Data Article

Knee osteotomy: Quality tools and readability data of information on the internet

James M. Broderick*, Andrea McCarthy, Niall Hogan

Department of Trauma & Orthopaedics, St. James’s Hospital, James’s Street, Dublin D08 NY1, Ireland

A R T I C L E   I N F O

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A B S T R A C T

Supplementary data for the article Osteotomy around the Knee: Assessment of Quality, Content and Readability of Online Information is provided. 45 unique websites were evaluated. The DISCERN score, JAMA (Journal of the American Medical Association) benchmark criteria and HONcode (Health On the Net) criteria are provided for reference. Readability of online information was analysed with Readability Studio Professional Edition, Version 2019 (Oleander Software Ltd.). The software assessed readability using eight different instruments: Flesch-Kincaid Reading Grade Level (FKGL), Flesch Reading Ease Score (FRES), Raygor Estimate, SMOG, Coleman-Liau, Fry, FORCAST and Gunning Fog. Data is also provided on the percentage of complex words, long words, Dale-Chall unfamiliar words, Fog words, as well as the number of ‘wordy’ items, overly long sentences and longest sentence length.

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* Corresponding author.
E-mail address: jamesbrod@gmail.com (J.M. Broderick).

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Specifications Table

| Subject                      | Health and medical sciences                  |
|------------------------------|---------------------------------------------|
| Specific subject area        | Osteotomy around the knee                    |
| Type of data                 | Appendix (1)                                 |
|                              | Table (3)                                    |
|                              | Figure (1)                                   |
|                              | Raw Data Document (1)                        |
| How data were acquired       | Primary data was acquired by searching four Internet search engines (Google, Yahoo!, Bing and Ask) with the search terms “high tibial osteotomy” and “knee osteotomy.” Each website’s text was converted into a Microsoft Word document (Microsoft, Redmond, WA). All hyperlinks, pictures, advertisements, copyright notices, and any other text that was not directly related to health information was subsequently removed. Secondary readability data was then acquired by analyzing the re-formatted documents with Readability Studio Professional Edition, Version 2019 (Oleander Software Ltd.). |
| Data format                  | Raw                                          |
|                              | Filtered                                     |
| Parameters for data collection | Online information related to osteotomy around the knee. |
| Description of data collection | Readability of online information related to osteotomy around the knee was analysed with Readability Studio Professional Edition, Version 2019 (Oleander Software Ltd.). |
| Data source location         | Institution: St. James’s University Hospital |
|                              | City: Dublin                                 |
|                              | Country: Ireland                             |
|                              | Primary Data Source:                         |
|                              | The list of unique websites evaluated is provided in Table 1. |
| Data accessibility           | With the article                             |
| Related research article     | Broderick J.M., McCarthy A., Hogan N. Osteotomy around the Knee: Assessment of Quality, Content and Readability of Online Information. The Knee. |

Value of the Data

- Readability, a metric that determines the ease with which text can be read and understood, is a major factor affecting the ability of patients to utilize health information. Readability of information is a key component of health literacy.
- Researchers involved with examining the quality and readability of health information, as well as those tasked with generating patient educational materials, will benefit from this supplemental material. Tools are provided to assess the quality and readability of healthcare information. The ‘wordy’ items list will act as a repository for commonly encountered complex words or phrases, with suggested alternatives, which content creators will be able to cross-reference against.
- Future studies will be required to assess the progress made in providing accurate, high quality and readily comprehensible healthcare information. The supplemental material provided here may be used in designing such studies, and furthermore, will provide baseline readability data against which future studies may compare their findings.

1. Data Description

Appendix A. The DISCERN Instrument, JAMA Benchmark Criteria and HONcode Criteria

A.1. The DISCERN Instrument

The DISCERN Instrument was developed by an expert group in the United Kingdom to allow consumers and information providers assess the quality of written health information. The
DISCERN Handbook ensures all users are able to understand and apply the instrument effectively [1]. 16 questions address clarity, balance, and content of information with each question representing a separate quality criterion. The original tool has 16 questions, each rated on a 5-point scale (1 = definite ‘no’; 2–4 = ‘partially meets criteria’; 5 = definite ‘yes’). The first eight questions relate to the reliability of the publication and seven questions address specific details of the information about treatment choices. The final question is an overall quality rating. Similar to Weil et al. [2], we omitted the final question to obtain a minimum score of 15 and a maximum score of 75. Websites were then classified by their total score as ‘excellent’ (63–75), ‘good’ (51–62), ‘fair’ (39–50), ‘poor’ (27–38) or ‘very poor’ (15–26).

A.2. The Journal of the American Medical Association (JAMA) Benchmark Criteria
The Journal of the American Medical Association (JAMA) benchmark criteria, originally published by Silberg et al. [3], represent four core standards to determine whether a source of information is credible, reasonable or useful: authorship, attribution, currency and disclosure. Authorship requires that the authors and contributors provide their affiliations and credentials. Attribution entails listing of references and sources for all content and indicating any relevant copyright information. Currency refers to the provision of the dates that content was posted and updated. Disclosure ensures that websites have properly demonstrated ‘ownership’ with any sponsorship, advertising, underwriting, commercial funding arrangements or potential conflicts of interest noted. One point is allocated for each core criterion that is met, with a maximum score of 4.

A.3. The HONcode Criteria
The Health on the Net Foundation is a non-profit, non-governmental organization, which seeks to establish ethical standards for publishing medical and health-related information on the internet. The Health On the Net code (HONcode) seal accredits websites that agree to comply with eight core standards (the HONcode Criteria [4]) and publish transparent health-related information.

