# APPENDIX

**Appendix A:** Literature Search Strategies

| Search number | Query |
|---|---|
| 15 | #13 AND #14 |
| 13 | #1 OR #2 OR #3 OR #5 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 |
| 14 | readability OR literacy |
| 12 | automated readability index OR ARI |
| 11 | Fry OR Edward Fry OR Fry graph |
| 10 | SMOG OR "simple measurement of gobbledygook index" |
| 9 | Coleman-Liau index OR Coleman-Liau |
| 8 | FOG count OR Gunning Fog |
| 7 | Dale-Chall OR Dale-Chall Cloze |
| 5 | rate index OR RIX |
| 3 | FORCAST |
| 2 | spache |
| 1 | flesch kincaid OR flesch-kincaid OR flesch reading ease OR flesch-kincaid reading ease OR flesch kincaid reading ease OR flesch-kincaid grade level index OR flesch kincaid grade level index |

## Cochrane Library (Reviews Only)

(flesch kincaid OR flesch-kincaid OR flesch reading ease OR flesch-kincaid reading ease OR flesch kincaid reading ease OR flesch-kincaid grade level index OR flesch kincaid grade level index OR spache OR FORCAST OR rate index OR RIX or Dale-Chall OR Dale-Chall Cloze OR FOG count OR Gunning Fog OR Coleman-Liau index OR Coleman Liau OR SMOG OR "simple measurement of gobbledygook index" OR Fry OR Edward Fry OR Fry graph OR automated readability index OR ARI):ti,ab,kw AND (readability OR literacy):ti,ab,kw" (Word variations have been searched)

## ERIC

((“flesch Kincaid” OR “flesch-kincaid” OR “flesch reading ease” OR “flesch-kincaid reading ease” OR “flesch kincaid reading ease” OR “flesch-kincaid grade level index” OR “flesch kincaid grade level index”) OR “spache” OR “FORCAST” OR (“Fry” OR “Edward Fry” OR “Fry graph”) OR (“rate index” OR “RIX”) OR (“automated readability index” OR “ARI”) OR (“Dale-Chall” or “Dale-Chall Cloze”) OR (“FOG count” OR “Gunning Fog”) OR (“Coleman-Liau Index” OR “Coleman-Liau”) OR (“SMOG” or “simple measurement of gobbledygook index”))

**Appendix B:** Inclusion and Exclusion Criteria

| Category | Inclusion | Exclusion |
|---|---|---|
| Aim | Assess the validity or accuracy of readability formulas in the evaluation of written health content | Assess the readability of content |
| Population/Content | Adults ages 18 years or older or written content directed towards adults | Children and adolescents (aged less than 18 years) or written content for children or adolescents |
| Intervention | Readability formulas assessing the ease with which a reader can understand written text<br><br>Readability formulas include:<br>● Flesch reading ease<br>● Flesch-Kincaid grade level index<br>● McLaughlin's SMOG<br>● Dale-Chall<br>● Spache<br>● FORCAST<br>● Fry graph<br>● Rate index (RIX)<br>● Automated readability index (ARI)<br>● Gunning Fog index<br>● Coleman-Liau index<br><br>Readability score reported as or translatable to a grade level equivalent to the U.S. education system | Formulas used to measure comprehensiveness<br><br>Formulas used to measure comprehension<br>● Cloze test<br><br>Formulas to measure the readability of tables, charts, or graphs:<br>● Suitability Assessment of Materials (SAM)<br>● PMOSE/IKIRSCH<br><br>Formulas to estimate literacy:<br>● Rapid Estimate of Adult Literacy in Medicine (REALM)<br>● Wide Range Achievement Test (WRAT)<br>● Test of Functional Health Literacy in Adults (TOFHLA)<br>● Newest Vital Sign<br>● Health Activity Literacy Study<br>● Brief Questions to Identify Patients with Inadequate Health Literacy<br><br>Formulas used to measure suitability or quality of content:<br>● Ensuring Quality Information for Patients (EQIP) |
| Comparator | ● Standard health textbooks at a specific grade level<br>● Panel ratings of difficulty | ● State or national average grade level<br>● Content creator's stated readability level<br>● Other readability formulas (i.e., comparative) |
| Outcomes | Correlation coefficient (e.g., Spearman, Pearson)<br><br>Measures of accuracy including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) | Agreement (e.g., correlation) between two or more readability formulas (i.e., comparative) |
| Setting | Any setting (e.g., healthcare organization) or modality (e.g., website, brochure) for which written health content may be provided | All other settings |
| Study design | Any | None |
| Language | English | Non-English |
| Quality | Good or fair quality | Poor quality |

