Readability of Adult Diagnostic Audiology Reports

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A thesis submitted in partial fulfilment of the requirements for the
Degree of Master of Audiology

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University of Canterbury

February 2021

Acknowledgements

I would like to thank Associate Professor Rebecca Kelly-Campbell for her incredible support throughout this thesis process – especially through redesigning this project as we entered a nationwide COVID-19 lockdown. You have taken the time to listen to my ideas, provide advice when required and been genuinely excited about this project. This thesis wouldn't have been possible without your help and guidance.

A special thank you to my secondary supervisor, Professor Megan McAuliffe, for reading drafts of this thesis and providing helpful feedback.

Thank you to Professor Vinaya Manchaiah at Lamar University for your help with obtaining ethical approval in the US for this study.

I extend my thanks to the clinicians and administrative staff in the US audiology clinics for their help obtaining the data for this thesis.

I'd also like to thank the University of Canterbury for the generous scholarship covering the tuition fees of this thesis.

To the Audiology lecturers and clinical educators – thank you for inspiring my interest in all things ears. I look forward to an exciting, challenging and rewarding career ahead.

Thanks to my classmates – what a wonderful bunch of people to have shared this journey with.

Most importantly thank you to my incredible husband, Luke. Thank you for supporting me throughout this demanding Master's programme. Your unwavering optimism, positivity and love has kept me going.

Note

Throughout this thesis, the term “patient” will be used to refer to the individual receiving audiology services. However, it is acknowledged that the term “client” may be the preferred or more appropriate term to use in some audiological settings. For consistency with previous research in this area, the term “patient” was selected for use in this thesis.

Abstract

Aim: This study aimed to examine the readability and word count of reports provided to adult patients following diagnostic audiological assessment.

Method: A total of 165 diagnostic reports were obtained from three clinical settings, comprising four clinics – one in New Zealand (university clinic) and three in the United States (two private practice clinics, one ear nose and throat (ENT) clinic). Mean reading grade level (RGL) of each report was ascertained using three commonly used readability measures: Flesch Kincaid (F-K), Gunning Fog Index (FOG) and Simple Measure of Gobbledygook (SMOG). Word count for each report was recorded. Mean RGL and word count was compared between the three clinical settings. In a subset of analyses of reports sampled from the US private practice setting, the variables report addressee (health care practitioner (HCP) or patient) and medical referral (referral versus no referral) were examined for their effect on mean RGL and word count of reports.

Results: The mean RGL of all reports sampled was 11.82, far exceeding the international health literacy recommendation to keep health information materials below the sixth RGL. Reports from the New Zealand university setting were longer and more difficult to read when compared to US private practice and ENT settings. Reports sampled from the US private practice setting were longer and more difficult to read than those sampled from the ENT setting. In the US private practice clinic setting, reports addressed to patients were shorter and easier to read than those addressed to HCPs with the patient copied in. Medical referral did not affect mean RGL or word count.

Conclusion: All diagnostic reports sampled exceeded the recommended level of six. The mean RGL and word count of reports differed by clinic setting and report addressee. Future research should aim to redesign and evaluate patient-friendly diagnostic reports that harness the use of plain language to support patient understanding.

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List of Abbreviations

ASHA	The American Speech-Language-Hearing Association
ENT	Ear, Nose and Throat
F-K	Flesch-Kincaid
FOG	Gunning Fog Index
GP	General Practitioner
NZ	New Zealand
NZAS	New Zealand Audiological Society
PCC	Patient-centred Care
PCP	Primary Care Physician
PP	Private Practice
RGL	Reading Grade Level
SDM	Shared Decision Making
SMOG	Simple Measure of Gobbledygook
US	United States
WHO	World Health Organisation

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1 Introduction

1.1 Overview

Hearing loss is a common impairment affecting hundreds of millions of adults throughout the world (WHO, 2020). Without effective intervention, hearing loss has serious and debilitating impacts for the individual affected, including impaired communication ability (Boothroyd, 2007), reduced quality of life (Dalton et al., 2003), poor educational outcomes, limited career trajectories (Hogan et al., 2009) and adverse psychological effects including social isolation, depression and anxiety (Barker et al., 2017). While effective rehabilitation strategies exist for those with hearing loss, the rate of help seeking and uptake of interventions among adults remains low (Abrams & Kihm, 2015; Bainbridge & Ramachandran, 2014). More work is required to educate those with hearing loss about their hearing health status and the subsequent rehabilitative options available.

For patient-centred and effective rehabilitation to occur, patients must have access to clear and comprehensible information about their hearing health (Kelly-Campbell & Manchaiah, 2020). In this way, the communication of an individual's hearing health status and the recommended treatment options available is a critical aspect in supporting patients to achieve optimal rehabilitative outcomes. Sharing this information with patients in a clear and accessible manner is more than a professional responsibility; it is an ethical imperative and patient right (Health & Disability Commissioner, 2020a).

In audiological settings, patient education about hearing health status and recommended treatment options is usually communicated verbally via informational counselling (ASHA, n.d.-b). However, patients have a limited capacity to accurately retain verbal information shared with them in an appointment (Kessels, 2003; Margolis, 2004a, 2004b; Martin et al., 1990; Watermeyer et al., 2012; Watermeyer et al., 2015). Therefore,

providing a written summary of diagnostic information has been highlighted as a key tool for imparting knowledge to patients (Margolis, 2004a).

One method of reinforcing the information shared with patients is to provide a copy of their diagnostic report. Diagnostic reports are a useful resource for patients as they contain patient-specific results and often a summary of the recommended rehabilitative options available. Diagnostic reports are also permanent, portable, and convenient for patients to share with friends and family/whānau (Richards, 2008; Roberts & Partridge, 2006). However, emerging evidence in audiology and other health fields suggests that receiving a copy of a diagnostic report or other health-related correspondence may not adequately support patients' understanding (Bennett et al., 2012; Donald & Kelly-Campbell, 2016; Martin-Carreras et al., 2019). While many studies have surveyed patients on their opinions of receiving health care correspondence and reports (Bartle et al., 2004; Brockbank, 2005; Brodie & Lewis, 2010), few have sought to examine how readable these are for patient use.

Little effort has been invested into researching the quality of diagnostic information patients receive following audiological assessment. However, the available evidence as well as anecdotal reports indicates that patients have poor understanding of their diagnostic audiological information, both verbally and in written format (Donald & Kelly-Campbell, 2016; Klyn et al., 2019; Margolis, 2004b; Watermeyer et al., 2015). One study has established that the readability and comprehensibility of a paediatric diagnostic audiology report provided to parents following assessment was poor (Donald & Kelly-Campbell, 2016). To date, no studies have investigated the accessibility of adult hearing test results in clinical practice by examining written diagnostic reports provided to patients following hearing assessment.

This thesis aims to examine the reading difficulty of adult diagnostic audiology reports provided to patients following hearing assessment. It is anticipated that knowledge

about the readability of diagnostic audiology reports may highlight areas of audiological practice that may or may not support effective patient education. It is hoped that the findings of this study will provide further insight into how accessible hearing health information is for patients following diagnostic assessment.

1.2 Hearing Loss

1.2.1 Prevalence

The World Health Organisation (WHO, 2020) estimates that approximately 466 million people currently live with a disabling hearing loss that impacts quality of life. Of this total, the overwhelming majority (92%) are adults (WHO, 2020). The prevalence of hearing loss is rising, with WHO estimates expecting more than 630 million people will be affected by hearing loss by the year 2030 (WHO, 2012). While hearing loss disproportionately affects those living in low-income countries, the burden is also significant in New Zealand (NZ) and the United States (US). NZ's most recent population estimates of hearing loss indicate that around 18.9% of the general population are affected (The National Foundation for the Deaf, 2016). In the US, self-report data indicates that the prevalence of hearing loss among those who are over the age of 12 is approximately 13% (Lin et al., 2013).

1.2.3 Impacts

The Global Burden of Disease study has placed hearing loss as the fifth leading cause contributing to years lived with disability in the world (The Lancet, 2016). The impacts of hearing loss at the individual level result primarily from impairments in speech perception. Deficits in speech perception affect an individual's ability to participate in social interactions and leisure activities, have meaningful employment, and enjoy the perception of sound (Boothroyd, 2007). Unaddressed hearing loss is correlated with a myriad of adverse outcomes including academic and workplace difficulties, and psychosocial problems such as stigma, isolation, anxiety, loneliness and depression (Huang et al., 2009; Lin et al., 2013;

Manchaiah & Danermark, 2016; Mueller et al., 2014). Hearing loss that remains unaided long-term has also been linked to higher rates of cognitive decline and dementia among older people (Huang et al., 2009; Lin et al., 2013).

The economic burden of hearing loss on society is significant (Graydon et al., 2019). According to WHO (2020) estimates, unaddressed hearing loss poses a global annual cost of approximately $750 billion USD. In New Zealand, hearing loss was estimated to cost a total of $957 million in 2016 (The National Foundation for the Deaf, 2016). The economic drain caused by hearing loss is explained by a range of factors including limited academic and career performance, unemployment, workplace absenteeism and increased pressure on health systems (Hogan et al., 2009).

1.3 Audiology

1.3.1 Adult Audiological Assessment and Rehabilitation

Adult audiological assessment involves the use of a range of objective and subjective tests to evaluate the integrity of the auditory system (Kreisman, 2015). These tests help to elucidate the nature and severity of an individual's hearing loss, and provide additional insight into likely prognosis and suitability of various rehabilitation and treatment strategies. A standard adult audiological evaluation involves recording a case history, followed by administration of the following tests: Otoscopy, pure-tone audiometry, speech audiometry, tympanometry and acoustic reflexes (ASHA, n.d.-d). Evaluation usually concludes with a verbal explanation of the hearing test results to the patient (ASHA, n.d.-b; Flasher & Fogle, 2012). Additional informational counselling may also include educating the patient about the nature and consequences of their ear and hearing related difficulties, explaining how appropriate interventions work and how they may be applied (Margolis, 2004).

Many effective rehabilitation strategies exist for those affected by hearing loss. These may include: (1) Sensory management, (2) instruction for communication strategies and

associated technologies, (3) perceptual training and (4) counselling (Boothroyd, 2007). According to Montano and Spitzer (2013, p. 65) effective rehabilitation should encompass a "person-centred approach to the assessment and management of hearing loss" that encourages the patient to participate in exploring ways to reduce the impact of their hearing impairment. Despite ample evidence that the use of hearing aids and cochlear implants reduces hearing loss induced deficits, enhances participation in daily activities and improves psychosocial wellbeing (Chisolm et al., 2007; Mulrow et al., 1990; Stark & Hickson, 2004), uptake remains low. According to WHO estimates, there is an 83% gap between hearing aid need and hearing aid use, with just 17% of people who could receive benefit from hearing aids actually owning and using them (WHO, 2020). Therefore, it is an audiologists' responsibility to educate patients about their hearing loss and work alongside them to find appropriate treatment and management options.

1.3.2 Referrals and Reports

A multidisciplinary team approach is often necessary in the assessment and management of hearing related disorders (Kreisman et al., 2015). For example, audiologists often play a role in identifying red flags and referring for conditions associated with hearing loss, such as vestibular dysfunction, depression, cognitive decline and ototoxicity (Nunez et al., 2019; Steiger, 2005). Similarly, audiologists may receive patient referrals for diagnostic assessment from a number of health care professionals (HCPs) involved in a patient's care. Therefore, dissemination of audiological assessment results often includes reporting to other relevant HCPs such as general practitioners (GPs)/primary care physicians (PCPs), ear nose and throat (ENT) doctors, psychologists, speech language pathologists and occupational therapists (Kreisman, 2015).

The most common referrals audiologists make are to GPs/PCPs and ENT doctors (Kreisman et al., 2015). These referrals are necessary for preventing further damage to

hearing and general health, avoiding medical complications and gaining clearance for the use of hearing aid devices in complex cases (Steiger, 2005). Audiologists also report to GPs/PCPs and ENT doctors of the outcome of hearing assessments and rehabilitative plans, providing any updates that are relevant for the patients' care. This is typically completed by providing a diagnostic report or letter outlining any hearing health history, test results and treatment or management recommendations. Individual clinics have their own referral and protocols reporting standards (Kreisman et al., 2015).

Audiologists may also refer patients to, or routinely write letters to the patient's GP/PCP to provide an update about the patients' hearing status (Kreisman et al., 2015). Some audiologists may only produce these letters upon request of the patient. As with other health professions, anecdotal evidence indicates that audiologists commonly copy the report to the patient. It is a matter of individual clinic policy as to whether this is done routinely or upon patient request. However, anecdotal evidence suggests that many patients prefer to receive a copy of their hearing test results, thus it is likely to be common practice among many audiology clinics.

1.4 Patient-Centred Care

A patient-centred approach is becoming increasingly recognised for its importance in audiological care (Grenness et al., 2014). Patient-centred care (PCC) is defined as "providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions" (Institute of Medicine, 2001, p. 40). PCC identifies the importance of considering a patient's experience, context, history, family, needs, values and individual strengths and weaknesses. The benefits of practicing with a patient centred approach are manifold. PCC contributes to enhanced patient satisfaction and health outcomes (Frampton & Charmel, 2009; Swenson et al., 2004) and has been linked with decreased readmission rates to hospital, reduced mean length of stay, lower

rates of mortality, reduced costs, and better chronic disease management (Frampton & Charmel, 2009; Meterko et al., 2010). Patients with chronic health conditions, such as hearing loss, benefit greatly from PCC (Michie et al., 2003). A patient-centred approach is especially important in circumstances where patients are faced with decisions about their care, such as when there is more than one suitable option available, or when management requires long-term buy in and adherence from the patient (Michie et al., 2003).