An Internet search provided the primary data source for assessment. Four search engines (Google, Yahoo!, Bing and Ask) were searched for the terms “high tibial osteotomy” and “knee osteotomy.” Forty websites were analyzed from Google and ten each from Yahoo!, Bing and Ask. Following exclusion criteria and removal of duplicated websites, forty-five unique websites were available for analysis.

Readability of a text is defined as “the determination by systematic formulae of the reading comprehension level a person must have to understand written materials [5].” The scales used in our study include seven reading grade level (RGL) scores (the Flesch-Kincaid Reading Grade Level [FKGL], Raygor Estimate, SMOG, Coleman–Liau, Fry, FORCAST and Gunning Fog) and one index score (the Flesch Reading Ease Score [FRES]). RGL is reported as a United States grade level, which denotes the years of education (based on the U.S. educational system) required to easily read and understand a piece of text. For each website evaluated, the seven RGL tests generated seven RGL scores, as well as a mean RGL. The FRES formula presents readability as an index score, based on sentence length and number of syllables. The score ranges from 0 to 100, with a higher score indicating easier readability.

‘Wordy’ items are either complex words or phrases that contain too many words and therefore require more advanced reading skills. A complete list of all ‘wordy’ items encountered is provided, along with suggested alternatives to improve text readability.

A summary of important linguistic units that influence readability scores is presented (Fig. 2). This provides an ‘at a glance’ overview of key elements analyzed by the readability formulae.

**Readability Raw Data Document.**
Raw data from the readability analysis of the 45 unique websites is provided.
This secondary data is provided as:

- **Readability Scores**
  - Raw scores of each of the 8 readability formulae for each website.
  - Summary scores of each readability formula for all 45 websites.
  - Grade score summary for each website.
  - Cloze score summary for each website.
• Histogram representation of scores for each readability formula for all 45 websites
  o Coleman-Liau
  o New Dall-Chall
  o Flesch Kincaid
  o FRES
  o FORCAST
  o Fry
  o Gunning-Fog
  o Raygor-Estimate
  o SMOG
• Box Plot representation of scores for reading grade level tests
• Words Breakdown
  o Difficult Words
    ■ % of complex works
    ■ % of long sentences
    ■ % of SMOG Hard words
    ■ % of FOG Hard words
    ■ % of Dale-Chall Unfamiliar words
  o All Words
    ■ Individual word count
    ■ Number of websites word appears in
• Sentences Breakdown
  o Long Sentences by website
    ■ Number of overly long sentences
    ■ Longest sentence length
    ■ Longest sentence
• Wordy Items
  o Presented by website

2. Experimental Design, Materials and Methods

Four search engines (Google, Yahoo!, Bing and Ask) were searched for the terms “high tibial osteotomy” and “knee osteotomy.” To reflect the disproportionate use of the search engines [6], we analysed the first 40 websites from Google and 10 each from Yahoo!, Bing and Ask. Searches were performed on April 08, 2020. Websites were excluded from further analysis if duplicate findings were noted between search engines, if the site was inaccessible, if the site was solely for advertisement purposes or if it was in video format. A total of 45 unique websites were analysed (Table 1).

All text from the articles was copied and pasted into separate Microsoft Word documents (Microsoft, Redmond, WA). All hyperlinks, pictures, advertisements, copyright notices, and any other text that was not directly related to health information were removed. Readability of the re-formatted documents was then analyzed with Readability Studio Professional Edition, Version 2019 (Oleander Software Ltd.). All reading grade levels (RGL) were reported as a United States grade level, which denotes the years of education (based on the U.S. educational system) required to easily read and understand a piece of text. We selected eight different instruments to assess readability (Table 2). These included seven RGL tests (Flesch-Kincaid Reading Grade Level [FKGL], Raygor Estimate, SMOG, Coleman- Liau, Fry, FORCAST and Gunning Fog) and one Index Score (the Flesch Reading Ease Score [FRES]). For each website, the seven RGL tests generated seven RGL scores, as well as a mean RGL. The FRES formula calculates the readability of a document, expressed as an index score, based on sentence length and number of syllables. The score ranges from 0 to 100, with higher scores indicating an easier readability. All websites were also analyzed for the percentage of complex words, long words, Dale-Chall unfamiliar words, Fog words, as well as the number of ‘wordy’ items, overly long sentences and longest sentence
Fig. 1. Study design.
### Table 1
List of unique websites evaluated.

