Materials and Methods:** A total of 250 websites assessed, 50 for each of the keywords ("acute rheumatic fever," "acute joint rheumatism", "rheumatic fever", "acute rheumatic carditis", "rheumatic carditis") on search engine Google (available at www.google.com). Sites with less information than ten sentences, chat, forum and commercial blog sites were excluded from the study. Average word count, average syllable number and words with an average syllable number of 4 and above were calculated. The average readability level was analyzed using Ateşman and Bezirci-Yılmaz readability formulas.

**Results:** A total of 50 out of 250 websites were eligible for examination after the applying of the exclusion criteria. Of the sites reviewed, 33 created by health-care professionals and the 17 by non-health-care professionals. The readability of the web sites was moderate difficulty according to the Ateşman formula, and comprehensible to people at undergraduate level according to the Bezirci-Yılmaz formula.

**Conclusion:** The readability level of patient educational texts related to acute rheumatic fever field on web sites was at academic literacy level. This information would be difficult to understand by the average education level in the Turkey.

**Keywords:** Acute rheumatic fever, child, internet, web sites, readability level

### Öz

**Amaç:** Bu çalışmanın amacı akut romatizmal ateşle ilişkili internet tabanlı hasta eğitim materyallerinin okunabilirliğini değerlendirmektir.

**Gereç ve Yöntem:** Herbir anahtar kelime ("akut romatizmal ateş", "akut eklem romatizması", "romatizmal ateş", "akut romatizmal kardit", "romatizmal kardit") için Google arama motorunda (www.google.com) 50 site olmak üzere toplam 250 web sitesi değerlendirildi. On cümleden daha az bilgi içeren siteler, sohbet, forum ve ticari blog siteleri çalışma dışı bırakıldı. Ortalama kelime sayısı, ortalama hece sayısı ve ortalama hece sayısı 4 ve üzerinde olan kelimeler hesaplanmıştır. Ortalama okunabilirlik seviyesi Ateşman ve Bezirci-Yılmaz okunabilirlik formülleri kullanılarak analiz edilmiştir.

**Bulgular:** Hariç tutma ölçütleri uygulandıktan sonra 250 web sitesinin toplam 50'si araştırma için uygun bulundu. İncelenen sitelerden 33'ü sağlık uzmanları ve 17'si sağlık personeli olmayan kişiler tarafından oluşturulmuştur. Ateşman formülüne göre web sitelerinin okunabilirliği orta derecede zor, Bezirci-Yılmaz formülüne göre lisans düzeyinde insanlar tarafından anlaşılabilir bulunmuştur.

**Sonuç:** Web sitelerindeki akut romatizmal ateş alanıyla ilgili hasta eğitimi metinlerinin okunabilirlik seviyesinin akademik okuryazarlık düzeyinde olduğu belirlenmiş ve bu bilgilerin Türkiye'deki ortalama eğitim düzeyi ile anlaşılması güç olacağı düşünülmektedir.

**Anahtar kelimeler:** Akut romatizmal ateş, çocuk, internet, web siteleri, okunabilirlik seviyesi

Yazışma Adresi/Address for Correspondence: Dr. Derya Arslan, University of Health Sciences, Konya Training and Research Hospital, Department of Pediatric Cardiology, Konya, Turkey E-mail: aminederya@hotmail.com  
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## INTRODUCTION

Acute rheumatic fever (ARF) remains a serious concern in many low-income countries, although the incidence of the condition has declined in Europe and North America. ARF is caused by an autoimmune response to a throat infection with *Streptococcus pyogenes*. The most important clinical manifestation is cardiac involvement, also termed rheumatic heart disease (RHD). Cardiac injury developing after ARF may trigger RHD; recurrent episodes of ARF may worsen RHD. Treatment efforts are hampered by the lack of accurate data on disease burden and the absence of effective diagnostic, prevention, and treatment methods. Prevention basically relies on the prompt recognition and treatment of streptococcal pharyngitis, and avoidance of recurrent infection by prescription of long-term antibiotics. Appropriate antibiotics prevent ARF if administered no more than 9 days after symptom onset. Recurrent attacks of ARF can have devastating outcomes; regular administration of antibiotics is recommended to prevent re-infection with group A streptococci and the subsequent possibility of ARF development. Secondary penicillin prophylaxis significantly reduces the incidence of RHD<sup>1-3</sup>. However, ensuring high-level patient adherence to secondary prophylaxis over many years is challenging. If patients are to be compliant, they must perceive the medication as necessary, and have a good understanding of the severity of their illness. To reduce mortality and morbidity, patients must be well informed about the disease; this increases compliance with treatment. It is important that the public, and more specifically, patients, have access to understandable patient educational materials (PEMs) pertaining to ARF. Patients with ARF are often seen in the acute setting. During follow-up, family members often search the Internet (an easily available resource). During outpatient follow-up, patients can also access the Internet to obtain PEMs on their condition. The Internet is often the most-used source of health-related information for patients and their relatives<sup>4</sup>.

