HOW EASY IS IT TO READ HEARING-RELATED WEBPAGES IN JAPANESE?

Zoe Alexander

A thesis submitted in partial fulfilment

of the requirements for the Degree of

Master of Audiology

Department of Communication Disorders

University of Canterbury

2018

ACKNOWLEDGEMENTS

I would like to thank my supervisor Dr Rebecca Kelly Campbell who has supported me throughout the thesis process and has reignited my passion for the Japanese language. To the Communication Disorders department at the University of Canterbury, thank you for giving me the opportunity to pursue such a rewarding career and for enriching my knowledge of things that I had never encountered before.

To my friends, family and classmates, it has been a crazy couple of years, thank you for always lending an ear and supporting my aspirations. I couldn't have done this without you always keeping me grounded and on track, whilst reminding me to have some fun too!

To Harry, we've worked so hard to get to where we are, and you've been by my side this entire time. I can't wait to embark on the next step of this adventure together. The future is bright.

ABSTRACT

Purpose: To assess the readability of hearing-related information on the internet in the Japanese language and compare the readability between webpages by origin, type of organisation, and author. This study also aimed to assess the quality of that information using the Health on the Net Foundation (HONcode) certification.

Method: Hearing-related search terms were identified by native Japanese speakers, resulting in five keywords. The keywords 聴覚障害 (hearing impairment), 難聴 (hearing loss), 補聴器 (hearing aid), 聞こえない (cannot hear), and 耳 (ear), were entered into the Japanese country code top-level domain (ccTLD) versions of the Google (google.com.jp) and Yahoo (yahoo.co.jp) search engines. The first 10 webpages retrieved from each search were recorded, resulting in 100 webpages. Information regarding webpage origin, type of organisation, author and HONcode certification status was also recorded. These were then matched against the inclusion/exclusion criteria, resulting in 28 unique webpages, whose readability was assessed using the Japanese Text Readability System formula: https://jreadability.net/en/. Descriptive statistics and a Box-Plot were used to assess the validity of the statistical data. A Chi Square test was used to determine whether the webpages were evenly distributed amongst the various characteristics recorded, and a univariate analysis of variance (UNIANOVA) was used to determine whether there were significant differences in readability of online hearing-related information between webpages.

Results: All but one of the 28 webpages had a JReadability level of Upper Intermediate or higher. 75% of the webpages were categorised as "profit", these webpages had significantly higher readability levels than "non-profit" webpages. The majority of the webpages originated from Japan. The author categorised as "professional" and "non-professional" was evenly

distributed amongst the webpages. Readability levels did not significantly differ based on type of organisation, and author. None of the identified webpages had HONcode certification.

Conclusion: The results of this study indicated that the majority of online hearing-related information in the Japanese language is difficult to read. The clinical implications of these findings and the limitations of the study are discussed. As internet penetration rates continue to rise it is important that the issue of poor readability is addressed, and that further research is done to investigate whether the quality of online hearing-related information meets acceptable standards to inform patients.

TABLE OF CONTENTS

:

LIST OF TABLES

LIST OF FIGURES

Chapter 1: Introduction

1.1. Study Overview

In studies conducted by the World Health Organisation (WHO) it has been estimated that around 15% of the world's population live with a disability, of these, adult onset hearing impairment was the third leading cause of disability worldwide (C. Mathers, Fat, Boerma, & World Health Organization, 2008; Officer & Posarac, 2011). Hearing impairment is a common sensory disability which can have detrimental effects on one's quality of life (Chia et al., 2007; Dalton et al., 2003). It has been demonstrated that those with a hearing impairment are more prone to depression, poor educational outcomes and unemployment when compared with the general population (Hogan, O'Loughlin, Davis, & Kendig, 2009; Järvelin, Mäki–torkko, Sorri, & Rantakallio, 1997; Li et al., 2014).

Increasingly people are turning to the internet to access health related information (Rice, 2006). Globally, internet penetration rates have surged from an estimated 10% in 2002 (Chen & Wellman, 2004) up to a global median of 67% in 2015 (Poushter, 2016). Much of the health-related information found on the internet is difficult to read and of variable quality (Benigeri & Pluye, 2003; Risk & Dzenowagis, 2001). To date, the majority of research surrounding hearing-related online health information has focused on websites in the English language. The consensus is that this information is difficult to read (Berland et al., 2001; Laplante-Lévesque & Thorén, 2015). Little attention has been given to hearing-related health information in other languages.

1.2. Hearing Impairment

1.2.1. Overview

Hearing impairment is a common sensory disability which can have detrimental effects on one's quality of life (Chia et al., 2007; Dalton et al., 2003). The impairment of hearing can be either complete or partial, and can be described by its origin and severity (Colman, 2015).

Conductive hearing impairments are acquired due to diseases, damage, or obstruction of the auditory pathway. Sensorineural hearing impairment can be congenital (present at birth), or acquired, these are often described as permanent as they are due to damage in the inner ear or neural pathways and are often irreversible (Harris & White, 2013). Mixed hearing impairment is a combination of conductive and sensorineural components. The fourth and most rare form of hearing impairment is central hearing impairment, this results from damage to the central nervous system (Gates et al., 1996). Hearing impairment is described as congenital when occurring at birth, with over half of these cases due to genetic conditions (Dietz, Löppönen, Valtonen, Hyvärinen, & Löppönen, 2009), in all other cases hearing impairment is described as acquired, which can be due to illness, injury (such as noise exposure), and/or age (Böttger & Schacht, 2013). Typically, severity of hearing impairment is classified using adjectives which correspond to levels on a scale. These scales typically range from normal hearing to a profound hearing impairment. It has been shown that even a slight hearing impairment can impact a child's speech and language development, whereas impairments at the other end of the scale equate to near or total impairment of hearing (Clark, 1981).

1.2.2. Worldwide Prevalence

In the Global Burden of Disease 2000 (Colin Mathers, Smith, & Concha, 2000) the authors highlight the difficulties faced when trying to make a true and accurate estimate of the worldwide prevalence of hearing impairment. Although many studies have been conducted with data across a range of countries, the majority of the data is incomplete, and the criteria used to define "hearing impairment" differs between studies. However, WHO has released new estimates regarding global prevalence of hearing impairment in 2018 and projections leading up to the year 2050 (World Health Organisation, 2018, July). These estimates define 6.1% of the world's population (or 466 million people) under what they categorise as living with a "disabling hearing loss". This level of hearing impairment is defined as thresholds over 40dB

HL for those over 15 years and 30dB HL for those 14 years and under, in the better hearing ear. Yet these numbers do not truly encompass every person that would be counted as having a hearing impairment from an audiological perspective (typically thresholds over 25dB HL) (Dalton et al., 2003). In addition many studies have demonstrated the debilitating effects of "a mild hearing loss" (20 – 39dB HL), especially pronounced in the paediatric and geriatric populations (Khairi Md Daud, Noor, Rahman, Sidek, & Mohamad, 2010; Rabbitt, 1991), thus this number may actually be a lot greater. WHO also estimated these numbers to rise from 630 million people in 2030 to over 900 million people in 2050. In the report it was stated that one third of people over 65 years of age are affected by a disabling hearing impairment. Populations (especially in developed countries) are expanding and aging, with the fastest growing segment consisting of individuals over the age of 65 years (Etzioni, Liu, Maggard, & Ko, 2003). This may be an indication as to why the projected number of people living with a hearing impairment rises so rapidly.

1.2.3. Prevalence in Japan

Asia is the most populated continent on Earth, estimates made around mid-2017 put the population of Asia at 4.4 billion people. This grossly surpasses the next most populous continent of Africa, which sits around 1.25 billion (DSW, 2017). Japan is the sixth largest country in Asia by population size, with current estimates surpassing 127 million people (United Nations, 2017). According to JapanTRAK 2015 (Avonum, 2015) it is estimated that around 11% of the total population live with a hearing impairment. Uchida (2012) estimated the hearing impaired population in Japan over 65 years of age to be 16.5 million.

1.3. Impact

Although hearing impairment's main effect is on one's sense of hearing it also contributes somewhat indirectly to a number of other factors in a person's life.   The

International Classification of Functioning, Disability and Health (ICF) created by WHO uses the terms "activity limitations" and "participation restrictions". An "activity limitation" is defined as the difficulty a person encounters in executing a task, a "participation restriction" is the difficulty an individual has becoming involved in life situations on a social level (World Health Organization, 2001). These terms are used often to help describe the impact that hearing impairment can have on an individual's life. A study by Helvik, Jacobsen, and Hallberg (2006) found a positive correlation between degree of hearing impairment and activity limitation (Pearson's $r = 0.54$), this is in consonance with previous studies that the authors looked at. It has been shown that even a mild hearing impairment can result in a severe participation restrictions, and has been associated with decreased life satisfaction and overall health (Solheim, Kværner, & Falkenberg, 2011). This may be due to how one perceives their own hearing impairment, which has been demonstrated as a main predictor of communication participation (Price, 2017).

While it is clear that hearing impairment is associated with reduced functioning and overall quality of life in those affected (Dalton et al., 2003), it is also important to note the impact that this can have on their friends, family, and colleagues. In effect, a study by Scarinci, Worrall, and Hickson (2008) examined the effects hearing impairment can have on that person's spouse. They highlighted increased difficulties in hearing-related activities such as television watching and phone use (due to their partner's need for increased volume), and emotional difficulties such as frustration and anxiety. These negative impacts that are placed upon a communication partner appear to be improved once the hearing-impaired individual seeks treatment. A systemic review conducted by Kamil and Lin (2015) reported improved communication, feelings toward their partner, and quality of life in communication partners following intervention.

4

1.4. Management of hearing impairment

1.4.1. Overview of Traditional Management Options

The current focus on hearing aids as the HI panacea and the sole form of rehabilitation is believed to be an incorrect one (Hickson & Worrall, 2003). Further, a study conducted by Chien and Lin (2012) estimated that only 14.7% of Americans over 50 years of age who had a hearing impairment actually use a hearing aid, this indicates that there are other management options available. For some types of hearing impairment, such as a conductive impairment due to cerumen impaction (seen in up to 30% of elderly patients with hearing impairment) (Yueh, Shapiro, MacLean, & Shekelle, 2003), the solution can be as simple as visiting a health care provider for ear wax removal. Nowadays, there are becoming more and more advanced methods to tackle hearing impairment, with a significant amount of research going into the role of genes on hearing impairment, and the possibility of hair cell regeneration to reverse pre-existing impairmentes (Steel, 2000). While there are many medical and technological interventions, another rehabilitation option that is becoming more popular is the use of communication strategies. These programmes vary greatly and can be personalised for each individual, in general the programmes aim to improve speech perception and communication, and can be used in conjunction with or in place of hearing aids (Laplante-Lévesque, Hickson, & Worrall, 2010).