| Search Engine | Website |
|---------------|---------|
| Google        | [https://www.hss.edu/conditions_knee-surgery-high-tibial-osteotomy.asp](https://www.hss.edu/conditions_knee-surgery-high-tibial-osteotomy.asp) |
|              | [https://orthoinfo.aaos.org/en/treatment/osteotomy-of-the-knee](https://orthoinfo.aaos.org/en/treatment/osteotomy-of-the-knee) |
|              | [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3374001/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3374001/) |
|              | [https://www.orthobullets.com/recon/3135/high-tibial-osteotomy](https://www.orthobullets.com/recon/3135/high-tibial-osteotomy) |
|              | [https://www.arthritis-health.com/surgery/knee-surgery/knee-osteotomy-surgery](https://www.arthritis-health.com/surgery/knee-surgery/knee-osteotomy-surgery) |
|              | [https://www.mayoclinic.org/tests-procedures/knee-osteotomy/about/pac-20394514](https://www.mayoclinic.org/tests-procedures/knee-osteotomy/about/pac-20394514) |
|              | [https://josr-online.biomedcentral.com/articles/10.1186/s13018-019-1333-4](https://josr-online.biomedcentral.com/articles/10.1186/s13018-019-1333-4) |
|              | [https://www.hindawi.com/journals/jhe/2019/8363128/](https://www.hindawi.com/journals/jhe/2019/8363128/) |
|              | [https://tocamd.com/knee-re-alignment-osteotomy/](https://tocamd.com/knee-re-alignment-osteotomy/) |
|              | [https://www.hindawi.com/journals/crir/2018/2493095/](https://www.hindawi.com/journals/crir/2018/2493095/) |
|              | [https://www.mihaiviooreanu.ie/](https://www.mihaiviooreanu.ie/) |
|              | [https://www.sciencedirect.com/topics/medicine-and-dentistry/high-tibial-osteotomy](https://www.sciencedirect.com/topics/medicine-and-dentistry/high-tibial-osteotomy) |
|              | [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3374001/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3374001/) |
|              | [http://www.newcastle-hospitals.org.uk/services/orthopedics-high-tibial-osteotomy-guide.pdf](http://www.newcastle-hospitals.org.uk/services/orthopedics-high-tibial-osteotomy-guide.pdf) |
|              | [https://en.wikipedia.org/wiki/High-tibial_osteotomy](https://en.wikipedia.org/wiki/High-tibial_osteotomy) |
|              | [https://www.pinehurstsurgical.com/wp-content/uploads/2016/05/High-Tibial-Osteotomy.pdf](https://www.pinehurstsurgical.com/wp-content/uploads/2016/05/High-Tibial-Osteotomy.pdf) |
|              | [https://jeo-esska.springeropen.com/articles/10.1186/s40634-019-0177-5](https://jeo-esska.springeropen.com/articles/10.1186/s40634-019-0177-5) |
|              | [https://www.raleighsportsmed.com/physiotherapy/Physiotherapy-high-tibial-osteotomy.pdf](https://www.raleighsportsmed.com/physiotherapy/Physiotherapy-high-tibial-osteotomy.pdf) |
|              | [https://www.mihaivioreanu.ie/](https://www.mihaivioreanu.ie/) |
|              | [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3374001/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3374001/) |
|              | [https://www.bonsecours.com/health-services/pdfs/knee-high-tibial-osteotomy-orthopedic-surgeon-portland-beaverton-gresham-oregon.html](https://www.bonsecours.com/health-services/pdfs/knee-high-tibial-osteotomy-orthopedic-surgeon-portland-beaverton-gresham-oregon.html) |
|              | [https://www.healio.com/orthopedics/knee/news/print/orthopedics-today/%7B6fc8a303-d686-4ad7-abb8-64745fde606%7D](https://www.healio.com/orthopedics/knee/news/print/orthopedics-today/%7B6fc8a303-d686-4ad7-abb8-64745fde606%7D) |
|              | [https://www.orthopedicsurgeonny.com/hto-high-tibial-osteotomy-treatment](https://www.orthopedicsurgeonny.com/hto-high-tibial-osteotomy-treatment) |
|              | [https://blog.peekmed.com/high-tibial-osteotomy](https://blog.peekmed.com/high-tibial-osteotomy) |
|              | [https://www.arlingtonortho.com/conditions/knee/knee-tibial-osteotomy-with-open-wedge/](https://www.arlingtonortho.com/conditions/knee/knee-tibial-osteotomy-with-open-wedge/) |
|              | [https://www.newyorkorthopedics.com/high-tibial-osteotomy.html](https://www.newyorkorthopedics.com/high-tibial-osteotomy.html) |
|              | [https://www.bIGHAMandwomens.org/assets/BWH/patients-and-families/Rehabilitation-Services/pdfs/knee-high-tibial-osteotomy-bwh.pdf](https://www.bIGHAMandwomens.org/assets/BWH/patients-and-families/Rehabilitation-Services/pdfs/knee-high-tibial-osteotomy-bwh.pdf) |
|              | [https://www.tandfonline.com/doifull/10.3109/17453674.2012.688725](https://www.tandfonline.com/doifull/10.3109/17453674.2012.688725) |
|              | [http://dhrihandknee.com/high-tibial-osteotomy-procedure-for-knee-arthritis/](http://dhrihandknee.com/high-tibial-osteotomy-procedure-for-knee-arthritis/) |
|              | [https://www.researchgate.net/publication/330282444](https://www.researchgate.net/publication/330282444) |
|              | [https://medcraveonline.com/MOJOR/high-tibial-osteotomy-in-patients-with-stages-2-and-3-of-knee-osteoarthritis-short-term-result-and-factors-affecting-the-outcome.html](https://medcraveonline.com/MOJOR/high-tibial-osteotomy-in-patients-with-stages-2-and-3-of-knee-osteoarthritis-short-term-result-and-factors-affecting-the-outcome.html) |
|              | [https://www.ismoc.net/high-tibial-osteotomy-i.html](https://www.ismoc.net/high-tibial-osteotomy-i.html) |
|              | [https://www.oaknepain.co.uk/treatment/high-tibial-osteotomy](https://www.oaknepain.co.uk/treatment/high-tibial-osteotomy) |
|              | [https://www.nuffieldhealth.com/treatments/tibial-osteotomy](https://www.nuffieldhealth.com/treatments/tibial-osteotomy) |
|              | [https://www.mayoclinic.org/treatments/knee-osteoarthritis/article-3056968](https://www.mayoclinic.org/treatments/knee-osteoarthritis/article-3056968) |
|              | [https://www.cumbriankneeclinic.co.uk/hto-high-tibial-osteotomy.php](https://www.cumbriankneeclinic.co.uk/hto-high-tibial-osteotomy.php) |
|              | [https://www.bONSECOURS.com/health-care-services/orthopedics-sports-medicine/knee-treatments/knee-osteotomy](https://www.bONSECOURS.com/health-care-services/orthopedics-sports-medicine/knee-treatments/knee-osteotomy) |
| Yahoo!       | [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4999379/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4999379/) |
|              | [https://www.guysandstthomas.nhs.uk/resources/patient-information/therapies/physiotherapy/Physiotherapy-following-high-tibial-osteotomy-surgery.pdf](https://www.guysandstthomas.nhs.uk/resources/patient-information/therapies/physiotherapy/Physiotherapy-following-high-tibial-osteotomy-surgery.pdf) |
|              | [http://www.newcastle-hospitals.org.uk/services/musculoskeletal-treatment-and-medication_high-tibial-osteotomy.aspx](http://www.newcastle-hospitals.org.uk/services/musculoskeletal-treatment-and-medication_high-tibial-osteotomy.aspx) |
| Bing         | [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4969364/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4969364/) |
## Table 2
Summary of readability formulae.