1.4.1 Shared Decision Making

When patients are involved and valued in their healthcare encounters, they are more motivated and willing to adhere to long-term treatment plans (Michie et al., 2003). In this way, shared decision making (SDM) is a key aspect of PCC and is considered an ethical imperative (Pryce & Hall, 2014). SDM refers to the process whereby patients and clinicians jointly reach decisions for care by considering the best available evidence provided from both parties (Barry & Edgman-Levitan, 2012). In this way, SDM challenges the traditional role of the clinician and patient by sharing the power and responsibility of the clinical encounter equally (Montano & Spitzer, 2014). A Cochrane Systematic Review reported evidence from 86 clinical trials supporting the benefit of SDM in clinical practice (Stacey et al., 2017). Advantages included greater patient knowledge of their health status, increased patient confidence in health decision making, and more patient involvement in health care interactions. The benefits of SDM for patients with chronic conditions have also been documented (Joosten et al., 2008). For example, patients with chronic high blood pressure benefit being involved in decision making (Schulman, 1979), and patients who are involved in decisions for their diabetes management are more likely to have improved blood sugar control (Kaplan et al., 1989).

PCC and SDM in audiology have received less attention when compared to other health fields (Grenness et al., 2014). A patient-centred approach is crucial in audiological

practice, whereby most treatment and management options require buy-in and adherence to be effective (Pryce & Hall, 2014). The benefits of patient-centred approaches to practice are significant for audiological practice. This is because the rehabilitation of hearing and balance disorders is multifaceted, and has vast medical, psychosocial, educational and physical implications, meaning that audiologists must be mindful of the various factors that affect a patient's life (Grenness et al., 2014). Unsurprisingly, evidence has also indicated that majority of adults with hearing impairment want to be included in the decision-making about their hearing health (Grenness et al., 2014; Laplante-Lévesque et al., 2010a, 2010b, 2012). Pryce and Hall (2014) suggest that audiologists can also reap the benefits of SDM through sharing responsibility for management decisions with patients. In this way, they may be less likely to experience feelings of frustration, inadequacy and powerlessness (Pryce & Hall, 2014). However, if patients are to fully participate in their health care encounters, health information must be provided in a way that is sensitive to their level of understanding.

1.5 Health Literacy

When interacting with the healthcare system, patients must be able to effectively perform a range of health-related tasks. These may include seeking appropriate health services, identifying and reading health information, reading medical letters, interpreting test results, and making informed decisions about treatment options (Gruman et al., 2010; Ministry of Health Manatū Hauora, 2015). Patients must also possess good oral language skills when communicating with health care providers. For example, they must accurately report relevant case history, ask about evidence for the efficacy of various treatment options, request advice and accurately express their needs, values and concerns (Gruman et al., 2010). The constellation of these skills is commonly referred to as 'health literacy'.

Many definitions and conceptualisations of health literacy exist (Parnell, 2014; Sorensen et al., 2012). One widely accepted definition is "the degree to which individuals

have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (Ratzan & Parker, 2000, p. 6). Nutbeam (2000) proposes that there are three main aspects of health literacy: (1) functional literacy, (2) communicative literacy and (3) critical literacy. Functional literacy refers to the rudimentary reading and writing skills necessary to perform basic tasks such as reading letters and filling out forms. Communicative literacy is concerned with those interpersonal skills and sophisticated cognitive and literacy skills that allow individuals to engage in healthcare interactions, as well as extract and synthesise health information from different sources relevant to their circumstances. Critical health literacy refers to the ability to judiciously analyse information that is presented. An example of critical health literacy may be evaluating the risks and benefits of treatment options, or assessing the credibility of different sources of health information (Nutbeam, 2000).

Historically, health literacy has been conceptualised as an individual's ability for discrete skills such as basic reading, writing and numeracy. However, evolvements in theory suggest that health literacy is a dynamic combination of the skills of both the individual receiving health care as well as the organisation or system providing the care (Parnell, 2014). In this way, HCPs must accept responsibility to provide care that is sensitive to an individual's level of health literacy.

1.5.1 Prevalence of Low Health Literacy

Low health literacy has long been considered a public health concern (Nutbeam, 2000). In 2003, a National Assessment of Adult Literacy examined the health literacy of 19,000 adults living in the US (Kutner et al., 2006). It was found that approximately one fifth of adults had basic health literacy, and a further 14% had lower than basic health literacy. More recent studies of health literacy rates in the Western world have confirmed this trend. In a survey of adults in eight European countries, more than half of the participants had

inadequate or limited health literacy (Sørensen et al., 2015). The latest analysis of public health literacy skills in NZ was in of the Adult Literacy and Life Skills Survey in 2006 (Education Counts, n.d.). At the time, over half of the NZ adults surveyed had poor health literacy skills, which is consistent with other Western countries such as the US, Australia and Canada (Education Counts, n.d.). Significant disparities in health literacy between NZ Māori and Pakeha have also been identified. It is estimated that nearly 80% of Māori males and 75% of Māori females have low health literacy skills (Ministry of Health Manatū Hauora, 2010). Taken together, evidence indicates that a significant proportion of the NZ population have difficulty performing basic health-related tasks.

Certain other demographics also bear greater risk for low health literacy. For example, older people, people with communication disorders, people with cognitive disorders, ethnic minorities, non-English speakers and those who are homeless or in poverty are also more likely to have low health literacy (Hester & Benitez-McCrary, 2006; Kindig et al., 2004). Other influencing variables include low socioeconomic status, the presence of learning disabilities, poor language skills and lower levels of education (for a review see Institute of Medicine, 2004). Therefore, it is expected that audiologists will often meet patients with low health literacy.

1.5.2 Impact of Low Health Literacy

Low health literacy has a myriad of adverse impacts at both the individual and societal level. Low health literacy has been established as a better predictor of a person's health than variables such as income, age, employment status and level of education (Weiss, 2007). One comprehensive systematic review reported moderate to strong evidence that poor health literacy was linked with a higher incidence of hospitalisation, utilisation of emergency care, greater risk of safety concerns such as misinterpreting health messages and mortality (Berkman et al., 2011). In this way, those with low health literacy understand less about their

health conditions and associated treatments, and are less likely to actively engage in PCC and SDM (Gilligan & Weinstein, 2014). This has serious implications for the management of chronic conditions, which call for increased collaboration between the patients, clinicians and the health care system (Parnell, 2014).

Beyond the individual level, poor health literacy causes major inefficiencies in health systems. For example, those with insufficient health literacy are more likely to have protracted hospital admissions and use emergency services more (Weiss, 2007). One report estimated that the cost of inefficiencies in health care related to low health literacy is between US $106 billion to $238 billion per year (Vernon et al., 2007).

The effect of hearing loss on health literacy has received limited attention. However, it follows that hearing loss adversely impacts a patient's ability to understand verbally communicated information provided during a health care encounter (Gilligan & Weinstein, 2014; Nair & Cienkowski, 2010). In a recent study of 300 adult patients at a university otology practice, it was found that the presence of hearing loss was a significant independent predictor of low health literacy (Tolisano et al., 2020).

Taken together, it is evident that measures must be taken to minimise the impact of poor health literacy on those interacting with the healthcare system. This is especially true for audiological practice. Low health literacy is increasingly being recognised as a health care systems issue (Rudd, 2010), and efforts to ameliorate the effects of low health literacy through patient education has been identified as a major public health goal (Nutbeam, 2000). Berkman et al. (2011) identified that health-related knowledge and patient self-efficacy mediate the association between low health literacy and adverse health outcomes. Therefore, HCPs must take the responsibility of supporting patients with low health literacy through providing clear and relevant health messages that enable informed choice.

1.6 Patient Education

Effective patient education is a key tool for reducing the effects of low health literacy and engaging patients in SDM (Tolisano et al., 2020). The predominant goal of patient education is to enhance patients' health literacy so they are empowered to make appropriate decisions for their health in accordance with their values and needs (Redman, 2004). Patient education is especially vital in the management of chronic health conditions, including hearing loss (Hoffmann & Worrall, 2004; Win et al., 2016). Patient education may be presented through a variety of modalities including print resources, informational counselling, verbal instruction, audio-visual materials and demonstration (Marcus, 2014; McKenna & Tooth, 2006).

The accurate and clear communication of health information has important professional, legal and ethical implications for audiologists (Falvo, 2004; Karnieli-Miller et al., 2009). According to the New Zealand Ministry of Health (MOH) Patient Code of Rights, health consumers have the right to obtain the information they require to make health decisions, as well as receive clear information about any tests, procedures and treatments received (MOH, 2016). This includes an explanation of the health condition in a way that can be understood by the consumer (MOH, 2016). According to Right Six, patients also have the right to receive a written summary of the information provided in a way they can understand (Health & Disability Commissioner, 2020b). Similarly, the American Speech-Language-Hearing Association (ASHA) model bill of rights for people receiving audiology services states that patients have "the right to receive a clear explanation of evaluation results" (ASHA, n.d.-c).

Patient education efforts are only effective when the information communicated is sensitive to those with low health literacy. In this way, information presented to a patient should be clear, comprehensible and able to be accurately recalled (Laplante-Lévesque et al.,

2010b). However, research into health information communication suggests that not all efforts are successful. For example, patients are often disappointed with the level and quality of information they receive when consulting with healthcare professionals (Fenton et al., 2017; Win et al., 2016). Insufficient appointment lengths, inadequate communication skills and the pressure to transmit significant amounts of information to patients in short periods of time have been linked with patient dissatisfaction when receiving education (Win et al., 2016). In interviews with patients following health care consultation for a variety of conditions, a general theme emerged that patients wanted more information about their health condition than they were provided (Coulter et al., 1999). Moreover, intended health messages are often misinterpreted or forgotten by patients (Marcus, 2014). For example, Kessels (2003) found that patients typically retain only half of the information shared with them in a medical appointment. Even more concerning, it is known that around half of the information recalled is often misinterpreted or remembered incorrectly (Kessels, 2003). It follows that attention is required to improve patient education so information is clear, comprehensible and supports accurate retention.

In audiological practice, the goal of patient education is for the patient to develop an understanding of hearing loss and its effects, as well as confidence and motivation for self-management (Redman, 2004). It is known that most patients want information about their hearing loss and hearing capabilities, and that informational counselling positively influences hearing aid use (Dillon, 2012). Moreover, patients who are provided with information about their hearing loss, in addition to being fit with hearing aids, report less hearing handicap (Andersson et al., 1994).

To date, little research has been invested into the effectiveness of patient education through informational counselling in audiological contexts (Grenness et al., 2015b). Existing studies have shown that patient recall and understanding of their audiological information

following assessment is poor (Martin et al., 1990; Watermeyer et al., 2012; Watermeyer et al., 2015; Watermeyer et al., 2017).The earliest study known to examine diagnostic information transfer to patients was by Martin (1990). The author surveyed patients on what was recalled following a diagnostic assessment, and found that no patients knew what the audiogram was (Martin et al., 1990). Later, Watermeyer et al. (2015) examined patient memory of diagnostic information after a hearing assessment. The authors found that patients were did not retain or comprehend the information from the audiogram, and only one patient out of five could recall the anatomical origin of their hearing loss. Similarly, another study found that parents of children with hearing loss were unable to recall basic features of the audiogram and the hearing mechanism (Watermeyer et al., 2012). In an online survey conducted by the Ida Institute, it was found that patients valued their ability to comprehend their hearing test results a six out of ten, and their ability to share the findings with others a five out of ten (Klyn et al., 2019). This indicates that the existing methods for educating patients about their hearing health likely does not promote SDM and PCC.

1.7 Written Patient Education Materials

Given that patients are often unable to accurately recall information from health care consultations, the provision of supplementary written information is critical in ensuring that intended messages have been clearly communicated (Hoffman & Worrall, 2004). In this way, patient education materials are a key means for imparting knowledge to patients, and are often relied upon to supplement and reinforce verbal explanations (Aldridge, 2004; Hoffmann & Worrall, 2004; Vermeir et al., 2015). Written materials are used extensively in the healthcare field and come in a wide variety of formats including letters, reports, pamphlets and instruction guides. Written materials are useful as they are permanent, portable, inexpensive to generate and ensure consistency of health messages for patients (Bernier, 1993; Hoffmann & Worrall, 2004). There is no doubt that most patients want to

receive education materials (Eaden et al., 1998; Tang & Newcomb, 1998). However, for education materials to be effective, they must be easily read and understood (Hoffmann & Worrall, 2004).

1.8 Readability

One method of assessing the literacy demand of written materials is by examining their readability. Readability is defined as the ease with which a passage of text can be read (McInnes & Haglund, 2011). Multiple features of a given text influence readability, including layout, sentence length, number of syllables, jargon and use of illustrations (Hayden, 2008).

Examining the readability of health materials is helpful for evaluating the appropriateness of health information for the intended audience. When consumers lack the skill to read a passage of text, they are at risk of misunderstanding the intended message or abandoning it completely (DuBay, 2004). Further, unreadable health materials prevent patients from meaningfully engaging in efforts to manage their own health.

There are multiple methods for examining the readability of a given resource. One commonly used measure of readability is reading grade level (RGL), which refers to the predicted number of years of education needed to understand a given text (Ley & Florio, 1996; McInnes & Haglund, 1996). According to McLaughlin (1969) a person who reads at or above a given RGL will understand between 90% to 100% of the information contained. Therefore, the RGL of a document should meet or be below the level at which a target audience can comprehend it. To support those with low health literacy, it is recommended that health materials be produced at the sixth RGL or lower (Doak et al., 1996). Other authorities have recommended a more conservative range between the third and fifth RGL (Wells, 1994).

1.8.1 Readability Formulas

Readability formulas are a valuable tool in health literacy research as they give an objective gauge of the skill required to read a given text (DuBay, 2004). Although only a proxy measure for comprehension, they provide a quick and convenient method for determining whether a given audience is likely to be able to comprehend a passage of text. Readability formulas typically comprise of multiple regression equations that predict the average years of education required to understand a given piece of text (Ley & Florio, 1996). Commonly used predictors used in readability formulas include average word length in syllables, proportion of common words used, proportion of polysyllabic words, proportion of monosyllabic words and average sentence length (Ley & Florio, 1996).