1.4.2. Online Health Information

With hearing impairment effecting such a large proportion of the population and continuous research being put into an ever-growing range of treatments, it is important that everyone can access and understand the information necessary to seek treatment. As internet penetration rates rise it is becoming more and more common for people to use the internet in conjunction with their physician as their primary source of health-related information (Sillence,

Briggs, Harris, & Fishwick, 2007). There are a range of reasons why people do not seek professional medical care, such as high cost and time restraints (Taber, Leyva, & Persoskie, 2015). On the other hand, using the internet for health information overcomes many of these things. The internet can be accessed almost anywhere, at any time, and often comes with little or no additional costs on top of monthly expenses. The problem that comes with online health information is that one cannot be assured of the quality and accuracy of the information they are receiving, and there are concerns that fraudulent treatments without scientific based evidence may be presented to consumers (Cline & Haynes, 2001). While health providers cannot prevent patients from using the internet as a source of information, they can improve their patients' experience by recommending high quality, appropriate resources (McMullan, 2006). This is best done on a patient by patient basis, with consideration put into nonbiased resources that the patient can easily understand, to help inform the decision making process (Iacovetto & Allen, 2015). In order for patients to understand any type of reading material, the material must be at an appropriate readability level for the patient. As it can be difficult to judge someone's reading ability based on a number of short appointments, it is recommended that, in general, health information should be written at a sixth-grade reading level, in order to be accessible to the majority of readers (Safeer & Keenan, 2005).

1.4.3. Validation of Online Health Information using the HONcode

The Health on the Net (HON) Foundation's Code of Conduct (HONcode) is a code of ethics targeted at online health related webpages to ensure that the information provided is objective, transparent, of high quality, and tailored to meet the needs of its intended audience (HON, 2017). It has a set of eight principles that must be followed for websites to meet certification standards. The webpage's information must: be provided by professionals unless clearly stated otherwise, be designed to support (not replace) a regular doctor/patient relationship, be supported by clear references, remain confidential (in terms of visitor data), be

evidence based (for treatments), be clear with contact details if visitors require more information, be transparent about funding/supporters, and must be distinguishable from paid advertisements (C. Boyer, Selby, Scherrer, & Appel, 1998). If a publisher believes that their site upholds these principals they are able to apply for accreditation on a voluntary basis (Bedell, Agrawal, & Petersen, 2004). Although this is a useful tool for validating webpages, a book written by Brunet, Ashbaugh, Herbert, Peace, and Programme (2010) about internet use and trauma, stated that just over 7500 webpages were HONcode certified. Although this sounds like a large number, in a 2001 article by Cline and Haynes (2001) they noted that there are more than 70,000 websites relating to health-information in existence, and since then this number has surely risen. This means that only a small proportion of all health-related websites are HONcode certified. As the process is voluntary it is difficult to determine whether this is due to websites not meeting the ethical standards set out by the HON Foundation, or simply a lack of awareness that such a thing exists.

1.5. Health Literacy and Readability

Kickbusch et al. (2005) describes health literacy as the ability to make sound health decisions on a day to day basis, it is an empowerment strategy which is used to increase people's ability to seek information, and to take responsibility and control over their own health. In other words, it is the ability to obtain, interpret and understand basic health information (Friedman, Hoffman-Goetz, & Arocha, 2006), a necessary skill to utilise the ever-growing array of health information available on the internet. Poor health literacy has been linked to patients being less likely to seek out health services/interventions, having a poor understanding about one's health condition and how to manage it, and therefore substandard levels of health in the long run (Doak, Doak, & Root, 1996; Priston, Searle, & New Zealand. Ministry of, 2010).

Readability levels are a tool that health professionals can use to ensure that the health information they are providing is comprehensible, even to those with low health literacy. Readability refers to the ease with which a passage of text can be read and understood (McInnes & Haglund, 2011), and is often described in levels, with the most common being reading grade level or RGL. It is recommended that written health information should be around a fourth- to sixth-grade reading level, to maximise the amount of people who will be able to comprehend them (Wang, Miller, Schmitt, & Wen, 2013). However, studies show that the majority of health information currently sits at an RGL that is beyond the abilities of the average patient (Beaver & Luker, 1997; Berland et al., 2001).

As of late there has become an increased interest in how one can improve the readability and in turn, the accessibility of written health information. There are number of ways in which this can be done, Hodges (2011) describes techniques such as sequencing, putting information into a logical order so that the most relevant information is displayed first, and structural cues, this being informative headings and signposts which direct the readers' attention. By assessing the current RGL of existing webpages it can be determined whether this is an issue to be

1.6. Japanese Readability

1.6.1. Japanese Language

There are around 128 million native Japanese speakers, making it the ninth most spoken language in the world (Simons & Charles, 2018).

The Japanese language is spoken most commonly on the main islands of Japan (Hokkaido, Honshu, Kyushu, and Shikoku), and, along with the Ryukyuan languages which are spoken on the small islands off Japan, comprise what linguists call the "Japonic Language" family (Shimabukuro, 2007). The origin of the Japanese language is largely unknown, however the earliest form of the language known as Old Japanese can be dated back to the eighth century

(Frellesvig, 2010). Although the earliest written form of Japanese comprised traditional Chinese Characters, linguists have concluded that spoken Japanese bares no linguistic relationship to the Chinese language (Deal, 2005). The suggestion that the Japanese and Korean languages have a direct connection has also been made by numerous scholars, however that theory also is widely debated (Vovin, 2010).

Japanese is a complex multiscriptual written language comprising of kanji (Chinese Characters) and kana (syllabic signs) (Matsunaga, 2014). A comprehensive Japanese dictionary called Dai Kan-Wa Jiten (Morohashi, 1966) states the total number of kanji to be close to 50,000, having said that, a much smaller list consisting of just over 2,000 kanji, known as jōyō kanji, is all that is said to be required to read Japanese newspapers and literature (Halpern, 1999). Japanese kana comprises of two separate writing systems, hiragana, which represents grammatical morphemes, and katakana, a character set used to represent foreign loan words (Sakuma, Sasanuma, Tatsumi, & Masaki, 1998). Written Japanese is further complicated by the large number of readings (morphemes or words) that a single kanji character can have (Wydell, Butterworth, & Patterson, 1995), and the multiple uses of kana that can be present throughout a sentence (Besner & Hildebrandt, 1987). For these reasons, Japanese is known as one of the most demanding languages to learn and master (Gethin & Gunnemark, 1997).

1.6.2. Past Readability Analyses in Japanese

Sato (2014) explained that a major obstacle in the past for completing readability analyses in the Japanese language is the clear definition of a "word". In English, words are separated by a space, Japanese on the other hand, does not utilize spaces. This was again emphasized at the 2007 Information Sciences Joint Conference by Narita and Pichl (2007) who explained that whilst use of hiragana (syllabic kana) can simplify a text, overuse can cause confusion due to homonyms and lack of word barriers. The use of kanji runs into similar

problems, where single kanji words (typically made up of two characters) give a clear meaning, but long strings of kanji become difficult to understand due to lack of grammatical properties such as prepositions and tenses (typically expressed in kana). Unlike many European languages such as English and Spanish, which have had extensive research into readability and a range of readability formulae, there does not appear to be a single formula that has been tried and tested across multiple studies by different researchers.

Currently the majority of Japanese readability literature has focussed on legal documents (Shinmori, Okumura, Marukawa, & Iwayama, 2003) and controlled language (CL) used for translation (Hartley, Tatsumi, Isahara, Kageura, & Miyata, 2012; Miyata, Hartley, Paris, Tatsumi, & Kageura, 2015). This reveals a major gap in the literature surrounding the readability of health-related information in Japanese.

1.6.3. Determining Readability of Japanese

The readability and quality of hearing-related information in Japanese on the internet has not been reported in the literature and there is currently no gold-standard Japanese readability formula used to assess this. Japanese readability formulae have been developed through different methods such as the analysis of text compilations (Sato, 2014), and statistical analyses that can be carried out by a computer (Sato, Matsuyoshi, & Kondoh, 2008; Yuka, Yoshihiko, & Hisao, 1988). Japanese differs from English in a number of ways linguistically, sentence structure and categorization are a couple of the main syntax differences noted in the literature (Fukui, 1988; Ishii, 1991). In addition, Japanese is further complicated by its usage of the 3 different writing systems mentioned above, which each vary in difficulty (Sakade, Henshall, Seeley, De Groot, & Ikeda, 2013). Japanese readability formulas therefore must take these writing systems into account when determining the overall readability score of a piece of text.

1.6.4. JReadability

This study assessed the readability of online hearing-health related information by using JReadability, a computer based system which uses word data such as the number of words per sentence, and the proportion of verbs in relation to the overall text to calculate a readability score which can then be interpreted by the user (Hasebe & Lee, 2015). For best results the system expects text to be between 500 and 1000 characters, and to be composed of multiple sentences, this will then result in the most reliable readability score. The readability formula was derived from analysis of 6 levelled corpora, consisting of two types texts (Japanese text books and text from National Diet Meeting Transcripts) (Lee, In Press). The final readability formula was selected from five models generated by multiple linear regression analysis, and can be seen in Table 1.1 below.

Table 1.1: JReadability Formula

Component	Value
Constant	11.724
No. of words per sentence	-0.056
Proportion of kango	-0.126
Proportion of wago	-0.042
Proportion of verbs	-0.145
Proportion of auxilliaries	-0.044

The formula is made up of 6 components. The mean number of words per sentence, which is often directly related to structural complexity of the sentence:

(1) the proportion of "kango" words, which are of Chinese origin, and are typically used for technical and/or abstract concepts,

11

(2) the proportion of "wago" words, which are words of Japanese origin, and are considered to be more basic and fundamental than "kango" words,

(3) the proportion of verbs among all words, which the Oxford Dictionary defines as a word used to describe an action, state, or occurrence (Stevenson, 2010),

(4) the proportion of auxiliary verbs, these serve to modify or 'anchor' the main verb in a sentence and have a number of uses such as: tense, mood, voice (passive or causative), negation etc (Anderson, 2011),

(5) the number of words per sentence,

(6) the constant, 11.724.

The authors did note that there were other aspects of text such as the visual appearance which could have an effect on ease of comprehension, however these aspects were omitted as they were not easy to obtain computationally (Lee, In Press).

The score obtained using the readability formula is then categorised into one of six difficulty levels. These range from "Lower Elementary", meaning that the reader can understand only the most basic and fundamental Japanese expression used in simple sentences, to "Upper Advanced", meaning that the reader can fully understand even the most complex and highly technical pieces of writing. This study will be using the "Upper-intermediate" level (2.5-3.4) as the cut off level for suitable readability. This is around a 6th grade reading level, which is recommended for health care information (DuBay, 2004).