| Readability Test         | Score Type       | Description                                                                 | Formula                                                                 |
|--------------------------|------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Flesch- Kincaid          | Grade Level      | Part of the Kincaid Personnel collection of tests. Designed for technical    | \( G = (11.8 \times (B/W)) + (0.39 \times (W/S)) - 15.59 \)            |
| Reading Grade Level      |                  | documents and suited to a broad array of disciplines.                      |                                                                        |
| Flesch Reading Ease      | Index Score (0–100) | Developed to assess the readability of newspapers. Best suited to assessing  | \( I = (206.835 - (84.6 \times (B/W)) - (1.015 \times (W/S))) \)        |
| Score                    |                  | school textbooks and technical manuals. Standard test used by many US        |                                                                        |
|                          |                  | government agencies. Scores range from 0 to 100, with higher scores          |                                                                        |
|                          |                  | denoting easier readability.                                                |                                                                        |
| The Raygor Estimate      | Grade Level      | Designed for most text, including literature and technical documents        | Calculated using the mean number of sentences and long words (≥6        |
|                          |                  |                                                                             | characters) per 100 words, which are plotted on to a RE Graph, where    |
|                          |                  |                                                                             | their intersection determines RGL.                                      |
| Fry                      | Grade Level      | Designed for a variety of texts including technical documents and literature | Calculated using the mean number of sentences and syllables per 100   |
|                          |                  | across a range of levels, from primary school level to university level.     | words, which are plotted on to a Fry Graph, where their intersection    |
|                          |                  |                                                                             | determines RGL.                                                        |
| SMOG                     | Grade Level      | Generally appropriate for secondary age (4th grade to college level) readers.| \( G = 1.0430 \times \sqrt{C} + 3.1291 \)                               |
|                          |                  | Tests for 100% comprehension, whereas most formulas test for around 50%–75%|                                                                        |
|                          |                  | comprehension. Most accurate when applied to documents ≥30 sentences in      |                                                                        |
|                          |                  | length.                                                                     |                                                                        |
| Coleman-Liau             | Grade Level      | Designed for secondary age (4th grade to college level) readers. Formula    | \( G = (-27.4004 \times (E/100)) + 23.06395 \)                         |
|                          |                  | is based on text from the 0.4 to 16.3 grade level range. Applicable to      |                                                                        |
|                          |                  | numerous sectors.                                                           |                                                                        |
| FORCAST                  | Grade Level      | Devised for assessing U.S. Army technical manuals and forms. It is the only  | \( G = 20 - (M/10) \)                                                 |
|                          |                  | test not designed for running narrative.                                    |                                                                        |
| Gunning Fog              | Grade Level      | Developed to assist American businesses improve the readability of their    | \( G = 0.4 \times (W/S + ((C^*/W) \times 100)) \)                       |
|                          |                  | writing. Applicable to numerous disciplines.                                 |                                                                        |

*G*=Grade level; *B*= Number of syllables; *W*= Number of words; *S*= Number of sentences; *RGL*= Reading Grade Level; *I*= Flesch Index Score; *RE*= Raygor Estimate; *SMOG*= Simple Measure of Gobbledygook; *C*= Complex words (≥3 syllables); *E* = predicted Cloze percentage=141.8401 - (0.214590 X number of characters) + (1.079812 X S); *M*= Number of monosyllabic words; *C^*/= Complex words with exceptions including, proper nouns, words made 3 syllables by addition of “ed” or “es”, compound words made of simpler words.
Table 3
‘Wordy’ items with suggested alternatives produced by readability studio software.

