# A readability analysis of French language online information on hearing related websites

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**ABSTRACT**

**Introduction.** The aim of this study was to provide a readability assessment of audiological and hearing-related websites in the French language found through country-specific search engines in localities where French is the national language.

**Methods**. Informers from 19 French speaking countries were asked to provide French search terms for the English equivalents of 'hearing loss', 'deafness' and 'hearing aids'. The resulting 64 unique search terms were then entered into the country-specific Google search engines that matched the informants' countries of residence. For each search performed, the first ten results were collated for readability analysis, location of website origin, type of organisation (commercial, non-profit or governmental) and whether they had HONcode certification. Readability analyses were conducted through an online readability tool provided by Recherche Clinique Paris Centre on theie website, which measured readability of each website's full-length text using an adaptation of the Flesch-Kincaid formula for the French language.

**Results.** The readability of the 432 unique websites analysed was found to be at a college RGL which exceeds by far the 6$^{th}$ RGL recommended by experts. France and Germany represented the origin of 60% of the websites. Less than 5% of the websites were linked with governmental institutions, 62,5 % were assessed as being commercial and almost one third of the websites were judged to be non-profit. Most of the websites (86%) did not have HONcode certification. A significant difference in mean readability was observed only for websites originating in some locations. No significant effect of type of organization was found on websites readability.

**Conclusion**. Results of this study show a scarcity of French-language hearing-related websites in easily-comprehensible language. Hearing professionals and web creators need to be aware of the range of health literacy levels of the general public and ensure that hearing websites are

written and presented with high-quality content in plain language. Patients should be directed to such websites by professionals and health agencies.

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## List of Abbreviations

| | |
|---|---|
| APHAB | Abbreviated Profile of Hearing Aid Benefit |
| ASHA | American-Speech- Language-Hearing Association |
| ccTLD | Country Coded Top Level Domain |
| CPU | Central Processing Unit |
| CRIE | Chinese Readability Index Explorer |
| dB | Decibels |
| DHL | Disabling Hearing Loss |
| FFL | French for foreign learners |
| GNI | Gross National Income |
| GPs | General Practitioners |
| HHIE | Hearing Handicap Inventory for the Elderly |
| HL | Hearing Loss |
| HON | Health on the Net |
| HONCode | Health on the Net Code of Conduct |
| ICT | Information and Communication Technology |
| IP | Internet Protocol |
| ITU | International Telecommunications Union |
| kHz | Kilohertz |
| NAAL | National Assessment of Adult Literacy |
| OME | Otitis Media with Effusion |
| PROM | Patient-Report Outcome Measure |
| REALM | Rapid Estimate of Adult Literacy in Medicine |
| RGL | Reading Grade Level |
| SAM | Suitability Assessment of Material Tool |
| Short-TOFHLA | Short-Test of Functional Health Literacy in Adults |
| *sl* | Average Sentence Length |
| US | United States |
| USD | United States Dollars |
| WHO | World Health Organisation |
| *wl* | Average Word Length |

# Chapter I. Introduction

## 1.1. Disabling Hearing Loss

The World Health Organisation (WHO; 2017) estimates that 360 million people around the world, about 5.3% of the total population, have disabling hearing loss (DHL). The WHO defines DHL for adults as a loss that is greater than 40 dB in the better hearing ear using the audiometric frequencies of 0.5, 1, 2 and 4 kHz. According to the WHO (2017), about 15% of adults around the world have some degree of hearing loss. A quarter of those adults are aged 65 years old and over, and nearly a third of people over the age of 65 years have a DHL. The WHO (2017) defines DHL for children, as a loss that is greater than 30 dB in the better hearing ear (using the same audiometric frequencies as adults) and estimates that 32 million people with DHL are under the age of 15 years. The WHO (1991) generated a classification of five grades to describe degree of hearing impairment. These are shown in Table 1, with the descriptions from the WHO's 2016 publication.

| **Grade of impairment** | **Corresponding audiometric ISO value (better ear)** | **Performance** | **Recommendations** |
|---|---|---|---|
| 0<br>No impairment | 25 dB HL or better | No or very slight hearing problems | |
| 1<br>Slight impairment | 26 - 40 dB HL | Able to hear and repeat words spoken in normal voice at 1 metre | Counselling.<br>Hearing aids may be needed. |
| 2<br>Moderate impairment | 41 - 60 dB HL | Able to hear and repeat words using raised voice at 1 metre | Hearing aids usually recommended. |
| 3<br>Severe impairment | 61 - 80 dB HL | Able to hear some words when shouted into better ear | Hearing aids needed. If not available, lip-reading and signing should be taught. |

| | | | |
|---|---|---|---|
| 4<br>Profound impairment | 81 dB HL or greater | Unable to hear and understand even a shouted voice | Hearing aids may help understanding words. Additional rehabilitation needed. Lip-reading and sometimes signing essential. |

*Table 1.1. WHO (2016) grades of hearing impairment*

The distribution of DHL around the world is uneven and unequal, with a higher prevalence showing exponentially with income reduction (Stevens et al., 2013). In their 2012 WHO report, Stevens and colleagues (2013) reported that there is an exponential relationship between gross national income (GNI) and the prevalence of DHL: as per capita GNI increases, the prevalence of DHL decreases. Not surprisingly, the WHO (2013) indicated that the prevalence of a DHL in children and adults was greatest in the following regions: South Asia, Asia Pacific, and Sub-Saharan Africa. In addition, the same report showed there is a negative linear relationship between parental literacy rates and the prevalence of DHL in children: as the parental literacy rates increases, the prevalence of DHL in children decreases. Together, these data indicate that some regions of the world are more at-risk for DHL, and factors such as parental literacy may play a role in reducing the prevalence of DHL.

The impact of DHL has been demonstrated in many studies. For children, DHL affects the child's access to speech sounds and can delay speech and language development (Tye-Murray, 2009). In addition, children with DHL are reported to experience more social and behavioural problems when compared with the peers with normal hearing (Vostanis, Hayes, De Feu, & Warren, 1997). Studies have shown that early identification and intervention of children with hearing impairment result in better speech and language function compared to later identified children with hearing impairment (Yoshinaga-Itano, Sedey, Coulter, & Mehl, 1998). For adults, DHL has been shown to result in social isolation and feelings of depression which can

lead to a reduction in the overall quality of life (e.g., Dalton, Cruickshanks, Klein, Klein, Wiley and Nondahl, (2003). The social effects of DHL have been documented for adults of all ages (Shield, 2006) and their significant others (e.g., Hétu, Jones, & Getty, 1993; Scarinci, Hickson, & Worrall, 2011).

The societal burden of DHL has also been well-documented. For example, Schroeder et al. (2006) found that the mean societal cost of congenital bilateral childhood hearing impairment was nearly 30% greater than that of children with normal hearing. Shield (2006) reported that adults with DHL have lower earning potential than adults with normal hearing. In addition, Ruben (2000) reported that the income of adults with DHL in the United States was 40%-50% of the adult population with normal hearing. Mohr et al. (2000) estimated that the lifetime expected societal cost for a person with Grade 3 or 4 hearing loss was nearly $300,000 USD.

### 1.2. Treatment of Hearing Loss

There are many interventions available to reduce or eliminate the impacts of DHL. The WHO (2013) stresses that most hearing loss cases are able to be treated through proven interventions after early diagnosis, and effective hearing loss reduction can be provided through public health systems. In fact, hearing loss in 60% of childhood cases is from preventable causes (World Health Organization, 2017b). The same report shows that recreational noise affects 1.1 billion people between the ages of 12-35 years and puts them at risk of hearing loss.

Hearing aids and communication programmes have been evidenced to be appropriate options for people with DHL, since they reduce limitations on activity and enable greater participation in society (Hickson, Laplante-Lévesque & Wong, 2013). The 2012 WHO report (Stevens et

al., 2013) found that, in the high-income countries, 40 million adults use one or more hearing aids (or around 54% of those with Grade 1 or higher hearing loss). The authors stated they did not have enough information to estimate the rate of hearing aid use in low- and middle-income countries, but they "suspect that [hearing aid] coverage is small to negligible." (Stevens et al., 2013, p. 151). While there are a number of appropriate intervention strategies, no one treatment is suitable for everyone. This is why it is important to educate families about the impact of DHL and the available interventions, which helps them to make informed decisions (Winiger et al., 2016).

In 2014, the WHO (Olusanya, Neumann, & Saunders) issued a policy and practice statement in which they acknowledged that the cost-effectiveness of many interventions (described in the section below) have been established in the developed world. However, these interventions are not accessible to many people who live in low- and middle- income countries. In addition, low- and middle-income countries have shortages of hearing professionals and support services. The report further suggested that many of these issues could be resolved through a better understanding of the causes and risk-factors of DHL for a given region. It stands to reason that increasing hearing health consumer's understanding of the causes and risk-factors of DHL would also help address the burden of DHL across the globe.

Appropriate provision of health information is a critical aspect in helping people make informed decisions about treatment choices (Klingbeil at al., 1995). Written health information provides a helpful supplement to verbal information (Hoffmann & Worrall, 2004; Shieh & Hosei, 2008). However, written health information is only useful when it is written at a level that the target audience can effectively read (Hoffmann & Worrall, 2004; Laplante-Lévesque, Brännström, Andersson, & Lunner, 2012). The internet has become a common source of health

information, particularly for stigmatising conditions (Fitzpatrick et al., 2008). However, Laplante-Lévesque and colleagues (2012) found that English-language websites resulting from searches using the words “hearing loss” and “hearing aids” were too difficult for many adults to read. This may lead to a barrier to making informed treatment choices for some people who cannot fully understand the material.

### 1.3. Health Literacy

Little has been done to allow patients to better understand their diagnoses and treatments, ensure they take medication correctly and make informed decisions about their care, even though much time and resource has been given to the streamlining of test result reporting and doctor order entries in order to minimise error and make clinical information more readily available. Nielsen-Bohlman and Lynn (2004) conclude in their report that a focus on health literacy is necessary to providing quality health care, something which is not being done effectively now.

Okan and colleagues (2018) defined health literacy as a combination of the ability, desire and knowledge to find, understand and evaluate information on health, using it to make informed decisions. The same authors argue that health literacy is linked with literacy and education, an amenity that gives empowerment to people. Ratzan and Parker (2000) defined health literacy as “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” (p. v). In essence, health literacy refers to an individual’s ability to understand healthcare information in order to make appropriate, informed decisions. In New Zealand, more than half of the adult population has low health literacy skills, scoring below the minimal requirements of life and work (Ministry of Health, 2010)

Health literacy not only means understanding medical information, but also implies the degree to which individuals have the capacity to obtain, process, and understand the basic health information and services needed to make appropriate health decisions. Research has shown that the main way to predict a patient's health status is health literacy (e.g., Baker et al., 2007; McInnes & Haglund, 2011). Surprisingly, health literacy, is thought to be a bigger predictor of consumer's health than age, education, ethnicity or income levels (American Medical Association, 1999). Instruments for estimating individuals' health literacy include the Rapid Estimate of Adult Literacy in Medicine (REALM), the Short-Test of Functional Health Literacy in Adults (Short-TOFHLA) and the National Assessment of Adult Literacy (NAAL). A literature review reveals that health literacy is an important indicator for evaluating the effectiveness of a health education program for the 21st century (Kopera-Frye, 2017).