1.7. Previous Research on Readability of Online Hearing-Related Information

To date, the majority of research surrounding hearing-related online health information has focused on websites in the English language. The consensus is that this information is difficult to read (Berland et al., 2001; Laplante-Lévesque & Thorén, 2015). Previous research has shown that the most common online search results are often the hardest to read (McInnes & Haglund, 2011), and that government web pages are significantly harder to read than

material originating from a not-for-profit organisation (Cheng & Dunn, 2015). Previous studies which have looked at online information regarding a range of health conditions have found there to be a lack of HONcode certification (Fisher, O'Connor, Flexman, Shapera, & Ryerson, 2016; Sajadi, Goldman, & Firoozi). In 2017 a similar study to this was conducted by Hsu (2017) who looked at the readability of online hearing-related health information written in traditional Chinese. This study concluded that this information was difficult to read when analysed with the Jing readability formula. It also found readability levels to differ depending on the organisation type of the hosting website, HONcode certification was included in the study however it could not be commented on as none of the returned webpages were certified.

1.8. Aims and Hypotheses

The first aim of this study was to assess the readability of hearing-related information on the internet in Japanese using the Japanese text readability measurement system "jReadability" (http://jreadability.net). The second aim was to assess the quality of this information using the HON code. Together this information is intended to provide a basic overview of where Japanese health related articles sit in terms of readability and quality of hearing-related health information.

The planned Research Hypotheses were:

Hypothesis 1: There is an even distribution in the type of organisation (government, non-profit, and commercial) found using the search criteria.

Hypothesis 2: There is an even distribution in the locality of the webpages found using the search criteria.

Hypothesis 3: There is an even distribution of type of organisation by locality.

Hypothesis 4: Webpages found using the criteria will have a JReadability level greater than Upper Intermediate.

Hypothesis 5: There is a significant difference in mean RGL between webpages based on locality.

Hypothesis 6: There is a significant difference in mean RGL between webpages based on type of organisation.

Hypothesis 7: There is an even distribution of HON certification by locality.

Hypothesis 8: There is an even distribution of HON certification by type of organisation.

Chapter 2: Methods

2.1. Identification of Search Terms

Participants were recruited via convenience and snowball sampling to complete an anonymous, online survey approved by The Human Ethics Committee at the University of Canterbury on 9 March 2018 (Appendix A1). The survey was hosted by Qualtrics and consisted of 3 sections. The first section was the participant information and consent forms (Appendix A2 and A3) which participants had to agree to before continuing with the survey. The second section asked participants to confirm they were over 18 years of age and that they were native speakers of Japanese. If either of these criteria were not met the participant was not eligible and the survey finished automatically. The final section asked participants to "list the words (in Japanese) you think people interested in learning about hearing impairment might use to search the internet in Japanese". Participants were encouraged to list as many words as possible that came to mind. The survey went live on 16 March 2018 and continued until 5 April 2018 when saturation was reached (2 consecutive participants did not produce any new search terms).

The survey generated 15 unique search terms, of which five were selected for this study due to being identified by two or more participants. These were 聴覚障害 (hearing impairment), 難聴 (hearing loss), 補聴器 (hearing aid), 聞こえない (cannot hear), and 耳 (ear).

2.2. Internet Search

A Toshiba Satellite L510 with a Windows 10 operating system was used to conduct the online webpage search. Google Chrome (Version 66.0.3359.181) and the HONCode Toolbar (Version 3.1.1) were utilized during the search. The five search terms identified were entered into Google Japan and Yahoo Japan, which are differentiated by Japan's country-coded Top-

Level Domain (ccTLD),a unique two letter internet domain reserved for a country or region. The ccTLDs for Google and Yahoo Japan are google.co.jp and yahoo.co.jp, respectively. After entering the five search terms into both search engines, the top ten webpages yielded were recorded, resulting in a total of 100 webpages.

2.3. Inclusion and Exclusion Criteria

To be included in the study, the webpages needed to meet the following criteria: (1) be primarily written in Japanese, (2) contain information relating to hearing or hearing impairment, (3) be freely available to the public, (4) contain information about the organisation hosting the website. Exclusion criteria were: (1) a Google-identified advertisement, (2) a video, (3) a directory listing, (4) less than 500 characters in length. All duplicate webpages were then removed so that the final collection contained only unique webpages. This resulted in a total of 28 unique websites which fit the criteria suitable to be included in the study.

2.4. Webpage Information

The uniform resource locator (URL) of each webpage was recorded. For the final 28 webpages that were included in the study further information about the hosting organisation (location and type) and whether or not the website had HON certification was recorded. Type of organisation was categorised as commercial/profit, or non-profit. In some instances, the information about the organisation hosting the webpage was not apparent; in these instances, further internet searches were conducted to obtain this information. For organisations that are targeted at a global audience (e.g., Wikipedia), the location of the webpage was coded as "world", the remaining webpages' location was recorded as "Japan". The HONcode Toolbar was used to assess whether the website had HON Code certification.

2.5. Readability

Readability was assessed using the Japanese Text Readability System formula: https://jreadability.net/en/. For each webpage paragraphs of plain text were sequentially copied and pasted into the online readability tool until a minimum of 500 characters were reached. This number was chosen as the creators of JReadability recommended that 500 – 1000 characters composed of multiple sentences should be used for optimal and reliable results. The results outputted from this computational tool were then entered into an Excel Spreadsheet containing all the information recorded about each website. As this tool does not assign a Reading Grade Level to each article, a rough estimate was made using the corresponding Japanese-Language Proficiency Test (JLPT) levels. This was used strictly for discussion purposes and was not included in the statistics. Instead the raw numerical JReadability level (consisting of two to three significant figures) was used to make more precise analyses of variance.

2.6. Statistics

IBM SPSS statistics version 25 (IBM Corp, 2017) was used to perform the statistical analysis. Descriptive statistics and a Box-Plot were used to assess the normality of the statistical data. A Chi Square test was used to assess hypotheses one, two, and three, and a univariate analysis of variance (UNIANOVA) was used to address the fifth and sixth hypotheses. The fourth, seventh, and eighth hypotheses did not need statistical analyses and will be commented on in the discussion.

Chapter 3: Results

3.1. Overview

Of the 100 webpages obtained during the internet search (5 search terms X first 10 results X 2 browsers (Google and Yahoo Japan)), 28 were included in the analyses after the removal of duplicates and application of the inclusion and exclusion criteria. The final 28 webpages included in this study can be seen in Table 3.1 below.

Table 3.1: Websites Retrieved After Matching Against Inclusion and Exclusion Criteria

Website	Location	Author	Organisation Type	Jreadability	Estimated Equivalent RGL
http://www.atarimae.jp/oshiete/2008/07/post-8.html	Japan	Non-Professional	Non - Profit	Lower-Advanced 2.29	Grade 8
https://www.cochlear.com/jp/home/understand/hearing-and-hl/what-is-hearing-loss-/types-of-hl/sensorineural-hearing-loss	World	Professional	Profit	Lower-Advanced 2.41	Grade 8
http://diamond.jp/articles/-/64443	Japan	Professional	Profit	Upper-Intermediate 3.15	Grade 6
https://www.g21.net/wp/disorder/impaired-hearing2/	Japan	Professional	Profit	Lower-Advanced 2.18	Grade 8
https://www.resound.com/ja-jp/hearing-loss/understanding	World	Professional	Profit	Upper-Intermediate 2.92	Grade 6
https://www.resound.com/ja-jp/hearing-loss	World	Professional	Profit	Upper-Intermediate 2.66	Grade 6
http://l-s-b.org/2015/07/one-side-hearing-loss/	Japan	Non-Professional	Profit	Upper-Intermediate 3.01	Grade 6
https://hochouki.senior-anshin.com/cont/sudden-deafness/	Japan	Professional	Profit	Upper-Intermediate 2.8	Grade 6
https://hochouki.senior-anshin.com/cont/hearing-loss-about/	Japan	Professional	Profit	Lower-Advanced 2.00	Grade 8
http://www.minamitohoku.or.jp/up/news/konnichiwa/200910/homeclinic.html	Japan	Professional	Profit	Lower-Advanced 1.97	Grade 8
http://gooddo.jp/video/?p=4696	Japan	Non-Professional	Non - Profit	Upper-Intermediate 2.57	Grade 6
https://www.jasso.go.jp/gakusei/tokubetsu_shien/guide_kyouzai/guide/choukaku_shougai.html	Japan	Non-Professional	Profit	Upper-Advanced 1.06	Grade 10
http://www.kanagawa-wad.jp/faq02.html	Japan	Non-Professional	Non - Profit	Lower-Advanced 2.30	Grade 8
https://eonet.jp/health/doctor/column03_1.html	Japan	Professional	Profit	Lower-Advanced 1.86	Grade 8
https://h-navi.jp/column/article/35025923	Japan	Non-Professional	Profit	Upper-Intermediate 2.55	Grade 6
http://meguroekimae-mimihananodo.com/ear_disease/	Japan	Professional	Profit	Lower-Advanced 2.07	Grade 8
https://www.oticon.co.jp/about_hearing/hearing-health/hearingloss	Japan	Professional	Profit	Lower-Advanced 2.30	Grade 8
https://www.panasonic.com/jp/corporate/sustainability/citizenship/pks/library/015sound/sou005.html	World	Non-Professional	Profit	Lower-Intermediate 4.11	Grade 3/4
http://www1.plala.or.jp/t_nishimura/tyoukaku.htm	Japan	Non-Professional	Profit	Lower-Advanced 2.00	Grade 8
https://www.starkeyjp.com/blog/2017/08/hearing-loss-situations	Japan	Professional	Profit	Lower-Advanced 2.50	Grade 8
http://takeda-kenko.jp/navi/navi.php?key=nantyou	Japan	Professional	Profit	Lower-Advanced 2.11	Grade 8
http://www.jibika.or.jp/citizens/daihyouteki2/mimi_disease.html	Japan	Professional	Profit	Lower-Advanced 2.22	Grade 8
https://www.tfd.deaf.tokyo/ろう運動/「聴覚障害者とは」/	Japan	Non-Professional	Non - Profit	Lower-Advanced 2.06	Grade 8
https://ds.adm.u-tokyo.ac.jp/receive-support/hearing.html	Japan	Professional	Profit	Lower-Advanced 2.04	Grade 8
https://japan.widex.com/ja-jp/hearing-loss/types-of-hearing-loss/sensorineural-hearing-loss	World	Professional	Profit	Lower-Advanced 1.92	Grade 8

Statistical analysis indicated that the distribution was not skewed, and had no significant outliers, but the z-score for kurtosis was significantly outside the range of what would be considered a normal distribution. Therefore, non-parametric testing was used.