| Wordy Items                              | Suggestion                      |
|------------------------------------------|---------------------------------|
| ability                                  | skill                           |
| absolutely                               | wholly                          |
| absolutely essential                     | essential                       |
| abundant                                  | enough                          |
| accelerate                                | hasten, quicken                 |
| acceptable                                | welcome                         |
| accompanied                               | went with                       |
| accompanying                              | going with                      |
| accomplished                              | did, done                       |
| accordingly                               | so, just so                     |
| accuracy                                  | correctness, exactness          |
| accurate                                  | correct, exact                  |
| accurately                                | correctly, exactly              |
| a certain amount of                       | some, much                      |
| achievable                                | doable, makeable                |
| achieve                                   | do, make                        |
| achieved                                  | did, made                       |
| achieves                                  | does, makes                     |
| achieving                                 | doing, making                  |
| acquired                                  | gained, got                     |
| actual                                    | real                            |
| actually                                  | really                          |
| adapt                                     | make fit                        |
| adapted                                   | made fit                        |
| additional                                | added, extra                    |
| additionally                              | added, more                     |
| adequate                                  | enough                          |
| adhere                                    | stick to, follow                |
| adjacent                                  | next to                         |
| adjacent to                               | close to, near, next to, beside, by |
| adjustment                                | settlement                      |
| adjustments                               | settlements                     |
| administered                              | managed                         |
| advantage                                 | plus                            |
| advantageous                              | helpful                         |
| advantages                                | pluses                          |
| adverse                                   | harmful                         |
| advise                                    | tell, recommend                 |
| advised                                   | told, recommended               |
| advocated                                 | spoke for                       |
| aggressive                                | forward, strong, attacking     |
| a great deal of                           | much, vast                      |
| a large number of                         | numerous, many                 |
| alleviate                                 | make easier                     |
| alleviated                                | made easier                     |
| alleviates                                | makes easier                    |
| alleviating                               | making easier                  |
| all of                                    | all (unless proceeding a pronoun) |
| almost all                                | most                            |
| alteration                                | change                          |
| alterations                               | changes                         |
| alternate                                 | take turns (between), every other (adj.) |
| alternative                               | choice                          |
| alternatives                              | choices                         |
| amendments                                | changes                         |
| an alternative                            | any other, another              |
| analysis                                  | review, breakdown, exam, study  |
| and also                                  | and, also                       |
| anterior                                  | front                           |
| anticipated                               | expected, awaited               |

(continued on next page)
Table 3 (continued)

| Wordy Items                  | Suggestion                          |
|------------------------------|-------------------------------------|
| a number of                 | a few                               |
| anxiety                     | fear                                |
| apex                         | tip                                 |
| apparent                    | clear, plain                        |
| appear                      | seem, come                          |
| appeared                    | seemed, came                        |
| appears                     | seems, comes                        |
| appropriate                 | proper (adj.), set aside (verb)     |
| appropriately               | properly                            |
| approval                    | praise, consent                      |
| approximately               | about                               |
| are prone to                | tend to                             |
| as a result                 | so, then, thus                      |
| as a result of              | because of, due to, following       |
| ascending                   | climbing, upward                    |
| as long as                  | if, since                           |
| as of now                   | about                               |
| as opposed to               | compared to                         |
| assist                      | aid, help                           |
| assistance                  | help                                |
| assisted                    | aided, helped                        |
| assuming that               | if                                  |
| as to whether               | whether                             |
| as well as                  | and, also                           |
| at about                    | about                               |
| at all times                | always                              |
| at present                  | now, today                          |
| attempt                     | try                                 |
| attempted                   | tried                               |
| attempts                    | tries                               |
| at the time                 | when                                |
| at this time                | now, right now                      |
| attractive                  | pleasing                            |
| augmentation                | increase                             |
| available                   | offered, ready                      |
| a wide range of             | assorted, extensive, numerous       |
| beneficial                  | helpful                             |
| benefit                     | help                                |
| benefits                    | helps                               |
| bilateral                   | two-sided                           |
| both of                     | both (unless proceeding a pronoun)  |
| by means of                 | by, with, from, in, over, through   |
| capacity                    | ability, power, position            |
| cartilage                   | gristle                             |
| categories                  | classes, groups                     |
| category                    | class, group                         |
| certainly                   | surely                              |
| cessation                   | stop, pause                         |
| characteristics             | traits                              |
| characterize                | describe                            |
| characterized               | described                           |
| clarify                     | make clear                          |
| collection                  | mass, heap                          |
| combined                    | joined                              |
| combining                   | joining                             |
| commenced                   | began                               |
| commences                   | begins                              |
| commitment                  | pledge                              |
| compensate                  | pay                                 |
| component                   | part                                |
| components                  | parts                               |

(continued on next page)
### Table 3 (continued)

| Wordy Items       | Suggestion                                      |
|-------------------|-------------------------------------------------|
| composed          | made up, created, calm (adj.)                   |
| compress          | squeeze                                         |
| compresses        | squeezes                                        |
| comprise          | form, include                                   |
| comprised         | formed, included                                |
| concerning        | about, on                                       |
| conclude          | close, end                                      |
| concluded         | closed, ended                                   |
| conclusion        | close, end                                      |
| conclusive        | final                                           |
| congenital        | inborn                                          |
| consequently      | so                                              |
| consolidation     | combination, merger                             |
| consolidations    | combinations, mergers                           |
| constitute        | be, form                                        |
| constituted       | was, formed                                     |
| constitutes       | makes up, forms                                 |
| construct         | build                                           |
| construction      | building                                        |
| constructs        | builds                                          |
| containing        | having, holding                                 |
| contains          | has, holds                                      |
| contemplate       | think about                                     |
| contemplating     | thinking about                                  |
| continue          | keep, keep on                                   |
| continued         | kept on                                          |
| continue on       | continue                                        |
| continues         | keeps on                                        |
| continuing        | keeping on                                      |
| contribute        | give, help                                      |
| contributed       | gave, helped                                    |
| contributes       | gives, helps                                    |
| contributing      | giving, helping                                 |
| contribution      | gift                                            |
| convenient        | handy                                           |
| conversion        | change                                          |
| conversions       | changes                                         |
| create            | make                                            |
| created           | made                                            |
| creates           | makes                                           |
| creating          | making                                          |
| criteria          | requirements                                    |
| debilitating      | weakening                                        |
| definitive        | final                                           |
| demonstrate       | show                                            |
| demonstrated      | showed                                          |
| demonstrates      | shows                                           |
| density           | thickness                                       |
| descending        | downward                                        |
| desired           | wished                                          |
| despite the fact  | although, even though, despite                  |
| determine         | decide, figure                                  |
| determined        | decided, figured                                |
| determines        | decides, figures                                |
| determining       | deciding, figuring                              |
| detrimental       | harmful                                         |
| develop           | make, grow                                      |
| developed         | made, grown                                     |
| developing        | making, growing                                 |
| develops          | makes, grows                                    |

