Readability
of the ACR-Endorsed Patient Education
Platform
Radiologyinfo.org
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No disclosures.
Purpose

Health care literacy directly impacts patient outcomes and gives patients autonomy over their care. Without proper information, patients cannot make educated decisions about their health.

The average American reads at a 7th or 8th grade reading level. However, the average healthcare literature is written at a 10th grade level (or higher).

Per the ACR website in 2017, radiologyinfo.org served over ONE MILLION visitors per month.

For these reasons and more, we decided to review the readability of our ACR and RSNA sponsored patient information website.
METHODS

Every discrete page on Radiologyinfo.org was analyzed
Duplicate pages were excluded

Total: 217

Extracted data included
- Number of characters per discrete page
- Number of words per discrete page
- Number of sentences per discrete page
- Average number of syllables per word
- Average number of words per sentence
- Date of last update
METHODS

Analysis with SIX measures of readability

Gunning Fox Index
Coleman-Liau Index
Flesch Kincaid Grade Level
Flesch Reading Ease Score
Automated Readability Index
Simple Measure of Gobbledygook
# Measures of Readability

<table>
<thead>
<tr>
<th>Readability Tool</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gunning Fog Index</td>
<td>$0.4 \left[ \frac{\text{Words}}{\text{Sentences}} + 100 \left( \frac{\text{Complex Words}}{\text{Words}} \right) \right]$</td>
</tr>
</tbody>
</table>
| Coleman-Liau Index                   | $(0.0588 \times L) - (0.296 \times S) - 15.8$  

$L$ is average number of letters per 100 words. $S$ is average number of sentences per 100 words. |
| Flesch Kincaid Grade Level           | $0.38 \left( \frac{\text{Total Words}}{\text{Total Sentences}} \right) + 11.8 \left( \frac{\text{Total Syllables}}{\text{Total Words}} \right) - 15.59$ |
| Flesch Reading Ease Score            | $206.835 - (1.1015 \times \text{Average sentence length}) - (84.6 \times \text{Average number of syllables per word})$ |
| Automated Readability Index          | $4.71 \left[ \left( \frac{\text{Characters}}{\text{Words}} \right) + 0.5 \left( \frac{\text{Words}}{\text{Sentences}} \right) \right] - 21.43$ |
| Simple Measure of Gobbledygook       | $1.0430 \sqrt{\frac{\# \text{Polysyllables} \times 30}{\text{Number of Sentences}}} + 3.1291$ |
WHAT DO THOSE MEAN?

# of Years of Formal US Education Required to understand the Reading Material

Coleman-Liau Index
Flesch Kincaid Grade Level
Automated Readability Index
Simple Measure of Gobbledygook

Flesch Reading Ease

Overall Complexity of the material, where higher mean decreasing complexity. For example, 0-30 indicates a college level. 90-100 is fifth grade level.

Average US Grade Level achieved to understand the reading material
### RESULTS

<table>
<thead>
<tr>
<th>Variable</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of characters (without spaces):</td>
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<td>25,328</td>
<td>12,098</td>
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<tr>
<td>Number of words:</td>
<td>559</td>
<td>5,095</td>
<td>2.384</td>
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<tr>
<td>Number of sentences:</td>
<td>41</td>
<td>258</td>
<td>133.6</td>
</tr>
<tr>
<td>Average number of characters per word:</td>
<td>4.8</td>
<td>5.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Average number of syllables per word:</td>
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<td>2.1</td>
<td>1.8</td>
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<tr>
<td>Average number of words per sentence:</td>
<td>13.6</td>
<td>23.7</td>
<td>17.8</td>
</tr>
</tbody>
</table>
## RESULTS

<table>
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<tr>
<th>Readability Tool</th>
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<th>Upper Limit</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gunning Fog Index</td>
<td>11.9</td>
<td>19.3</td>
<td>14.4</td>
</tr>
<tr>
<td>Coleman-Liau Index</td>
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<td>12.6</td>
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<tr>
<td>Flesch Kincaid Grade Level</td>
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<td>17.1</td>
<td>12.6</td>
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<tr>
<td>Automated Readability Index</td>
<td>8.8</td>
<td>16.7</td>
<td>11.5</td>
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<tr>
<td>Simple Measure of Gobbledygook</td>
<td>12.2</td>
<td>17.5</td>
<td>14.1</td>
</tr>
<tr>
<td>Flesch Reading Ease</td>
<td>9.2</td>
<td>51.3</td>
<td>36.5</td>
</tr>
</tbody>
</table>
Table 1:
Grade Level of Patient Educational Materials From Radiology.org
CONCLUSIONS

Radiologyinfo.org is at a reading level that is too high per the recommended guidelines, even though most (97%) pages were updated in the last 2 years.

By improving readability, we can improve patient understanding, which can translate into improved patient satisfaction.

Further, patients can understand our role as radiologists in their overall clinical care.
WAYS TO IMPROVE READABILITY

- Decrease syllable count per word, which may mean substituting complex words with more simple terminology.
- Emphasize only one major point or topic at a time.
- Decrease total words per sentence.
- Be consistent with your terminology. For example, "contrast", "dye", "iodinated contrast", "contrast material" all have a similar meaning. Remain consistent throughout your work.
- In radiology, using long words can be inevitable. Explaining them and providing a pronunciation guide can help with comprehension of the material.
- Use the word "you" instead of "the patient". I.E., speak in the first person.
REFERENCES


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