It has been reported that RGLs produced from different readability formulas are not always in agreement for the same piece of text (Wang et al., 2013). This is likely in part due to differences in the comprehension criterion adopted when the formulas were developed, as well as differing methods for calculation and validation. For example, Ley (1995) calculated the readability of 1296 health related documents. Analyses revealed 171 absolute differences in RGL assigned among readability formulas for the same passage of text. Because of this discrepancy, experts recommend obtaining a mean RGL using several formulas to increase statistical confidence in the recommended RGL (Friedman et al., 2006; Ley & Florio, 1996). The following formulas are used widely in the evaluation of health materials and are known to correlate highly with each other, indicating good validity (Ley & Florio, 1996; Ley, 1996; Wells, 1994).

1.8.1.1 Gunning Fog Index (FOG).

The Gunning Fog Index (FOG) was developed to establish why many high school graduates in the 1930's had inadequate reading skills to understand materials such as newspapers and business documents (DuBay, 2004). It was hypothesised that such texts were

often full of unnecessary ‘fog’ and complexity which prevented readers from grasping the intended message. The FOG was validated against text passages assuming the reader could answer 90% of comprehension questions (Ley & Florio, 1996). According to the FOG formula, reading difficulty is determined by average sentence length and number of polysyllabic words per 100 words of text (DuBay, 2004). The FOG formula produces an estimated number of years of education required to understand the text (DuBay, 2004). The FOG RGL is calculated using the following equation (DuBay, 2004):

$$\text{Grade} = 0.4 + (\textit{average sentence length} + \textit{complex words})$$

1.8.1.2 Simple Measure of Gobbledygook (SMOG).

The Simple Measure of Gobbledygook (SMOG) formula was developed and published in 1969 as an alternative to the FOG (McLaughlin, 1969). RGL is derived by calculating the number of polysyllabic words per 30 sentences, which is intended to measure complex word density (McLaughlin, 1969). The SMOG has been recommended as the formula of choice when evaluating patient health materials, as it is a more stringent method of estimating RGL due to its assumption of 100% text comprehension (Fitzsimmons et al., 2010). It has also been reported to have greater consistency of results over other formulas and uses more recent validation criteria for RGL estimation (Wang et al., 2013). The SMOG formula is often used for examining the readability of health information. It demonstrates a 0.985 correlation with the grade of readers who have complete comprehension of test materials (McLaughlin, 1969). The SMOG RGL is calculating using the following equation (McLaughlin, 1969):

$$\text{Grade} = 3 + \sqrt{}(\textit{polysyllabic word count}) \times (30 \div \textit{number of sentences})$$

1.8.1.3 Flesch-Kincaid RGL (F-K RGL).

The Flesch-Kincaid Reading Grade Level (F-K RGL) was initially developed for determining reading difficulty of technical manuals in the US Navy (Kincaid et al., 1975).

Readability is calculated using average number of words per sentence and syllables per word (DuBay, 2004). The F-K RGL was validated against two sets of passages which are based on a comprehension criterion at which half of a sample of army personnel scored 75% on a multiple-choice test (Ley & Florio, 1996). According to Wang et al. (2013), the F-K RGL is the most commonly used measure of readability in the assessment of health information materials. The F-K RGL formula has received criticism over its validity due to its lower comprehension criteria, which gives an underestimate of reading difficulty compared to other readability formulas (Fitzsimmons et al., 2010). The F-K RGL is calculated using the following equation (Kincaid et al., 1975):

$$\text{Grade} = (0.39 \times \textit{average no. of words per sentence}) + (11.8 \times \textit{average no. of syllables per word}) - 15.59$$

1.9 Readability of Patient Education Materials

A key method of supporting health literacy is to provide patients with clear and comprehensible education materials. Despite the fact that patient education materials are intended for patient use, there is often little thought given to their readability (Davis et al., 1990). According to Rudd (2013), more than 1500 peer reviewed studies have reported that health materials from online and print media are written at a level that is too difficult for its intended target audience. One study investigated the gap between reader ability and the readability of clinical patient education materials in a primary care setting (Davis et al., 1999). The authors found a significant difference between average patient reading skills and the reading ability required to understand the text (Davis et al., 1999). Most materials examined required more than 11 years of formal education to read, with a mean five-year difference between patients' reading ability and the RGL of patient materials available in public clinics.

Studies have reported that patient education materials in audiology are not matched to patients' health literacy levels. One study examined the readability of hearing aid user guides

sampled from various hearing aid manufacturers (Caposecco et al., 2014). All user guides were found to be inappropriate for patient use, with the mean RGL of all guides exceeding the recommended level of six (Caposecco et al., 2014). Joubert and Gijinthi (2013) examined the reading difficulty of pamphlets on new born hearing screening in South Africa. The authors found that more than half exceeded the recommended RGL of six (Joubert & Githinji, 2013). Moreover, many studies have reported that online hearing-related information is too demanding for majority of patient audiences to read, with RGLs consistently surpassing the recommended level of six (Laplante-Lévesque & Thorén, 2015). Taken together, evidence supports the notion that traditional hearing-related patient education materials are not readable for majority of patient audiences. However, very few studies have sought to examine health materials used by patients beyond the traditional patient-targeted resources mentioned previously.

1.10 Written Diagnostic Reports

In the health domain, diagnostic reports represent a comprehensive written account of a clinical assessment and evaluation (Goldfarb & Serpanos, 2020). While these reports are usually prepared for use by other health professionals, it is common practice to provide copies of diagnostic reports to patients. In fact, written diagnostic reports can be considered a key source of individualised and up-to-date health information for patients in audiology (Kelly-Campbell & Manchaiah, 2020). These documents are sometimes also called ‘copy letters’, and are sent between HCPs about a patient’s care and treatment, with the patient copied in (Harris et al., 2018). In some instances, diagnostic reports may be written directly to a patient should they request it, or if it is the clinic’s policy.

Audiologists often write reports summarising diagnostic information and management recommendations for other HCPs and patients. Most standard diagnostic audiology reports follow a similar format which includes case history, assessment information, clinical

impression and recommendations (Goldfarb & Serpanos, 2020). These reports serve several purposes including: (1) reporting diagnostic and rehabilitative information to patients and other health professionals, (2) providing analysis of diagnostic results about hearing or balance complaints, (3) answering queries from other health professionals that referred the patients, and (4) making recommendations for additional diagnostic testing, management and any other onward referrals required (Burrus & Willis, 2022). Patients are usually provided copies of these reports. In some cases, audiologists may produce reports summarising diagnostic information that is written specifically to patient.

1.11 Summary of Research on Providing Diagnostic Reports/Copy Letters to Patients

Providing copies of written reports to patients has significant scope to enhance transparency of health care encounters and better involve patients in decision making (Wu et al., 2013). Copying patients in to correspondence about them is thought to make health consumers better informed, improve patient compliance and prevent misunderstandings and errors between health care practitioners and patients (Wu et al., 2013). In fact, copying patients in is considered best practice among many medical professionals (Richards, 2008).

Most of the research investigating the uses and benefits of copy letter practice has originated from medical settings in the United Kingdom (UK). In 2003, the UK Department of Health recommended the routine practice of copying patients in to correspondence about them (Department of Health, 2003). Reasons for this practice included: (1) increased trust between patients and health professionals, (2) more informed patients, (3) enhanced opportunity for patient decision making, (4) improved patient compliance with treatment recommendations and (5) more accurate records (Department of Health, 2003). Importantly, copy letter practice has been specifically endorsed for use among those with access issues, including those with hearing loss (Jelley & Walker, 2003).

An evaluation of the literature on copy letter practice in the medical field indicates that many patients want to receive copies of their healthcare correspondence (Ansari et al., 2011; Brockbank, 2005; Brodie & Lewis, 2010; Cassini et al., 2011; Clark et al., 2008; Dale et al., 2004; Jelley & Walker, 2003; Nandhra et al., 2004; Treacy et al., 2008). Patients report a significant increase in satisfaction when they receive the letters, which has been demonstrated across a range of contexts including cardiology (Brodie & Lewis, 2010), oncology (Krishna & Damato, 2005), otolaryngology (Pothier et al., 2007; Saunders et al., 2003), haematology (O'Reilly et al., 2006) and psychiatry (Dale et al., 2004). No studies have investigated patient perceptions of copy letter practice in non-medical healthcare contexts, such as audiology.

The positive psychological effects of providing patients with copy letters has been demonstrated. One study found that when patients received a copy of their diagnostic report following oncology consultation, they reported less anxiety and exhibited improved recall of test findings (Spodik et al., 2008). It is known that in other healthcare contexts, patients feel that receiving a report of their test results helps them to feel informed, involved, supported, and in control (Brodie & Lewis, 2010; Jelley & Walker, 2003). One study also reported that patients felt receiving a report improves the retention of their health information (Bartle et al., 2004).

Written reports and copy letters also have the added benefit that they contain a summary of the patients' personalised health information (Manchaiah et al., 2020). Personalised information provides added value to the patient beyond the generic patient education materials, which are usually targeted at heterogeneous patient audiences. Evidence suggests that patients want to receive custom tailored information about their own health, including diagnostic test results (Eaden et al., 1998; Jones et al., 1999). For example, Tang and Newcomb (1998) found patients with high cholesterol expressed desire to see their

cholesterol readings and have a comparison with the normal range (Tang & Newcomb, 1998). In the same study, the authors trialled post-consultation written summary with a group of participants which contained their health condition, test results and recommendations for management. The participants expressed they found it highly valuable to have a record of their health status, and found it helpful for absorbing the information. Patients also felt this contributed to an enhanced sense of satisfaction with their clinician (Tang & Newcomb, 1998). Moreover, it has been reported that the information being shared between HCPs is rated as important to know by patients and families (Bartle et al., 2004).

Patients often report increased understanding of their health information when they receive copies of their letters and diagnostic reports. Interestingly, some studies report that patients feel they understand more than 90% of the information contained in their copy letters (Brodie & Lewis, 2010; Krishna & Damato, 2005). However, these studies almost exclusively rely on subjective measures of patient understanding. In these studies, patients are asked about whether they understood the contents of the document, and only 'yes' or 'no' response options are given. Unfortunately, this method provides little insight into the extent of an individual's comprehension. Additionally, comprehension is not verified objectively in any way. Consequently, there is a lack of high quality evidence showing that copy letters/diagnostic reports are accessible for patients and improve understanding (Harris et al., 2018).

Despite the many reported positive benefits of copy letter practice, several concerns have been raised about their appropriateness for patient use. Karnieli-Miller (2009) investigated patients' views of receiving endoscopic lab reports following consultation with a specialist. Patients were generally disappointed with the comprehensibility of reports due to unclear messages, vague and technical wording and insufficient explanations of findings and their implications. More than half of the respondents reported not understanding the contents

of the letter, and in some cases, participants perceived a sense of disrespect and lack of caring when receiving these reports (Karnielli-Miller, 2009). For example, one participant commented "I didn't understand a word… it was about me, but not to me" (Karnieli-Miller et al., 2009, p. 345).

Many studies cite the excessive use of medical terminology as a problem with receiving copy letters and diagnostic reports (Baxter et al., 2008; Harris et al., 2018; Jelley & Walker, 2003; Krishna & Damato, 2005; White et al., 2004). Patients feel that receiving unclear communication mystifies the meaning of test results and causes confusion and misinterpretations (Karnielli-Miller, 2009). In a survey of patient's views on reviewing their health records, Keselman et al. (2007) found that lack of conceptual knowledge was cited as a problem in trying to understand the meaning of the documents. Moreover, survey respondents identified the use of professional language and unexplained abbreviations as barriers to understanding, with respondents expressing a desire for simpler explanations using layman's terms (Keselman et al., 2007).

A major gap in the literature on copy letter practice is that no studies report on the content of correspondence studied (Baxter et al., 2008). Therefore, evaluating the literature for what aspects of copy letters/diagnostic reports patients find useful is difficult. Baxter et al. (2008) suggests that research must move on from examining subjective perspectives on copy letter practice, to examining the quality of copy letter/diagnostic report content for patient use.

1.12 Readability of Reports and Health Care Correspondence

As discussed previously, evidence suggests that many clinical letters are written at a level that makes them inaccessible for patients to understand (Bartle et al., 2004; Bennett et al., 2012; Bhandari, 2010; Brockbank, 2005; Choudhry et al., 2016; Donald & Kelly-

Campbell, 2016; Wu et al., 2013). This is unsurprising given that they are oftentimes primarily intended for use by other health professionals.

A small body of published research has examined the readability of clinical copy letters and diagnostic reports provided to patients across a range of medical and allied health disciplines. Taken together, the research indicates that clinical letters have poor readability, with majority of the reported RGLs consistently above the recommended level of six. Evidence also indicates that reports are more difficult to read than other general patient education materials, with many requiring approximately tertiary level education to understand (Bhandari, 2010; Donald & Kelly-Campbell, 2016; Martin-Carreras et al., 2019; Wu et al., 2013).

Roberts and Partridge (2006) analysed the readability of 84 GP letters copied to patients following cardiorespiratory consultation in a hospital setting. Letters were written by either consultant or trainee medical doctors. The mean F-K RGL of letters was 10.72, indicating an average of 10 years of formal education was required to read the letters. In another hospital setting, Choudry et al. (2019) examined the readability of 497 trauma discharge summaries written by doctors and provided to patients following hospital discharge. Using F-K RGL, the authors found that a mean of 10 years of formal education was required to read the summaries. Further analyses showed that only 65% of the patients who received the reports had the skills adequate to read their discharge summaries.

Three studies have analysed the readability of reports sampled from mental health contexts. Bhandari (2010) analysed the readability of clinical letters copied to patients from an older people's mental health team. The authors did not report the number of reports analysed, nor who wrote the reports. The mean SMOG RGL was 17.2, and there was no letter written with a SMOG RGL of less than 14. Later, O'Mahony and Kalk (2011) examined the readability of all new clinical assessment letters produced by a community mental health

service over a three-month period. Results indicated that no letters were rated as ‘easy’ or’ very easy’ to read according to the Flesch Reading Ease tool. The number of reports assessed was not disclosed. Bennett, Drane and Gilchrist (2012) investigated the readability of 300 GP letters written by psychologists following mental health assessment. Using the SMOG RGL formula, the mean of all reports was 12.7 and FK-RGL was 9.9.