(continued on next page)
Table 3 (continued)

| Wordy Items                  | Suggestion                      |
|------------------------------|---------------------------------|
| deviates, turns away         | change                          |
| deviation                    | hard                            |
| difficult                    | troubles                        |
| difficulties                 | trouble                         |
| discovered                   | found out                       |
| disrupt, confuse              | interrupted, confused           |
| disrupting, confusing        | because, since, given that      |
| eccentric                    | odd                             |
| elect, pick                  |                               |
| electing, picking            |                               |
| elevate, lift up             |                               |
| elevated, lifted up           |                               |
| elevates, lifts up            |                               |
| elevating, lifting up         |                               |
| elevation                    |                               |
| elicit, draw out, call forth |                               |
| eliminate, cut               |                               |
| eliminated, dropped          |                               |
| eliminating, cutting, dropping|                               |
| eminence, high place         |                               |
| employment, work, job, use   |                               |
| encountered, met             |                               |
| encourage, urge              |                               |
| encouraged, urged            |                               |
| encourages, urges            |                               |
| encouraging, urging          |                               |
| endeavours, tries, attempts  |                               |
| ensure, make sure            |                               |
| ensured, made sure           |                               |
| ensures, makes sure          |                               |
| equines, horses              |                               |
| equivalent, equal            |                               |
| established, set up, proved  |                               |
| evaluate, check, rate        |                               |
| evaluated, checked, rated    |                               |
| evaluating, checking, rating |                               |
| evaluation, check, rating    |                               |
| evaluations, checks, ratings |                               |
| evidenced, showed            |                               |
| evidences, shows             |                               |
| evident, clear               |                               |
| examination, check           |                               |
| examine, check, look at      |                               |
| examined, checked, looked at |                               |
| except when, unless          |                               |
| exchange, trade              |                               |
| exchanged, traded            |                               |
| exchanging, trading          |                               |
| explain, show, tell          |                               |
| explained, showed, told      |                               |
| explaining, showing, telling |                               |
| explains, shows, tells       |                               |
| external, outer              |                               |
| facilitate, ease, help        |                               |
| facilitates, eases, helps    |                               |
| familiar, known              |                               |
| feasible, can be done        |                               |
| final, last                  |                               |

(continued on next page)
| Wordy Items                          | Suggestion                                      |
|-------------------------------------|-------------------------------------------------|
| first introduced                    | introduced                                      |
| for the sake of                     | for                                             |
| frame of mind                       | attitude, posture, view, viewpoint              |
| frequently                          | often                                           |
| from start to finish                | completely, thoroughly                          |
| function                            | act, role                                       |
| fundamental                         | basic                                           |
| general                             | broad                                           |
| general consensus                   | consensus                                       |
| generally                            | broadly                                         |
| generate                            | create, make                                    |
| generating                          | creating, making                               |
| gives rise to                       | causes, leads to, results in                   |
| has a tendency                      | tends to                                        |
| has no                              | lacks                                           |
| has the ability to                  | can                                             |
| have an influence on                | affect, influence                               |
| have a tendency                     | tend to                                         |
| have no                             | lacks                                           |
| have the ability to                 | can                                             |
| hazardous                           | risky, unsafe                                   |
| heterogeneous                       | varied                                          |
| high degree of                      | abundant, ample                                 |
| horizontally                        | sideways                                        |
| however                             | but                                             |
| identical                           | same the same as                                |
| identical to                        | ID                                              |
| identification                      | named, found                                    |
| identified                          | names, finds                                    |
| identifies                          | name, find                                      |
| identify                            | naming, finding                                 |
| identifying                         | draws, shows                                    |
| illustrates                         | at once, right away, right now                  |
| immediately                         | near                                            |
| imminent                           | hit, change                                     |
| impact                              | harm, weaken, reduce                            |
| impair                              | harmed, weakened, reduced                       |
| impaired                            | urgent                                          |
| imperative                          | carrying out                                    |
| implementation                      | ahead of, before, by                            |
| in advance of                       | to                                              |
| in an effort to                     | like                                            |
| in a similar fashion                | because, since, as, as far as                  |
| inasmuch as                         | along with, as well as                          |
| in association with                 | where                                           |
| in cases where                      | at times, sometimes                             |
| in certain cases                    | cut                                             |
| incision                            | cuts                                            |
| incisions                           | close to, near                                  |
| in close proximity to               | partial                                         |
| incomplete                          | along with, and, combined with, coupled         |
| in conjunction with                 | compared to                                     |
| in contrast to                       | bother                                          |
| inconvenience                       | blended, joined, mixed                          |
| incorporated                        | show                                            |
| indicate                            | shown                                           |
| indicated                           | shows                                           |
| indicates                           | showing                                         |
| indicating                          | clue, sign                                      |
| indication                          |                                                 |