While there is not a complete consensus (c.f., Nielsen-Bohlman & Institute of Medicine, 2004), it is generally recommended that health materials be written at the sixth-grade level (Doak, Doak, & Root, 1996). For example, the readability of information material for patients has been recommended to be no higher than sixth-grade level by a number of American healthcare organisations, such as the National Work Group on Cancer and Health, the American Medical Association and the National Institutes of Health, while the recommended readability level should be lower than eighth-grade according to the Centers for Disease Control and Prevention (Badarudeen & Sabharwal, 2010). Nutbeam (2000) proposed a model of health literacy with three different levels of complexity, with a more functional approach to just measures of achievement in reading or writing. These levels are:

1. Basic/functional literacy— where patients have enough basic skills in reading and writing in order to effectively participate in everyday situations.

2. Communicative/interactive literacy—along with participating in everyday situations, patients are able to extract information and meaning from a wider range of communication forms, including online materials, as well as applying information to different circumstances.
3. Critical literacy—patients have sufficient cognitive and social skills to critically analyse information and utilise it to gain greater control over life events and situations.

These classifications show that the higher the literacy level, the greater a patient's autonomy and empowerment will be. Progressing from one level to another is dependent on cognition as well as exposure to different information, both in content and method, as well as the way a person responds to this communication, which is influenced by their self-efficacy, personal and social skills. Elderly people, minorities, less educated and poorer people are found to have higher rates of low or limited health literacy (Parker, 2000). These findings support the WHO 2012 report described earlier. In conclusion, health literacy should be considered to be an "essential life skill" in today's society, with the population ageing and more need for people to manage their own chronic diseases to cut down on health spending, as well as a more diverse range of treatment types and health services offered (Kickbusch, 2008).

### 1.4. Cost of limited health literacy

It is estimated that limited health literacy has an economic cost of more than $73 billion USD to the US healthcare system (Weiss, 2003). Volandes and Paasche-Orlow (2007) bring sufficient evidence to show that limited health literacy negatively impacts health and is a significant risk factor for poor health outcomes. The authors propose a set of three ideas to address this issue:

1. Creating a medical culture where healthcare workers presume that patients have a limited literacy, instead of a functioning one,
2. Investing in the development of technology across different platforms to support meaningful communication for patients,
3. Working towards more equitable spending, in which healthcare decision-makers should be prepared to allocate vast resources towards patients with limited health literacy, rather than working with set payment per performance.

In a critique addressing the study conducted by the aforementioned authors, Dees (2007) argues that investing disproportionate resources towards people with limited health literacy may not change the inequalities faced by them in society as a whole.

These concepts have recently been applied to online health information. Diviani and colleagues (2015) surmised that the ability to fully understand, and therefore evaluate or trust health information online is negatively related to people with low health literacy. They propose that further work is needed in identifying the different criteria used by people when evaluating health information online, as well as developing definitions and measures to share for the most frequently used outcomes in the evaluation of health information online. Berkman and colleagues (2011) link poor health literacy to substandard access to healthcare, limited skill in disease management, errors in medication treatment, higher costs for healthcare, poor health knowledge, inability to effectively use the healthcare system, inferior skills in health communication, and lower health outcomes (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011). A person's risk of having poor health can be more accurately determined by their health literacy than other factors, such as ethnicity, age, socio-economic status or education level (McInnes & Haglund, 2011, citing American Medical Association, 1999).

There is a social stigma associated with illiteracy which adds to the problem. Adults with low levels of literacy are often ashamed and try to disguise the fact from others, including healthcare providers and even family members (Parikh et al., 1996). Because many people with low literacy levels are ashamed, this often stops them from asking for more simple materials to read, or from clarifying what medication labels, forms or written instructions mean (Parker, 2000). Weiss (2003) conveys the concern about using readability tools to simplify text could lead to loosing or oversimplifying valuable information.

### 1.5. Readability

Reading is a large component of health literacy, which is why a readability assessment is a key way to check a document's comprehension (Atcherson et al., 2014). Dale and Chall (1949, p. 1) defined readability as "The sum total (including the interactions) of all those elements within a given piece of printed material that affect the success of a group of readers have with it. The success is the extent to which they understand it, read it at an optimal speed, and find it interesting."

There are many ways to assess readability. Computational analyses are those that use statistical methods such as regression and correlation to calculate a readability score using a readability formula. These analyses extract textual attributes that are quantified in order to predict the level of difficulty of a passage of text (Klare, 1974). These types of computational analyses are often reported in Reading Grade Level (RGL). Non-computational analyses are those that use comprehension measures to describe and predict the level of difficulty of a passage of text. One example of a non-computational analysis is the Cloze Test (Taylor, 1953) in which every nth

word (typically every 5th) in a passage is left blank. Readers are asked to fill in the blanks with the word they think completes the sentence. While non-computational analyses generally produce more accurate results, they are more time-consuming and not practical for large-scale studies (Lau, 2006).

### 1.6. Readability Formulas

Readability formulas usually combine elements that measure the difficulty of vocabulary, (word length, for example), with ones that measure grammatical difficulty, (sentence length can be used for this.) There are a number of readability formulas that have been designed for native English speakers, but few for other specific languages. A reader's comprehension of written material can be affected by its readability (Badarudeen & Sabharwal, 2010). While readability formulas provide a mathematical calculation of elements that make up sentences or phrases in selected text, they do not provide any other information about comprehension. (Bruce, Rubin, & Starr, 1981). The following table presents an overview of text features analysed in readability formulas.

| | **Elements taken into account** | | | | |
|---|---|---|---|---|---|
| **Formula** | Long word count | Sentence count | Syllable count | Word count | Word frequency |
| Flesch-Kincaid (Flesch, 1948) | ✓ | ✓ | | ✓ | |
| Flesch Reading Ease (Flesch, 1979) | ✓ | ✓ | | ✓ | |
| Fry Readability Graph (Fry, 1977) | ✓ | ✓ | | ✓ | |
| Gunning FOG Index (Gunning, 1952) | | ✓ | ✓ | ✓ | |
| New Dale-Chall (Chall & Dale, 1995) | | ✓ | | ✓ | ✓ |

*Table 1.2. Elements factored into readability formulas. Adapted from Leroy et al., 2008b*

It is important to keep an individual's health literacy in mind when deciding if a website is appropriate for them to read, because readability formulas were not designed specifically for medical language (Shedlosky-Shoemaker, Sturm, Saleem, & Kelly, 2008). A website might include many short medical terms and be judged as being easy to read because the words are short. This does not mean that they will be understood by people who are unfamiliar with that medical discipline. On the other hand, sentences are sometimes longer in medical websites, since terms are defined within the text, creating longer sentences. Even though such text was written to give more clarification, because sentences are long, the readability scores will be lower, indicating a more difficult text to read (Shedlosky-Shoemaker et al., 2008).

### 1.7. French language and French speaking countries

French is the fourth most used language on the internet when based on user numbers and the sixth most prevalently used language in the number of Web pages (L'Organisation Internationale de la Francophonie, 2014). More than 86 million people in Europe speak French. The majority, almost 63 million, live in France, while 9.6 million live in Italy, 8.5 million live in Belgium and over 5 million live in Switzerland. Luxembourg and Monaco also are home to French speakers, with almost half a million speakers in Luxembourg and fewer than 30,000 in Monaco. The number of these European French speakers for whom French is their native languages almost 66 million (Simons and Fennig, 2017). In the same report, it is shown that over 11 million people speak French in North America, with 10 million living in Canada and 1.3 million in the United States. French is the native language for almost 9 million of these North Americans. Data from the same study indicates that around 5 million people in the Caribbean speak French, with the largest population, over 4 million, living in Haiti.

It is estimated that 54.7% of people born in Africa speak French on a regular basis or as a native language, a percentage which has been rapidly increasing. Between 2010 and 2014, it has been found that over 15% more people are French speakers in Sub-Saharan Africa, with an average growth of 30% growth during this period in Benin, Burkina Faso, Burundi, Cameroon, Democratic Republic of Congo, Gabon and Senegal. More people in Africa are choosing to learn to speak French now as well. The French Institute Annual Activity Report for 2012-2013 shows that the number of registered French language learners has greatly increased, with language learners doubling over that time in South Sudan, tripling in Gabon and increasing fivefold in Cameroon, as examples (Institut Français, 2012).

Over 77 million people are native speakers of French worldwide, among 220 million people who speak French (Leman, 2017). In the same article it was shown that French is among the top ten languages that are most frequently spoken around the world, and because of the wide French colonial spread in the 19$^{th}$ and 20$^{th}$ centuries, a number of countries now use French as a commonly spoken or official language. Having the ability to speak French can be advantageous, considering that it is the second most learned language worldwide, the second working language in most international companies, and the third most used business language (L'Organisation Internationale de la Francophonie, 2014).

### 1.8. Readability of French language

Conquet's work in 1957 was the first to introduce readability in the French language, while studies of readability in English had already been conducted for more than thirty years prior to that. To date, there have been comparatively few studies into French readability. Kandel and Moles (1958) were the first to adapt the Flesch readability formula for native French speakers,

followed by De Landsheere (1963). The unique nature of the French language was only factored into a formula by Henry (1975), who assessed the readability levels of 60 primary and secondary school textbook texts with cloze tests, then based three formulas on them. Cornaire (1988) applied Henry's formulas to French for foreign learners (FFL) (François & Fairon, 2012).

More recently, Mesnager (1989) developed a readability tool for children's books inspired by Dale and Chall's (1948) formula and Daoust and colleagues (1996) created the SATO-CALIBRAGE programme which, because it makes use of Natural Language Processing-enabled features, could be regarded as the first computational formula for native French speakers (François & Fairon, 2012). While the Flesch reading ease formula (1948) and Dale-Chall formula (1948) were both designed for analysing the readability levels of adult texts, they are both used for text written specifically for children. Along with the aforementioned two formulae, Farr, Jenkins and Paterson's (1951) simplification of the Flesch reading ease formula are the three most widely used tools for assessing text written for adults (Tekfi, 1985).

Different studies have explored other factors impacting the ease of understanding health information. Comprehension of website texts has been compared to comprehension of printed text in some studies. Dail (2004) found that readers used different strategies when reading online as opposed to when they read printed text. In a study that aimed to compare the French language teaching websites and the textbooks, it was shown that websites teaching French grammar have double the amount of words as their textbook counterparts (Mavasoglu & Dincer, 2014). The same authors note that websites also have about triple the number of clauses than textbooks, as well as more explanations. With this in mind, it is likely that such websites will show a more difficult readability than the textbooks (Mavasoglu & Dincer, 2014).

Perceived readability among non-native language speakers is less often based on deeper comprehension features than among native language speakers, with a greater correlation with sentence and word length (Uitdenbogerd, 2005).

The Flesch-Kincaid formula and its adaptations for the French language have been the tools of choice when it comes to assessing readability of French texts for more than fifty years.
The original English version was created to minimise human error in military technical manuals (Ritchie, Tornari, Patel, & Lakhani, 2016). Linguistic modifications have been needed to apply the Flesch-Kincaid formula to the French language, mostly to cater for the syllable and sentence length and count differences from English (Tekfi, 1985). My thesis also employs an adaptation of the Flesch-Kincaid formula for the French language. The mathematical equation used by the authors of the software tool can be found in Chapter 2, Section 2.5.

