# Innovation Connections Research by Macquarie University/Biotext (2018-19)

## Summary report on Project #1: *Readability metrics for health communication*

This project investigated the linguistic and demographic aspects of health communication, in order to identify issues in the readability of health information for different kinds of consumers in Australia. It analysed conventional readability metrics and alternative ways of assessing text difficulty for first- and second-language users of English readers, public and professional. The main finding was that alternative metrics are needed to assess readability for broad spectrum readerships. The several facets of the inquiry and findings from the 5 phases of the Project #1 research are documented in individual reports, as listed below.

### Phase 1 *Linguistic aspects of readability, health literacy and health communication*

Readability is a matter of language complexity as well as readers' ability to understand and extract meaning from it: two complementary aspects to investigate. We first scoped the language aspects to be considered in readability assessments: their continual expansion from the 1940s to 2020. They began with the average length of words and sentences, but now include many other aspects of language, such as the relative frequency/familiarity of words for the reader, lexical density, the internal complexity of sentences, and the cohesion between sentences. All can contribute to the relative ease or difficulty of the language in which readers look for health information.

From the consumer side, accessing health information requires functional literacy and a minimum level of numeracy -- with which barely half the Australian population are equipped. The two factors combine to generate below par levels of *health literacy* in the general public. A further concern is the high proportion of second-language users of English (L2s) among Australian health professionals, many of whom are recruited from overseas. Their ability to read and comprehend English medical information impacts on the health community at large.

### Phase 2 *Readability checkers used by Australian government and their scoring systems*

Several readability checkers were examined in this second phase of the project, to investigate the reliability of their findings, and the adequacy of their assessment. The conventional Flesch-Kincaid readability checker used in Australian government and education was tested on three health texts of low, middle and high complexity, consisting of scientific, bureaucratic and journalistic writing. The grade level results were pretty consistent in differentiating the relative difficulty of the three texts, but found the bureaucratic text scored quite close to the level of the scientific text. The SMOG readability checker which registers the frequency of *polysyllabic* words (proxy for technical terms) found all three texts relatively more difficult than the Flesch-Kincaid scores, i.e. 1 to 2 grades higher in complexity. It indicates that Flesch-Kincaid scores underestimate the difficulty of health texts for lay readers, and the value of SMOG assessments. Yet both SMOG and Flesch-Kincaid are purely

quantitative measures, not designed to provide qualitative insights into the language differences between texts with different scores.

A much less well known readability tool Coh-Metrix was also used to discriminate the three sample texts, using its Text Ease and Readability Assessor (TERA). It uses a set of five linguistic factors to assess the readability of texts: narrativity, syntactic simplicity, word concreteness, referential cohesion, deep cohesion. It also provides "estimated grade levels" rather like Flesch-Kincaid, and likewise found the bureaucratic text much closer to the scientific than the journalistic text in terms of difficulty. Coh-Metrix's special contribution to analysing readability is its use of factors that go across sentences, such as narrativity (low for the scientific and bureaucratic texts, higher for the journalistic text); and referential cohesion (lowest for the journalistic text, high for the other two). Thus Coh-Metrix provides deeper insights into the nature of a text's language and its inputs to reader comprehension.

## Phase 3  *Benchmarking readability for Australian consumers of health information*

In this third phase we took up the issue of literacy in the wider Australian community, and what might be appropriate target levels of readability for reaching a wide spectrum of consumers. Australia's literacy and numeracy levels are surveyed from time to time by the international Organisation for Economic Co-operation and Development (OECD). Its surveys from the 2011-2 (PIAAC) Program for the International Assessment of Adult Competencies (PIAAC) showed that 44% of the Australian community have limited reading skills, meaning that while they may recognise the words written, they lack  ability to draw inferences from the sentences they read, or construct meaning across  multiple paragraphs.

Australia's NAPLAN reading and numeracy standards for school grades consist of developmental skills like those of PIAAC assessments. But they are less tightly tied to expectations at particular grades levels, and emphasise the range of abilities at each grade level covered: Grades 3, 5, 7 and 9. The proposition that website content developers should aim for Year 7 readability level (in NAPLAN terms), is therefore a less precise target than it sounds, while it recognises the wide range of literacy skills in the Australian community, and the limited language competency of numerous second-language users of English. The challenge for such Australians in reading websites is predictable from a preliminary analysis carried out on a corpus of health websites on community health issues. The Flesch-Kincaid scores returned an average readability grade score of 8.3 for them, while the SMOG average score (taking account of technical terms) was grade 11. This suggests that much health information is written above the level of comprehension for almost half the Australian community.

## Phase 4  *Reading skills of Australians who use English as a second language*

The issue of English proficiency among migrants to Australia was the focus of the fourth phase. We first scoped the sizes of the 12 major language communities of second-language English speakers, and their present trajectories of growth, using the 2016 Census figures. The statistics on English competency (= *low* proficiency, self-reported) are of considerable interest, being highest for speakers of East Asian background: Mandarin, Cantonese, Vietnamese and Korean (25-32%), and

lowest for Filipinos (3%) for and Hindi (5%) immigrants.  The patterns of assimilation and full switch to English vary with the culture. While most Dutch or German immigrants shift to English in the first generation, others take two or three generations.