(continued on next page)
| Wordy Items                  | Suggestion                  |
|-----------------------------|-----------------------------|
| indications                 | clues, signs                |
| individual                  | person, single              |
| individuals                 | people                      |
| individuals who             | those who                   |
| inferior                    | lesser                      |
| inhibition                  | restraint                   |
| in isolation                | along                       |
| initial                     | first                       |
| initially                   | at first                    |
| initiate                    | begin                       |
| initiated                   | started                     |
| in most cases               | mostly, most of these, often, usually for |
| in order for                | to, for                     |
| in order to                 | that is                     |
| in other words              | questions                   |
| inquiries                   | at times, sometimes         |
| in some cases               | aside, despite, although    |
| in spite of                 | office, company, school     |
| institution                 | not enough                  |
| insufficient                | as for                      |
| in terms of                 | inner, inside               |
| internal                    | without                     |
| in the absence of           | in, with, if, by, for       |
| in the case of              | in, about for, of           |
| in the context of           | with, before                |
| in the presence of          | correct, right, justified   |
| in the right                | in that                     |
| in the sense that           | review, check, look over    |
| investigate                 | reviewed, checked, looked over |
| investigated                | reviewing, checking, looking over can |
| investigating               | is able to                  |
| is able to                  | comprises                   |
| is composed of              | comprises                   |
| is comprised of             | coheres to, conforms with   |
| is consistent with          | is                         |
| is defined as               | depends on, hinges on       |
| is dependent on             | conforms with               |
| is in line with             | it is important that        |
| it is important that        | must, should                |
| it is important to note     | note                        |
| it is probable that         | probably                    |
| it should be noted          | note                        |
| just about                  | about                       |
| known as                    | called, named               |
| limitation                  | limit                       |
| limitations                 | limits                      |
| limited number of           | a few, little, meager, not many, scant, only so many, some, spare, sparse |
| located                     | found                       |
| locates                     | finds                       |
| locating                    | finding                     |
| location                    | place                       |
| maintain                    | keep, support               |
| maintained                  | kept, supported             |
| maintaining                 | keeping, supporting         |
| maintains                   | keeps, supports             |
| majority                    | most                        |
| manufactured                | made                        |
| manufactures                | makes                       |
| massive                     | large                       |
| maximum                     | most, greatest              |

(continued on next page)
| Wordy Items                      | Suggestion                           |
|---------------------------------|--------------------------------------|
| methodologies                   | methods, designs, plans              |
| methodology                     | method, design, plan                 |
| meticulous                      | very careful                         |
| minimize                        | decrease, lessen                     |
| minimised                       | decreased, lessened                  |
| minimize                        | decrease, lessen                     |
| minimized                       | decreased, lessened                  |
| modification                    | change                               |
| modifications                   | changes                              |
| modified                        | changed                              |
| modifying                       | changing                             |
| monitor                         | check, watch                         |
| monitored                       | checked, watched                     |
| monitoring                      | checking, watching                   |
| multiple                        | many                                 |
| necessarily                     | needed, needed to                    |
| necessary                       | needed                               |
| necessitate                     | cause, need                          |
| necessitates                    | causes, needs                        |
| needs to have                   | needs                                |
| need to have                    | need                                 |
| never ever                      | never                                |
| no matter how                   | however                              |
| no more than                    | only                                 |
| notify                          | let know, tell                       |
| not many                        | few                                  |
| not possible                    | impossible                           |
| numerous                        | many                                 |
| objective                       | aim, goal                            |
| objectives                      | aims, goals                          |
| oblique                         | slanting                             |
| observed                        | saw, seen                            |
| observing                       | seeing                               |
| obtain                          | get                                  |
| obtained                        | got                                  |
| obtaining                       | getting                              |
| obtains                         | gets                                 |
| occurrence                      | event                                |
| occurrences                     | events                               |
| of major importance             | is important, are important, was important |
| on a regular basis              | regularly                            |
| on the basis of                 | by, from, because of, assuming, based on, from |
| on the contrary                 | rather, instead                      |
| on the other hand               | however                              |
| on the side of                  | with                                 |
| on the surface                  | seemingly, apparently                |
| operate                         | run, work                            |
| operated                        | ran, worked                          |
| operating                       | running, working                     |
| opt for                         | choose                               |
| option                          | choice, way                          |
| options                         | choices, ways                        |
| other similar                   | similar                              |
| outside of                      | outside (unless proceeding a pronoun) |
| over and over again             | repeatedly                           |
| over the course of              | during, throughout                   |
| participate                     | take part                            |
| participated                    | took part                            |
| participating                   | taking part                          |
| particular                      | specific                             |