Two studies have examined the readability of radiology reports written by radiologists provided to patients following x-ray. One study analysed 97,052 reports collected over a five-week period from a large metropolitan health system in the U.S (Martin-Carreras et al., 2019). Using FK-RGL, SMOG and FOG, the mean RGL of all reports was 13. Just 650 reports, or 0.7%, were written at or below the recommended RGL of six. Hyunsoo et al. (2019) analysed the readability of 110 lumbar spine MRI reports in an academic medical centre, using F-K RGL, FOG and the Coleman-Liau Index. The mean RGL of all reports was 13. No reports were found to be at or below the recommended RGL of six.

In a large study of medical records, Wu et al. (2013) compared the readability of medical documents produced in a hematology/oncology department to online patient targeted education materials available on Medline Plus. A total of 50,000 referral letters were selected from the hospital database for readability analysis. Referral letters had a mean FOG RGL of 13.81, SMOG RGL of 12.30 and F-K RGL of 9.44. The authors found that referral letters copied to patients were significantly more difficult to read than patient education materials offered on the Medline Plus website (Wu et al., 2013). Further, more than three quarters of the words appearing in referral documents copied to patients could not be found in a general dictionary, compared with only 2.6% of terms in patient education materials from Medline Plus.

Todhunter et al. (2010) examined the readability of outpatient letters to GP/PCPs copied to patients following consultation with an otolaryngologist. A total of 295 clinical

letters were found to have a mean F-K RGL of 9 and a Flesch Reading Ease score of 61.8, indicating the documents were 'fairly difficult' to read. In a review of clinical letters copied to gerontology patients following consultation with a specialist, the average letter required approximately 17 years of education needed to read the content, with no letters having a SMOG RGL of 14 or less (Bhandari, 2010).

Only one study has examined the readability of a paediatric diagnostic audiology report (Donald & Kelly-Campbell, 2016). Donald and Kelly-Campbell (2016) assessed a mock paediatric audiology report for readability and comprehensibility. Readability measures revealed that the original report was "difficult" to read, with a SMOG and F-K RGL of 16 and 14.8 respectively. Semi-structured interviews with naïve parents revealed that the report was confusing and difficult to read. Parents reported difficulty with excessive use of jargon and audiology-specific terminology, as well as units and numbers. Participants questioned the usefulness of the report and highlighted the need for professional assistance in understanding the information (Donald & Kelly-Campbell, 2016). Perhaps most concerning was that most participants did not gather from the report that the hypothetical child had a hearing impairment. Further, the readability analysis was only completed on one mock report, and therefore the findings lack some generalisability to real world settings. The readability of diagnostic audiology reports has yet to be established in an adult population—though it appears likely that similar issues may exist. Therefore, the follow research question is posed:

Research Question 1: What is the mean RGL of adult diagnostic audiology reports?

1.12.1 Factors Affecting Readability of Diagnostic Reports

Beyond merely reporting the RGL of clinical correspondence and reports, very few studies have examined variables that influence their readability. Bennett, Drane and Gilchrist (2012) examined the impact of professional group membership on the readability of 300 clinical letters copied to patients from a community mental health setting. The number of

letters per professional group was not reported. Using SMOG and F-K RGL, it was found that psychologists wrote letters with the poorest readability when compared to other professional groups (psychiatrists and specialist nurses). Bennett et al. (2012) also compared the readability of clinical letters sent by trainee versus permanent staff. Trainees (*n = 27*) produced letters with a higher RGL than those written by permanent members of staff (*n* = 245). In another community mental health team, O'Mahony and Kalk (2010) assessed all letters written over a 3-month period for readability using the Flesch Reading Ease formula. The authors found that no reports were rate as 'easy' or 'very easy' to read. However, the authors did not state the number of reports that were analysed for readability overall. Therefore, the research rigour and statistical validity of the findings this study cannot be ascertained.

Only one study has investigated the effect of clinic setting on the readability of health-related reports. In their examination of radiology reports, Martin-Carreras et al. (2019) compared three clinic settings in one hospital (emergency, inpatient and outpatient) for effect on readability. Reports were analysed for mean RGL using FOG, F-K and SMOG RGL. The authors reported that letters in inpatient settings had a significantly higher mean RGL (13.3) than those produced in emergency (12.9) and outpatient (12.9) settings.

As the present study is aimed at examining the readability of clinical letters written by audiologists, it was decided that a similar concept would be to investigate the readability between clinic settings. Because audiologists work in a diverse array of settings including universities, ENT (medical) clinics and private practices, it is possible that letters written in different settings may have differing levels of readability. For example, it is feasible that reports written in a medical setting such as an ENT clinic may contain more complex words and unfamiliar concepts to patients than those written by other audiologists. Therefore, the following research questions are posed:

Research Question 2: What are the mean RGLs of diagnostic reports in different audiology clinic settings?

Research Question 3: Is there a significant difference in RGL of diagnostic reports between audiology clinic settings?

The effect of report/letter addressee on the readability and/or comprehensibility of written reports in health has been investigated in three studies. One study investigated the readability of clinical outpatient letters copied to patients versus written directly to patients in a hospital cardiorespiratory setting (Roberts & Partridge, 2006). The study involved sending two letters to each of the 84 patients in the study. One letter was prepared specifically for the patient and one letter was a copy of their report to the GP. According to the Flesch Reading Ease formula, letters written directly to patients were significantly easier to read than those written to GPs with the patient copied in. The authors also found that patients rated the letters written to them as significantly easier to understand, with most patients expressing a preference for the letter targeted to them (Roberts & Partridge, 2006).

Bennett et al. (2012) also examined the impact of report/letter addressee (patient versus GP) on the readability of letters produced in their community mental health setting. Letters written to patients (n = 142) were significantly more readable (at least one RGL lower) than those written to GPs or other clinicians (n = 158) with the patient copied in (Bennett et al., 2012). Finally, using the Flesch Reading Ease readability measure, O'Mahony and Kalk (2010) found that letters written directly to patients with the GP copied in were significantly easier to read than those written to GPs with patients copied in. However, it was noted that no letters were rated as 'easy' or 'very easy' to read. This effect has yet to be examined this in an audiological setting.

Research Question 4: Is there a significant difference in mean RGL of diagnostic reports depending on who the report is addressed to?

As previously discussed, it is common in private practice audiology to provide referral to a GP/PCP or ENT following diagnostic assessment. It follows that there may be some basic differences in the content and style reports that contain a medical referral, versus those that do not. For example, reports containing a referral to a medical professional may be more difficult to read due to higher incidence of complex words, or length of sentences. In their study of a large corpus of medical documents, Wu et al. (2013) found that referral letters had a higher incidence of unfamiliar words when compared with other letter types including patient notes. The authors also found that up to two thirds of the words used in referral letters could not be found in basic medical dictionaries. However, no research has examined differences in readability between reports that contain and medical referral and reports that do not. Therefore, this study will seek to examine whether there are differences in readability between these two report types in diagnostic audiology reports.

Research Question 5: Is there a significant difference in mean RGL of diagnostic reports which contain a medical referral vs no medical referral?

1.13 Word Count

A separate method for evaluating diagnostic reports for patient use is to examine their word count. A small number of studies have examined the word count of health-related correspondence provided to patients. Wu et al. (2013) found that medical referral letters were longer than non-referral letters by approximately 100 words. In their study on radiology reports, Martin-Carreras et al. (2019) reported that letters written in an outpatient setting had a higher word count that letters written in inpatient or hospital settings. Finally, in their study of reports sent to patients following cardiorespiratory consultation, Roberts and Partridge (2006) compared the word count of paired reports sent to the GP versus the patient. The reports sent to patients were significantly shorter than those sent to GPs, by a mean of 100

words. No studies have investigated word count of reports in an audiological setting, nor have they sought to make comparisons of word count under different conditions.

Research Question 6: Is there a significant difference in word count for reports depending on clinic setting, report addressee and presence of referral?

1.14 Study Rationale

Taken together, the evidence suggests that the current practices for sharing audiological test results with patients via verbal explanations and patient education materials is often ineffective and insensitive to low health literacy. The provision of diagnostic reports to patients has scope to improve the transparency of health care interactions for patients, and help them to best understand their health condition and engage in decision-making. However, existing evidence suggests that health-related reports are often unreadable for patients.

In an audiological context, the provision of diagnostic reports to patients following assessment is a method for sharing test results with patients and engaging them in decision making about their hearing health. Evidence suggests that in current clinical practice, diagnostic reports are provided to patients with little concern for their readability or usability (Donald & Kelly-Campbell, 2016). Following on from Donald and Kelly-Campbell (2016), this study intends to examine the readability of adult diagnostic audiology reports. To the author's knowledge, this is the first study to examine the readability of diagnostic reports sent to adult patients in audiological settings, and examine variables which might influence readability.

The present study aims to examine the readability, measured in mean RGL, and word count of adult diagnostic audiology reports sampled in different clinical settings in NZ and the US. The study will examine the influence of clinical setting the report was written in (NZ university, US private practice, US Ear Nose and Throat (ENT) clinics) on mean RGL and word count. In one clinic setting (US private practice) the effect of report addressee (patient

or HCP) and presence of medical referral contained within the report (referral vs no referral) will be examined for its effect on mean RGL and word count. Note that due to differences in clinic policies and procedures between clinical settings, it was decided to examine the effect of report addressee and medical referral in just the US private practice setting. The US private practice setting was selected as it had a policy of writing two diagnostic reports for each patient; one to the GP/PCP and one to directly to the patient. Therefore, it is possible to make paired comparisons in mean RGL and word count depending on these variables.

1.15 Hypotheses

Following on from the general research questions posed previously, the following hypotheses have been established.

The following hypotheses relate to comparisons made between the three clinic settings.

1. The mean RGL of the diagnostic reports sampled from each clinic setting (NZ university, US private practice, US ENT) will exceed the recommended RGL of six.
2. There is no significant difference in mean RGL of diagnostic reports between clinic settings (NZ university, US private practice, US ENT).
3. There is no significant difference in mean word count of diagnostic reports between each clinic setting (NZ university, US private practice, US ENT).

The following hypotheses apply to those within the US private practice setting.

4. There is no significant difference in mean RGL of diagnostic reports by report addressee (patient vs HCP) for reports sampled from US private practice.
5. There is no significant difference in mean RGL of diagnostic reports between those who receive a medical referral and those who do not receive a medical referral from US private practice.

6. There is no significant interaction effect of report addressee (HCP or patient) and medical referral (referral vs no referral) on mean RGL for diagnostic reports sampled from US private practice.
7. There is no significant difference in word count of diagnostic reports by report addressee (patient vs HCP), for reports sampled from US private practice.
8. There is no significant difference in word count of diagnostic reports between those who receive a medical referral and those who do not receive a medical referral, for reports sampled in the US private practice.
9. There is no significant interaction effect of report addressee (HCP or patient) and referral (referral vs no referral), on word count for diagnostic reports sampled from US private practice.

2 Method

2.1 Overview

The purpose of this study was to investigate the readability of adult diagnostic audiology reports and to examine factors which may influence their readability. The study also aimed to explore the word count of reports, and examine variables which may impact this. The dependent variables in this study were mean RGL and mean word count. The independent variables examined were clinic setting (NZ university, US private practice, US ENT), report addressee (patient or HCP), and presence of medical referral (referral vs no referral). The effect of report addressee and medical referral was examined in only the private practice setting (comprising of two clinic locations of the same organisation).

2.2 Recruitment

Four clinics participated in the study: one university clinic in NZ, one US ENT clinic and two US private practice clinics (same organisation). US clinicians working at the private

practice and ENT clinics participated in return for Continuing Education Units (CEUs). Permission was obtained from individual clinic managers at each setting in NZ and the US prior to data collection.

2.3 Ethical Approval

Separate ethical approval was required for each country. Ethical approval for sampling of reports in the NZ university clinic was obtained on 12 June 2020 from The Human Ethics Committee at the University of Canterbury (see Appendix A). Ethical approval for sampling of reports in the US was received on 3 June 2020 from the Lamar University Human Subjects Review Board (see Appendix B).

2.4 Power Analysis

An *a priori* power analysis was performed to determine the number of reports required for each analysis. Due to the limited existing research in the area, a conservative effect size of $d = 1.0$ was selected to represent a clinically significant effect. Statistical power was set to 0.8 and the significance level was set to 0.05.

For the comparison of mean RGL of reports in each clinical setting to the recommended level of six, 10 reports were required from each clinic setting. For the analysis of readability and word count between clinic settings, a total of 75 documents would be required. Therefore, 25 documents would be required from each clinic setting. For a mixed model ANOVA comparing the effect of medical referral and report addressee in the US private practice clinic, a total of 42 documents would be needed, with 21 in each group.

2.5 Inclusion and Exclusion Criteria for Reports

Reports were included in the readability analysis if they met all the following criteria:

1) Subject of the report was aged 18 years or over.

2) The primary purpose of the document was to report on diagnostic audiological findings. The assessment purpose may be a full diagnostic test, annual review, or general follow up appointment.
3) The report contained at least 100 words of text for accurate readability analysis (excluding salutations, date and headings).
4) Report must have been addressed to the patient, or addressed to either the GP/PCP or ENT, with the patient copied in.

2.6 Sampling from NZ University Clinic

Reports were sourced by the author of this study from their electronic files in the university clinic database. All reports were ordered alphabetically by surname and assigned a number. A random number generator was used to select reports for analysis.

2.7 Sampling from US Private Practice Clinic

Reports were sourced from electronic files in the clinic database by administrative staff. Reports were ordered by the patients' unique ID and a random number generator was used to select the reports for analysis. Readability analysis for a total of 30 reports were requested for both report addressee types; patient and HCP (defined as either GP/PCP or ENT). As per the private practice clinic's policy, all patients had two documents associated with them: (1) a report addressed to them and (2) a report sent to a HCP involved in their care. In order to make paired comparisons, both reports for each patient were analysed for mean RGL and word count.

2.8 Sampling from US ENT Clinic

Reports were sourced from electronic files in the ENT clinic database by administrative staff. The author requested readability analysis for a total of 30 reports addressed to either the patient or to a HCP with the patient copied in. Reports were ordered

by the patients' clinic ID and a random number generator was used to identify reports for analysis.