## 1.9. Online Health Content. Audiology Online Health Information

### 1.9.1. Internet statistics

We Are Social's "Digital in 2017 Global Overview" (2017) report on Internet usage around the world for 2017 reports that half of the world's population is now connected to the internet, as of 2017, a 10% increase in usage from 2016. The Pew Research Center's Study on Americans' Internet Access: 2000-2015, found that regardless of age, education, ethnicity, household income or location, more people are likely to use the internet than not. They estimate that 84% of American Adults Use the Internet, and since 2012, more than half the adults aged 65 and older are internet users. Even among people who have not completed high school, 66% are internet users (Pew Research Center, 2015). Eurostat's 2016 'Survey on ICT (information and communication technology) usage in households and by individuals' found that more than

four fifths of Europeans used the internet in 2016, with 85% of European households having internet access from home and 71% of people saying they used the internet on a daily basis. More than 80% have used the internet to search for information (Eurostat, 2016).

In 2017, 88% of adults in Great Britain used the internet at least every week, up from 51% in 2006 (Office for National Statistics, 2017). Chinn and Fairlie (2007), looking at a report of global development indicators (World Bank, 2003) showed that internet user numbers are based on reported ISP subscriber numbers, estimates of users or by using a predicted multiplier to multiply the amount of Internet hosts. Because of this, rented computers with internet connection may not be factored in, leading to a possible understatement of Internet use, especially in developing countries (Chinn & Fairlie, 2007).

Internet World Stats (2017) define internet penetration rate as the percentage from a given population that uses the internet In Africa, there is a 25% gender gap in internet penetration. The gender gap represents the difference between the Internet user penetration rates for males and females relative to the Internet user penetration rate for males, as compared to 11% worldwide (International Telecommunications Union, 2017). Almost 9 out of 10 young people who are not using the internet are from Africa or Asia and the Pacific (ITU, 2017).

Internet use is expanding quickly across Africa, with seven of the ten countries with fastest internet use growth among their populations around the world located there. Compared to the developed world, though, very few people are internet users. In 2017, 29% of people throughout Africa were internet users and it is estimated from current growth figures that it is likely to be in the 2020s before more than half the people on this continent will use the internet (L'Organisation Internationale de la Francophonie, 2014).

### 1.9.2. Online Health Information

The internet plays a dominant role in today's world, permeating every aspect of the human experience. While, a few decades ago, information tended to come mainly from reliable sources – teachers, professionals and published work, these days the internet provides a plethora of indirect information, often with less reliability and accuracy (Brossard, 2013). 'Just Google it' is a common phrase, capturing how people do not feel the need as often to seek expert advice, but to look it up themselves. While watching television remains the main medium in which people interact with science content, the internet has become the main place people go to when looking for science-related information (Brossard, 2013).

Gregory and Miller (1998) explain that traditionally, science communication has been undertaken by professionals with the goal of making complex scientific information accessible to the general public, almost like a translation exercise. The modern tendency to search online for information presents huge implications for science or health-related fields, since there is so little regulation of content on the internet. If information found is not medically accurate or relevant to the person searching for it, it could lead to potential harm. (Beaunoyer et al., 2017).

In 2006, 80% of internet users in the United States of America had used online searching for at least one of seventeen health topics, a percentage which had remained stable for the last four years, despite growth in internet use and faster connections in homes (Fox, 2006). Fox suggests that most people use search engines to start browsing, then tend to visit two or more websites that show in results (Fox, 2006). This is important because online information influences the health behaviour of almost half of the people who search for it (Fox & Jones, 2009).

Health information in a printed format is linear - writers guide the reader through the order in which the text has been placed. In an online context, this is broken with hypertext and other kinds of links. This is important to remember when evaluating information online. Sites linked to may have a different readability or reliability of information. It may also take a number of clicks for a person to find the information sought for after landing on a website's homepage (Beaunoyer, Arsenault, Lomanowska, & Guitton, 2017). Weinreich and colleagues (2008), analysed how people routinely interact with websites and found that just 10% of the browsing lasted more than two minutes and more than half of the visits lasted less than ten seconds.

### 1.9.3. Online Audiology Information and Readability

It is estimated that the overall prevalence of people with communication disorders is between 5-10% in the US (Ruben, 2000). The same author considers that the impact of these disorders on the US economy is between $154-186 billion annually. In a longitudinal study spanning 25 years, (Amieva, Ouvrard, Meillon, Rullier, & Dartigues, 2018) it was suggested that there is a high correlation between hearing loss and the “D tetrad” - death, dementia, depression and disability.

There is a scarcity of studies regarding the impact online audiological information has on individuals with hearing impairment, and the few studies conducted show that they use the internet as much as the general population (Peddie & Kelly-Campbell, 2017). In another study, this time focussing on Swedish hearing aid users, it was found that 60% of participants were accessing the internet (Thorén et al., 2013).

Using the internet to access health information is a greater challenge for people living with intellectual disability, or limitations in speech, sight, hearing or language (Wuhlisch & Pascoe,

2011). Audiologists and speech pathologists, who specialise in human communication, are in a position to use their professional skills when filtering complicated medical information to people with a lower health literacy (Carney-Thomas, 2017). Such patients provide audiologists with a chance to individualise information to meet their unique needs.

Audiology practice routinely engages tasks for auditory comprehension and processing in order to assess receptive and expressive language performance. This leads to clinical decisions being made with the resulting data and scores (Carney-Thomas, 2017). Concerns about the clinical implications of the reliability of data obtained from people with impaired literacy skills have been expressed in several studies (Kelly-Campbell et al., 2012; Atcherson et al, 2013). Other studies have addressed the readability of questionnaires, reports and outcome measures commonly used in communication disorders have consistently found that information is written at much higher levels than those recommended for an adequate patient comprehension (Atcherson et al., 2013; Atcherson et al., 2014; Donald and Kelly-Campbell, 2016).

Recently, researchers have investigated the readability of hearing related health information, whether in print or on the internet. In a comprehensive systematic review of studies pertaining to the readability of online hearing related information, Laplante-Levésque and Thorén (2015) analysed fifty English language peer-reviewed articles from 2005 to 2014 and concluded that individuals with a hearing impairment and their significant others need between 9 and 14 years of education to effectively understand online information on hearing. Atcherson and colleagues (2014) examined the readability of audiology and speech language pathology-related consumer materials on the website of the American-Speech-Language-Hearing Association (ASHA) and reported that of the 225 articles, more than 85% were written at a ninth reading grade level or higher, a level that far exceeded what health literacy experts

recommend. Laplante-Lévesque and colleagues (2012) found from a readability study into 66 hearing impairment related websites that on average, people needed at least eleven years of schooling in order to comprehend the online patient information given.

Although hearing aid manufacturers' websites are present in all the country-specific search engines, often with a higher ranking, the reading grade level of these websites is consistently above what expert recommendations suggest they should be. Joseph et al (2016), investigating client education materials from well-known hearing aid brands, found that the content on average was at a 10th grade reading level. An earlier study examining the reading grade level of language used during routine one on one audiological appointments and hearing aid pamphlets reported an 8th grade level for these materials (Nair & Cienkowski, 2010).

Specific hearing-related conditions have also been investigated. In a study investigating the readability of online patient information about vestibular schwannoma, 46% of the search results were found to be irrelevant or inappropriate for public use. In addition, 63.8% of the relevant websites were authored by healthcare information providers and hospitals (Spiers, Amin, Lakhani, Martin, & Patel, 2017). The same study showed that health information about acoustic neuroma found online had readability levels much higher than the recommended 6$^{th}$ reading grade level.

Tinnitus information on websites preferred by general practitioners was studied by Fackrell and colleagues (2012). They found that all websites were lacking details on tinnitus assessment or management choices. Not one website was found to have comprehensive information on these topics for GPs, meaning they would need to refer to more than one website for a more comprehensive overview of the subject. Similar results were found in a recent study which

scrutinized 134 websites dedicated to tinnitus (Manchaiah et al., 2018). Authors reported that on average, only those who had completed at least ten to twelve years of schooling were able to sufficiently understand information about tinnitus online.

One of the most common conditions encountered in paediatric audiology is otitis media with effusion (OME). Schekelle and colleagues (2002) reported a number of 2.2 million cases annually in the United States with almost 90% of the American children having at least one episode in pre-school years. An epidemiological cohort study conducted in five western European countries found an incidence of 256/1000 person-years for otitis media (Liese et al., 2014). Very often, parents and caregivers will try to find out more about this condition, commonly known as “glue ear” and the internet is one of the most accessible options for this particular age group, young adults (Office for National Statistics, 2017). Assessing the quality and readability of online information on glue ear showed a great diversity in quality and readability for online materials on this topic (Ritchie et al., 2016). Pothier (2005) reported a mean RGL of 13.57 when he analysed the first twenty British websites on Google engine search which contained information for patients dedicated to otitis media with effusion. Another study that assessed the patient education information relating to ear tubes and ear tube surgery from 84 websites, found that only 22 of them had readability levels suitable for average adult comprehension (McKearney & McKearney, 2013).

Little research has been published on hearing-related health information in languages other than English. An examination of the readability of patient-related outcome measures related to audiology and otolaryngology in the Spanish language has shown a marked difference between the recommended reading grade level and the actual results (Coco et al., 2017). The research found a range of readability grade levels in the Spanish translations for the Hearing Handicap

Inventory for the Elderly Screening Version (HHIE-S), between 5th to 10th grade, with the Abbreviated Profile of Hearing Aid Benefit (APHAB) range from 6/8th to 8/9th grade.

Recent research analysing 39 hearing-related websites written in traditional Chinese found significant differences between the RGL obtained with two different readability formulas – the CRIE 1.0 and the Jing formulas respectively (Hsu, 2017). This research found that a quarter of the websites analysed with the CRIE 1.0 formula required more than 6 years of education to effectively comprehend, while 81% of the same websites were found to reach these same levels when measures with the Jing formula. In the same study, it was reported that the readability levels were similar between websites, regardless of the types of organisations they represented – governmental, non-profit or commercial.

The internet has changed the way in which patients and their families find information. The majority of internet users look for health information online and when a child has a medical concern or is facing surgery, their parents will often look online to find out more about the issue. The quality of health material for parents online is varied, as with its readability. Because parents are making medical decisions for their children, it is vital to ensure that they access high quality health information that is easy to understand, complete and targeted at them to ensure that the decisions they make are well informed (Wong & Levi, 2017). Nearly half the parents of children with hearing-related conditions refer to the internet to find health information for them. Two thirds of these parents agreed that the medical decisions they made for their children were influenced by the information that they read online (Semere et al., 2003).

## 1.10. Quality of online health information. Patterns of Consumer Online Searching

### 1.10.1. Quality of online health information

Readability is a critical concern for health information accessed online, as well as is the quality of information given. Not all content is clear, current, balanced and unbiased when it comes to patient choice - websites might be biased towards companies and sponsors and authors might not be well qualified (Shedlosky-Shoemaker et al., 2008). When Meric and colleagues (2002) assessed a number of websites related to breast cancer, they only found that a small minority contained inaccurate information (7%), but these sites were less likely to disclose authorship, include references, reveal commercial interest or be kept up to date than ones containing more accurate information. Eysenbach and colleagues (2002), in a systematic review of studies assessing the quality of consumer-oriented health websites, concluded that 70% of the studies reviewed found that quality was a problem on the internet and only 9% of the studies presented a more positive outlook of the quality of the websites analysed.

Another qualitative study looking at how consumers appraise online health information, showed that participants considered websites to be trustworthy based on whether they were from official authorities or not, as well as the understandable and professional style of writing, inclusion of scientific references and a professional layout. Some rated other features as quality criteria, such as search functions within the site or ability to contact owners, as well as an easy-to-navigate layout and links to recommended websites. The ability to see a photo of the site author or owner helped some participants determine a site's trustworthiness. Some non-expert

consumers rated disclosure statements and website owner details as important quality markers but did not look for them when online (Eysenbach & Köhler, 2002).