3.2. Hypotheses

3.2.1. Hypothesis 1

The first hypothesis said that there is an even distribution in the type of organisation (non-profit/government, and profit/commercial) found using the search criteria. Of the 28 webpages, 21 were categorised as profit/commercial, and 7 were categorised as non-profit/government, this can be seen in Figure 3.1. A Chi Square test was used to demonstrate that organisation type was not equally distributed in the population, χ^2 (1, N = 28) = 7.0, p = .013.
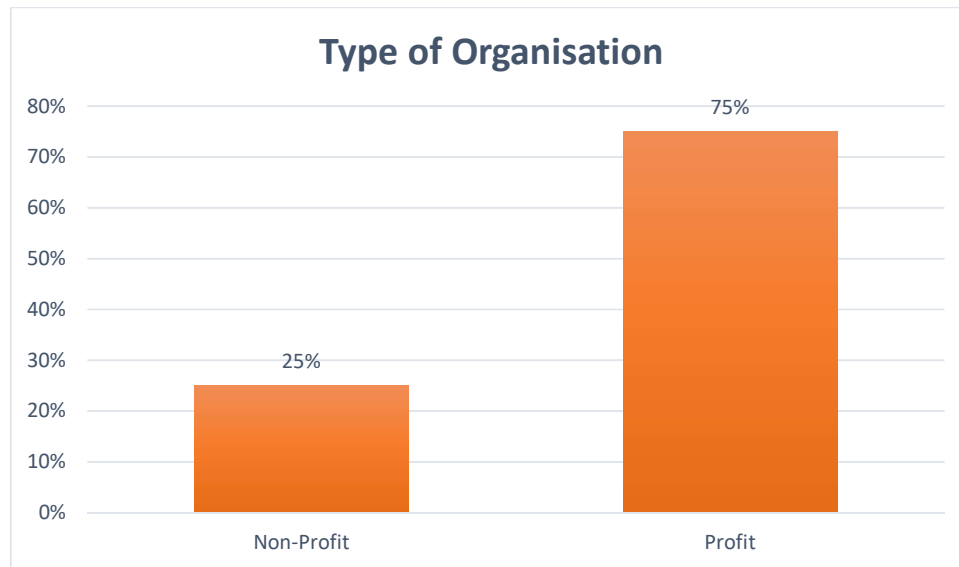
Figure 3.1: The proportion of the type of organisation for the 28 webpages.

3.2.2. Hypothesis 2

A chi-square test of goodness-of-fit was also performed to determine whether there was an even distribution in the locality of webpages found using the search criteria. The locality of webpages was not equally distributed in the population, χ^2 (1, N = 28) = 5.14, p = .036. The proportion of Japan and World webpages can be seen in Figure 3.2 below.
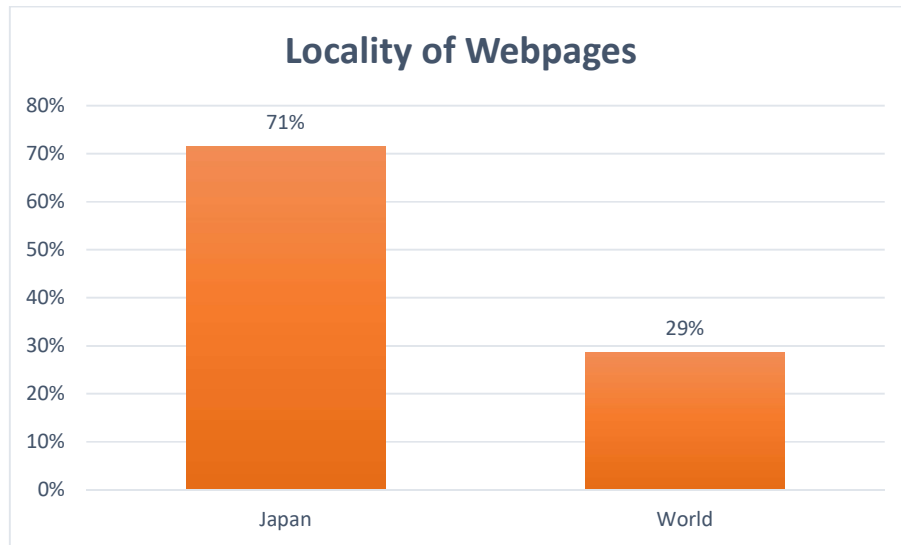
Figure 3.2: The proportion of the locality for the 28 webpages.

3.2.3. Hypothesis 3

A cross-tabulation demonstrated that the distribution of type of organisation by locality was not significant from expected, χ^2 (1, N = 28) = .933, p = .306.

3.2.4. Hypothesis 4

It was hypothesised that webpages found using the criteria would have a mean readability level greater than the "Upper Intermediate" JReadability level (2.5-3.4). Descriptive statistics showed that readability levels ranged from 1.06 to 4.11 with no significant outliers, as seen in Figure 3.1 below.

Results of a one-sample t-test indicated a significantly lower (t(27) = -6.080, p<.001) mean readability level (M = 2.33, SD = 0.58) which was more difficult than the Upper Intermediate JReadability level. Thus, the null hypothesis was not supported.
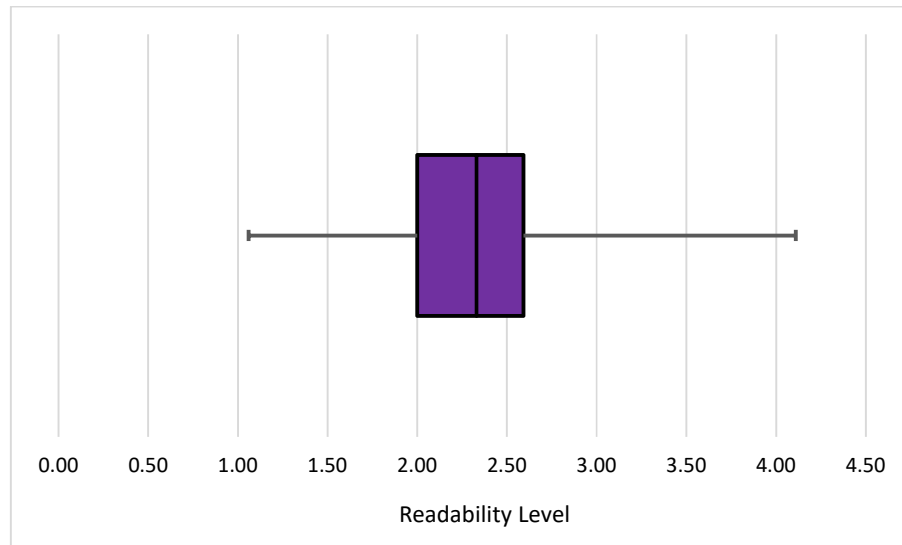
Figure 3.3: Boxplot of JReadability Levels of Japanese Webpages

3.2.5. Hypothesis 5

A Univariate ANOVA was used to assess whether there was a significant difference in mean readability level between webpages based on locality. This indicated that there were not significant differences in readability level based on the locality of the webpage, $F(1, 27)=2.948$, $p=.100$. Readability levels from Japan based webpages ($M=2.252$, $SD=.451$) were not significantly higher than readability levels from world based webpages ($M=2.529$, $SD=.832$, $p=.100$). However the statistical power was low (0.385) meaning that there was insufficient data to detect any but the largest differences.

3.2.6. Hypothesis 6

An analysis of variance indicated that there were significant differences in readability level based on type of organisation, $F(1, 27)=18.58$, $p<.001$. Profit organisation's readability scores were significantly higher ($M=2.373$, $SD=0.617$) than scores from Non-profit organisations ($M=2.204$, $SD=0.481$, $p<.033$).

3.2.7. Hypotheses 7 and 8

The seventh and eighth hypotheses regarding HON certification could not be tested because no website found in this study was HON certified.

3.2.8. Additional Findings

This study also included information on the author (professional vs. non-professional) of each webpage. The proportion of each group can be seen in Figure 3.4 below.

Figure 3.4: The proportion of the type of author for the 28 webpages.

A chi-square test of goodness-of-fit was performed to determine whether there was an even distribution in the author of webpages found using the search criteria, this was supported by the test, χ^2 (1, $N = 28$) = 0.571, p = .572.

Post hoc analyses indicated that readability level of webpages written by professional authors (M=2.319, SD=0.387) were not significantly higher than those written by non-professional authors (*M*=2.347, *SD*=0.792, *p*=.210).

Chapter 4: Discussion

4.1. Overview

In this study, the readability of 28 unique webpages written in the Japanese language were assessed using the JReadability formula. Google Japan and Yahoo Japan were used to retrieve these webpages using five keywords: 聴覚障害 (hearing impairment), 難聴 (hearing loss), 補聴器 (hearing aid), 聞こえない (cannot hear), and 耳 (ear). The webpages were first measured against the inclusion and exclusion criteria, before being organised and compared by location ("Japan" vs. "world"), author ("professional" vs. "non-professional"), and organisation type ("profit" vs, "non-profit"). This study also sought to analyse the proportion of webpages with and without HONcode certification, based on origin, however, none of the webpages identified in this study were HONcode certified.

The results of this study indicate that the majority of online hearing-related information in the Japanese language is difficult to read. Seven of the 28 total webpages had JReadability scores falling within the "Upper Intermediate" range, which is on the cusp of what would be considered an appropriate reading level for the general population. In addition, there was only one webpage assessed which had a "Lower Intermediate" JReadability level, meaning that it is written at an accessible reading level. There was not an even distribution in the type and location of the webpages found. As expected, 70% of the webpages originated in Japan, with the remaining proportion classified as "world" in origin. The webpages found under the "world" origin category tended to be large encyclopaedias, such as Wikipedia, which are translated into a number of languages. There was no significant difference in readability levels found between "world" and "Japan" located webpages. This test was underpowered, therefore it is possible that an effect has gone undetected. The preponderance of websites also fell into

the "profit" category type, and generally were part of a hearing aid manufacturer's website, with information aimed at informing potential buyers. The results showed that "profit" webpages were significantly easier to read than "non-profit" webpages. This study also sought to determine whether the author of a webpage (a hearing professional vs. a layperson) had an impact on the readability of the content. This characteristic was evenly distributed throughout the webpages and indicated that webpages written by "professional" authors are not significantly harder to read than those written by "non-professional" authors.

The following chapter will outline these results in relation to the literature and what implications this may have on future research and clinical resources.