Given that Internet-based PEMs are often accessed by patients and their relatives in efforts to understand the risks associated with medical and/or surgical interventions, clinicians must ensure that patients are well informed about treatment and follow-up<sup>5</sup>. One study showed that up to 80% of adults in the US search online for health-related information<sup>6</sup>. The

Turkish Statistical Institute has reported that 55.9% of Turks use the Internet, and that 62.1% have sought health-related or medical information online<sup>7</sup>. The Internet plays an increasingly important role in terms of medical information for patients, aiding medical decision making. One report indicated that 56% of those who used the Internet to obtain medical information considered that this information changed their overall approach to the maintenance of personal health or the health of someone in their care<sup>8</sup>. However, much of the health information available online, including materials from hospitals and university-affiliated websites, is written at a level that exceeds average adult reading comprehension<sup>9</sup>. Individuals indeed utilize Internet PEMs to increase their medical knowledge and their understanding of diseases and treatments. However, the readability of Internet-based PEMs on ARF remains to be determined. Our main objective was to assess the readability of Internet-based PEMs related to ARF. In our previous literature review (published in Turkish), we found no prior study that had explored the readability of patient information on ARF. We hypothesized that most PEMs would not meet the currently recommended readability criteria.

## MATERIALS AND METHODS

The University of Health Sciences, Konya Training and Research Hospital Education Planning Board approved the work (decision no. 48929119/774). We used Google (available at [www.google.com](http://www.google.com)) to access 250 websites in February 2019; we searched groups of 50 sites using each of the key phrases “acute rheumatic fever,” “acute joint rheumatism,” “rheumatic fever,” “acute rheumatic carditis,” and “rheumatic carditis” to identify online PEMs discussing ARF-related topics. Texts that contained fewer than 10 sentences; chat sites and commercial blogs; and sites that contained only pictures, tables, and videos were excluded. Articles that were not PEMs were also excluded, as were texts in languages other than Turkish, materials in graphic or table form, and articles with fewer than 30 sentences. All information that met the inclusion criteria was stored as Microsoft Word (Microsoft Corporation, Redmond, WA, USA) files. Additional text that did not pertain to patient education (guidance on Web navigation, copyright notices, disclaimers, author contact details, questionnaires, references, Web uniform resource locators, addresses, and telephone numbers) was deleted to prevent it from

inappropriately affecting readability scores. The average numbers of words and syllables, and the numbers of words with four or more syllables, were calculated manually and entered into Microsoft Office Excel 2016®. To evaluate the readability level of informed consent forms, we used the Ateşman and Bezirci-Yılmaz formulae to transform the data to a computer-readable format<sup>10,11</sup>.

### Measurability measurements

We used the Ateşman and Bezirci-Yılmaz formulae to determine the readability of Turkish informational texts from the included websites<sup>10,11</sup>.

First, the texts were edited in the Microsoft Word environment. Then, the average number of words (average sentence length), average number of syllables (average word length), and number of words with four or more syllables were calculated manually and entered into Excel. The data were then transferred to dedicated software and used to calculate readability values with the Ateşman and Bezirci-Yılmaz formulae<sup>10,11</sup>.

### Ateşman readability formula

The Ateşman Readability Formula, developed by Ateşman in 1997, is the Turkish adaptation of Flesch's Reading Ease Formula<sup>10</sup>. It is based on word and sentence lengths and yields scores of 0–100; higher scores indicate that texts are easier to read and lower scores suggest that texts are difficult to understand (Table 1).