The Health on the Net's Code of Conduct (HONCode) is recommended as a reliable tool to evaluate health information on web sites (Shedlosky-Shoemaker et al., 2008). Clear criteria are given, against which sites are evaluated, and accreditation is given for compliant websites, which can in turn, display the HON Code logo to reassure visitors that quality information can be found there. A browser plugin is available to be downloaded from the HON Code website, which readers can use to check any website's HON Code accreditation. A database of HON accredited websites is also available through this plugin (http://www.hon.ch/HONcode/Plugin/Plugins.html). It is important to note that, once a website receives HON Code accreditation, there is no strict enforcement of continued compliance (Meric et al., 2002). The HON Code is currently used by over 7300 certified websites in 102 countries, with more than 10 million pages assessed. Its 8 criteria for websites are shown in table 1.3.

| | |
|---|---|
| Authority | qualifications and identity of the author made clear |
| Complementarity | not seeking to replace a doctor but supporting a doctor-patient relationship |
| Privacy | personal data submitted by visitors treated respectfully |
| Attribution | correct citations given |
| Justifiability | claims related to benefits and performance given support |
| Transparency | presentation is accessible and email information provided is accurate |
| Financial disclosure | funding sources identified |
| Advertising policy | editorial content clearly distinguished from advertising content |

*Table 1.3. The HON Code criteria (Health on the Net Foundation, 1995). Retrieved from https://www.hon.ch/HONcode/Patients/Conduct.html*

Aside from the HON Code, there are other tools frequently employed to analyse the reliability of online content. The Suitability Assessment of Material (SAM) tool, developed by Doak and colleagues in 1993, has been widely used as a quality index. It contains 22 statements, covering six categories: content, literacy demand, graphics, layout and typography, learning stimulation and motivation, and cultural appropriateness (Atcherson et al., 2014). Significant criticism has been attracted by the SAM tool due to its numerous limitations; not much is known about the development and rationale behind the tool, therefore its internal validity has been questioned by many (Beaunoyer, Arsenault, Lomanowska, & Guitton, 2017). Beaunoyer and colleagues also note that the SAM tool does not easily measure cultural appropriateness and is highly subjective.

The DISCERN instrument, developed in the late 1990s, helps both patient and health professional to assess the quality of health information about treatment options(Shedlosky-Shoemaker, Sturm, Saleem, & Kelly, 2008). It contains 16 questions that address the objectives of an article, relevance, information sources used, bias, treatment benefits and risks mentioned, emphasis on shared decision-making and mention of further resources to access, among other things (Charnock, Shepperd, Needham, & Gann, 1999). While the DISCERN tool was developed to attend to the shortcomings of the SAM tool, it does not rate content accuracy and is highly dependent on subjective interpretation and rating (Ritchie et al., 2016). Contrary to this finding, Laplante-Lévesque and colleagues (2012) citing Ademiluyi et al. (2003) noted that the DISCERN tool has good internal validity and inter-rater agreement.

### 1.10.2. How consumers access online health information

Searching for online health information can be acknowledged as a prologue and an epilogue to meeting a medical professional (Leroy, Helmreich, Cowie, Miller, & Zheng, 2008a). A search

engine is usually the starting point and two or more of the identified webpages are then usually visited (McInnes & Haglund, 2011). Briggs and colleagues (2002) propose that users make quick preliminary judgements of the trustworthiness of sites and then look more in-depth at information in a few that they select, resulting in long-term use of one or more specific sites that they feel they can trust. This idea is further supported in a later study (Sillence at al., 2007), which suggests that most internet users rapidly screen large numbers of sites found by using general search engines, using quite basic information to help them judge appropriateness of content. They then are expected to spend more time searching through a few selected sites of their choice, considering the content more carefully.

Leroy and colleagues (2008) found that literacy experts judged certain documents to have a more complex readability level than required, while members of the general public said they were at a suitable level to read. The same study concluded that there is a significant correlation between the Flesch-Kincaid readability grade level and ease of reading among the general population. 'Accuracy of Information' was considered by patients and health professionals in Boyer's study to be the most pressing issue facing the medical internet, followed by 'Trustworthiness' for patients and 'Finding Information / Navigation' and 'Availability of Information' for professionals (Boyer et al., 2002)

Medical sites or sections targeted at medical professionals were shown to be accessed by three out of four non-medical-professional people, whether patients or not. The main reason given by 80% of respondents in explanation for this was that they preferred to access more complex information. 45% of respondents explained that information accessed otherwise is too basic. Some researchers and health professionals are concerned that patients could misunderstand or be led astray by the complexity and amount of medical information (Leroy, Helmreich, Cowie,

Miller, & Zheng, 2008b). Boyer noted that 86% of participants in his study cross-checked information by conducting alternative searches and 32% asked their doctors to clarify information found online that they did not understand (Boyer et al., 2002).

McMullan (2006), asserted that because patients were now much more active in finding and using online health information, health professionals would respond to such patients by collaborating and analysing the online information found by the patient or pointing them towards suitable health information websites. A less desirable response from clinicians is feeling threatened by the internet-educated patient (McMullan, 2006). Acknowledging the patients' efforts in looking for online health information helps the patients to feel validated and listened to (Bylund et al., 2007; Peddie & Kelly-Campbell, 2017). In New Zealand, Peddie and Kelly-Campbell (2017), studying a group of eleven participants with hearing loss, found that ten of them had looked online for health information, but interestingly, none of them had discussed their findings with any hearing professional. The main considerations when choosing a website amongst the participants in this study were familiarity, the appearance of an official ownership of the website, a placement within the top ten of the search results and web accessibility.

Kochkin (2005) found that a large number of people report dissatisfaction with their hearing aids, resulting in a significant percentage not using them (between 10% to 20%). When a hearing aid is first trialled, there are usually a few meetings where the new user is instructed on best practice in use, including maintenance, best ways to communicate with hearing aids and warranty information. Kochkin also found from analysing MarkeTrak VII survey data that the average time spent on instructing new hearing aid users in hearing aid care during this trial period is 45 minutes, meaning that new hearing aid users have a lot of additional information to try to understand in quite a brief period of time. Desjardins and Doherty (2009) argue that for older patients with age-related memory

loss, valuable information communicated during these times may be forgotten or not comprehended well from the outset, which could be a factor in patient dissatisfaction with their hearing aids. Similar conclusions have reached Griffin and colleagues (2003), who suggest in their study that only 35% of the information presented verbally is retained by the clients.

### 1.11. Current study

This study is part of a larger project which is assessing and comparing the readability of online hearing information in the 10 most-commonly spoken languages. My thesis has documented the readability level of French-language websites on hearing related health and how it compared to the readability of websites in the English language. Whenever it was possible, similar approaches have been made regarding the methodology of other studies from this project. This includes, but is not limited to, the search strategy, webpage inclusion criteria and the choice of the quality assessment tool, the HON Code certification. The preferred readability formula in my study was an adaptation of the Flesch index for the French language. The readability formulas are usually in agreement with each other, so it can be adequate to use only one formula for assessing readability (Friedman and Hoffman-Goetz 2006, as cited in Shedlosky-Shoemaker, 2009). The only considerations for the choice of this formula were the ease of use and being publicly available.

Internet information about hearing in the English language has been found to be at a higher readability level than the recommended levels and it is well researched in the literature. The United States Department of Health and Human Services stipulates that the average American health consumer is at a 6-7th grade reading level, therefore medical information written at a higher level can be difficult to comprehend for most of the population (Walsh & Volsko, 2008).

According to the Ethnologue report (Simons G. & Fennig. C.(Eds), 2017), French is a language spoken on all continents, ranked as the eighth most commonly spoken language in the world, with currently more than 220 million speakers. It is estimated that by 2050, that number will grow to more than 700 million. There is a scarcity of research when it comes to French language readability, particularly considering health information.

This study has evaluated the readability level of hearing related websites in French, if there were any significant differences between websites coming from different localities or type of organisation (governmental, non-profit, or commercial). In addition, the study has described the quality of the websites by determining how many of them had Health on the Net (HON) certification, and if the proportion of HON certification was different by locality or by type of organisation.

### 1.12. Study Hypotheses

1. There is an even distribution in the type of organisation (government, non-profit, and commercial) across the unique websites found using the search criteria.
2. There is an even distribution in the ccTLD of the unique webpages found using the search criteria.
3. There is an even distribution of type of organisation across the unique webpages by locality of origin.
4. Unique webpages found using the search criteria will have a mean readability score less than 70.
5. There is a significant difference in mean readability between webpages based on locality of origin.
6. There is a significant difference in mean readability between webpages based on type of organisation.
7. There is an even distribution of HON certification across the webpages by locality of origin.
8. There is an even distribution of HON certification across the webpages by type of organisation.

# Chapter 2. Methods

## 2.1. Overview. Criteria of inclusion

The design of this study was influenced by previous studies on readability of online health information as well as the methodologies employed in the larger project of which this is a part. No ethical approval was required.

As a first criterion, French had to be an official language for a country for it to be included in this study. This is the case in 29 countries, even though French is spoken by a large part of the population in around 60 countries worldwide (Leman, 2017). The countries that have French as an official language are Belgium, Benin, Burkina Faso, Burundi, Cameroon, Canada, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, France, Gabon, Guinea, Haiti, Ivory Coast, Luxembourg, Madagascar, Mali, Monaco, Niger, Republic of the Congo, Rwanda, Senegal, Seychelles, Switzerland, Togo and Vanuatu" (Leman, 2017).

The second inclusion criterion for this study was the existence of a Google country code top-level domain (ccTLD), as Google was the search engine used exclusively in all searches.

During July 2017, when the search was conducted, Google was the dominant search engine for desktop or laptop computers, with 76.22% use for online searches (Net Marketshare, 2017). According to the same report, 8.68% of internet searches were conducted through Baidu, 7.60% through Bing and 6.02% through Yahoo; the remaining 20 recorded search engines used during July 2017 were each used for less than 1% of searches. Google was the dominant search engine again for mobile devices, with 95.12% use for online searches (Net Marketshare, 2017). Baidu, Yahoo and Bing, the next most popular search engines at the time, were each used for between

1-2% of online searches (1.61%, 1.21% and 1.11% respectively) with the remaining 17 most used search engines each used for less than 0.5% of searches.

According to the second criterion, six countries- Comoros, Guineea, Equatorial Guineea, Monaco, Seychelles and Vanuatu- do not have ccTLD, therefore they were excluded from the list of 29 countries. After a more in-depth examination, another three countries- Burundi, Rwanda and Luxemburg- were further excluded from the study. Burundi and Rwanda have both ccTLDs, but French is not spoken by the majority of the population, it is only used in administrative and political circles (Irakoze, 2015; Samuelson & Friedman, 2010). In Luxemburg, French only remains the language of legislation, due to the application of the Napoleonic civil code in this country (European Comission, 2007).