Permanent residents and certain classes of migrants on temporary visas are afforded English language courses (up  to 510 free lessons) by the Adult Migrant Education Program. Problems in this provision include the arbitrariness of the allocation of hours, since estimates vary widely as to how long it take to learn to speak, read and write another language -- depending on the learner's heritage language, their age, and everyday exposure to English (very little opportunity for those in manual or service work). Yet those on short term visas are required to improve their English proficiency on standard tests such as IELTS (International English Language Testing Service) to be eligible for visa extensions.  Immigrant health professionals recruited to work in the health system are also under considerable pressure to raise their English proficiency to secure professional registration, or be obliged to move back overseas. Their problems in satisfying the language requirements of their visas indicate ongoing difficulties in accessing English-based information on Australian health websites.  Notional levels of the language proficiency required to read a text are provided by both IELTS and CEFR (Common European Framework of Reference [for language learning]), which can be applied as scales of difficulty for L2 readers: IELTS from 4 - 8+; CEFR from A1/2  and B1/2  to  C1/2.

A new Coh-Metrix readability tool to assess the readability of information for second language (L2) readers was tested on sample texts. This is Coh-Metrix L2, which uses 3 factors all different from those involved in the general Coh-Metrix tool (TERA) discussed above (in phase 2).  Coh-Metrix L2 is informed by psycholinguistic research into the reading process for L2 learners, such as the importance of familiar vocabulary and regular syntactic patterns. Its composite score differentiates the readability of texts for immigrants in the community, and in service industries or among the ranks of health professionals.  The composite Coh-Metrix L2 scores of the sample material used in previous tests indicated that the bureaucratic text was actually more difficult than the scientific one for immigrant readers.

## Phase 5  *Readability and access to information across the health sector*

In the fifth and final phase of this readability research we focus on the information needs and language issues for health professionals across the various health sector *specialisms,* those of doctor, nurse, physiotherapist, administrator. The emphasis on interdisciplinary health management means that health professionals must be able to share information with staff from other specialisms, with different educational backgrounds and levels of training.  An ever- increasing proportion are overseas-educated, second-language users of English, apart from hospital administrators, who tend to be Australian-born and -educated. The difficulty of sample texts written by administrators was found by Coh-Metrix measures in phases 2 and 4 to be almost as great if not greater than scientific writing. This finding was underscored in phase 5, using all readability metrics included in this research to compare full length medical texts on areas of mental health-care and an administrative handbook. The administrative text was again  found more difficult than the medical/scientific texts on all the readability metrics used in this research. Both L1 and L2 readers would be challenged by it.

The readability of documents shared within medical specialisms is also of concern. Medical specialists writing to a GPs reserve the right to make full use of specialised medical terminology, even though they accept the need to write in plain English to their patients. Overseas-trained allied health professionals would also benefit from doctors/specialists using plainer English in their instructions, and from plainer language in documents provided by health administrators. Research on language deficits of trainee doctors in non-English-speaking countries shows they need help with specialised English medical terms *as well as* the semi-technical nouns and verbs that are part of general science education for locally trained health professionals.

One other issue in providing readable and accessible information across the health sector is the importance of visual displays of quantitative information (e.g. graphs, tables) which support and complement the verbal text. Their value depends on readers' statistical and graphical literacy, though research has found they may be limited in some primary health-care providers, let alone the general community (as noted in phase 1). Yet the alternative forms of presenting statistics used in reports of the Australian Bureau of Statistics (ABS) – both graphs and tables -- helps those who make sense of numerical values in one form or the other. Meanwhile infographics and line diagrams (e.g. process charts) could be more widely used.

## Conclusions: *Readability metrics for online health information in Australia*

This research has identified multiple issues in relation to the language of health texts, and the extent to which readability metrics in their present form are effective measures of their difficulty. While the conventional Flesch-Kincaid is easy to apply on large texts, it doesn't identify key features such as the use of technical terms (as does SMOG), nor other aspects of vocabulary, syntax and cohesion measured by Coh-Metrix, which are known to impact on readability. Alternative metrics are needed to identify the level of difficulty for readers.

The reader's side of measuring readability is better recognised in the "easability" factors built into the multidimensional Coh-Metrix measures. These are linked to the cohesive elements of the text which help readers to construct meaning continuously from sentence to sentence and extract the overall message. Coh-metrix L2 recognises the likely obstacles to second-language readers' understanding of written English, such as unfamiliar vocabulary, and complex and unpredictable syntax. These problems also apply to first-language readers with low literacy.

Australian websites that are designed to deliver health information across public and professional communities are challenged by the need to make it readable across a very wide spectrum of literacy in English. Yet messages in simple or easy-read English are unlikely to satisfy the informational needs of more highly trained readers. We should not expect a one-size-fits-all approach to health messaging. The solution would be to have separate, clearly identified segments of the website for (i) basic public information, and (ii) for professional needs. Content could then be optimised for these different readerships, and appropriate metrics of readability applied according to their demographics.