4.2. Readability

This study supported the hypothesis that online hearing-related health information in Japanese is difficult to read. The webpages identified in this study were analysed using the JReadability formula. Additionally, the readability level of "Upper Intermediate," or 2.5-3.4, was chosen as an equivalent level to the recommended RGL of 6 which is used in research studies relating to English health-related information (Doak et al., 1996; DuBay, 2004; Wang et al., 2013). The mean readability score in this study came to 2.3, or a "Lower Advanced" level; this is above the recommended "Upper Immediate" level, and thus supports the fourth hypothesis.

This is the first published study to assess the readability of online hearing-related information in the Japanese language. The results of this study are in line with similar studies conducted in German and Chinese, which also found that online hearing-health information is generally difficult to read (Hsu, 2017; Toth, 2017). Laplante-Lévesque and Thorén (2015) conducted a systematic literature review of online health information in the English language, in which the authors found the reported mean readability levels ranged from 9 to 14. They

concluded that the problem is well documented, and it is now time to act and address this challenge. The webpages in this study ranged in readability from "Upper Advanced" (1.06) to "Lower Intermediate" (4.11), with just a single webpage falling below the "Upper Intermediate" level. This study produced similar findings to those mentioned earlier, which all indicated that online health information, hearing-related or otherwise, is consistently written at an RGL above the recommended 6th grade level. Although there has been a lack of research into readability levels of health information in the Japanese language, there is already sufficient evidence indicating that online information in Japanese is likely to be difficult for the general public to read and comprehend.

4.2.1. Organisation Type of Webpages

Webpage type was split into two categories: "profit" (which included all commercial sites) and "non-profit" (such as charities). This split was not evenly distributed, disproving the third hypothesis, with 21 webpages being classed as "profit" and 7 categorised as "non-profit". This was unsurprising considering that when the keyword "hearing aids" was used as the search term, the webpages generated were mainly from hearing aid manufacturers and vendors. In addition to this, when other keywords such as "hearing loss" were entered into the search engine, a large proportion of the webpages retrieved were also of commercial origin.

Explaining a health condition is important for marketers as it gives them the opportunity to let potential consumers know why they need their product and what their product can do to help the consumer (Corbin, Kelley, & Schwartz, 2001). The readability scores from the "profit" webpages were significantly higher than those from the "non-profit" category, meaning that they were easier to read. This may be due to "profit" websites' need to be as accessible to the average reader as possible so the maximum number of sales can be made. Whereas the "non-profit" webpages were typically set up as a academic or informative resource, as these

webpages make no money out of people reading the information, they are free to use whatever language they wish. A similar study was conducted by Hsu (2017) which also found "non-profit" webpages to have a higher readability level than "profit" webpages. It was hypothesized that this is due to more resources and a higher focus placed on readability. The same study also found a significantly higher number of commercial webpages during the search. Although the commercial ("profit") webpages were easier to read than the "non-profit" webpages, there is a concern that these pages are biased in terms of what information they provide to consumers. A study by Kiili, Leu, Marttunen, Hautala, and Leppänen (2018) found that students in sixth grade were not adept at identifying these biases. This may mean that although the text is at an acceptable RGL, the ability of a reader to interpret the content is still compromised. This kind of bias subsequently leads to an inferior quality of information provided when compared to non-affiliated webpages, such as the "non-profit" webpages seen in this study (Kelly, Feeley, & O'Byrne, 2016).

4.2.2. Locality of Webpages

Webpages were also categorised by origin, as either "Japan" or "world". These were not evenly distributed, with the majority of webpages identified as being of Japanese origin. There was no significant difference in readability levels based on origin. Thus, these results did not support hypotheses 2 and 5. It is important to keep in mind that the sample size of the "world" websites was small, and the statistical power was low (0.385) for this test, indicating that there was insufficient data to detect all but the largest differences.

4.2.3. Professionalism of Webpage Author

The author/s of each webpage were categorised as either "professional" or "non-professional", was based on whether they had a qualification relevant to the field of hearing loss. If this information could not immediately be found on the page (due to lack of authorship) it was derived from the overall nature of the website. For example, a webpage with no author

found on a medical or academic website was classed as "professional," whereas a webpage found on Wikipedia was classed as "non-professional". There was an even distribution in author professionalism for webpages found using the search criteria. No significant differences in readability levels were found between "professional" and "non-professional" authors. This differs from results found in a previous study by Okuhara, Ishikawa, Okada, Kato, and Kiuchi (2017), which showed that articles written by "professional" authors tended to be more difficult to read than those written by "non-professional" authors. In this study the authors of 16 webpages were classed as "professional", and the remaining 12 webpages were classed as "non-professional". The "non-professional" portion did consist of 3 webpages from the site Wikipedia, which allows multiple authors to edit, meaning it is possible for the primary author to be a "professional". The researcher chose the "non-professional" classification for this webpage however, as Wikipedia pages can continually be edited by anyone, and could subsequently lead to inaccuracies if they were not classed as such.

4.3. Wikipedia

Three out of the twenty-eight webpages identified in this study originated from the website Wikipedia. In the past many academics viewed Wikipedia negatively, with debates about its scope, accuracy, and how its use would affect students' understanding of a topic (Selwyn & Gorard, 2016). This view has changed somewhat, as many academics now see the site as a valuable resource for students and public alike (Head & Eisenberg, 2010). A 2007 study by Devgan et al. found that 100% of the webpages they analysed from the Wikipedia site relating to common surgeries performed in the US provided accurate information to the reader. However, of these webpages one third had incomplete information which could impede a comprehensive understanding of the procedure. It was also found that the frequency of which a webpage was edited was correlated with the quality of the webpage (Devgan, Powe, Blakey, & Makary, 2007). Another study by Clauson, Polen, Boulos, and Dzenowagis (2008) which

27

compared Wikipedia pages to a more traditionally edited database seeking information on drugs, had similar findings. The authors found that whilst the Wikipedia pages were fairly accurate and up to date with the information provided, they had a narrower scope than the other database, and there was a high risk of critical omissions which could be detrimental to consumers health if used exclusively. In this study, webpages originating from Wikipedia were classified as having "non-professional" authors. It is important to note however, that there is a high possibility that "professional" authors (such as ENTs and audiologists) have contributed to the webpage. Despite this, the pages will remain classed as "non-professional" due to the premise of Wikipedia: an online encyclopaedia, written collaboratively by those who use it (Wikipedia, 2018). Strictly speaking, regardless of how many professionals are involved in transcribing a webpage that allows for multiple authors, such as Wikipedia, there is always a possibility for a non-professional to make their own edits to the webpage at any time. If a health professional does believe that a page may be of use to their clients, it is important that they use a permanent link for a specific version of entry to prevent the spread of misinformation (Clauson et al., 2008).

4.4. HONcode Certification

Medical and health related websites can gain certification by complying with the 'Health on the Nets' Code of Conduct (HONcode). The HONcode aims to address the issues that can arise with the availability and accessibility there now is to publish information on the internet, by assessing the reliability and credibility of said information. Certification is not awarded, but is something that websites must apply for. Certification status is free for the first year, and requires an annual membership fee, which can differ depending on the characteristics of the website, in the years following (C. Boyer et al., 1998). None of the webpages in this study were HONcode certified, which may be due to a lack of awareness. When the 5 search terms were entered into the HONsearch, only a few websites appeared to be certified, with one

particular website "news-medical.net" based in the UK and Australia, providing nearly all of the search results (News Medical, 2018). A study by Risoldi Cochrane, Gregory, and Wilson (2012) examined 107 webpages relating to health information in the English language and found that 66% of these were HONcode certified. Although the HONcode appears to be well utilised in English speaking countries, two 2017 studies examining online hearing-related health information in Traditional Chinese and Hindi, also retrieved no webpages with HONcode certification (Diwan, 2017; Hsu, 2017). The HONcode foundation is currently working on an automated tool which can assess whether websites comply to the HONcode principles, with the aiming of gaining certification a quicker and easier process. However, this is a European project currently focusing only on the English language, the authors do note that further research must follow to ensure that the multilingual nature if the Web is fully accounted for (Célia Boyer, Frossard, Gaudinat, Hanbury, & Falquetd, 2017).

4.5. Clinical Implications

This study has demonstrated that much of the hearing health related information found on the internet is difficult to read. It is imperative that our patients can truly comprehend the information they are getting so they can make informed decisions regarding their health and treatment options available (Hibbard & Peters, 2003). One of the ways that researchers have suggested tackling this issue is to rewrite the written materials and hand-outs available in clinics to ensure that these meet the requirements needed to be understood by all clients. While this is certainly an important obstacle to overcome, it will take a lot of time and research to get to the point where the material is comprehensive enough that it covers all areas of a topic necessary for true comprehension, but is also succinct and at a comfortable readability level and will not be burdening to read. The other issue is that even if clinical reading materials were all vetted and standardised, we still cannot prevent clients from returning home and searching for this information in their own web-browser. As this study did not identify any HONcode

certified websites in Japanese, the alternative use of measurement tools such as SAM and DISCERN may be actively used to seek out the best material available. SAM is the Suitability Assessment of Materials instrument designed by Doak et al. (1996) which provides a systematic method for practitioners to assess the suitability of health care instruction. The evaluation criteria consist of 22 factors that are split into 6 categories which the practitioner scores from 0 – 2. The total score is then converted into a percentage which corresponds with three ratings: superior, adequate, or not suitable. DISCERN follows a similar format in which the user must give a score to the written piece of information for 16 different questions, regarding whether the piece does or does not meet certain criteria (D Charnock, Shepperd, Needham, & Gann, 1999). Whilst SAM focuses on how suitable a piece of material is to its intended audience, DISCERN is concerned about the reliability and quality of the material. Both tools are widely used and readily available (Deborah Charnock & Shepperd, 2004; Hoffmann & Ladner, 2012), and together provide practitioners with a comprehensive understanding of the calibre at which a piece of written material currently stands. If research continues, health professionals can collaborate using the tools mentioned above to create libraries of high-quality, intelligible health information in multiple languages (McInnes & Haglund, 2011). Clinicians may then pass these verified websites/materials along to consumers to view at their leisure. This study has revealed that at present, there does not appear to be an appropriate range of accessible, quality assured hearing-health related information available in Japanese on the internet. Consequently, clinicians must remain wary when recommending online health information to consumers.

4.6. Limitations and Further Research

One of the limitations of this study was the method of identification of the search terms. Although participants were asked what words they would use to find this information on the internet, it is not the same as actual people seeking hearing related health information.