The subsequent steps of the study are outlined in the diagram below:

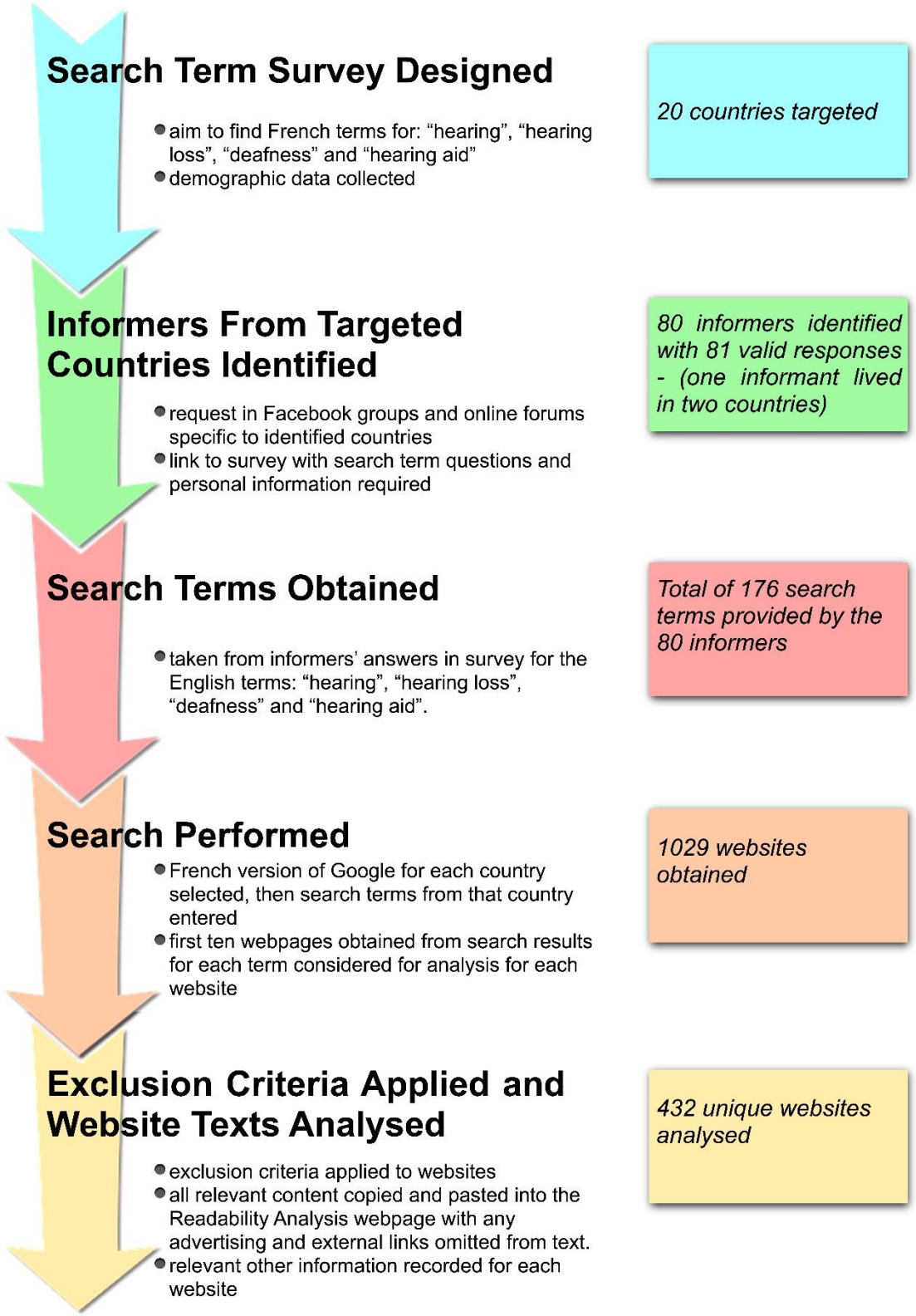


*Figure 2.1. Study sequence*

## 2.2. Identifying informers

In order to obtain a comprehensive picture of the online health information, a search began for the identification of informers in the remaining 20 countries. A number of hearing impairment related forums was first attempted as a source of possible informers, but the respondents did not match the geographical extent of the French-speaking world; more than 90% of the respondents were from France, Switzerland or Canada.

The website www.facebook.com was then employed for a greater penetration in social media. Potential informers were asked either to complete a quick questionnaire in Facebook Messenger or a link to Google Forms was provided. A pdf copy of the questionnaire is included in Appendix 1. This stage lasted for 2 months, afterwards the Google Forms link and Facebook posts were inactivated. The goal was to obtain a minimum of two informers from each of the 20 countries. Despite numerous attempts and joining miscellaneous forums, no participants were found from Central African Republic. In total, 106 respondents participated or filled in the questionnaire. Once results were collated, responses from respondents that did not meet certain criteria were then disregarded.

Criteria of exclusion of the study were:

(1) under 18 years of age;

(2) not answering all the questions in the questionnaire;

(3) French was not the native language- bilingual respondents were accepted;

(4) not residing in the top-level domain country.

After applying the exclusion criteria, there were eighty informers left which provided eighty-one responses. One participant completed the survey twice, since she had dual citizenship and spent an equal amount of time living in two countries included in the study. She was asked to

complete the survey with responses that best represented terms used by people from each of these countries. The countries with the respective number of informants can be seen in the following table:

| | **Country** | **No. informants** |
|---|---|---|
| 1. | Belgium | **7** |
| 2. | Benin | **3** |
| 3. | Burkina Faso | **2** |
| 4. | Cameroon | **1** |
| 5. | Canada | **2** |
| 6. | Chad | **2** |
| 7. | Democratic Republic of Congo | **2** |
| 8. | Djibouti | **2** |
| 9. | France | **22** |
| 10. | Gabon | **2** |
| 11. | Haiti | **2** |
| 12. | Ivory Coast | **3** |
| 13. | Madagascar | **1** |
| 14. | Mali | **1** |
| 15. | Niger | **2** |
| 16. | Republic of Congo | **2** |
| 17. | Senegal | **5** |
| 18. | Switzerland | **18** |
| 19. | Togo | **2** |

*Table 2.1. Number of informants for countries included in the study*

Thirty-six participants were between 18-30 years of age, forty-two between 31-60 and two were older than 60 years of age.

### 2.3. Obtaining search terms

Each participant was asked to provide four French terms commonly used in their country of residence as a translation for the English terms: “hearing”, “hearing loss”, “deafness” and “hearing aid”. The actual questions used can be accessed in Appendix. A total of 176 search terms were provided by the 80 informers.

### 2.4. Performing the search. Exclusion criteria

The computer used for this study was an Acer Aspire F5-572G laptop with an Intel® Core™ i5-6200U CPU processor, using Windows 10 Home Edition as an operating system.

The search was performed over a two-week period, ending on 18 July 2017, by entering first the ccTLD Google webpage into the Google Chrome internet Browser - Version 61.0.3163.100 (Official Build) (64-bit). For each ccTLD, the French version of the Google webpage was selected and then the search terms provided by the informants of the respective country were entered into the search box.

To obtain a more accurate sampling of what people would find online, only the first ten webpages obtained from the search results were considered for the analysis. Eysenbach and Köhler (2002) found that 97.2 % of clicks on a link were performed on the first 10 search results. Similar patterns have been observed by van Deursen and van Dijk (2009) who noted that only 9% of the participants opened the second page of the search results and by the online advertising network Chitika Insights (2013) which reported that in an average Google search, 92% of traffic is generated from sites listed on the first page of search results.

Each of the ten websites obtained for each individual search term were opened and all relevant content was copied and pasted into the Readability Analysis webpage. All advertising and external links were omitted from the Readability Analysis.

Not all the websites obtained from the search results were analysed, the exclusion criteria being as follows:

- Websites providing only verb conjugations,
- Google books,
- Video/Video link websites,
- In other languages than French,
- Not related to hearing or audiology,
- Less than 100 words,
- Synonyms or translation services,
- ADblock restricted,
- Asking for subscription for viewing the article.

Each website analysed had its URL and the following information collected and added to an Excel document:

- Country-coded Top-Level Domain,
- Search term,
- Locality of origin,
- Readability score,
- Type of organisation: commercial, non-profit or governmental,
- Whether or not the website had HON certification.

The HON certification was obtained using the HONcode toolbar for Google Chrome, available through the HON website, https://www.hon.ch/20-years/en/tools.html.

The locality of origin was determined through an IP tracker extension for Google Chrome, available through https://www.tcpiputils.com.

The type of organisation was assessed individually for each website by reading content and further subpages if needed.

### 2.5. Software used for analyses

The software used for all the analyses was provided by Recherche Clinique Paris Centre on their website, http://www.recherchecliniquepariscentre.fr/?page_id=8088&lang=en. The Readability and Patient Information Tool was an adaptation of the English Flesch Index, developed by a collaboration between the Recherche Clinique Paris Centre and Georges Pompidou European Hospital in Paris. There are two peer-reviewed articles that have successfully used this Readability Tool (Menoni et al., 2010; Menoni et al., 2011).

Written consent was obtained from the developers of the tool for its utilisation in this study. Unsuccessful attempts were made to contact the programmer of the tool to find out more about its coding. The equation used to calculate the Flesch score is $206.835-(1.015sl) -(0.846wl)$, where the average sentence length ($sl$) is the mean number of words in a sentence, while the average word length ($wl$) is the mean number of syllables in a word (Menoni et al., 2010). A text score can range between 0 and 100, with texts scoring closer to 100 much more easily understood than texts scoring closer to 0.

The relevant content of each webpage analysed was copied and pasted into the online tool, http://www.rechercheclinique pariscentre.fr/?page_id=3169, and a button was pressed to calculate the Flesch Score.

The advantages of using this software were its simplicity, without the need for any formatting of text or exclusion of images, as well as the length of text used not affecting the outcome or speed of analysis. Being an online tool voided the need to download any Readability software and ensure it was compatible with computers used.

### 2.6. Readability scores/ Interpretation

The interpretation of the scores obtained can be found in the following table, retrieved from http://www.rechercheclinique pariscentre.fr/?page_id=8088&lang=en.

| Flesch indices | Stylistic level | Grade level |
|---|---|---|
| 0 to 30 | Very difficult | University |
| 30 to 50 | Difficult | College |
| 50 to 60 | Fairly difficult | High school |
| 60 à 70 | Standard | 7-8th |
| 70 to 80 | Fairly easy | 6th |
| 80 to 90 | Easy | 5th |
| 90 to 100 | Very easy | 4th |

*Table 2.2. Interpretation of Flesch score*

## 2.7. Statistical Analysis

For the Statistical Analysis, the IBM SPSS 24th Edition software was employed. Cross-tabulations and frequency distributions were used to analyse quantitative data, assessing the relationships between different variables. Correlations among different variables were identified using the Pearson chi-square test to assess the general agreement between them.

# Chapter 3. Results

## 3.1. Descriptive statistics

The 80 informers provided a total number of 176 search terms. The search terms obtained from the English term “hearing” have yielded almost exclusively grammar websites in the search results and therefore were excluded from the analysis. After removing the duplicates, a number of 64 unique search terms remained. The majority of the unique search terms each yielded less than 1% of the websites. The term “surdité” (deafness) yielded the highest number of websites (14.7%) by far. The next highest yielding term was “prothèses auditives” (hearing aids), with 6.9%.

The total number of websites included in this analysis was 1029 but only 432 of these were unique websites. Nearly half of the websites (45.4%) originated from France. An additional 14.6% of the websites originated from Germany. Together, these countries account for 60% of the website origins.

Most of the websites (86%) did not have HON certification. From the 432 unique websites, only 20 (4.62%) were linked with governmental institutions, 142 (32.87%) were assessed as being non-profit and almost two thirds of the websites (62.50%) were judged to be commercial.

