Readability tools: are they useful for medical writers?

John Dixon

MedComms Networking Event, 4th October, 2017
www.MedCommsNetworking.com
As I sincerely aspire to successfully secure employment within the boundaries of this establishment, do you presuppose that I possess the necessary competencies to achieve this inspirational objective?
Readability: definition

…“extent to which…[readers]…understand…[text]…, read it at an optimum speed, and find it interesting.”¹

…“the ease of…comprehension due to the style of writing”²

…“ease of reading words and sentences”³

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Readability: why is it important?

Delivering readable text means your writing will:

- Have greater impact
- Be understood more easily
- Help to increase the chance articles are published


Four major elements of readability

- 800 adults tested on range of material (books, magazines, newspapers)
- Of 228 elements affecting readability, 4 major elements were identified

We can measure style

Readability

Style

Vocabulary

Sentences

Content

Concept difficulty

Idea density

Idea flow

Design

Typography

Columns, lines

Illustrations

White space

Organisation

Sections

Chapters

Headings

Paragraphs

Two common formulas

- **Flesch reading ease** (‘reading ease’)
- **Flesch–Kincaid grade level** (education ‘grade level’)

**Measure:**
- Average words per sentence
- Average syllables per word

**Used by:**
- Microsoft Word and other tools to provide readability statistics
Flesch reading ease formula

\[
\text{Flesch reading ease} = 206.835 \cdot (\text{average words per sentence}) - 1.015 \cdot (\text{average syllables per word}) - 84.6
\]

Readability stats in Microsoft Word

**PC:** File / Options / Proofing / Spelling and Grammar

**Mac:** Word / Word Preferences / Spelling and Grammar

When correcting spelling and grammar in Word

- Check grammar with spelling
- Show readability statistics
To improve and maximise both clinical and cost efficiency, patients with selected medical problems traditionally seen by doctors in secondary care could frequently be managed by the UK National Health Service (NHS) in primary care. A general medical practitioner with special interest (GPwSI) possesses the capability to manage some patient referrals with certain conditions in a general practice setting rather than the same work being undertaken by a consultant-led team in a hospital outpatient department (OPD). This paper documents an innovative new service model, supported by findings from an ear, nose and throat (ENT) clinic, instigated to manage a limited range of ENT conditions, and set up and run by a GPwSI in a general practice setting during an 18-month pilot study commencing April 2001. The aims of the investigation were to evaluate the clinical efficiency of the service, which is defined as the proportion of patients successfully managed without subsequent referral to secondary care, and the cost efficiency of the service, this defined as the amount saved per new patient referred. Further, a number of other service parameters were established, including pattern of referral, time taken to full capacity, mean delay to first appointment, attendance rate and overall patient satisfaction.
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Readability stats in Microsoft Word

- **Words per sentence**
- **Flesch reading ease**
- **Flesch–Kincaid grade level**
- **Passive sentences %**
### Two common formulas

<table>
<thead>
<tr>
<th>Formula</th>
<th>Output range</th>
<th>Units</th>
<th>Very easy reading</th>
<th>Very difficult reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flesch reading ease</td>
<td>100 to 0</td>
<td>—</td>
<td>90–100</td>
<td>0–29</td>
</tr>
<tr>
<td>Flesch–Kincaid grade level</td>
<td>5 to &gt; 16</td>
<td>Education grade</td>
<td>5</td>
<td>&gt; 16</td>
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</tbody>
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# Formulas: interpretation

<table>
<thead>
<tr>
<th>Flesch reading ease</th>
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<th>Interpretation</th>
<th>Age</th>
<th>Educational institution</th>
<th>Examples</th>
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<td>14</td>
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<td>Reader’s Digest, The Sun</td>
<td>17</td>
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<tr>
<td>50–60</td>
<td>10</td>
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<td>21</td>
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- **Recommended grade level for patient education material is 6th grade**

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- Average adult reading level is 9th grade

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Formulas ignore grammatical issues

The quick brown fox jumps over the lazy dog.

9 words: FRE = 94.3; F–K grade level = 2.3

Jumps the quick brown fox over dog the lazy.

9 words: FRE = 94.3; F–K grade level = 2.3
Readability of biomedical journals

- Readability formulas were **not** primarily developed to measure the readability of scientific research articles
- So we need to appreciate what biomedical research articles score when using readability formulas
Readability of biomedical journals

- Flesch reading ease range: 15–32
- Flesch–Kincaid grade level range: 16–19

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<td>Biomedical journals</td>
<td>&gt; 29</td>
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Readability of biomedical journals

Hall (2006):

“Original articles published in surgical journals contain too many long sentences and complex words. Readability indices are useful tools because they promote the use of simple English. It is realistic for authors to aim for Flesch scores [reading ease] above 30 when creating manuscripts.”
Formulas count everything!