**Table 1. Ateşman readability ranges in Turkish.**

Readability range	Level
90-100	Very easy
70-89	Easy
50-69	Moderately difficult
30-49	Hard
1-29	Very hard

Readability Score =  $198.825 - 40.175 \times (\text{total number of syllables}/\text{total number of words}) - 2.610 \times (\text{total number of words}/\text{total number of sentences})$

### Bezirci-Yılmaz readability formula

The Bezirci-Yılmaz Readability Formula was developed in 2010 and is based on the length of sentences, the number of syllables in words, and the statistical features of the Turkish language.<sup>11</sup> The number of syllables in words is calculated by multiplying the word numbers by unique parameters; the readability level is formulated as follows:

- $\sqrt{(\text{ANW} \times ((\text{H3} \times 0.84) + (\text{H4} \times 1.5) + (\text{H5} \times 3.5) + (\text{H6} \times 26.25)))}$
- ANW: average number of words
- H3: average number of three-syllable words
- H4: average number of four-syllable words
- H5: average number of five-syllable words
- H6: average number of words with six or more syllables.

According to this formula, readability declines as the length of sentences increases. Moreover, an increase in the number of syllables in words renders it difficult to read those words and thus, indirectly, sentences containing the words. The formula evaluates sentence lengths in texts and the numbers of syllables in words and was developed in 2010 based on the characteristics of earlier formulae and the statistical features of the Turkish language. The number of syllables in words is calculated by multiplying them by corresponding parameters.

According to this formula, an increase in sentence length reduces the readability of a text. In the same way, an increase in the number of syllables in words renders those words, and the sentences containing them, difficult to read. The formula is used to grade texts by reference to the educational levels of Turkey: 1–8 = primary school, 9–12 = secondary (high) school, 12–16 = undergraduate education, and >16 = postgraduate education.

### Text content evaluation

The explanatory information content of texts obtained using the key phrases was evaluated.

Criteria used:

1. Ethology: information on the microorganism causing the disease (*Streptococcus pyogenes* or Group A  $\beta$ -hemolytic *Streptococcus*) and the importance of treatment;
2. Pathogenesis: how does ARF develop and is ARF contagious?;
3. Clinical Information: main symptoms and signs: arthritis, carditis, Sydenham chorea, arthralgia, subcutaneous nodules, erythema marginatum;
4. Laboratory Information: useful tests and the findings thereof;
5. Previous Treatments: steroids, NSAIDs;
6. Side Effects: side effects of drugs used as primary therapies;
7. Secondary Protection: what is this, and how long should it endure?;

8. Daily Life: does the disease affect the daily life of the child and the family?;
9. Long-Term Course: what is to be expected in the long term?.

### Statistical analysis

We used SPSS® ver. 21 software (IBM Inc., USA) for data analysis. The normality of data distribution was checked using the Shapiro–Wilk test. Descriptive

statistics are presented as frequencies with percentages. Numerical data are shown as means with standard deviations. The independent-samples *t*-test was used to compare variables that were distributed normally, and the Mann–Whitney *U*-test was employed otherwise. All statistical analyses featured the formulation of two-way hypotheses with 5% significance thresholds and 95% confidence intervals.

**Table 2. Readability values and statistical analysis of informative texts about ARF((**

(Mean±Std. Err.)	All Sites(n=50)	Health Professionals (n=33)	Non-health Professionals (n=17)	P value
Ateşman Readability <sup>2</sup>	50.75±1.44	52.54±1.72	47.27±2.44	0.08
Bezirci-Yilmaz Readability <sup>2</sup>	12.48±0.47	12.15±0.53	13.11±0.92	0.34
Mean number of syllables <sup>1</sup>	3.43±0.54	2.85±0.02	4.55±1.59	0.005
Mean number of words <sup>2</sup>	12.02±0.46	12.21±0.52	11.65±0.91	0.57
Mean number of words with four and above syllables <sup>2</sup>	3.97±0.16	3.77±0.18	4.34±0.32	0.09

<sup>1</sup>Mann-Whitney U test; <sup>2</sup>Independent two samples t-test were performed