## 3.2. Readability scores

The mean readability score for all the unique websites was 42.86 (ranging from 11.8 to 81.9) which places it as college Reading Grade Level (RGL), exceeding by far the 6$^{th}$ grade recommended level.

Only 12 websites (2.78%) were written at or below the 6th grade recommended level with an additional 26 websites (6.02%) being written at 7th-8th RGL. Fifty-six websites (12.96%) were written at university RGL while most of the websites, 266 (61.57%), were written at college RGL and 72 websites (16.67%) were written at a high school RGL. The correlation between the RGL and readability scores was shown in Table 2.2. A graphic representation of the percentages of the unique websites written at each RGL can be seen in Figure 3.1.

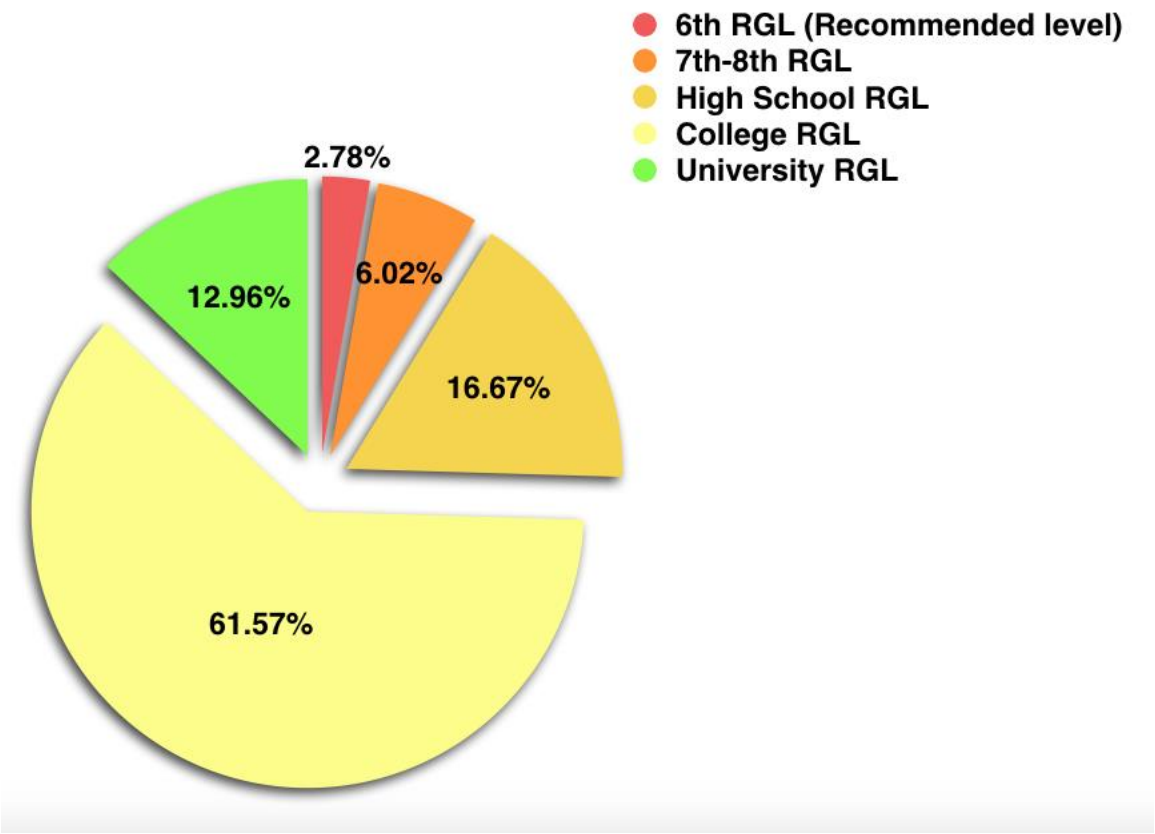


*Figure 3.1. Pie chart with percentages of unique websites written at different RGLs*

Two-thirds (8) of the 12 websites written at the recommended RGL originated from France, 2 were from Germany, 1 from Ireland and 1 from Switzerland. In addition, 8 were online dictionaries, 3 were forum-like webpages and 1 was an educational pamphlet about deafness.

The mean readability scores for the websites identified through all ccTLD Google search engines can be seen in figure 3.2. All mean scores are at a college RGL (range 36.8-44.8)

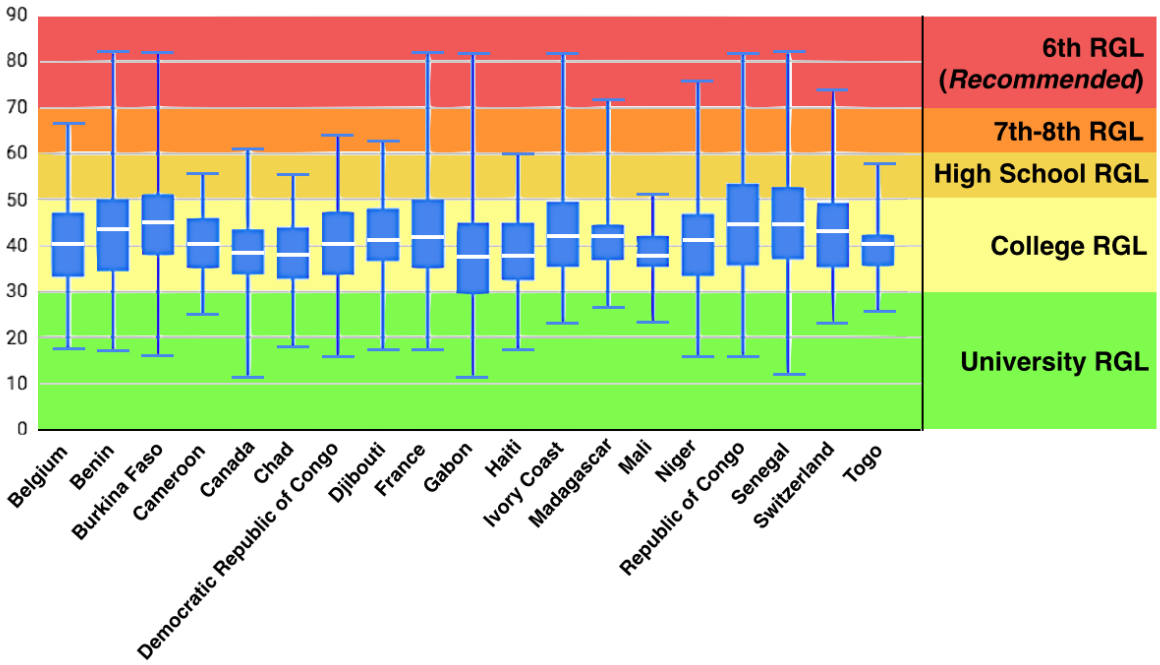


*Figure 3.2. Mean readability scores for websites on ccTLDs*

The mean readability scores of the websites found through ccTLDs from the African, European and North American continents can be seen in Figure 3.3.

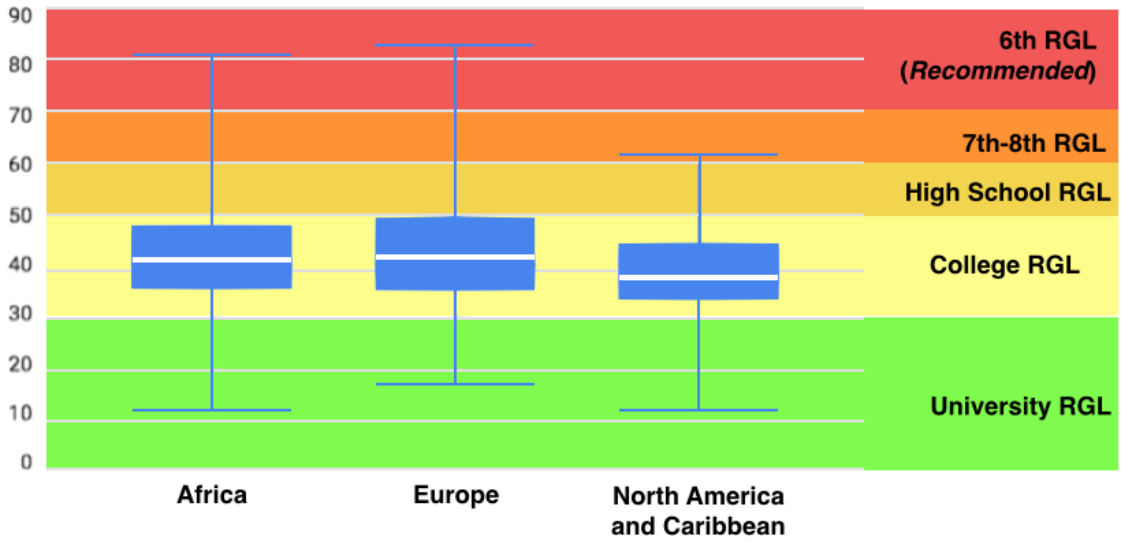


*Figure 3.3. Mean readability scores for websites on ccTLDs from each continent*

The mean readability score of the websites found on European ccTLDs was 42.18, while the readability scores of the websites found on African and North American and Caribbean ccTLDs were 41.98 and 38.59, respectively.

### 3.3. Hypotheses testing

3.3.1 It was hypothesised that there is an even distribution of the type of organisation (government, non-profit, and commercial) across the unique websites found using the search criteria. The Chi Square test was performed, and the null hypothesis was rejected: $\chi^2 (2) = 217.05$, $p < 0.001$.

3.3.2 There is an even distribution in the ccTLD of the unique webpages found using the search criteria. For the second hypothesis, the countries representing the locality of origin for less than five websites were collapsed into a new cell called "other" so the Chi Square test could be performed. These five counties were Japan, Denmark, Sweden, Austria and Spain. Chi Square test was then performed, and the null hypothesis was rejected: $\chi^2 (15) = 1310.15$, $p < 0.001$.

3.3.3 There is an even distribution of type of organisation across the unique webpages by locality of origin. Pearson's Chi Square test was performed, and the null hypothesis was rejected.

$\chi^2 (11) = 876.33$, $p < 0.001$.

3.3.4 Unique webpages found using the search criteria will have a mean readability score more than 70. Descriptive statistics and the single sample *t* test were used

to test this hypothesis. The analysis found that the mean readability score (M=42.86, SD=12,13) was significantly lower than 70. T (431) = 46.48, p<0.001 and the null hypothesis was not supported.

3.3.5 It was hypothesised that there is a significant difference in mean readability between webpages based on locality of origin. The mean readability for each location is shown in Table 3.1. A two-way univariate analysis of variance (ANOVA) was employed to test this premise, using type of organisation and location of organisation as the two independent variables. The Levene's test of homogeneity of variance was not significant: *F* (11,420) = 0.95, p = 0.49, indicating this assumption was met. There was no significant interaction between type and location of webpage host: *F* (11, 403) = 1.78, p = .0256. Therefore, the simple main effects were examined.