2.9 Readability Analysis

The primary researcher performed the readability and word count analyses of documents obtained at the NZ university clinic. Clinic administrative staff performed readability analysis at the US ENT and private practice clinics. Administrative staff completing this task received an email outlining instructions for how to complete the readability analysis.

Readability analyses were performed using a free online tool WebFX https://www.webfx.com/tools/read-able/. For each report, three readability measures were recorded: FOG, SMOG and F-K RGL. Prior to analysis, the following textual elements were identified and deleted from each report: Page header and footer, salutations, date and headings/subheadings. Bullet pointed information was converted into sentences. The 'text by direct input' option was selected on the readability webpage and the text content of reports was copied from the electronic patient files and pasted into the textbox. Readability indices and word count were recorded for each document in a Microsoft Excel spreadsheet. Mean RGL was calculated for each report in the spreadsheet by taking the mean of FOG, SMOG and F-K RGLs.

2.10 Statistical Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 25 for Macintosh (IBM Corp, 2017). Prior to analysis, all variables were examined for bias by examining boxplots for outliers. Single sample t-tests, between group ANOVAs and mixed model ANOVAs were used to answer the research questions. An alpha level of 0.05 was selected *a priori* to define significance for all analyses.

3 Results

3.1 Overview

A total of *n* = 165 diagnostic reports identified as being addressed to patients or copied in to patients were analysed for readability and word count. Of the total number of diagnostic reports, *n* = 60 were sampled from the NZ university setting. From the US private practice setting, a total of *n* = 84 reports were sampled across two clinic locations. For the US ENT setting, *n* = 21 were sampled. Due to state-wide COVID-19 lockdown restrictions, data collection was terminated at the US ENT setting before sampling was complete.

3.2 Descriptive Statistics

The mean of the three readability measures were taken to derive a mean RGL score for each report. Table 1 shows the mean RGL and word count of the total reports sampled across all clinic settings.

Table 1.

Mean Readability and Word Count Statistics for Total Sample (n =165)

	F-K	SMOG	FOG	Mean RGL	Word Count
M	10.42	9.65	13.17	11.82	210
SD	1.54	1.35	1.57	1.15	60.41

Note. M = Mean, *SD* = Standard Deviation, *F-K* = Flesch-Kincaid, *FOG* = Gunning Fog Index, *SMOG* = Simple Measure of Gobbledygook, *RGL* = Reading Grade Level.

Table 2 presents the descriptive statistics for individual RGL measures, mean RGL and mean word count for reports sampled from each clinic setting. Note that reports from the US private practice are split by report addressee (HCP vs patient) for the between group analyses.

Table 2.

Mean Readability and Word Count Statistics by Clinic Setting

	F-K	FOG	SMOG	Mean RGL	Word Count
Clinic Setting					
Private Practice (HCP)					
N = 42					
M	9.84	12.57	8.76	11.63	255
SD	0.85	1.00	0.72	0.90	60.98
Minimum	8.10	10.40	7.80	10.33	143
Maximum	12.40	15.80	11.30	14.45	363
Private Practice (Patient)					
N = 42					
M	9.24	12.04	8.80	11.03	183.33
SD	0.85	0.99	0.61	0.74	45.26
Minimum	8	10	8	10	100
Maximum	11	14	10	12	300
ENT					
N = 21					
M	9.81	12.90	9.63	10.78	178.72
SD	0.81	0.81	0.72	0.73	23.10
Minimum	8.60	11.60	8.40	9.83	117
Maximum	11.20	14.30	11.40	12.17	221
University					
N = 60					
M	11.69	14.46	10.86	12.33	365.59
SD	1.39	1.53	1.31	1.33	118.82
Minimum	9.60	11.50	8.90	10.07	182
Maximum	15.90	18.70	14.80	15.97	737

Note. M = Mean, *SD* = Standard Deviation, *F-K* = Flesch-Kincaid, *FOG* = Gunning Fog Index, *SMOG* = Simple Measure of Gobbledygook, *RGL* = Reading Grade Level.

Normality was examined for mean RGL and word count for each clinic setting. All assumptions of normality were met by examining skewness, kurtosis and box plots for outliers. Therefore, parametric testing was used to test each of the following planned hypotheses.

3.3 Between Group Analyses

The following sections apply to the analyses examining differences in mean RGL and mean word count of reports between the three clinic settings (NZ university, US private

practice, US ENT). Note that for hypothesis 1, all US private practice letters were combined for readability analyses (both patient and HCP addressed letters). For hypotheses 2 and 3, only the HCP addressed reports were include in the comparison between clinic settings. This was to increase the validity of comparisons, because the NZ university and US ENT settings do not write letters directly to patients.

3.3.1 Hypothesis 1: The mean RGL of the diagnostic reports sampled from each clinic setting (NZ university, US private practice, US ENT) will exceed the recommended RGL of six

Single sample t-tests were conducted to examine for significant differences in mean RGL from the recommended level of six for each clinic setting. Results indicated that the mean RGL was greater than the recommended level of six for the US private practice setting (n = 84, M = 11.33, SD = 0.87), $t(84) = 59.30$, $p < .001$, $d = 6.13$, ENT setting (n = 21, M = 10.78, SD = 0.75), 6 $t(21) = 34.52$, $p < .000$, $d = 7.37$, and university setting (n = 60, M = 12.33, SD = 1.19), $t(69) = 43.67$, $p < .001$, $d = 5.56$.

3.3.2 Hypothesis 2: There is no significant difference in mean RGL of diagnostic reports between clinic settings (NZ university, US private practice, US ENT)

To examine this hypothesis, a one-way univariate ANOVA was conducted. The test for homogeneity of variance was significant, however, due to the large sample size the central limit theorem was assumed. There were no significant outliers. The results revealed a statistically significant difference in mean RGL between the three settings F (2, 122) = 16.96, $p < .000$, $\eta_p^2 = .217$.

Post-hoc testing was employed to examine for significant individual differences in mean RGL between the three clinic settings. An LSD post-hoc test revealed that the mean RGL for the university setting (n = 60, M = 12.33, SD = 1.33) was significantly higher than the mean RGL for the private practice setting (n = 42, M = 11.63, SD = 0.90) $p < .001$, d = 0.62 and significantly higher than the ENT setting (n = 21, M = 10.78, SD = 0.73) $p < .001$, d

= 1.66. The mean RGL for the ENT setting was significantly lower than the mean RGL from the private practice setting $p < .05$, $d = 1.04$.

3.3.3 Hypothesis 3: There is no significant difference in mean word count of diagnostic reports between each clinic setting (NZ university, US private practice, US ENT)

A one-way univariate ANOVA examined if there were any differences in mean word count between the settings. The test for homogeneity of variance was significant $p < .001$. However, due to the large sample size for this analysis, equal variances were assumed due to the central limit theorem. There were no significant outliers. A one-way ANOVA revealed that there was a significant difference between the settings for mean word count F (2, 122) = 40.35, $p < .000$, $\eta_p^2 = .40$.

An LSD post-hoc test was conducted to examine individual differences in mean word count between each clinic setting. Testing revealed that the mean word count for the private practice setting ($n = 42$, $M = 255.00$, $SD = 60.98$) was significantly different from the mean word count for the university setting ($n = 60$, $M = 365.59$, $SD = 118.82$) $p < .000$, $d = 1.17$. The mean word count for the private practice setting was also significantly different from the mean word count for the ENT setting ($n = 21$, $M = 178.72$, $SD = 23.10$) $p = < .05$, $d = 1.65$. The mean word count for the university setting was significantly different from the mean word count for the ENT setting $p < .001$, $d = 2.19$.

3.4 Within-group Analyses of Reports Sampled from US Private Practice Setting

The following were exclusively completed using data from the US private practice setting (sampled from two clinic locations). Reports from both locations were combined for these analyses as they were sampled from the same organisation.

A total of 84 reports were sampled, which comprised of two reports per patient (a total of 42 patients). Each client had two reports associated with them; one addressed directly to the patient and one addressed to a HCP with the patient copied in. This allowed for paired comparisons of mean RGL and word count by report addressee and presence of referral. Half

of the patients (n = 21) had a medical referral, and the patients (n = 21) did not. Therefore, there were a total of 42 reports containing a referral and 42 not containing a referral. Note that for analyses of the effect of medical referral, all 84 reports were grouped by whether they contained a referral vs no referral. Therefore, both categories (referral vs no referral) contained reports addressed to the HCP and patient.

3.4.1 Hypothesis 4: There is no significant difference in mean RGL of diagnostic reports by report addressee (patient vs HCP) for reports sampled from US private practice

To address hypotheses 4, 5 and 6, a two by two mixed model ANOVA was used to examine the main effects of report addressee (patient vs HCP) and presence of a referral (referral vs no referral) for mean RGL. Results indicated that there was a significant difference in mean RGL by report addressee (patient n = 42, M = 11.01, SD, 0.74); (HCP n = 42, M = 11.63, SD = 0.90), F (1, 40) = 14.42, $p < .001$, $\eta_p^2 = .026$, d = 0.75. This indicated that the reports addressed to HCPs had a significantly higher mean RGL than reports addressed to patients.

3.4.2 Hypothesis 5: There is no significant difference in mean RGL of diagnostic reports between those who receive a medical referral and those who do not receive a medical referral from US private practice

Results of a mixed model ANOVA showed that there was no significant difference in mean RGL between the reports that contained a referral (n = 42, M = 11.13, SD = .13) and the reports that did not contain a referral (n = 42, M = 11.50, SD = .13), F (1, 40) = 3.97, p =.053.

3.4.3 Hypothesis 6: There is no significant interaction effect of report addressee (HCP or patient) and medical referral (referral vs no referral) on mean RGL for diagnostic reports sampled from US private practice

Results from a mixed model ANOVA showed there was no significant interaction effect of report addressee and referral F (1, 40) = 2.756, df = 1, p = .105 on mean RGL.

3.4.4 Hypothesis 7: There is no significant difference in mean word count of diagnostic reports by report addressee (patient vs HCP) for reports sampled from US private practice

To address hypotheses 7, 8 and 9, a mixed model ANOVA was conducted to examine the effect of report addressee and referral on mean word count of reports. The within-subjects factor was word count and the between-subjects factor was mean RGL. The data met the assumptions of a mixed model ANOVA. Results indicated that reports addressed to patients (n = 42, M =183.21, SD = 45.80) had a significantly lower word count than reports addressed to HCPs (n = 42, M = 255.00, SD = 60.98), F (1, 40) = 47.26, $p < .001$, $\eta_p^2 = .542$, d = 1.32.

3.4.5 Hypothesis 8: There is no significant difference in word count of diagnostic reports between those who receive a medical referral and those who do not receive a medical referral for reports sampled in US private practice

Results from a one-way ANOVA indicated that there was no significant difference in mean word count of reports between those who got a referral (M = 239.98, SD = 7.97) and those who did not (M = 198.24, SD = 7.97), F (1,40) = 13.71, p = .216.

3.4.6 Hypothesis 9: There is no significant interaction effect of diagnostic report addressee (HCP or patient) and medical referral (referral vs no referral) on word count of reports sampled from US private practice

Results from the mixed model ANOVA indicated that there was no significant interaction effect of report addressee and referral on the mean word count of reports F (1, 40) = 1.579, df = 1, p = .216.

4 Discussion

4.1 Overview

It is becoming recognised that clinical letters and diagnostic reports are an important source of information for patients in both general health settings (Bennett et al., 2012; Brodie & Lewis, 2010; Choudhry et al., 2016; Jelley & van Zwanenberg, 2000) and audiology specifically (Donald & Kelly-Campbell, 2016; Kelly-Campbell & Manchaiah, 2020; Manchaiah et al., 2020). However, for these reports to be useful to patients, they must be

readable for patient audiences. This study sought to examine the readability of reports copied to patients, or addressed directly to them, following diagnostic audiological evaluation. The data were collected across three different clinical settings, comprising of four clinics. Variables that may have affected readability were examined. These included clinic setting (NZ university, US private practice and US ENT), report addressee (HCP or patient) and presence of medical referral (referral vs no referral). The study also aimed to describe and compare the word count of reports collected by clinic setting, report addressee and medical referral. Data collection was completed at a university audiology clinic in NZ, one US private practice clinic across two locations and one US ENT clinic.

The results of this study demonstrated that diagnostic audiology reports provided to patients are written well above the recommended RGL of six, indicating they are too difficult to read for patient audiences. This finding was irrespective of clinic setting, who the report was addressed to, and the presence of medical referral. Subsequent analyses identified that reports sampled from the NZ university setting were longer and more difficult to read than those sampled from the US private practice and ENT settings. Reports sampled from the private practice setting were also longer and more difficult to read compared with those sampled from the US ENT setting.

When examining the analyses of reports sampled from the US private practice clinic (who writes directly to patients about their test results), it was found that the reports addressed to patients were shorter and easier to read than those addressed to HCPs. The presence of medical referral had no significant effect on readability or word count. These findings reinforce the need to provide patients with more appropriate written resources following diagnostic audiological assessment to support their understanding and decision making.

4.2 Readability

4.2.1 Readability of Reports Compared to Recommended Level of Six

It was hypothesised that the mean RGL of reports sampled from all clinics would exceed the international recommendation to keep written health materials below the sixth RGL (Weiss, 2003). Using the mean of readability measures from FOG, SMOG and F-K RGL, it was found that the mean RGL of documents across all clinic settings exceeded the recommended RGL of six. No report sampled was found to be at or below the recommended RGL of six across any of the individual measures of readability. Of all reports sampled, the lowest mean RGL reported was 9.73 and the highest was 15.70. This indicates that even the easiest report to read required at least nine years of formal education to adequately understand it, and the most difficult report required a tertiary level education to understand it.

The finding that all reports were above the recommended RGL of six aligns with the magnitude of published evidence that written health materials are often too difficult for majority of patients to read and comprehend (Gemoets et al., 2004; Shieh & Hosei, 2008; Wang et al., 2013). This is consistent with research in the audiology context, which demonstrates that patient targeted materials are typically written at a level that is prohibitive to patient understanding. In a systematic review covering the readability of hearing health information on the Internet, it was found that the materials available required a mean of 9 – 14 years of education to read the content (Laplante-Lévesque & Thorén, 2015). Moreover, in a study of the readability of audiology and speech language pathology materials published on the ASHA website, Atcherson et al. (2014) found that more than 80% of the content had an RGL of at least nine. The readability of patient-report outcome measures has also been examined in adult audiological rehabilitation. In a readability analysis of ten patient-reported outcome measures, Douglas and Kelly-Campbell (2018) found that majority exceeded the recommended RGL of six.