(continued on next page)
Table 3 (continued)

| Wordy Items        | Suggestion |
|--------------------|------------|
| perform            | do         |
| performed          | did/done   |
| performing         | doing      |
| permit             | let        |
| permitted          | do         |
| physician          | doctor     |
| physicians         | doctors    |
| point of view      | opinion    |
| portion            | part       |
| portions           | parts      |
| position           | place      |
| positioned         | placed     |
| possession         | have, own  |
| posterior          | rear       |
| predominant        | superior   |
| predominantly      | superiorly |
| preferable         | better     |
| preparation        | readiness  |
| previous           | earlier, past |
| previously         | before, earlier |
| primarily          | mainly, firstly |
| primary            | main, first |
| prior to           | before     |
| probability        | chance     |
| procedure          | rule, way, method |
| procedures         | rules, ways, methods |
| proceed            | do, go on  |
| produced           | made       |
| produces           | makes      |
| producing          | making     |
| proficient         | expert, skilled |
| profound           | deep, thoughtful |
| program            | plan       |
| propagated         | bred, reproduced |
| propensity         | inclination, tendency |
| purchased          | bought     |
| rapid              | quick      |
| rapidly            | quickly    |
| reason why         | reason     |
| reciprocating      | giving in return |
| recommend          | suggest    |
| recommended        | suggested  |
| recommends         | suggests   |
| reduce             | cut        |
| reduced            | cut        |
| reduces            | cuts       |
| reducing           | cutting    |
| reduction          | cut        |
| regimen            | routine, rule |
| reimburse          | pay back   |
| reinforce          | strengthen |
| remain             | stay       |
| remained           | stayed     |
| remaining          | staying, left over |
| remains            | stays      |
| request            | ask        |
| require            | need       |
| required           | needed     |
| requirement        | need       |
| requirements       | needs      |
| requires           | needs      |

(continued on next page)
### Table 3 (continued)

| Wordy Items          | Suggestion                        |
|----------------------|-----------------------------------|
| requiring            | needing                           |
| resulted in          | lead to                           |
| result in            | lead to                           |
| resulting in         | leading to                        |
| results in           | leads to                          |
| retain               | keep, hold                        |
| retained             | kept, held                        |
| retention            | keeping, holding                  |
| reversion            | return                            |
| review               | check                             |
| reviewed             | checked                           |
| reviewing            | checking                          |
| rigidity             | stiffness                         |
| satisfied            | happy, content                    |
| scrutinized          | inspected, examined               |
| segment              | part                              |
| segments             | parts                             |
| similar              | like                              |
| simultaneously       | at the same time                  |
| so as to             | to                                |
| solicited            | asked for                         |
| sooner or later      | eventually                        |
| speculate            | reflect, guess, surmise, suppose  |
| strategy             | plan                              |
| submit               | send, give                        |
| subsequently         | later, next                       |
| substantially        | later, after                      |
| substantially        | real, strong, large               |
| sufficient           | really, strongly, largely         |
| sufficiently         | enough, ample                     |
| suitability          | amply                             |
| superior             | fitness                           |
| take into consideration | consider                      |
| taken into account   | considered                        |
| taken into consideration | considered                      |
| tertiary             | third                             |
| the fact that        | that                              |
| the majority of      | most, most of                    |
| the other way around | the opposite                     |
| the reason for       | because, since, why              |
| therefore            | so, thus                          |
| thereof              | its, their                        |
| the sum of           | all                               |
| to a certain extent  | in a sense, somewhat, partly      |
| took into account    | considered                        |
| transmits            | sends                             |
| transmitted          | sent                              |
| typically            | often                             |
| uncommonly           | rarely                            |
| up until             | until                             |
| usually              | often                             |
| utilization          | use                               |
| utilize              | use                               |
| utilized             | used                              |
| utilizing            | using                             |
| validate             | confirm                           |
| value                | cost, worth                       |
| variation            | change, difference                |
| variations           | changes, differences              |

(continued on next page)
Table 3 (continued)

| Wordy Items                      | Suggestion                  |
|----------------------------------|-----------------------------|
| via                              | in, on, by                  |
| viable                           | workable                    |
| visualize                        | picture                     |
| visualized                       | pictured                    |
| visualizes                       | comprised                   |
| was comprised of                 | when                        |
| whenever                         | since                       |
| whereas                          | about, regarding            |
| with regard to                   | write                       |
| write down                       |                             |

*‘Wordy’ items are complex words and phrases that contain too many words.

**Fig. 2.** Linguistic unit summary of all articles

Complex words are words with ≥ 3 syllables; Long words are words with ≥ 6 characters; Fog Words are words that contain ≥ 3 syllables that are not proper nouns, combinations of easy or hyphenated words, or two-syllable verbs made into three by adding -es and -ed endings; Dale-Chall unfamiliar words are words that do not appear on a list of 3000 common words that are known to most 4th-grade students; Overly long sentences are defined as those with a word count greater than 22 words.

length. Complex words are defined as words with ≥ 3 syllables and long words as those with ≥ 6 characters. Dale-Chall unfamiliar words are defined as those that do not appear on a list of 3000 common words that are known to most 4th-grade students. Fog words are words that contain ≥ 3 syllables that are not proper nouns, combinations of easy or hyphenated words, or two-syllable verbs made into three by adding -es and -ed endings. ‘Wordy’ items include complex words and phrases that contain too many words. Overly long sentences are defined as those with a word count greater than 22 words.

Experimental design is outlined in Fig. 1.

**Ethics statement**

This study analyzed the educational material on publicly accessible websites and as such was exempt from IRB review.
CRediT Author Statement

James M. Broderick conceived and designed the study, participated in data acquisition, performed the statistical analysis and drafted the manuscript. Andrea McCarthy performed a literature review and participated in data acquisition. Niall Hogan participated in study design. All authors read and approved the final manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have or could be perceived to have influenced the work reported in this article.

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None

Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.dib.2020.106624.

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