The ANOVA revealed a significant main effect of location on readability: *F* (11,420) = 2.07, p = 0.02, supporting the null hypothesis. Post hoc testing using a LSD correction revealed the mean readability was not significantly different for some locations. These are indicated by the asterisks in Table 3.1.

| Location of website host | Mean | Standard Error |
|---|---|---|
| Other | 48.43 | 3.99 |
| France | 44.77 | .84 |
| Sweden* | 44.46 | 4.52 |
| Ireland* | 43.08 | 2.90 |

| | | |
|---|---|---|
| US | 42.92 | 2.02 |
| Switzerland | 42.86 | 2.26 |
| Europe* | 42.05 | 3.32 |
| Germany* | 41.76 | 1.81 |
| Belgium* | 40.78 | 4.88 |
| Canada | 39.17 | 2.02 |
| Netherlands | 36.37 | 2.22 |
| Italy | 35.34 | 4.23 |

* Locations where the mean readability did not differ significantly from other locations, based on post hoc testing ($p > .05$).

*Table 3.1. Mean readability and standard error of webpages from various locations.*

The post hoc testing did reveal some significant differences in mean readability of webpages based on location. The readability of webpages originating in France was significantly higher than the readability of webpages originating in: the Netherlands ($p < .001$), Canada ($p = .01$), and Italy ($p = .03$). In addition, the readability of webpages originating in the Netherlands was significantly lower than the readability of webpages originating in: Switzerland ($p = .04$), the United States ($p = .03$), and those coded as "other" ($p = .01$). Those webpages coded as "other" had mean readability scores significantly higher than webpages originating in Canada ($p = .04$) and Italy ($p = .02$).

A visual representation of the summary of the statistically significant differences in readability scores of the websites from different localities of origin can be seen in Figure 3.4.

| | Germany | France | Switzerland | USA | Netherlands | Canada | Italy | Ireland | Europe | Belgium | United Kingdom | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Germany | | | | | | | | | | | | |
| France | | | | MD = 5.66, p < 0.05 | MD = 11.60, p < 0.01 | MD = 9.71, p < 0.01 | | | | | | |
| Switzerland | | | | MD = 9.67, p < 0.05 | MD = 15.60, p < 0.01 | MD = 13.71, p < 0.01 | MD = 16.64, p < 0.01 | | | | | |
| USA | | MD = -5.66, p < 0.05 | MD = -9.67, p < 0.05 | | | | | | | | | |
| Netherlands | | MD = -11.60, p < 0.01 | MD = -15.60, p < 0.01 | | | | | MD = -11.41, p < 0.01 | | | MD = -12.10, p < 0.05 | MD = -12.68, p < 0.01 |
| Canada | | MD = -9.71, p < 0.01 | MD = -13.71, p < 0.01 | | | | | | | | | MD = -10.80, p < 0.05 |
| Italy | | | MD = -16.64, p < 0.01 | | | | | MD = -12.45, p < 0.05 | | | MD = -13.14, p < 0.05 | MD = -13.72, p < 0.05 |
| Ireland | | | | | MD = 11.41, p < 0.01 | | MD = 12.45, p < 0.05 | | | | | |
| Europe | | | | | | | | | | | | |
| Belgium | | | | | | | | | | | | |
| United Kingdom | | | | | MD = 12.10, p < 0.05 | | MD = 13.14, p < 0.05 | | | | | |
| Other | | | | | MD = 12.68, p < 0.01 | MD = 10.80, p < 0.05 | MD = 13.72, p < 0.05 | | | | | |

MD= mean difference

*Figure 3.4. Statistically significant differences in readability scores of the websites from different localities of origin.*

Better readability for the websites originating from the countries in the left column as compared to those in the top row is pictured in green while lower readability is shown in red.

3.3.6 There is a significant difference in mean readability between webpages based on type of organisation. A two-way analysis of variance was employed for this hypothesis and the null hypothesis was partially supported.

The ANOVA revealed there was no significant main effect of type of organisation: $F$ (2, 403) = 2.21, p = .11. Table 3.2 shows the means and standard errors of the readability of the webpages, based on type.

| Type of website host | Mean | Standard Error |
|---|---|---|
| Government | 50.40 | 3.91 |
| Non-profit | 45.52 | 2.11 |
| For-profit | 41.87 | 1.32 |

*Table 3.2. Mean readability and standard error of webpages from different types of organisations.*

3.3.7. There is an even distribution of HON certification across the webpages by locality of origin. Chi square test could not be performed as 11 cells (45.8%) have expected count less than 5, violating the assumption of Chi Square Crosstabulation testing.

3.3.8. There is an even distribution of HON certification across the webpages by type of organisation. The assumption of minimum cell size was not violated, as only 1 cell had an expected count less than 5. The Pearson Chi Square test revealed that there is a significantly uneven distribution of HON certification across the

webpage types: $\chi^2(2) = 14.74$, $p = 0.001$. Table 3.3 shows the expected and actual count for the variables in the crosstabulation.

| HON certification | Type of Webpage | | |
|---|---|---|---|
| | Commercial | Non-profit | Government |
| Yes | Count: 18<br>Expected: 26.9 | Count: 25<br>Expected: 14.1 | Count: 0<br>Expected: 2.0 |
| No | Count: 252<br>Expected: 243.1 | Count: 117<br>Expected: 127.9 | Count: 20<br>Expected: 18.0 |

HON = Health on the Net

*Table 3.3. Results of the crosstabulation for type of webpage and HON certification.*

# Chapter 4. Discussion

## 4.1. Overview

Readability formulas are widely used in most of current research on health information on the internet, since they show the suitability of texts for their intended audiences. DuBay (2004) suggests that because over 1000 studies on readability formulas have been published and that over 200 such formulas are in use, they are valid tools for theoretical and statistical use. This study assessed the quality and readability of 432 websites in French language related to hearing and audiology. A few measures were taken to ensure the real-world authenticity of the searches: the use of country-specific versions of the search engine, only assessing the websites on the first page of results per search and using informers from each locality studied to identify key search terms. According to Laplante-Lévesque and colleagues (2012) using authentic search patterns and country-specific search engines reflects a more accurate experience for people accessing the internet for hearing-related information.

This study analysed the full-length of the websites rather than employing samples of the texts, as in some previous studies (McInnes and Haglund, 2011; Laplante-Lévesque et al., 2012). This had the advantage of offering a more comprehensive readability assessment of the online text, although one can argue that there is a large variability of the readability of different sections of the materials, as shown by Kingbeil (1995) and, more recently by Douglas and Kelly-Campbell (2018).

The 432 unique websites were obtained through 19 country specific Google search domains. Although the African countries represented 14 of these 19 domains, none of the websites analysed were African in origin. In fact, except for one Japanese site, all the websites originated from Europe and North America.

The overall readability score of the websites analysed was 42.86, which places it at a College RGL, more precisely, 10th RGL. This is comparable with previous results for the audiological websites obtained in similar studies of English language websites and unfortunately denotes a pattern visible across the majority of health-related websites. Despite all the numerous studies showing similar trends, little change is evident in the readability of current health websites in different languages for the last decade.

### 4.2. Research questions

1. It was hypothesised that there is an even distribution of the type of organisation (government, non-profit, and commercial) across the unique websites found using the search criteria.

The results of this study do not support this hypothesis. Almost two thirds of the websites were of commercial origin, one third were judged to be "non-profit" and only 4.62% were linked with governmental institutions. Similar trends in distribution of the website type have been observed by Laplante-Lévesque et al. (2012) and Hsu (2017).

2.There is an even distribution in the ccTLD of the unique webpages found using the search criteria.

The findings of my study rejected this hypothesis. Although there were some similarities in the distribution of the websites on African ccTLDs, these were not observed in the search results of the European countries and Canada which had a tendency to show websites originating in the same locality.

3.The third hypothesis was aiming to find if there is an even distribution of type of organisation across the unique webpages by locality of origin.

The results of my study do not support this hypothesis either. Out of the 201 websites originating from France, 119 had a commercial origin (59%), 72 websites were non-profit (36%) and only 10 were linked to governmental institutions. Almost half of the websites originating from Germany were of commercial type and almost three quarters of the websites originating from the united states were judged to be for profit.

4.Unique webpages found using the search criteria will have a mean readability score less than 70.

The mean readability score across all the unique websites was 42.86, result that supports the fourth hypothesis. The score places the readability at a college RGL, 10$^{th}$ RGL, to be more precise, exceeding by far the 6$^{th}$ recommended RGL. This is in agreement with previous studies in various languages which have investigated the readability of online audiological content. Laplante-Lévesque and Thorén (2015), in a systematic review analysing the English online hearing-related information found that people need, on average, 9 to 14 years of schooling in order to comprehend the internet information. In New Zealand, Potter (2015) analysed 520 individual webpages related to hearing information retrieved from the country specific Google engine and found that the online content was written at a 12$^{th}$ RGL. Coco and colleagues (2017), measuring the readability level of some commonly used audiological and otolaryngologic patient-reported outcome measures (PROMs) in Spanish language observed that the range of readability levels for the HHIE-S was fifth to 10th/ 12th grade and the range for the APHAB was sixth/eighth to eighth/ninth grade respectively. Hsu (2017) found that 25% of the audiology-related websites in Chinese have a mean RGL higher than 6, according to the CRIE 1.0 formula,

but according to the Jing Formula, 81% of the websites were written at higher than the 6th recommended RGL. Toth (2017) analysed 39 audiology-related websites in German language and noticed that 12 years of education are necessary to understand that information. In contrast, Diwan (2017) found that the online hearing-related material in Hindi is below the 6th recommended level, the mean RGL being 5.33.

5.There is a significant difference in mean readability between webpages based on locality of origin.

The fifth hypothesis was partially supported by my results, the websites originating in some countries had a mean readability score significantly different from others, as described in detail in chapter 3.3.5.

6.It was hypothesized that there is a significant difference in mean readability between webpages based on type of organisation.

Statistical analyses did not find any significant interaction effects between websites' origins and type of organization. A trend in readability scores of the websites based on type of organization was observed, but it did not reach statistical significance. Similarly, Laplante-Lévesque et al. (2012) found that readability of the websites was independent of the type of organization. The same conclusion has reached Manchaiah and colleagues (2018), assessing English websites dedicated to tinnitus. In contrast, Hsu (2017) and Diwan (2017) found a significantly higher RGL of governmental hearing-related websites in Chinese and Hindi respectively.

8.There is an even distribution of HON certification across the webpages by type of organisation.

Findings from this study do not support the last hypothesis. From the 432 unique websites, only 43 (14%) had HON certification. Of these 43, 18 webpages represent commercial interests while the other 25 are non-profit websites. Interestingly enough, no governmental websites had HON certification. Laplante-Lévesque and colleagues (2012) found the exact same percentage of websites with HON certification in their study. In contrast, 60 % of the governmental websites and 2% of the commercial websites had HON certification. Manchaiah and colleagues (2018), scrutinizing 134 English websites related to tinnitus found that 42.9% of the governmental websites and only 12% of the commercial ones investigated had the HON certification.

### 4.3. A comparison between the readability of audiology and other health related websites

The findings of this study are compatible with other studies which have evaluated different health information online. Cherla and colleagues (2012) found, in evaluating readability of online material related to endoscopic sinus surgery, that 96.8% of patient education materials scored above the recommended sixth-grade reading level, and while information from hospitals and university-affiliated sites had a lower readability than others, they were still higher than the recommended levels. In the same way, Patel and colleagues (2013) also found that the average readability score when evaluating online education material for thyroid surgery patients was at tenth-grade, higher than recommended levels. Cheng & Dunn's (2015) study results suggest that for Australian people with low-literacy levels, there is a very small amount of suitable health information available online. Muthukumarasamy and colleagues (2012) found that readability scores for the websites for patients undergoing thyroidectomy was

variable and it was interesting to note that the site which scored the highest Flesch Reading Ease Score had been written by a patient.