**Table3. Content analysis of informational texts related to ARF**

Content* n (%)	No content/ Content	All Sites (n=50)	Health Professionals (n=33)	Non-health Professionals (n=17)	P value
Etiology	no	14 (28)	4 (12.1)	10 (58.8)	<b>0.01</b>
	there is	36 (72)	29 (87.9)	7 (41.2)	
Pathology	no	3 (6)	2 (6.1)	1 (5.9)	0.98
	there is	47 (94)	31 (93.9)	16 (94.1)	
Clinic	no	21 (42)	10 (30.3)	11 (64.7)	<b>0.02</b>
	there is	29 (58)	23 (69.7)	6 (35.3)	
Laboratory	no	33 (66)	18 (54.5)	15 (88.2)	<b>0.02</b>
	there is	17 (34)	15 (45.5)	2 (21.8)	
Primary treatment	no	31 (62)	17 (51.5)	14 (82.4)	<b>0.03</b>
	there is	19 (38)	16 (48.5)	3 (17.6)	
Primary treatment side effects	no	34 (68)	19 (57.6)	15 (88.2)	<b>0.03</b>
	there is	16 (32)	14 (42.4)	2 (21.8)	
Secondary prophylaxis	no	28 (56)	14 (42.4)	14 (82.4)	<b>0.01</b>
	there is	22 (44)	19 (57.6)	3 (17.6)	
Daily life	no	33 (66)	19 (57.6)	14 (82.4)	0.08
	there is	17 (34)	14 (42.4)	3 (17.6)	
Possible looking	no	35 (70)	20 (60.6)	15 (88.2)	<b>0.04</b>
	there is	15 (30)	13 (39.4)	2 (21.8)	

\* chi-square test

## RESULTS

We used Google (available at [www.google.com](http://www.google.com)) to access 250 websites in February 2019; we searched groups of 50 sites using each of the key phrases “acute rheumatic fever,” “acute joint rheumatism,” “rheumatic fever,” “acute rheumatic carditis,” and “rheumatic carditis.” Fifty of the 250 websites were eligible for inclusion after application of the exclusion

criteria. Of these sites, 33 were created by healthcare professionals and 17 were created by others. The mean readability scores derived using the Ateşman and Bezirci-Yilmaz formulae, the average numbers of words and syllables, and the average numbers of words with four or more syllables are shown in Table 2.

The mean readability scores were  $52.54 \pm 1.72$  for sites prepared by healthcare professionals and  $47.27$

$\pm 2.44$  for sites prepared by non-health professionals. These values correspond to “moderately difficult” and “difficult,” respectively; the difference between groups was not significant. The mean Bezirci-Yılmaz readability scores were  $12.15 \pm 0.53$  for sites prepared by healthcare professionals and  $13.11 \pm 0.92$  for sites prepared by others. Both of these values correspond to the “undergraduate level” according to the Bezirci-Yılmaz formula. The average number of words and the number of words with four or more syllables were significantly greater in texts from websites created by non-healthcare professionals than in those from websites created by healthcare professionals ( $p = 0.005$  and  $p = 0.09$ , respectively). Articles by healthcare professionals contained more relevant information (Table 3).

## DISCUSSION

We found that the PEM readability level far exceeded the current recommendation of the Ateşman and Bezirci formulae<sup>10,11</sup>. The readability level of informed consent forms for ARF treatment was moderately difficult. According to the Bezirci classification, the readability level was “undergraduate.” Our most important finding is that an undergraduate level of education was required to read most currently available PEMs on ARF disseminated easily found Web sites. Our findings are important because the Internet is currently the most commonly used patient education resource in Turkey and, indeed, worldwide. With the use of Internet PEMs, it is important to ensure that informed consent is indeed informed. Patient misunderstanding of Internet content can lead to significant confusion<sup>5,12</sup>.

The concept of readability emerged in the United States in the early 1800s, and refers to the suitability of written text (in any language) relative to the readers’ educational level.<sup>13</sup> The determination of text difficulty is based principally on the numbers of syllables and words. The average American has a readability level between grades 7 and 8, corresponding to “average difficulty” and a Flesch Reading Ease Score of roughly “standard” to “fairly difficult”<sup>14,15</sup>.