It is interesting that the mean RGL of reports in this study clearly exceed those reported in other studies evaluating audiology resources. For example, one study examined the readability of pamphlets for parents of children with hearing loss and found that majority scored at the sixth or seventh RGL (Joubert & Githinji, 2013). However, it is likely that the observed differences are explained by the fact that diagnostic reports are most often written for the benefit of other health professionals, and therefore contain more complex sentences and higher density of complex words. The results of this study align with the findings of Wu et al. (2019) who compared the readability of referral letters to Medline Plus articles, which were considered by the authors to be exemplars of high quality patient education materials. The authors found that the RGL of referral letters was significantly higher than Medline Plus articles by approximately one to two RGLs. Interestingly, the results of this study demonstrated that even when reports were written for patients, they still exceeded the recommended RGL of six. This finding is further explored in section 4.2.3.

The literature base on the readability of clinical correspondence and reports is still developing. However, the results of this study support emerging evidence that clinical correspondence sent or copied to patients is too difficult for patients to read. For example, the mean RGL of all reports sampled in this study was 11.82, in line with those reported by Bennett et al. (2012), Roberts and Partridge (2006) and Wu et al. (2013) when comparing mean F-K RGL. Interestingly, Martin-Carreras et al. (2019) found that the readability of radiology reports using the same measures had a mean RGL of 13, which is greater than that reported in this study. This may have been due to medical information being contained within the reports, which might contribute to longer words with more syllables, and greater sentence lengths. However, this is speculative given that it was not to possible examine the contents of the reports in this study due to ethical limitations.

Only one previous study has examined the readability of an audiology report—though it related to the paediatric population. According to readability analyses completed by Donald and Kelly-Campbell (2016) the standard mock paediatric report had an F-K RGL of 14.1 and SMOG of 15.5, compared with a total mean F-K RGL of 10.42 and SMOG of 9.65 in the current study. These differences in findings may be explained by several factors. First, there are inherent differences in the content and purpose of reports when comparing adult and paediatric populations. For example, the content of the mock report used by Donald and Kelly-Campbell explained results of tests typically used in the paediatric population including auditory brainstem response (ABR) and otoacoustic emissions (OAEs). The inclusion of these results may have introduced additional jargon (including a higher frequency of polysyllabic words) and lengthier sentences when compared with the test battery of the adult population. Second, the paediatric report analysed by Donald and Kelly-Campbell (2016) analysed only one mock report developed from a template from one clinical setting. As the reports sampled in this study comprised real reports from three settings, it is likely that the present results bear a better representation of those used in the real world.

4.2.2 Readability and Clinic Setting

The current study also aimed to examine whether there were differences in mean RGL of reports generated from different clinic settings (NZ university, US private practice, US ENT). These three settings represent some of the most common practice types for adult audiology services (ASHA, n.d.-a; Planey, 2019). As no previous research has examined the effect of clinic setting on the readability of health materials, it was hypothesised that there would be no significant difference in the readability of reports sampled from each clinic setting. However, it was found that reports sampled from the NZ university clinic had a significantly higher mean RGL than those sampled from ENT and private practice settings in the US. Reports sampled from the university clinic were closer in mean RGL to the private

practice, but almost two mean RGLs higher than those sampled from an ENT setting. Despite this, reports sampled from ENT and practices still had reported mean RGL of approximately 10.78, far exceeding the international recommendation of six. The mean RGL of reports sampled from US private practice were also significantly higher than compared to the US ENT clinic setting, by almost an entire RGL. When examining the effect size, around 20% of the variance in mean RGL of reports was explained by clinic setting.

The results of this study provide preliminary evidence that there may be real differences in report reading difficulty between different audiology settings. It is unclear why reports sampled from the NZ university setting were more difficult to read than those produced in the other settings. However, it is possible that as a training institution, staff and students are encouraged to write reports with a high level of technical accuracy, which may in turn influence a higher RGL due to the higher proportion of polysyllabic words and greater sentence length. Moreover, in this clinic it is policy for audiology students to produce the reports with approval from clinical educators. This suggests that audiology students may partially be responsible for producing reports with a higher RGL. However, this theory conflicts with the findings of Bennett et al. (2012), who found that in a child and adolescent mental health setting, reports written by mental health trainees had a significantly lower RGL than those written by permanent members of staff. It is also possible that cultural differences writing style and in reporting standards between NZ and the US contributed to differences in mean RGL.

It was also interesting to find that the reports sampled from private practice settings were longer and more difficult to read when compared with those sampled from the ENT clinic settings. The word count of reports from the ENT setting indicates that on average the reports written are shorter than other clinic settings by around 100 words. It could be that these reports at this clinic require less detail and are briefer in nature. For example, the

reports produced at the ENT setting may be solely focused disseminating the results of diagnostic assessment for ENT specialists.

One previous study has examined conceptually similar effects of clinical setting on the readability of diagnostic reports. In their examination of readability of radiology reports, Martin Carreras et al. (2019) investigated the effect of patient setting (inpatient, outpatient and emergency) and report author (academic versus community radiologists) on the readability of reports. The authors reported a significant effect of patient setting on mean RGL, with reports sampled from inpatient settings being more difficult to read by approximately one RGL. The authors reported no significant effect of academic versus community radiologists on readability of reports. This finding is in opposition to the present study, as report authors from an education institution wrote reports that were more difficult to read. However, due to differences in study methodology, as well as clinical practice and subject matter between radiology and audiology, it is difficult to meaningfully compare the results of the current study with those of Martin Carreras et al. (2019). Further research is required to replicate and elucidate the effects found in this study in other geographical locations, across multiple clinic settings.

4.2.3 Readability and Report Addressee

The current study examined the effect of report addressee on the readability of reports in one US private practice setting, across two clinic locations. As it was the private practice clinic's policy to write two letters for each patient (one letter to the patient and one letter to the HCP), it was possible to make paired comparisons for the readability of reports under both conditions. Analyses revealed a statistically significant difference between the two groups, with reports addressed to HCPs showing a mean RGL of 11.63 and reports sent to patients with a mean RGL of 11.01. While statistically significant, it should be noted that the mean RGL for both addressee types indicates that a high school level education is required to

understand the reports. Therefore, although the difference is statistically significant, it may be unlikely to have any clinical significance as both report types require a very similar level of education to read, with both considerably exceeding the recommended RGL of six. While it is encouraging to find that clinicians may be writing reports with patients in mind, and possibly attempting to use simpler language and sentence structure, it is evident that this is not enough to support patient health literacy.

A small number of studies have examined the effect of report addressee on the readability of diagnostic letters and health care correspondence. Bennett (et al., 2012) examined the effect of report addressee on readability of assessment letters written by clinical psychologists and sent to patients in a community mental health service. They also found that reports addressed to patients were easier to read than reports sent to other HCPs with patients copied in. Patient reports had a SMOG RGL of 11.71 compared GP letters with the patient copied which had a SMOG RGL of 13.63. Similarly, Gilchrist et al. (2016) investigated report addressee (patient or GP/referrer) on readability of clinical letters following assessment with a Child and Adolescent Mental Health Service (CAMHS). The authors reported that letters sent to patients had a significantly lower F-K RGL of 9.4 when compared to those written to other HCPs with an F-K RGL of 10.4. Similar findings have been reported previously (Bhandari, 2010; O'Mahony & Kalk, 2011; Roberts & Partridge, 2006). These findings support the results of the current study which show that although reports sent to patients had a significantly lower RGL, they were still written at a level considered too difficult for most patients to read and comprehend. Therefore, though clinicians may be attempting to write letters to patients in a more readable way, it is still insufficient for patient understanding.

4.2.4 Readability and the Effect of Medical Referral

As hypothesised, the results of this study indicated that the presence of referral had no significant effect on the readability of the reports. This finding was interesting, given that referral letters might be more complicated to read due to a greater amount of detail required. No previous research has investigated the role of medical referral versus no referral on the readability of diagnostic reports. While the mean differences demonstrated a difference in mean RGL, with referral letters having a higher mean RGL, this observation was only trending toward significance and did not meet the pre-determined level of .05. Further examination of the effect of referral versus no referral in other clinic types and sub-specialties of audiology may be warranted in future studies.

4.3 Word Count

A second area of investigation in this study was the word count of reports. Differences in word count of reports was examined between clinical settings, report addressees and letters with and without medical referral. While word count does not represent a direct measure of how usable reports are for patient audiences, it highlights that longer reports may be more onerous for patient audiences to read, given that perhaps a larger amount of information may be disseminated.

4.3.1 Word Count and Clinic Setting

It was hypothesised that there would be no significant difference in word count between reports sampled from each clinic setting. However, it was found that there were significant differences in word count between all clinic settings. The mean word count for university reports was 365.59, when compared to 178.72 and 281.74 words for ENT and private practice settings respectively. An examination of effect size showed that almost half of the variance in word count was explained by clinic setting. It is unclear as to why the university clinic setting had the longest reports. However, an examination of the descriptive

statistics indicates that reports sampled from the university clinic had a standard deviation of 118.82 words, indicating significant variability in the reports sampled. It was also interesting that ENT settings produced the shortest reports, which may be consistent with the idea that they are intended to be brief in nature.

To our knowledge, only one study has examined the effect of clinic setting on length of clinical reports. Martin-Carreras et al. (2019) found differences in word length of reports for patients who had been assessed by a community mental health team. Those who had been seen in an outpatient setting received longer reports than those in inpatient settings or emergency departments. Again, due to major differences in service delivery and health contexts, it is difficult to make meaningful comparisons between this study and the present. However, the results of this study are consistent with the evidence that there are differences in word count depending on clinic setting.

4.3.2 Word Count and Report Addressee

For the US private practice clinic, it was hypothesised that there would be no difference in word count between reports sent to patients versus those sent to HCPs (GP/PCP or ENT). The results of this study showed that reports addressed to patients were significantly shorter than reports addressed to HCPs. Results indicated that the mean word count of reports sent to HCPs was 250 words, whereas the mean word count of reports sent to patients were on average around 180 words. It was found that report addressee explained more than half the variance in mean word count, and demonstrated a large statistical effect.

These results are in line a previous study which examined the readability and length of post-consultation letters to patients following cardiorespiratory evaluation (Roberts & Partridge, 2006). Letters sent to patients were on average almost 100 words longer than letters sent to HCPs. Due to the design of this study, it is not possible to establish the reason for differences in word length between report addressee types. However, this finding

indicates that clinicians may be consciously writing reports to patients in a briefer format, and perhaps excluding additional information and detail that may be reserved for other HCPs. Further study may be warranted to examine reasons for this difference, and the impact on the quality of reports for patient use.

4.3.4 Word Count and Referral

In line with the hypothesis, there was no significant effect of referral on word count for the US private practice clinic. This indicates that report lengths are similar regardless of whether a medical consultation has been requested. This is interesting, as intuitively it may be expected that reports containing referral to a medical doctor may be longer than other letters as they require rationale of referral and greater detail. To the author's knowledge, no previous research has examined the effect of medical referral on readability of healthcare correspondence.

4.4 Clinical Implications

Health information shared with patients is often forgotten or recalled incorrectly. (Kessels, 2003). Studies show the same problems occur in audiology, with patients having a poor understanding of their diagnostic information (Martin et al., 1990; Watermeyer et al., 2012; Watermeyer et al., 2015; Watermeyer et al., 2017). Taken together, evidence supports the need for verbal explanations to be supplemented with clear written materials that support patient's understanding of their hearing health information (Hoffmann & Worrall, 2004; Little et al., 1998; Margolis, 2004a). One method of sharing individualised information on hearing health status is to provide patients with a copy of their diagnostic report following consultation. However, as with any other written health material, the usefulness of receiving a diagnostic report is entirely dependent on the accessibility of the resource.

This was the study to examine the readability of real adult diagnostic audiology reports. The results of this study clearly demonstrate that written diagnostic audiology reports

are too difficult to read for the general adult population. This is regardless of the clinic setting the report was written in, who the report was addressed to, and presence of medical referral. This is concerning as it indicates that the level of information audiologists provide to patients following diagnostic assessment is inappropriate and unlikely to support PCC and SDM. In this way, a lack of patient comprehension of their diagnostic report will considerably limit the benefit of receiving the report.

The finding that all reports exceeded the recommended level of six is concerning given that approximately half of New Zealanders have health literacy skills that are inadequate for everyday life (Ministry of Health Manatū Hauora, 2010). Similarly, it is estimated that approximately 36% of adults in the US have low health literacy (Berkman et al., 2011). This suggests that a high proportion of patients receiving copies of their diagnostic reports are at risk of not being able to read it. It should also be noted that using the recommended RGL of six may underestimate the reading difficulty of reports for the general population. In fact, some researchers have called for health information to be written at the fourth RGL to maximize the number of consumers who can read and understand the material (Weiss, 2003).

Providing information in a format that is too difficult to understand may unintentionally lead to harmful effects. For example, patients may feel alienated from their care and experience unnecessary confusion about their hearing health. They may also be less engaged and satisfied with their health care provider (Elder & Barney, 2012). Moreover, it is known that when patients receive diagnostic reports that are too difficult to understand, they can feel angry, anxious and disrespected (Donald & Kelly-Campbell, 2016).

It was encouraging to find that patient addressed reports were shorter and had a lower mean RGL than HCP addressed reports. This indicates that clinicians may be aware of the need to simplify written information for patients. Nevertheless, patient addressed reports

were still too difficult to read, indicating that clinicians are either unaware of patients' low health literacy, or unequipped with the skills to write more patient friendly reports.