Studies into the readability of health information online in Europe and the US show that available information is above an average adult's reading ability. The average readability of 352 international health websites reviewed by McInnes and Haglund (2011) showed an average reading grade level of 12.3. None of them met the grade 6 level, which is recommended. Similarly, cancer-related websites studied worldwide showed grade 10.7 to be the minimum average reading grade (Friedman & Hoffman-Goetz, 2006).

Evaluating the readability and quality of thryroplasty information online, Ting and colleagues (2014) found an average Flesch Kincaid grade level of 11.46 in websites targeted at patients, far too high for average American readers to comfortably read, and at 14.33 for professionals.

Eloy and colleagues (2012) found the readability levels on all otolaryngology association websites to be above the recommended fourth to sixth-grade reading level, ranging from 9.7 to 17.1 grade level.

Hu and Ferster, when studying the readability and quality of online information about treatment of swallowing disorders, found that the average readability of the sites was almost at 12th grade level, far exceeding the American Medical Association and the National Institutes of Health recommended 4th-6th grade level.

Langille and colleagues (2012) found that the average reading grade level for online texts relating to obstructive sleep apnoea was 11.0, with the highest in the range reaching grade 15.8.

### 4.4. Limitations

Traditional readability formulas have been readily accepted in educational and research circles. At the same time, there has been wide criticism of them, since they only are able to measure surface processes, leaving deeper features, such as text processing, consistency and syntactic complexity unanalysed. (McNamara et al., 1996). While readability formulas are unable to assess how factors such as design or use of non-text features affect comprehension, they provide a basis from which to assess comprehension while focusing on language features alone. Tools currently used to analyse health information online have been developed specifically for printed material, which is not an interactive medium in the way that the internet is, full of multimedia material. This is vital to remember, since some patients access information online through video or audio, rather than text, meaning that online health information analysis can be incomplete. (Finnie et al., 2010). Because classic readability formulas were designed to be measurement tools - explanations of text difficulty, they have drawn criticism, since they have often been incorrectly used by writers as predictors of difficulty instead. (Crossley, et al., 2008). Furthermore, reader's familiarity with health content is not accounted for in these formulas, along with their motivation or cultural background. Readability formulas are also limited in that they do not measure suitability of language to the intended audience or the design and layout of the information presented (Doak et al., 1996; Kelly-Campbell et al., 2012).

There are a few limitations arising from the construct of my study. In the first place, the limited number of informers from African countries have resulted in a limited number of search terms, as compared to the European countries. More accurate results would probably have been obtained if the number of informers from each country would have been similar.

Secondly, the choice of English terms provided to the informers was personal, but previous studies of a similar construct were taken into account. Great consideration was given to the

possibility of cueing the informers regarding their answers. I have considered that the least cueing will be achieved by asking the questions both in English and French but only providing the terms in English. This has had the undesirable effect of recruiting only participants who, besides having French as their native language, had a minimal fluency in English as well; however, this might be, questionably, the best way to minimize any cueing. Whether this is a valid point remains a subject for further discussion.

Another limitation of this study is the choice of the website quality indicator, the HONcode certification. The Health on the Net Foundation has been and still is one of the most reputed and most successful initiatives to ensure that online health information has a high ethical standard. Websites displaying the HON certificate have been assessed against eight ethical principles, which, while not guaranteeing the completeness of the content, shows that effort has been made to relay quality information in an ethical manner. Before a website can be HON certified, it undergoes a formalised application process, and membership is not granted until any needed improvements and changes have been made. Member sites are monitored over time to ensure continuing compliance but there is some debate about the vulnerability of the system due to the policing in real time of more than 7 300 websites (Nater & Boyer, 2000).

Because the internet is dynamic, the websites assessed in this study do not fully represent all the hearing-related websites in French that are currently online. Also, as more people turn to social media for information, such sites are more likely to show in search engine results. Therefore, it could be beneficial for continued research into the readability of user-created content and social media sites for hearing related information in French.

Finally, not testing one of the hypotheses represents another limitation of this study.

### 4.5. Practical implications

It has been found that patients in the United States of America who completed eight or fewer years of schooling are very likely to have poor health literacy, while the health literacy of those who completed tertiary education is likely to be adequate. The NALS did find, however, that up to 20% of adults who had obtained high school diplomas scored in the lowest of five proficiency levels. Another interesting aspect is that two thirds of participants who scored in the lowest skill level of NALS had described themselves as being able to read well or very well. (Parker, 2000).

A big step in addressing some of this problem will be to create and foster a culture in health care where it is normal for help to be offered in completing important documents and where readers are available for patients whenever health information is communicated (Parker, 2000). Chew and colleagues (2008), found that instead of asking individuals about their reading competence, any issues with health literacy would be identified by asking them how confident or comfortable they felt filling out forms by themselves.

Communication disorders, which includes hearing impairment have potentially a disabling impact on affected people, interfering with behaviour, well-being and social participation (McKinnon, McLeod, & Reilly, 2007). The audiological patients and clients

are at increased risk for low health literacy skills due to their sensory or cognitive deprivation; these individuals require additional professional and social support to compensate for these obstacles (Atcherson et al., 2014). The same authors note that it is important for audiologists to meet individual needs with appropriate information, be health literate themselves and communicate well in a variety of ways.

A number of government and non-profit organisations have created guidelines as a result of these findings, which set out to help content writers to create suitable texts for average people who use the information. Educators, literacy students and health professionals are able to access guidelines created by the State of California Health Literacy Initiative and Medline. In addition, while links to health information at more easy reading levels are available on the "World Education" website. (Leroy, Miller, Rosemblat, & Browne, 2008). The National Institutes of Health requires for all government-produced documents to be written in plain language while hospitals also give patients brochures created with these guidelines in mind. (Leroy et al., 2008). In a similar manner, sustained efforts to improve the readability of ASHA's website pages have been admirably made by ASHA's Associate Director for Audiology Professional Practice (Atcherson et al., 2014).

It is important to remember that other factors may also influence how consumers evaluate online health information. People might be anxious or fearful about a diagnosis or their symptoms when searching online for health information, so it is valuable for providers of such information to consider the emotional responses to content delivered, especially if describing serious conditions (Beaunoyer, Arsenault, Lomanowska, & Guitton, 2017).

Assessing the reading ability of patients can be a first step towards better communication in a healthcare situation. Rapid Estimate of Adult Literacy in Medicine (REALM), developed by Davis and colleagues, is a word recognition test designed to be used in a clinical setting, which measures a patient's reading ability by having them read a list of progressively more difficult words until they are unable to correctly pronounce them. Because the REALM test can be completed in five minutes, it is not an onerous addition to any consultation.

Another test, the TOFHLA (The Test of Functional Health Literacy in Adults), developed by Parker and colleagues in 1995, measures functional health literacy requiring reading and computational skills by testing a patient's ability to read passages and phrases using real health care materials (Parker, 2000). An abbreviated version of this tool in French was created by Connor and colleagues in 2013. The Short-Test of Functional Health Literacy (S-TOFHLA) was developed and validated initially to assess the literacy of French speaking population is Switzerland and can be administered in seven minutes (Connor, Mantwill, & Schulz, 2013).

### 4.6. Future Directions

It would be beneficial for further study into health literacy online to inform policy and appropriate resource creation, which in turn can help online health information providers to ensure that their online information is comprehensible, enabling health literacy (Cheng & Dunn, 2015). While care needs to be taken in how health information is communicated, a more holistic, structural approach is needed to improve health literacy in a population. Offering support needs to be normalised, personalised and community-based, with the goal of greater empowerment and independence among people in their communities. Patients need to feel more confident to act on health information given to them, knowing that they have an active support-base. Underlying structural and political systems in education must be understood and addressed for such an approach to be normalised.

Having patients access incorrect health information or misinterpreting it could have severe implications, which is why it is vital for online health websites to not only be accurate, but easy to understand and in formats that are considered to be of a consistently high standard (Whitten, Nazione, & Lauckner, 2013). As internet penetration increases and more people search online for health information, the need to further research and develop methods to measure the quality

and readability of health websites should be prioritised to ensure that people access the best content possible.

In order for health-related communication in print and online to be effective, material needs to be targeted to meet the readability and health literacy levels of the people it is intended to reach. It can be useful for audiologists to find readability levels of existing material, then adapt the text to help with user-comprehension. In this sense, it is worth mentioning the examples set by Ming and Kelly-Campbell (2018) of a tinnitus brochure which was revised so that the RGL had decreased from 10.5 to 5.9 and by Donald and Kelly -Campbell (2016) who reduced the RGL of a paediatric audiological report by 8.3 years. In any community, there will be a range of readability and health literacy levels, so having patient communication at different reading levels available will ensure that communication is more suitable for all patients, especially those with low literacy skills.

A novel approach towards the audiology of tomorrow has been proposed by Brännström and colleagues (2015) who have successfully developed an internet-based platform for clinicians and their clients alike to promote evidence-based practices, enhance client information retention and ease the audiologist's workload.

In my opinion, one way to match readability levels of websites with an individual's health literacy skills would be the development of a browser extension or device app that analyses website content as it appears in search results and assigns a score through a basic readability tool. The difficulty levels can then be displayed alongside search results through a very simple, colour-coded graphic indicator - a dot, for example; green for easy-to-read, yellow for intermediate level of difficulty and red for hard-to-read texts. Users can then select websites based on the colour code that they, or their health professionals, have deemed most suitable for their reading abilities.

### 4.7. Conclusion

The focus of this thesis was solely on the readability of French hearing-related websites. According to this study's results, it can be concluded that the clear majority of hearing-related websites in the French language are inaccessible to people with low literacy skills.

By improving the readability of such sites, one aspect of health literacy is enhanced for people with lower levels of reading, since the information is more easily accessible to them. Working to boost readability alone is only one contributor to a higher health literacy and further work is needed to raise this among people with hearing loss. As Manchaiah and colleagues (2018) assert, improving health literacy is one key goal in accomplishing a desired health outcome.

Overall, the results of this study suggest that there is high need for quality, easy to read online information on audiology in the French language. A responsibility lies with hearing professionals, health providers and website creators to create easily-comprehensible information for people with concerns about hearing to use in their decision making.

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# Appendix. Survey questionnaire



## 2 minute survey for Native French Speakers Enquête de 2 minutes pour les francophones

Nous étudions la variation des termes de recherche utilisés par les francophones autochtones dans différents pays et nous apprécions deux minutes de votre temps pour répondre à ces questions.

Imaginez que vous souhaitez en savoir plus sur certaines questions liées à l'audition, vous faites donc une recherche Google en français.

1. **What would you type into Google in French to find out more information about HEARING?**

2. **What would you type into Google in French to find out more information about HEARING LOSS?**

3. **What would you type into Google in French to find out more information about DEAFNESS?**

4. **What would you type into Google in French to find out more information about HEARING AIDS?**

## Please provide the following information about yourself:

5. **Is French your Native Language?**
*Mark only one oval.*

- Yes
- No

6. **What country are you from?**

7. **What country do you live in?**

8. **How old are you?**
*Mark only one oval.*

- Under 18
- 18-30
- 31-60
- Over 61

## Please forward this survey to other Native French Speaking people in your country that you know. Thank you kindly. Veuillez faire parvenir ce sondage à d'autres personnes francophones de votre pays d'origine que vous connaissez. Merci beaucoup.

Here is the link: https://goo.gl/forms/BEKApl6fBzGg0Dbs1