**Appendix C:** Excluded Studies at Full-text

| Reason for Exclusion | Citation |
|---|---|
| Wrong aim | Brangan S. Development of SMOG-Cro readability formula for healthcare communication and patient education. Coll Antropol. 2015;39(1):11-20.<br><br>Burke V, Greenberg D. Determining readability: How to select and apply easy-to-use readability formulas to assess the difficulty of adult literacy materials. Adult Basic Education and Literacy Journal. 2010;4(1):34-42.<br><br>Caylor JS, Sticht TG. Development of a Simple Readability Index for Job Reading Material. 1973.<br><br>Contreras A, García-Alonso R, Echenique M, Daye-Contreras F. The SOL formulas for converting SMOG readability scores between health education materials written in Spanish, English, and French. J Health Commun. 1999;4(1):21-9.<br><br>Cramer EH. A Quick Guide to Readability Formulas. 1978;17(5):416-17.<br><br>Cunningham J, Hiebert E, Mesmer H. Investigating the validity of two widely used quantitative text tools. Read Writ. 2018;31:813-33.<br><br>DuBay WH. The classic readability studies. Costa Mesa, CA: Impact Information.<br><br>Felsenthal NA, Felsenthal H. Utilizing the Computer to Assess the Readability of Language Samples. 1972.<br><br>Imoisili OE, Levinsohn E, Pan C, Howell BA, Streiter S, Rosenbaum JR. Discrepancy Between Patient Health Literacy Levels and Readability of Patient Education Materials from an Electronic Health Record. Health Lit Res Pract. 2017;1(4):e203-e7.<br><br>Janan D, Wray D. Reassessing the Accuracy and Use of Readability Formulae. 2014;11:127-45.<br><br>Jindal P, MacDermid JC. Assessing reading levels of health information: Uses and limitations of flesch formula. Educ Health (Abingdon). 2017;30(1):84-8.<br><br>Longo J. The relative readability of ten collegiate english handbooks with a validation of the Fry readability graph for levels 13-17. Indiana University of Pennsylvania; 1981.<br><br>Luk A, Aslani P. Tools used to evaluate written medicine and health information: Document and user perspectives. Health Educ Behav. 2011;38(4):389-403.<br><br>Olson AV. Readability Formulas--Fact or Fiction. 1984.<br><br>Smith EA, Senter RJ. Automated readability index. Amrl tr. 1967:1-14.<br><br>Thomas G, Hartley RD, Kincaid JP. Test-retest and inter-analyst reliability of the Automated Readability Index, Flesch Reading Ease Score, and the Fog Count Journal of Reading Behaviors. 1975;7(2):149-54.<br><br>U.S. Department of Health and Human Services. Using readability formulas: A cautionary note. Toolkit for Making Written Material Clear and Effective; 2010.<br><br>Wang L-W, Miller M, Schmitt M, Wen F. Assessing readability formula differences with written health information materials: Application, results, and recommendations. Res Social Adm Pharm. 2013;9(5):503-16.<br><br>Zheng J, Yu H. Assessing the Readability of Medical Documents: A Ranking Approach. JMIR Med Inform. 2018;6(1):e17.<br><br>Zhou S, Jeong H, Green PA. How consistent are the best-known readability equations in estimating the readability of design standards? IEEE Transactions on Professional Communication. 2017;60(1):97-111. |
| Wrong population or content type | Begeny JC, Greene DJ. Can readability formulas be used to successfully gauge difficulty of reading materials? Psychology in the Schools. 2013;51(2). |
| Wrong comparator | Clauson KA, Zeng-Treitler Q, Kandula S. Readability of patient and health care professional targeted dietary supplement leaflets used for diabetes and chronic fatigue syndrome. J Altern Complement Med. 2010;16(1):119-24.<br><br>Grabeel KL, Russomanno J, Oelschlegel S, Tester E, Heidel RE. Computerized versus hand-scored health literacy tools: A comparison of Simple Measure of Gobbledygook (SMOG) and Flesch-Kincaid in printed patient education materials. J Med Libr Assoc. 2018;106(1):38-45. |

| Reason for Exclusion | Citation |
| --- | --- |
| | Kim H, Goryachev S, Rosemblat G, Browne A, Keselman A, Zeng-Treitler Q. Beyond surface characteristics: A new health text-specific readability measurement. AMIA Annu Symp Proc. 2007:418-22.<br><br>McGrath L, Millar BC, Moore JE. Using plain language to communicate with clinical trial participants: Comparison of readability calculators. Contemp Clin Trials. 2022:123(106995):1-6. |