Formulas will also count:

- Author–date citations
  
  (Smith and Jones, 2017) = 4 words

- Text and numbers in tables, graphs and reference lists

- Numbers used in body text, including statistics

- Equations
Four major elements of readability

Readability: writer and reader factors

Readability: writer and reader factors

Vocabulary issues

- Specialised, technical vocabulary may “artificially increase the number of ‘hard’ words”¹
- Word familiarity is more important than word length²

So, when editing biomedical text, simplify:

- Particularly long sentences
- Long/difficult, non-technical words

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Formula-derived statistics: pros

- Objective and quantifiable measure of style
- Rapid results via software/tools
- Can predict comprehension and inclination to read on
- Reader input not needed
- Can help writers improve simplicity of text
- Can be used as a “warning” tool

Formula-derived statistics: cons

- Can’t measure:
  - quality of grammar
  - content, format and organisation
  - reader factors: interest, reading skill, prior knowledge, motivation
  - audience understanding – particularly for specialised audience

- Writing ‘to the formula’ may not improve readability

- Variation between formula results

Online readability tools: scope

Provide readability statistics:
- Calculate scores from a range of formulas
- Calculate average readability score

Highlight difficult text (a visual analysis):
- Long/difficult sentences
- Long/difficult words¹
- Words that could be simplified²
- Use of passive voice
- Adverbs

1. Readable.IO. Available from: https://readable.io
Scientific research articles are difficult to read. This is because scientists write using complex sentences and long words. Yet, it can take courage to write really clear, simple text. Many scientists failed to learn how to write using readable text. Academic writers remain fond of the passive voice. They smother verbs and nominalise them into nouns, separate the subject from the verb and put lists in the middle of sentences. They embed multiple dependent clauses into sentences. So, what a joy it is to find a research article that is easy to read! Of the many roles of a medical writer, writing and editing research text is one of the key challenges. So, we explore ‘readability’ and concentrate on how formulas, formula-derived statistics and other readability tools can help writers edit such material, with a particular emphasis on practical work and work on real examples. The workshop has four objectives. (1) Participants should know what makes a document readable. (2) Participants will know what formulas measure and what the statistics mean. (3) We identify the pros and cons and of readability formulas. (4) Online tools will be explored to help edit scientific research articles.
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Readability Rating

To improve your readability, try using shorter sentences and simpler words where possible.

Readability Grade Levels

- Flesch-Kincaid Grade Level: 21.4
- Gunning Fog Index: 25.6
- Coleman-Liau Index: 15
- SMOG Index: 21
- Automated Readability Index: 21.9
- Average Grade Level: 21.4

Readability Scores

<table>
<thead>
<tr>
<th>Readability Formula</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flesch Reading Ease</td>
<td>13.1</td>
</tr>
<tr>
<td>Spache Score</td>
<td>8.6</td>
</tr>
<tr>
<td>New Dale-Chall Score</td>
<td>8.2</td>
</tr>
</tbody>
</table>

Text Quality

<table>
<thead>
<tr>
<th>Text Quality</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentences &gt; 30 Syllables</td>
<td>5</td>
</tr>
<tr>
<td>Sentences &gt; 20 Syllables</td>
<td>5</td>
</tr>
<tr>
<td>Words &gt; 4 Syllables</td>
<td>3</td>
</tr>
<tr>
<td>Words &gt; 12 Letters</td>
<td>2</td>
</tr>
<tr>
<td>Passive Voice Count</td>
<td>4</td>
</tr>
<tr>
<td>Adverb Count</td>
<td>4</td>
</tr>
</tbody>
</table>
Screening text for readability

Readability statistics and tools can be used to screen any text you have edited:

- Biomedical research articles
- Patient education material
- Training material
- Website text
- Blogs…
From a completed draft, it’s best to remove:

- Author–date citations
- Tables, graphs and reference list
- Equations
### Screening biomedical research text

- **In MS Word, use the Readability Statistics tool to establish:**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flesch Reading Ease</td>
<td>low values e.g. &lt; 20 suggest readability could be improved</td>
</tr>
<tr>
<td>Flesch–Kincaid Grade Level</td>
<td>high values, e.g. &gt; 16 suggest readability could be improved</td>
</tr>
<tr>
<td>Average words per sentence</td>
<td>if approaching 30, some sentences could be too long</td>
</tr>
<tr>
<td>Passive sentences %</td>
<td>if &gt; 40%, consider rewriting some in the active voice</td>
</tr>
</tbody>
</table>


Screening biomedical research text

- Try other readability tools to highlight:

<table>
<thead>
<tr>
<th>Problem sentences</th>
<th>consider simplifying long, complex sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long words</td>
<td>is a shorter alternative available/appropriate?</td>
</tr>
<tr>
<td>Passive voice</td>
<td>consider rewriting in the active voice, if appropriate</td>
</tr>
<tr>
<td>Adverbs</td>
<td>needed?</td>
</tr>
</tbody>
</table>
Conclusions

- Readability formulas usually measure average sentence length and word difficulty
- Other tools can identify long sentences, long words, difficult words, use of passive voice and adverbs
- Readability tools can be used to screen biomedical research articles and any other written material – to help editors improve readability

BUT

- Use other well-documented advice to help improve readability!


Gudex, C. & Pedersen, J. 2017. Can you recognise the four main ways that English sentences can be structured? *Medical Writing*, 26, 30-34.


Lang, T. 2017. How to shorten a text by up to 30% and improve clarity without losing information. *Medical Writing*, 26, 21-25.


Thank you

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