Information seekers may do several things differently, such as using multiple keywords or a question whilst searching; therefore, we cannot assume that our method resulted in true "real world" results. This study used the JReadability formula which categorises pieces of writing into difficulty levels based on information found in textbooks used when learning the Japanese language. It is also scaled so that 0 is most difficult, and 6.5 is the easiest, contrasting with the RGLs typically used when assessing readability. This difference makes it more difficult to draw comparisons across languages, apart from the fact that Japanese hearing related health information also appears to be difficult to read. There was some difficulty in finding a readability formula for the Japanese language as studies surrounding Japanese readability were quite sparse, and the formulae used in the studies tended to be one-offs made specifically for the study or for a certain type of document (e.g. legal documents) (Sato et al., 2008; Yuka et al., 1988). Therefore, it would be worthwhile for future research to work towards developing a mainstream readability formula for the Japanese language that can also be converted into reading grade level, making cross comparisons across different studies and languages a simpler task.

In general, readability can be improved by using plain language and avoiding jargon, introducing ideas in a logical sequence, relating new concepts to ones already familiar to the reader, keeping sentences short and concise, and using structural cues such as headings and bullet points to separate text into manageable chunks (Hodges, 2011). For improving Japanese text readability specifically one can limit the use of unfamiliar kanji and katakana (as this often represents unfamiliar loan words), reduce the use of kango words and compounds (which are often highly technical, with ambiguous readings), reduce the use of tootens (like the English comma) by separating phrases into their own sentences, and as with other languages keep sentences as short and concise as possible (Hasebe & Lee, 2015; Yuka et al., 1988).

This study only took the words of the written text into account when calculating readability. However, it has been shown that there are other factors that impact readability, such as the appearance of a piece of text including font, colour, size, and spacing (Lee, In Press). This may be something that can be studied more in depth, with the ideal characteristics then implemented in further research studies. As previously discussed, whilst commercial/profit webpages tend to be at a more appropriate readability level, they are also more prone to bias than other types of webpages. These biases can be detrimental to the overall quality of a webpage. It is important therefore, to look beyond the readability level and into the quality, to distinguish which webpages are the most appropriate for clinical use. The tools DISCERN and SAM may be utilised in further studies to more critically appraise hearing-health related information (D Charnock et al., 1999; Doak et al., 1996). These are standardised quality and suitability indexes that can be used by authors, clinicians, and patients alike, and would be a good starting point for an initial analysis of the quality of current Japanese hearing-related health information. Ideally, future health information will be evaluated by both readability and quality of information prior to publication.

4.7. Conclusions

Surveys showed that by the end of 2004 more than three quarters of all internet users had searched online for health information (Rice, 2006). As this number continues to grow, it has become imperative that health-care professionals utilise validation tools to ensure that their clients are not accessing misinformation (Goslin & Elhassan, 2013). Interest is also growing in the field of health literacy, how we can improve this, and how we can cater to the wide range of abilities of the general public (Sørensen et al., 2012). Readability refers to the ease at which a piece of writing is understood by a reader. When something is too difficult to read it becomes inaccessible to people with low levels of health literacy (McInnes & Haglund, 2011). This study sought to establish a base-line for the current hearing-health related information available

online written in the Japanese language, and found that the webpages discussed in this study, identified by a set of commonly used keywords entered into search engines, were too difficult for the general population to understand (DuBay, 2004). Access to good quality information is crucial for consumers to make informed decisions regarding their healthcare (Edwards & Elwyn, 2009). This study also found that commercial/profit webpages were easier to read than non-profit webpages, nevertheless their readability scores were still higher than desired. Improving readability levels of online health information is an important step towards creating accessible content to aid consumers on their health care journeys. Further improvements can be made by assessing the quality of the information provided to safeguard consumers against misinformation, bias, and omissions.

References

Anderson, G. D. S. (2011). Auxiliary Verb Constructions (and Other Complex Predicate Types): A Functional–Constructional Overview. *Language and Linguistics Compass, 5*(11), 795-828. doi:10.1111/j.1749-818X.2011.00311.x

Avonum. (2015). JapanTrak 2015.

Beaver, K., & Luker, K. (1997). Readability of patient information booklets for women with breast cancer. *Patient Education and Counseling, 31*(2), 95-102. doi:10.1016/S0738-3991(96)00988-3

Bedell, S. E., Agrawal, A., & Petersen, L. E. (2004). A systematic critique of diabetes on the world wide web for patients and their physicians. *International Journal of Medical Informatics, 73*(9), 687-694. doi:https://doi.org/10.1016/j.ijmedinf.2004.04.011

Benigeri, M., & Pluye, P. (2003). Shortcomings of health information on the Internet. *Health Promotion International, 18*(4), 381-386. doi:10.1093/heapro/dag409

Berland, G. K., Elliott, M. N., Morales, L. S., Algazy, J. I., Kravitz, R. L., Broder, M. S., . . . McGlynn, E. A. (2001). Health Information on the Internet: Accessibility, Quality, and Readability in English and Spanish. *285*(20), 2612-2621. doi:10.1001/jama.285.20.2612

Besner, D., & Hildebrandt, N. (1987). Orthographic and phonological codes in the oral reading of Japanese Kana. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 13*(2), 335-343. doi:10.1037/0278-7393.13.2.335

Böttger, E. C., & Schacht, J. (2013). The mitochondrion: A perpetrator of acquired hearing loss. *Hearing Research, 303*, 12-19. doi:https://doi.org/10.1016/j.heares.2013.01.006

Boyer, C., Frossard, C., Gaudinat, A., Hanbury, A., & Falquetd, G. (2017). How to sort trustworthy health online information? Improvements of the automated detection of HONcode criteria. *Procedia Computer Science, 121*, 940-949. doi:https://doi.org/10.1016/j.procs.2017.11.122

Boyer, C., Selby, M., Scherrer, J. R., & Appel, R. D. (1998). The Health On the Net Code of Conduct for medical and health Websites. *Computers in Biology and Medicine, 28*(5), 603-610. doi:https://doi.org/10.1016/S0010-4825(98)00037-7

Brunet, A., Ashbaugh, A. R., Herbert, C. F., Peace, N. S. f., & Programme, S. (2010). *Internet Use in the Aftermath of Trauma*: Ios Press.

Charnock, D., & Shepperd, S. (2004). Learning to DISCERN online: applying an appraisal tool to health websites in a workshop setting. *Health Education Research, 19*(4), 440-446. doi:10.1093/her/cyg046

Charnock, D., Shepperd, S., Needham, G., & Gann, R. (1999). DISCERN: an instrument for judging the quality of written consumer health information on treatment choices. *Journal of Epidemiology and Community Health, 53*(2), 105-111. doi:10.1136/jech.53.2.105

Chen, W., & Wellman, B. (2004). The global digital divide–within and between countries. *IT & society, 1*(7), 39-45.

Cheng, C., & Dunn, M. (2015). Health literacy and the Internet: a study on the readability of Australian online health information. *Australian and New Zealand Journal of Public Health, 39*(4), 309-314. doi:10.1111/1753-6405.12341

Chia, E.-M., Jin Wang, J., Rochtchina, E., Cumming, R., Newall, P., & Mitchell, P. (2007). *Hearing Impairment and Health-Related Quality of Life: The Blue Mountains Hearing Study* (Vol. 28).

Chien, W., & Lin, F. R. (2012). Prevalence of hearing aid use among older adults in the united states. *Archives of Internal Medicine, 172*(3), 292-293. doi:10.1001/archinternmed.2011.1408

Clark, J. G. (1981). Uses and abuses of hearing loss classification. *Asha, 23*(7), 493-500.

Clauson, K. A., Polen, H. H., Boulos, M. N. K., & Dzenowagis, J. H. (2008). Scope, Completeness, and Accuracy of Drug Information in Wikipedia. *Annals of Pharmacotherapy, 42*(12), 1814-1821. doi:10.1345/aph.1L474

Cline, R. J. W., & Haynes, K. M. (2001). Consumer health information seeking on the Internet: the state of the art. *Health Education Research, 16*(6), 671-692. doi:10.1093/her/16.6.671

Colman, A. M. (2015). *A Dictionary of Psychology*.

Corbin, C. L., Kelley, S. W., & Schwartz, R. W. (2001). Concepts in service marketing for healthcare professionals. *The American Journal of Surgery, 181*(1), 1-7. doi:https://doi.org/10.1016/S0002-9610(00)00535-3

Dalton, D. S., Cruickshanks, K. J., Klein, B. E. K., Klein, R., Wiley, T. L., & Nondahl, D. M. (2003). The Impact of Hearing Loss on Quality of Life in Older Adults. *The Gerontologist, 43*(5), 661-668. doi:10.1093/geront/43.5.661

Deal, W. E. (2005). *Handbook to Life in Medieval and Early Modern Japan*: Facts On File, Incorporated.

Devgan, L., Powe, N., Blakey, B., & Makary, M. (2007). Wiki-Surgery? Internal validity of Wikipedia as a medical and surgical reference. *Journal of the American College of Surgeons, 205*(3, Supplement), S76-S77. doi:https://doi.org/10.1016/j.jamcollsurg.2007.06.190

Dietz, A., Löppönen, T., Valtonen, H., Hyvärinen, A., & Löppönen, H. (2009). Prevalence and etiology of congenital or early acquired hearing impairment in Eastern Finland. *International Journal of Pediatric Otorhinolaryngology, 73*(10), 1353-1357. doi:https://doi.org/10.1016/j.ijporl.2009.06.009

Diwan, S. (2017). *Readability ease of online hearing related information in Hindi: a thesis submitted in partial fulfilment of the requirements for the degree of Master of Audiology in the Department of Communication Disorders at the University of Canterbury.* (Dissertation/Thesis). Retrieved from http://canterbury.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwY2AQNtIz0EUrE1A3tTLALuUE73xBNwL_uYG5tkamFsA6xZgZNEEKOtcxIgK-RBBkCFL14CbIwOOCNK0txMCUmifCYA9anw45BbtSATQJopCfpgA5mEIBdI00sM5QAO8kSU1RgB5fCtINZCt4gCaSRRkU3VxDnD10EZbGQwdb4qGOMxJjYAF231MlGBSM0swNTYG5wMA8DVhbJgEbZMbGJsnGFkkpaYkWpqkpkgxSuM2RwicpzcBlBKpkwAMCMgysacAEmyqLHBZy4OABAGR-dfE

Doak, C. C., Doak, L. G., & Root, J. H. (1996). Teaching Patients with Low Literacy Skills. *American Journal of Nursing, 96*(12), 16. doi:10.1097/00000446-199612000-00022

DSW. (2017). Datenreport der Stiftung Weltbevölkerung 2017.

DuBay, W. H. (2004). The Principles of Readability. *Online Submission*.

Edwards, A., & Elwyn, G. (2009). *Shared decision-making in health care : Achieving evidence-based patient choice*. Oxford, UNITED KINGDOM: Oxford University Press.