The results of this study may provide support for the finding that clinicians have limited understanding of how they can make hearing health information more accessible (Atcherson et al., 2013). This is particularly important as audiologists should be aware of health literacy challenges among their patients, as those with hearing loss may be at further risk of health literacy when compared with the general population (Gilligan & Weinstein, 2014). For example, older patients, those with cognitive impairments and additional sensory impairments such as hearing and vision loss are at high risk of low health literacy (Gilligan & Weinstein, 2014).

It is worth noting that the basic definition of health literacy defines it as a characteristic of the health consumer (Ancker et al., 2020). However, the results of this study also pose a timely question about the structure of health care systems and whether they are set up to best serve patients and include them in their care. The US Department of Health and Human Services has proposed defining a new term, 'health information fluency', to better emphasise the responsibility of health organisations in providing accessible and comprehensible information (Ancker et al., 2020). This contrasts with the definition of 'health literacy', which is defined by the skills and abilities of the health care consumer when faced with health tasks. This new term reflects an important shift in the onus of health literacy onto those who are producing health information. In this way, supporting patient health fluency by finding efficient and practical ways of improving written health information must be prioritised.

The findings of this study serve to remind clinicians of the need to redesign health materials with patients in mind. As previously discussed, diagnostic reports present a key opportunity for clinicians to impart and reinforce information to their patients (Haga et al.,

2014). By optimising diagnostic reports, either through making changes to existing report templates, or designing a patient-friendly targeted report, clinicians can provide patients with a helpful resource that supports PCC and SDM.

The recommended RGL of six was adopted as a best practice mark in this study, as it has been determined to be the level at which 75% of adult readers can understand (Doak, Doak and Root, 1996). However, other authorities have recommended that health materials should be written at or below the fourth RGL to maximise the number of people able to read them (Weiss, 2003). Further, when the audience of a given materials has additional risk of low health literacy, such as those with sensory or cognitive impairments, or for whom English is a second language, the recommended level of the material is at the third RGL (Weiss, 2003).

It should also be acknowledged that diagnostic reports do not exist in isolation, but represent only a partial source of information available following diagnostic assessment. Rather, diagnostic reports exist alongside other sources of information including verbal explanations and informational counselling, written information (such as pamphlets) and online material. The findings of this study serve to support the notion that patients are unlikely to be receiving adequate information on their hearing health status following diagnostic assessment with an audiologist, whether this be through verbal informational counselling, patient targeted materials, online information or diagnostic reports (Grenness et al., 2015a; Manchaiah et al., 2020; Martin et al., 1990; Watermeyer et al., 2012; Watermeyer et al., 2015; Watermeyer et al., 2017).

4.5 Study Limitations

4.5.1 Limitations of Study Design

The results of this study should be interpreted considering several limitations. Perhaps most importantly, it should be acknowledged that this was a field study which sampled real

reports from different clinical settings. While field studies improve face validity of results and represent data collected from the real world, control over the variables studied is reduced.

As this study sampled real reports from different clinical settings, it was difficult to operationalise variables due to differences in clinical policies. For example, the term 'report addressee' was used as a proxy measure for 'target audience' of the report. As the primary researcher was not involved in data collection for the US reports, it was not possible to ascertain exactly who the target audience was for some reports. However, blank report templates from each of the clinics were examined, and therefore, the risk of low validity for this variable was mitigated as practicably as possible.

An additional threat to validity is that reports were sampled in both NZ and the US. Therefore, it is possible that differences observed in readability of reports between the NZ university clinic and US private practice or ENT clinics may be explained by differences in geographic location, culture or models of service delivery. Moreover, differences in training between audiologists in NZ and the US may contribute to differences in the readability of reports. Ideally, all data collection would have been limited to one country to prevent the effects of possible confounding variables. Therefore, it should be noted that this was a study of specific clinic settings and the findings cannot necessarily be further generalised to other clinics. Additional research is required to establish whether these findings hold true in other clinics, practice types and countries.

It should also be noted that the general writing style of individual audiologists may have impacted the outcome of this study. The number of audiologists contributing to reports was not known. Therefore, it cannot be ascertained as to whether the effect of an individual's writing style may have had undue influence over the study results.

4.5.2 Limitations of Readability Formulas

Readability formulas do not provide a direct measure of reader comprehension. By nature, readability formulas only give a prediction of the level of reading ability required for a text, and only consider surface features of a text such as sentence length and the number of syllables in words (Redish, 2000). Therefore, readability formulas may underestimate text difficulty for specialist types of materials such as audiology reports. For example, a hearing-related word with a low number of syllables such as “pinna” may contribute to a lower RGL, despite it being an unfamiliar word to most lay readers. Readability formulas cannot assess other features of a text that contribute to reading ease and understanding, such as organisation, text font, page layout, tone, word order or imagery (Redish, 1981). Therefore, using these formulas alone cannot evaluate how effectively a given message has been received by the reader. Readability measures should be complemented with measures actual patient comprehension for full and accurate analysis.

It should also be noted that readability scores are often dependent on the formula used (Redish, 2000). As this study derived a mean RGL from three readability formulas, two of which use a comprehension criterion less than 100%, it is possible that reading difficulty is greater than shown by common readability formulas. Further, many readability formulas were developed for evaluating general literacy (Wang et al., 2013). For example, in general literacy 75% comprehension may be adequate for a reader to get the ‘gist’ of a text. However, as noted by Wang et al. (2013), health related information should be assessed and reported using a higher level of comprehension as misunderstandings of health information may have dire effects for the patient audience. Therefore, it is possible that the reported RGLs in this study are a conservative estimate of the skills required to read the text.

4.5.3 Impact of COVID-19 on Data Collection

Due to COVID-19 restrictions imposed in the US where reports were sampled from, data collection was terminated early in the US ENT clinic, resulting in a smaller number of reports than anticipated.

4.6 Future Research

It is known that well designed patient education materials are effective in reinforcing health messages, enhancing knowledge and promoting treatment adherence (Hill, 1997). However, the findings of this study support the evidence base showing that health-related correspondence is too difficult for many patients to read and use. Future research should now focus on investigating ways that diagnostic reports can be optimised for patient use. The development of these materials is likely to be welcomed by many audiologists, as clinicians have expressed their desire for better and more appropriate tools to share hearing test results and recommendations with patients (Klyn et al., 2019).

Donald and Kelly-Campbell (2016) demonstrated that it is possible to revise a paediatric audiology report for parent use according to best practice guidelines. Improvements were made to the report in areas such as language, content, organisation, layout, typography and the inclusion of graphics. The authors found that changes made to the report improved parents' comprehension and self-efficacy when interpreting a child's hearing test results (Donald & Kelly-Campbell, 2016). This was achieved without compromising the veracity of the report. Therefore, future research should aim to re-develop adult diagnostic audiology reports that are suitable for patient use. This could be achieved by creating a report template like that of Donald and Kelly-Campbell (2016), with prepared fields that clinicians can populate according to the patients' results. A randomised-controlled trial may then be implemented to examine whether there are differences in patient comprehension and self-

efficacy when patients receive a revised or unrevised report following diagnostic audiological consultation.

Other methods of improving reports for patient use have been suggested in the field of genetics. In an opinion piece on improving genetic reports for patient use, Haga et al. (2014) suggest several methods for optimising reports. For example, providing an interpretive summary at the beginning of a diagnostic report for patients may be an effective method for promoting patient understanding. This may reduce demands on the clinicians' time as they would not be required to produce a separate report. Another option is to provide a summary letter to append to a traditional diagnostic report, which would provide more extensive information for the patient about the tests completed and results. A third option is to create a standardised patient user guide to complement a traditional diagnostic report. Haga et al. (2014) suggest be a useful resource for patients to use navigate their report. It could include a glossary of terms, and explanation of common test results. Future research could look to implement these in a randomised-controlled trial to determine which method optimises patient understanding and limits the demand on clinicians.

It is anticipated that with better understanding of their hearing test results, patients may be more equipped to engage in meaningful discussions with their audiologists about what their hearing health status means for them, and appropriate management and rehabilitation options (Haga et al., 2014). Follow on studies may look to assess and revise audiology reports in other areas of practice, such as auditory processing disorders, cochlear implants and vestibular assessments.

Additional research may also be warranted to further elucidate the relationship between RGL of reports in different clinic settings. Future studies should be designed to control for confounding factors like geographical location to improve the validity of findings.

If true differences were detected between clinic settings, targeted support and interventions could be delivered to improve the readability of health-related materials.

4.7 Conclusion

This was the first study to investigate the readability of adult diagnostic audiology reports sampled from various clinical settings. Previous research has demonstrated that patient education materials, both in audiology and the general health domain, are not suitable for patient use. This study found that written diagnostic reports sent to patients following audiological assessment are no different. Reports are a key adjunct to oral informational counselling, and further research should focus on investigating ways in which adult diagnostic audiology reports can be revised and implemented in a way that supports patient health literacy and SDM. It is hoped that the findings of this study might encourage clinicians to look review and optimise the quality of the diagnostic information they are sharing with the patients to best support them in decision making for their own hearing health.

References

Abrams, H. B., & Kihm, J. (2015). An introduction to Marketrak IX: A new baseline for the hearing aid market. *Hearing Review, 22*(6), 16.

Aldridge, M. D. (2004). Writing and designing readable patient education materials. *Nephrology Nursing Journal, 31*(4), 373-377.

Ancker, J. S., Grossman, L. V., & Benda, N. C. (2020). Health literacy 2030: Is it time to redefine the term? *Journal of General Internal Medicine, 35*(8), 2427-2430. doi:10.1007/s11606-019-05472-y

Andersson, G., Melin, L., Scott, B., & Lindberg, P. (1994). Behavioural counselling for subjects with acquired hearing loss: A new approach to hearing tactics. *Scandinavian Audiology, 23*(4), 249-256. doi:10.3109/01050399409047516

Ansari, I., Saif, R., Sen, G., Lochan, R., Jacob, M., Manas, D., & White, S. (2011). The HPB clinic: Do patients want a copy of their clinic letter? *The Bulletin of the Royal College of Surgeons of England, 93*(8), 1-2. doi:10.1308/bull.2011.93.8.1

ASHA. (n.d.-a). *Audiologist roles and responsibilities*. https://www.asha.org/Students/Audiologist-Roles-and-Responsibilities/

ASHA. (n.d.-b). *Hearing evaluation*. https://www.asha.org/public/hearing/Hearing-Evaluation/

ASHA. (n.d.-c). *Model bill of rights for people receiving audiology or speech-language pathology services*. https://www.asha.org/public/outreach/bill_rights/

ASHA. (n.d.-d). *Types of tests used to evaluate hearing in children and adults*. https://www.asha.org/public/hearing/Types-of-Tests-Used-to-Evaluate-Hearing/

Bainbridge, K. E., & Ramachandran, V. (2014). Hearing aid use among older United States adults: The National Health and Nutrition Examination Survey, 2005–2006 and 2009–2010. *Ear and Hearing, 35*(3), 289. doi:10.1097/01.aud.0000441036.40169.29

Barker, A. B., Leighton, P., & Ferguson, M. A. (2017). Coping together with hearing loss: A qualitative meta-synthesis of the psychosocial experiences of people with hearing loss and their communication partners. *International Journal of Audiology, 56*(5), 297-305. doi:10.1080/14992027.2017.1286695

Bartle, D., Diskin, L., & Finlay, F. (2004). Copies of clinic letters to the family. *Archives of Disease in Childhood, 89*(11), 1032-1033. doi:10.1136/adc.2004.051938

Baxter, S., Farrell, K., Brown, C., Clarke, J., & Davies, H. (2008). Where have all the copy letters gone? A review of current practice in professional–patient correspondence. *Patient Education and Counseling, 71*(2), 259-264. doi:10.1016/j.pec.2007.12.002

Bennett, D. M., Drane, E., & Gilchrist, A. (2012). Readability of CAMHS clinical letters. *Child and Adolescent Mental Health, 17*(3), 161-165. doi:10.1111/j.1475-3588.2011.00624.x

Berkman, N. D., Sheridan, S. L., Donahue, K. E., Halpern, D. J., & Crotty, K. (2011). Low health literacy and health outcomes: An updated systematic review. *Annals of Internal Medicine, 155*(2), 97-107. doi:10.7326/0003-4819-155-2-201107190-00005

Bernier, M. J. (1993). Developing and evaluating printed education materials: A prescriptive model for quality. *Orthopedic Nursing, 12*(6), 39-46. doi:10.1097/00006416-199311000-00008

Bhandari, N. (2010). Readability–writing letters to patients in plain English. *The Psychiatrist, 34*(10), 454-454. doi:10.1192/pb.34.10.454

Boothroyd, A. (2007). Adult aural rehabilitation: What is it and does it work? *Trends in Amplification, 11*(2), 63-71. doi:10.1177/1084713807301073

Brockbank, K. (2005). Copying patient letters–Making it work. *Clinical Governance: An International Journal, 10*(3), 231 - 240. doi:10.1108/14777270510627590

Brodie, T., & Lewis, D. (2010). A survey of patient views on receiving vascular outpatient letters. *European Journal of Vascular and Endovascular Surgery, 39*(1), 5-10. doi:10.1016/j.ejvs.2009.09.019

Burrus, A. E., & Willis, L. B. (2022). *Professional communication in speech-language pathology: How to write, talk, and act like a clinician* (Fourth ed.). Plural Publishing.