Many different formulae have been used to calculate readability. Each language has unique word and sentence structures. Turkish is an agglutinative language; the numbers of letters and syllables in words can be high, and a meaning that can be

imparted by a word in Turkish sometimes requires an entire sentence in another language. The use of formulae employed to evaluate languages other than Turkish for the assessment of Turkish text would be inappropriate. Therefore, we used the Ateşman and Bezirci-Yılmaz formulae to determine the readability of Turkish texts. The average Turkish sentence lengths are 9–10 words in the Ateşman formula and 10–11 words in the Bezirci-Yılmaz formula. Words contain a mean of 2.6 syllables in both formulae<sup>10,11</sup>.

About 75% of American adults can read at the sixth-grade level without difficulty<sup>16</sup>. The ability to understand, interpret, and adapt health information accessed via the Internet reflects the level of health literacy. According to the latest data from the Turkish Statistical Institute (TUIK, 2016), 5% of individuals aged  $\geq 25$  years in Turkey are illiterate, but 16% are university graduates<sup>17</sup>. However, a 2014 study determined that the general health literacy index of Turkey was 30.4%, and that 64.6% of the adult population thus lacked adequate health literacy<sup>18</sup>. In Turkey and worldwide, website disclosure forms often lack clarity and readability, and their comprehension requires significant education<sup>19-21</sup>. Half of all patients leave the offices of doctors without adequate understanding of their disease or treatment plan<sup>22</sup>. The number of patients per doctor may be excessive in Turkey, reducing the time the doctor allocates to each patient. In December 2013, the number of physicians per 100,000 people in the EU was 346, the WHO European Region average was 334, and the number for Turkey was 171, essentially the 172 in 2001. The Turkish number is thus about half the EU average<sup>23</sup>. The Internet is currently the most commonly employed resource for patient education in the United States and Turkey; the use of Internet PEMs helps to ensure that informed consent is real<sup>5,7</sup>. Although Internet use is high, health literacy may be low. In 2014, two-thirds of the Turkish population lacked adequate health literacy<sup>18,24</sup> and thus the ability to understand medical information and fulfill medical instructions, which compromises the effective use of health services. In addition, the readability of Internet content is poor; misunderstanding can cause significant confusion. We found that the readability of information forms prepared by healthcare professionals and others was very insufficient, but that the former texts had comprehensive content. However, in agreement with the findings of earlier studies in various fields of medical science, we found that the poor readability of Internet-based PEMs compromises patient

comprehension, reducing the extent to which patients trust healthcare-related Internet sources<sup>25,26</sup>.

As the limitation of our study, the content of online PEMs on ARF far exceeds current readability recommendations, and is thus not accessible to the millions of Turkish people who exhibit limited health literacy. This problem is compounded by authors' tendency to overestimate the literacy of patients and their relatives.

As a conclusion This study is the first to analyze the readability levels of websites on ARF. Using the Ateşman formula, we found that the average readability level was "moderately difficult." Employing the Bezirci criterion, we found that the readability level was "undergraduate." As the Internet is currently the most commonly used source of information for patients who must make medical decisions, redesigning the content of websites providing PEMs on ARF is a first step that will enable health-illiterate patients to make informed decisions. Improvements in readability would enhance understanding of the risks and benefits of ARF treatments contemplated by millions of Turkish patients. Online interrogators want material that is easy to understand; patient-directed medical information must be rewritten at a more understandable level. However, we found no study on ARF in the literature. As ARF is common in Turkey, and as it causes serious complications, it is important to increase the readability of associated PEMs. However, text content is also very important. Our current study has several limitations. Text quality and variability could not be evaluated because Turkish Internet sites are not subject to quality control.

**Yazar Katkıları:** Çalışma konsepti/Tasarımı: DA, BK, MST; Veri toplama: DA, BK, MST; Veri analizi ve yorumlama: DA, BK, MST; Yazı taslağı: DA, BK, MST; İçeriğin eleştirel incelenmesi: DA, BK, MST; Son onay ve sorumluluk: DA, BK, MST; Teknik ve malzeme desteği: DA, BK, MST; Süpervizyon: DA, BK, MST; Fon sağlama (mevcut ise): yok.  
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