Etzioni, D. A., Liu, J. H., Maggard, M. A., & Ko, C. Y. (2003). The Aging Population and Its Impact on the Surgery Workforce. *Annals of Surgery, 238*(2), 170-177. doi:10.1097/01.SLA.0000081085.98792.3d

Fisher, J. H., O'Connor, D., Flexman, A. M., Shapera, S., & Ryerson, C. J. (2016). Accuracy and reliability of internet resources for information on idiopathic pulmonary fibrosis. *American journal of respiratory and critical care medicine, 194*(2), 218-225.

Frellesvig, B. (2010). *A History of the Japanese Language*: Cambridge University Press.

Friedman, D. B., Hoffman-Goetz, L., & Arocha, J. F. (2006). Health literacy and the World Wide Web: Comparing the readability of leading incident cancers on the Internet. *Informatics for Health and Social Care, 31*(1), 67-87. doi:10.1080/14639230600628427

Fukui, N. (1988). DERIVING THE DIFFERENCES BETWEEN ENGLISH AND JAPANESE: A CASE STUDY IN PARAMETRIC SYNTAX. *ENGLISH LINGUISTICS, 5*, 249-270. doi:10.9793/elsj1984.5.249

Gates, G. A., Cobb, J. L., Linn, R. T., Rees, T., Wolf, P. A., & D'Agostino, R. B. (1996). Central auditory dysfunction, cognitive dysfunction, and dementia in older people. *Archives of Otolaryngology–Head & Neck Surgery, 122*(2), 161-167. doi:10.1001/archotol.1996.01890140047010

Gethin, A., & Gunnemark, E. V. (1997). *The Art and Science of Learning Languages*: Intellect.

Goslin, R. A., & Elhassan, H. A. (2013). Evaluating internet health resources in ear, nose, and throat surgery. *The Laryngoscope, 123*(7), 1626-1631. doi:doi:10.1002/lary.23773

Halpern, J. (1999). *The Kodansha kanji learner's dictionary*: Kodansha International (JPN).

Harris, J., & White, V. (2013). *A Dictionary of Social Work and Social Care*: OUP Oxford.

Hartley, A., Tatsumi, M., Isahara, H., Kageura, K., & Miyata, R. (2012). *Readability and translatability judgments for 'Controlled Japanese'.* Paper presented at the Proceedings of the 16th EAMT Conference (Trento, Italy).

Hasebe, Y., & Lee, J.-H. (2015). Introducing a Readability Evaluation System for Japanese Language Education. *CASTEL/J*.

Head, A. J., & Eisenberg, M. B. (2010). How today's college students use Wikipedia for course-related research. *2010*. doi:10.5210/fm.v15i3.2830

Helvik, A.-S., Jacobsen, G. W., & Hallberg, L. R. M. (2006). Life Consequences of Hearing Loss in Terms of Activity Limitation and Participation Restriction. *Scandinavian Journal of Disability Research, 8*(1), 53-66. doi:10.1080/15017410500300413

Hibbard, J. H., & Peters, E. (2003). Supporting informed consumer health care decisions: data presentation approaches that facilitate the use of information in choice. *Annual review of public health, 24*(1), 413-433.

Hickson, L., & Worrall, L. (2003). Beyond hearing aid fitting: improving communication for older adults. *International Journal of Audiology, 42*(S2), 84-91. doi:10.3109/14992020309074649

Hodges, N. J. (2011). Science Speaks: Improving Readability of Texts. *International Journal of the Book, 8*(3), 55.

Hoffmann, T., & Ladner, Y. (2012). Assessing the suitability of written stroke materials: an evaluation of the interrater reliability of the suitability assessment of materials (SAM) checklist. *Topics in stroke rehabilitation, 19*(5), 417-422. doi:10.1310/tsr1905-417

Hogan, A., O'Loughlin, K., Davis, A., & Kendig, H. (2009). Hearing loss and paid employment: Australian population survey findings. *International Journal of Audiology, 48*(3), 117-122. doi:10.1080/14992020802449008

Hsu, P.-H. (2017). Readability of hearing related internet information in traditional Chinese.

Iacovetto, M. C., & Allen, L. A. (2015). Transitioning into a digital world: Time for providers to recommend internet health information? *American Heart Journal, 170*(1), 1-2. doi:https://doi.org/10.1016/j.ahj.2015.04.002

IBM Corp. (2017). IBM SPSS Statistics for Windows (Version 25.0). Armonk, NY: IBM Corp,.

Ishii, Y. (1991). Operators and empty categories in Japanese.

Järvelin, M. R., Mäki–torkko, E., Sorri, M. J., & Rantakallio, P. T. (1997). Effect of Hearing Impairment on Educational Outcomes and Employment up to the Age of 25 Years in Northern Finland. *British Journal of Audiology, 31*(3), 165-175. doi:10.3109/03005364000000019

Kamil, R. J., & Lin, F. R. (2015). The Effects of Hearing Impairment in Older Adults on Communication Partners: A Systematic Review. *Journal of the American Academy of Audiology, 26*(2), 155-182. doi:10.3766/jaaa.26.2.6

Kelly, M. J., Feeley, I. H., & O'Byrne, J. M. (2016). A Qualitative and Quantitative Comparative Analysis of Commercial and Independent Online Information for Hip Surgery: A Bias in Online Information Targeting Patients? *The Journal of Arthroplasty, 31*(10), 2124-2129. doi:https://doi.org/10.1016/j.arth.2016.03.011

Khairi Md Daud, M., Noor, R. M., Rahman, N. A., Sidek, D. S., & Mohamad, A. (2010). The effect of mild hearing loss on academic performance in primary school children. *International Journal of Pediatric Otorhinolaryngology, 74*(1), 67-70. doi:https://doi.org/10.1016/j.ijporl.2009.10.013

Kickbusch, I., Maag, D., Wait, S., Health, A. f., Future, t., & UK, I. L. C. (2005). *Navigating Health: The Role of Health Literacy*: Alliance for Health and the Future, International Longevity Centre-UK.

Kiili, C., Leu, D. J., Marttunen, M., Hautala, J., & Leppänen, P. H. T. (2018). Exploring early adolescents' evaluation of academic and commercial online resources related to health. *Reading and Writing, 31*(3), 533-557. doi:10.1007/s11145-017-9797-2

Laplante-Lévesque, A., Hickson, L., & Worrall, L. (2010). Rehabilitation of Older Adults With Hearing Impairment: A Critical Review. *Journal of Aging and Health, 22*(2), 143-153. doi:10.1177/0898264309352731

Laplante-Lévesque, A., & Thorén, E. S. (2015). Readability of Internet Information on Hearing: Systematic Literature Review. *American Journal of Audiology, 24*(3), 284-288. doi:10.1044/2015_AJA-14-0091

Lee, J.-H. H., Yoichiro. (In Press). Readability Measurement for Japanese Text Based on Leveled Corpora. *Papers on Japanese Language from Empirical Perspective*.

Li, C., Zhang, X., Hoffman, H. J., Cotch, M., Themann, C. L., & Wilson, M. (2014). Hearing impairment associated with depression in us adults, national health and nutrition examination survey 2005-2010. *JAMA Otolaryngology–Head & Neck Surgery, 140*(4), 293-302. doi:10.1001/jamaoto.2014.42

Mathers, C., Fat, D. M., Boerma, J. T., & World Health Organization. (2008). *The Global Burden of Disease: 2004 Update*: World Health Organization.

Mathers, C., Smith, A., & Concha, M. (2000). Global burden of hearing loss in the year 2000. *Global burden of Disease, 18*(4), 1-30.

Matsunaga, S. (2014). Introduction to the Special Section: New Perspectives on the Japanese Writing System and Reading Japanese as L1 and L2. *Japanese Language and Literature, 48*(2), 335-339.

McInnes, N., & Haglund, B. J. A. (2011). Readability of online health information: implications for health literacy. *Informatics for Health and Social Care, 36*(4), 173-189. doi:10.3109/17538157.2010.542529

McMullan, M. (2006). Patients using the Internet to obtain health information: How this affects the patient–health professional relationship. *Patient Education and Counseling, 63*(1), 24-28. doi:https://doi.org/10.1016/j.pec.2005.10.006

Miyata, R., Hartley, A., Paris, C., Tatsumi, M., & Kageura, K. (2015). *Japanese controlled language rules to improve machine translatability of municipal documents.* Paper presented at the Proc. of MT Summit.

Morohashi, T. (1966). *Dai Kan-Wa jiten*: Taishūkan shoten.

Narita, J., & Pichl, L. (2007). On Readability Categorization Of Japanese Text *Information Sciences 2007* (pp. 783-789): World Scientific.

News Medical. (2018). About Us | Medical.   Retrieved from https://www.news-medical.net/medical/about

Officer, A., & Posarac, A. (2011). World report on disability. *Malta: World Health Organization & The World Bank*.

Okuhara, T., Ishikawa, H., Okada, M., Kato, M., & Kiuchi, T. (2017). A readability comparison of anti- versus pro-influenza vaccination online messages in Japan. *Preventive Medicine Reports, 6*, 47-52. doi:10.1016/j.pmedr.2017.02.013

Poushter, J. (2016). Smartphone ownership and internet usage continues to climb in emerging economies. *Pew Research Center, 22*.

Price, N. M. (2017). *Communicative participation in adults with hearing impairment: Associated variables and correlations with the Communicative Participation Item Bank (CPIB) and existing measures.* (Master of Audiology), University of Canterbury.

Priston, M., Searle, P., & New Zealand. Ministry of, H. (2010). *Kōrero mārama: health literacy and Māori : results from the 2006 Adult Literacy and Life Skills Survey*. Wellington, N.Z: Ministry of Health.

Rabbitt, P. (1991). Mild hearing loss can cause apparent memory failures which increase with age and reduce with IQ. *Acta Oto-Laryngologica, 111*(sup476), 167-176. doi:10.3109/00016489109127274

Rice, R. E. (2006). Influences, usage, and outcomes of Internet health information searching: Multivariate results from the Pew surveys. *International Journal of Medical Informatics, 75*(1), 8-28. doi:https://doi.org/10.1016/j.ijmedinf.2005.07.032

Risk, A., & Dzenowagis, J. (2001). Review Of Internet Health Information Quality Initiatives. *Journal of Medical Internet Research, 3*(4), e28. doi:10.2196/jmir.3.4.e28

Risoldi Cochrane, Z., Gregory, P., & Wilson, A. (2012). Readability of consumer health information on the internet: A comparison of US government–funded and commercially funded websites. *Journal of health communication, 17*(9), 1003-1010.

Safeer, R. S., & Keenan, J. (2005). Health literacy: the gap between physicians and patients. *Am Fam Physician, 72*(3), 463-468.

Sajadi, K. P., Goldman, H. B., & Firoozi, F. (2011). Assessing Internet Health Information on Female Pelvic Floor Disorders. *The Journal of Urology, 186*(2), 594-596. doi:10.1016/j.juro.2011.03.137

Sakade, F., Henshall, K., Seeley, C., De Groot, H., & Ikeda, J. (2013). *A guide to reading and writing Japanese: a comprehensive guide to the Japanese writing system* (Fourth ed.). North Clarendon, Vermont: Tuttle Publishing.

Sakuma, N., Sasanuma, S., Tatsumi, I. F., & Masaki, S. (1998). Orthography and phonology in reading Japanese kanji words: Evidence from the semantic decision task with homophones. *Memory & Cognition, 26*(1), 75-87. doi:10.3758/bf03211371

Sato, S. (2014). *Text Readability and Word Distribution in Japanese.* Paper presented at the LREC.

Sato, S., Matsuyoshi, S., & Kondoh, Y. (2008). *Automatic Assessment of Japanese Text Readability Based on a Textbook Corpus.* Paper presented at the LREC.

Scarinci, N., Worrall, L., & Hickson, L. (2008). The effect of hearing impairment in older people on the spouse. *International Journal of Audiology, 47*(3), 141-151. doi:10.1080/14992020701689696

Selwyn, N., & Gorard, S. (2016). Students' use of Wikipedia as an academic resource — Patterns of use and perceptions of usefulness. *The Internet and Higher Education, 28*, 28-34. doi:https://doi.org/10.1016/j.iheduc.2015.08.004

Shimabukuro, M. (2007). *Accentual History of the Japanese and Ryukyuan Languages : A Reconstruction*. Folkestone, UNITED KINGDOM: BRILL.

Shinmori, A., Okumura, M., Marukawa, Y., & Iwayama, M. (2003). *Patent claim processing for readability: structure analysis and term explanation.* Paper presented at the Proceedings of the ACL-2003 workshop on Patent corpus processing-Volume 20.

Sillence, E., Briggs, P., Harris, P. R., & Fishwick, L. (2007). How do patients evaluate and make use of online health information? *Social Science & Medicine, 64*(9), 1853-1862. doi:https://doi.org/10.1016/j.socscimed.2007.01.012

Solheim, J., Kværner, K. J., & Falkenberg, E.-S. (2011). Daily life consequences of hearing loss in the elderly. *Disability and Rehabilitation, 33*(22-23), 2179-2185. doi:10.3109/09638288.2011.563815

Sørensen, K., Van den Broucke, S., Fullam, J., Doyle, G., Pelikan, J., Slonska, Z., . . . European, C. H. L. P. (2012). Health literacy and public health: A systematic review and integration of definitions and models. *BMC Public Health, 12*(1), 80. doi:10.1186/1471-2458-12-80

Steel, K. P. (2000). New interventions in hearing impairment. *BMJ : British Medical Journal, 320*(7235), 622-625.

Stevenson, A. (2010). *Oxford dictionary of English* (3rd ed.). New York, NY: Oxford University Press.

Taber, J. M., Leyva, B., & Persoskie, A. (2015). Why do People Avoid Medical Care? A Qualitative Study Using National Data. *Journal of General Internal Medicine, 30*(3), 290-297. doi:10.1007/s11606-014-3089-1

Toth, B. (2017). *Readability of hearing-related information on the Internet in the German language: a thesis submitted in partial fulfilment of the requirements for the degree of Master of Audiology, Department*

of Communication Disorders, University of Canterbury. (Dissertation/Thesis). Retrieved from http://canterbury.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwY2AQNtIz0EUrE1A3tTLALuUE73xBNwL_uYG5tsAGO2jDKTNoghR0rmNEBHyJIMgQpOrBTZCBxwVpWluIgSk1T4QhELQ-HXIKdqVCfpoC6OpoYD2hC949kpqiAD2yFKRDAYiADTEFyPBcaglQDsx3BxWbeQqwMUVRBkU31xBnD12EM-Khwy_xUOcaiTGwADv0qRIMCikpaYlJxklGJmaJFiamFmnALJNibGFgmgw6bc3SLE2SQQq3OVL4JKUZuIxA1Q54iECGgTUNmIRTZZFDRw4cYAApznzB

Uchida, Y. S., S; Nakashima, T; Ando, F; Shimokata, H;. (2012). Estimates of the size of the hearing-impaired elderly population in Japan and 10-year incidence of hearing loss by age, based on data from the National Institute for Longevity Sciences-Longitudinal Study of Aging (NILS-LSA). *Nihon Ronen Igakkai Zasshi., 49*(2), 222-227. doi:10.3143/geriatrics.49.222

United Nations. (2017). *World Population Prospects: The 2017 Revision, Key Findings and Advance Tables.* .

Vovin, A. (2010). *Korea-Japonica: A Re-Evaluation of a Common Genetic Origin*: University of Hawaiʻi Press.

Wang, L.-W., Miller, M. J., Schmitt, M. R., & Wen, F. K. (2013). Assessing readability formula differences with written health information materials: Application, results, and recommendations. *Research in Social and Administrative Pharmacy, 9*(5), 503-516. doi:https://doi.org/10.1016/j.sapharm.2012.05.009

Wikipedia. (2018). Wikipedia: Introduction. Retrieved from https://en.wikipedia.org/wiki/Wikipedia:Introduction

World Health Organisation. (2018, July). WHO Global Estimates on Prevalence of Hearing Loss. Retrieved from http://www.who.int/pbd/deafness/estimates/en/

World Health Organization. (2001). International classification of functioning, disability, and health : ICF.

Wydell, T. N., Butterworth, B., & Patterson, K. (1995). The inconsistency of consistency effects in reading: The case of Japanese Kanji. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21*(5), 1155.

Yueh, B., Shapiro, N., MacLean, C. H., & Shekelle, P. G. (2003). Screening and management of adult hearing loss in primary care: Scientific review. *JAMA, 289*(15), 1976-1985. doi:10.1001/jama.289.15.1976

Yuka, T., Yoshihiko, O., & Hisao, Y. (1988). *A computer readability formula of Japanese texts for machine scoring.* Paper presented at the Proceedings of the 12th conference on Computational linguistics-Volume 2.

Appendix A

Appendix A1: Ethics Approval Letter

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2018/04/LR

9 March 2018

Zoe Alexander
Communication Disorders
UNIVERSITY OF CANTERBURY

Dear Zoe

Thank you for submitting your low risk application to the Human Ethics Committee for the research proposal titled "How Easy is it to Read Webpages about Hearing in Japanese?".

I am pleased to advise that this application has been reviewed and approved.

Please note that this approval is subject to the incorporation of the amendments you have provided in your emails of 21ˢᵗ February and 5ᵗʰ March 2018.

With best wishes for your project.

Yours sincerely

R. Robinson
pp.

Professor Jane Maidment
Chair, Human Ethics Committee

Please print or save this sheet for your records

Study title: How Easy is it to Read Webpages about Hearing in Japanese?

My name is Zoe Alexander. I am a second year, Master of Audiology student at the University of Canterbury. I am conducting a research study that aims to measure how easy (or not) it is to read webpages about hearing that are in Japanese.

Who is being sought?

Anyone who can read Japanese is invited to participate in this research.

What would I need to do?

You will be asked to complete a short online survey. It should take about 5 minutes of your time. The survey will ask you to list terms you think people interested in learning about hearing impairment might use to search the internet in Japanese. Please list as many words you can think of.

Will I get paid?

No. There is no compensation for your involvement.

What else do I need to know?

While taking the online survey, you can exit the survey and the website. This means you have opted to withdraw, or remove yourself from the research study.

Participation is voluntary and you have the right to withdraw or remove yourself from the survey and the research study at any stage without providing a reason. If you withdraw, all information relating to you will be removed unless data analysis has concluded. After data analysis has concluded, removal of individual data may not be practically achievable.

What happens to the survey information or data?
A research thesis is a public document and will be available through the University of Canterbury Library. The results of the research project may be published in a peer-reviewed

journal, but everyone taking part in the study may be assured of the confidentiality of all data gathered in this investigation. To ensure anonymity and confidentiality, survey data s will be organised by a unique alpha-numeric code. All research survey information will be stored in password-protected electronic formats, in keypad locked, research labs at the University of Canterbury. Only the researcher (Zoe Alexander), primary supervisor (Rebecca Kelly-Campbell), and co-supervisor (Greg O'Beirne) will have access. Data will be kept for a period of five years before it is destroyed, per University of Canterbury Human Ethics Committee and research protocols.

What if I want to know about how the research study turned out?
The survey website will have a section where you can request a summary of the results of the survey and the research study.

Who is supervising the research study?
The research project is being carried out as a requirement for the Master of Audiology degree at the University of Canterbury. The research study is supervised by: Dr. Rebecca Kelly-Campbell - rebecca.kelly@canterbury.ac.nz and Associate Professor Greg O'Beirne (gregory.obeirne@canterbury.ac.nz).

Who approved this research study?
This project is being reviewed and approved by the University of Canterbury Human Ethics Committee. Participants wishing to lodge a complaint should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

Appendix A3: Consent Form

Please print or save this form for your records

THIS CONSENT FORM WILL BE HELD FOR A PERIOD OF FIVE YEARS

Study title: How Easy is it to Read Webpages about Hearing in Japanese?

Researcher: Zoe Alexander

- I have been given a full explanation of this project and have had the opportunity to ask questions and have them answered.
- I understand what is required of me if I agree to take part in the research.
- I understand that participation is voluntary, and I may withdraw at any time without providing a reason or rationale. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- I understand that any information or opinions I provide will be kept confidential to the researcher, supervisor, and co-supervisor, and that any published or reported results will not identify the participants or their place of work. I understand that a thesis is a public document and will be available through the UC Library.
- I understand that all data collected for this study will be kept in locked and secured facilities and/or in password protected electronic form and will be destroyed after five years.
- I understand the risks associated with taking part and how they will be managed.
- I understand that I am able to receive a report on the findings of the study by contacting the researcher at the conclusion of the project.
- I understand that I can contact the researcher: *Zoe Alexander* **zoe.alexander@pg.canterbury.ac.nz**, or *Rebecca Kelly-Campbell* rebecca.kelly@canterbury.ac.nz or *Greg O'Beirne* gregory.obeirne@canterbury.ac.nz for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)

By ticking the box below, I agree to participate in this research project.

□ I agree to participate in this research project (continue to survey).

Sincerely, Zoe Alexander

If you do not to participate in this research project, click here to exit the survey.