Caposecco, A., Hickson, L., & Meyer, C. (2014). Hearing aid user guides: Suitability for older adults. *International Journal of Audiology, 53*, 43-51. doi:10.3109/14992027.2013.832417

Cassini, C., Thauvin-Robinet, C., Vinault, S., Binquet, C., Coron, F., Masurel-Paulet, A., Bonithon-Kopp, C., Mercier, S., Joly, L., & Huet, F. (2011). Written information to patients in clinical genetics: What's the impact? *European Journal of Medical Genetics, 54*(3), 277-280. doi:10.1016/j.ejmg.2011.03.006

Chisolm, T. H., Johnson, C. E., Danhauer, J. L., Portz, L. J., Abrams, H. B., Lesner, S., McCarthy, P. A., & Newman, C. W. (2007). A systematic review of health-related quality of life and hearing aids: Final report of the American Academy of Audiology task force on the health-related quality of life benefits of amplification in adults. *Journal of the American Academy of Audiology, 18*(2), 151-183. doi:10.3766/jaaa.18.2.7

Choudhry, A. J., Baghdadi, Y. M., Wagie, A. E., Habermann, E. B., Heller, S. F., Jenkins, D. H., Cullinane, D. C., & Zielinski, M. D. (2016). Readability of discharge summaries: With what level of information are we dismissing our patients? *The American Journal of Surgery, 211*(3), 631-636. doi:10.1016/j.amjsurg.2015.12.005

Clark, M., Benbow, S. M., Scott, V., Moreland, N., & Jolley, D. (2008). Copying letters to older people in mental health services-policy with unfulfilled potential. *Quality in Ageing and Older Adults, 9*(3), 31. doi:10.1108/14717794200800018

Coulter, A., Entwistle, V., & Gilbert, D. (1999). Sharing decisions with patients: Is the information good enough? *BMJ, 318*(7179), 318-322. https://doi.org/10.1136/bmj.318.7179.318

Dale, J., Tadros, G., Adams, S., & Deshpande, N. (2004). Do patients really want copies of their GP letters? A questionnaire survey of older adults and their carers. *Psychiatric Bulletin, 28*(6), 199-200. doi:10.1192/pb.28.6.199

Dalton, D. S., Cruickshanks, K. J., Klein, B. E., 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.

Davis, T. C., Crouch, M. A., Wills, G., Miller, S., & Abdehou, D. M. (1990). The gap between patient reading comprehension and the readability of patient education materials. *Journal of Family Practice, 31*(5), 533-538.

Department of Health. (2003). *Copying letters to patients: Good practice guidelines*. Department of Health London.

Dillon, H. (2012). *Hearing aids* (2nd ed.). Boomerang Press. doi:10.1097/01.aud.0000436254.15629.5b

Doak, C. C., Doak, L. G., & Root, J. H. (1996). *Teaching patients with low literacy skills*. Lippincott. doi:10.1037/e518822004-001

Donald, A. J., & Kelly-Campbell, R. J. (2016). Pediatric audiology report: Assessment and revision of an audiology report written to parents of children with hearing impairment. *Journal of Speech, Language, and Hearing Research, 59*(2), 359-372. doi:10.1044/2015_jslhr-h-15-0120

DuBay, W. H. (2004). *The principles of readability*. Impact Information.

Eaden, J. A., Ward, B., Smith, H., & Mayberry, J. F. (1998). Are we telling patients enough? A pilot study to assess patient information needs in a gastroenterology outpatient

department. *European Journal of Gastroenterology & Hepatology, 10*(1), 63-67. doi:10.1097/00042737-199801000-00012

Education Counts. (n.d.). *Literacy and numeracy in New Zealand: Findings from the Adult Literacy and Life Skills Survey*. https://www.educationcounts.govt.nz/publications/series/Adult-Literacy/7

Elder, N. C., & Barney, K. (2012). "But what does it mean for me?" Primary care patients' communication preferences for test results notification. *The Joint Commission Journal on Quality and Patient Safety, 38*(4), 168-AP161. doi:10.1097/00042737-199801000-00012

Falvo, D. R. (2004). *Effective patient education: A guide to increased compliance*. Jones & Bartlett Learning.

Fenton, C., Al-Ani, A., Trinh, A., Srinivasan, A., Marion, K., & Hebbard, G. (2017). Impact of providing patients with copies of their medical correspondence: A randomised controlled study. *Internal Medicine Journal, 47*(1), 68-75. doi:10.1111/imj.13252

Fitzsimmons, P. R., Michael, B., Hulley, J. L., & Scott, G. O. (2010). A readability assessment of online Parkinson's disease information. *The Journal of the Royal College of Physicians of Edinburgh, 40*(4), 292-296. 10.4997/jrcpe.2010.401

Flasher, L. V., & Fogle, P. T. (2012). *Counseling skills for speech-language pathologists and audiologists* (2nd ed.). Delmar Cengage Learning.

Frampton, S. B., & Charmel, P. A. (2009). *Putting patients first: Best practices in patient-centered care*. John Wiley & Sons.

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. https://doi.org/10.1080/14639230600628427

Gemoets, D., Rosemblat, G., Tse, T., & Logan, R. (2004). Assessing readability of consumer health information: An exploratory study. *Studies in Health Technology and Informatics, 107,* 869.

Gilligan, J., & Weinstein, B. E. (2014). Health literacy and patient-centered care in audiology—implications for adult aural rehabilitation. *The Journal of Communication Disorders, Deaf Studies & Hearing Aids, 2,* 110. doi:10.4172/2375-4427.1000110

Goldfarb, R., & Serpanos, Y. C. (2020). *Professional writing in speech-language pathology and audiology* (Third ed.). Plural Publishing, Inc.

Graydon, K., Waterworth, C., Miller, H., & Gunasekera, H. (2019). Global burden of hearing impairment and ear disease. *The Journal of Laryngology & Otology, 133*(1), 18-25. doi:10.1017/s0022215118001275

Grenness, C., Hickson, L., Laplante-Lévesque, A., & Davidson, B. (2014). Patient-centred care: A review for rehabilitative audiologists. *International Journal of Audiology, 53,* S60-S67. doi:10.3109/14992027.2013.847286

Grenness, C., Hickson, L., Laplante-Lévesque, A., Meyer, C., & Davidson, B. (2015a). Communication patterns in audiologic rehabilitation history-taking: Audiologists, patients, and their companions. *Ear and Hearing, 36*(2), 191-204. doi:10.1097/aud.0000000000000100

Grenness, C., Hickson, L., Laplante-Lévesque, A., Meyer, C., & Davidson, B. (2015b). The nature of communication throughout diagnosis and management planning in initial audiologic rehabilitation consultations. *Journal of the American Academy of Audiology, 26*(1), 36-50. doi:10.3766/jaaa.26.1.5

Gruman, J., Rovner, M. H., French, M. E., Jeffress, D., Sofaer, S., Shaller, D., & Prager, D. J. (2010). From patient education to patient engagement: Implications for the field of

patient education. *Patient Education and Counseling, 78*(3), 350-356. doi:10.1016/j.pec.2010.02.002

Haga, S. B., Mills, R., Pollak, K. I., Rehder, C., Buchanan, A. H., Lipkus, I. M., Crow, J. H., & Datto, M. (2014). Developing patient-friendly genetic and genomic test reports: Formats to promote patient engagement and understanding. *Genome Medicine, 6*(7), 58. doi:10.1186/s13073-014-0058-6

Harris, E., Rob, P., Underwood, J., Knapp, P., & Astin, F. (2018). Should patients still be copied into their letters? A rapid review. *Patient Education and Counseling, 101*(12), 2065-2082. doi:10.1016/j.pec.2018.06.014

Health & Disability Commissioner. (2020a). *The code and your rights*. https://www.hdc.org.nz/your-rights/the-code-and-your-rights/

Health & Disability Commissioner. (2020b). *The code and your rights*. https://www.hdc.org.nz/your-rights/the-code-and-your-rights/

Hester, E. J., & Benitez-McCrary, M. (2006). Health literacy: Research directions for speech-language pathology and audiology. *The ASHA Leader, 11*(17), 33-34. doi:10.1044/leader.ftr2.11172006.33

Hill, J. (1997). A practical guide to patient education and information giving. *Baillière's Clinical Rheumatology, 11*(1), 109-127. doi:10.1016/s0950-3579(97)80036-2

Hoffmann, T., & Worrall, L. (2004). Designing effective written health education materials: Considerations for health professionals. *Disability and Rehabilitation, 26*(19), 1166-1173. https://doi.org/10.1080/09638280410001724816

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

Huang, C., Dong, B., Lu, Z., Yue, J., & Liu, Q. (2009). Chronic diseases and risk for depression in old age: A meta-analysis of published literature. *Ageing Research Reviews, 9*(2), 131-141. doi: 10.1016/j.arr.2009.05.005

IMB Corp. Released 2017. *IBM SPSS Statistics for Macintosh, Version 25.0*. Armonk, NY: IBM Corp.

Jelley, D., & van Zwanenberg, T. (2000). Copying general practitioner referral letters to patients: A study of patients' views. *British Journal of General Practice, 50*(457), 657-658.

Jelley, D., & Walker, C. (2003). Copying clinical letters: Access issues for specific patient groups. *Quality in Primary Care, 11*(3), 215-220.

Jones, R., Pearson, J., McGregor, S., Cawsey, A. J., Barrett, A., Craig, N., Atkinson, J. M., Gilmour, W. H., & McEwen, J. (1999). Randomised trial of personalised computer based information for cancer patients. *BMJ, 319*(7219), 1241-1247. https://doi.org/10.1136/bmj.319.7219.1241

Joosten, E. A., DeFuentes-Merillas, L., De Weert, G., Sensky, T., Van Der Staak, C., & de Jong, C. A. (2008). Systematic review of the effects of shared decision-making on patient satisfaction, treatment adherence and health status. *Psychotherapy and Psychosomatics, 77*(4), 219-226. doi:10.1159/000126073

Joubert, K., & Githinji, E. (2013). Quality and readability of information pamphlets on hearing and paediatric hearing loss in the Gauteng Province, South Africa. *International Journal of Pediatric Otorhinolaryngology, 78*(2), 354-358. https://doi.org/10.1016/j.ijporl.2013.12.018

Kaplan, S. H., Greenfield, S., & Ware, J. E. (1989). Assessing the effects of physician-patient interactions on the outcomes of chronic disease. *Medical Care,* 110-127. doi:10.1097/00005650-198903001-00010

Karnieli-Miller, O., Adler, A., Merdler, L., Rosenfeld, L., & Eidelman, S. (2009). Written notification of test results: Meanings, comprehension and implication on patients' health behavior. *Patient Education and Counseling, 76*(3), 341-347. doi:10.1016/j.pec.2009.07.021

Kelly-Campbell, R., & Manchaiah, V. (2020). How to provide accessible hearing health information to promote patient-centered care. *Perspectives of the ASHA Special Interest Groups, 5*(1), 173-180. doi:10.1044/2019_persp-19-00044

Keselman, A., Slaughter, L., Arnott-Smith, C., Kim, H., Divita, G., Browne, A., ... & Zeng-Treitler, Q. (2007). Towards consumer-friendly PHRs: Patients' experience with reviewing their health records. *American Medical Informatics Association.*

Kessels, R. P. (2003). Patients' memory for medical information. *Journal of the Royal Society of Medicine, 96*(5), 219-222. doi: 10.1258/jrsm.96.5.219

Kincaid, J. P., Fishburne, R. P., Rogers, R. L., & Chissom, B. S. (1975). Derivation of new readability formulas (Automated readability index, Fog count and Flesch Reading Ease Formula) for navy enlisted personnel. doi:10.21236/ada006655

Kindig, D. A., Panzer, A. M., & Nielsen-Bohlman, L. (2004). *Health literacy: A prescription to end confusion*. National Academies Press.

Klyn, N. A., Rutherford, C., Shrestha, N., Lambert, B. L., & Dhar, S. (2019). Counseling with the audiogram. *The Hearing Journal, 72*(11), 12-13. doi:10.1097/01.hj.0000612568.43372.73

Kreisman, B., Smart, J., & John, A. . (2015). Diagnostic audiology. In J. Katz (Ed.), *Handbook of Clinical Audiology* (7th ed., pp. 119 - 134). Wolters Kluwer Health. doi:10.1097/00003446-198608000-00010

Krishna, Y., & Damato, B. (2005). Patient attitudes to receiving copies of outpatient clinic letters from the ocular oncologist to the referring ophthalmologist and GP. *Eye, 19*(11), 1200-1204. doi:10.1038/sj.eye.6701740

Kutner, M., Greenburg, E., Jin, Y., & Paulsen, C. (2006). *The health literacy of America's adults: Results from the 2003 National Assessment of Adult Literacy*. National Center for Education Statistics.

Laplante-Lévesque, A., Hickson, L., & Worrall, L. (2010a). Factors influencing rehabilitation decisions of adults with acquired hearing impairment. *International Journal of Audiology, 49*(7), 497-507. doi:10.3109/14992021003645902

Laplante-Lévesque, A., Hickson, L., & Worrall, L. (2010b). 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., Hickson, L., & Worrall, L. (2012). What makes adults with hearing impairment take up hearing aids or communication programs and achieve successful outcomes? *Ear and Hearing, 33*(1), 79-93. doi:10.1097/aud.0b013e31822c26dc

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

Ley, P., & Florio, T. (1996). The use of readability formulas in health care. *Psychology, Health & Medicine, 1*(1), 7-28. doi:10.1080/13548509608400003

Lin, F. R., Yaffe, K., Xia, J., Xue, Q.-L., Harris, T. B., Purchase-Helzner, E., Satterfield, S., Ayonayon, H. N., Ferrucci, L., & Simonsick, E. M. (2013). Hearing loss and cognitive decline in older adults. *JAMA Internal Medicine, 173*(4), 293-299.

Little, P., Griffin, S., Kelly, J., Dickson, N., & Sadler, C. (1998). Effect of educational leaflets and questions on knowledge of contraception in women taking the combined

contraceptive pill: Randomised controlled trial. *BMJ, 316*(7149), 1948-1952. doi:10.1136/bmj.316.7149.1948

Manchaiah, V., & Danermark, B. (2016). *The experience of hearing loss: Journey through aural rehabilitation*. Taylor & Francis. doi:10.4324/9781315630090

Manchaiah, V., Kelly-Campbell, R. J., Bellon-Harn, M. L., & Beukes, E. W. (2020). Quality, readability, and suitability of hearing health-related materials: A descriptive review. *American Journal of Audiology, 29*(3), 513-527. https://doi.org/10.1044/2020_AJA-19-00040

Marcus, C. (2014). Strategies for improving the quality of verbal patient and family education: A review of the literature and creation of the educate model. *Health Psychology and Behavioral Medicine: An Open Access Journal, 2*(1), 482-495. doi:10.1080/21642850.2014.900450

Margolis, R. H. (2004a). Boosting memory with informational counseling: Helping patients understand the nature of disorders and how to manage them. *The ASHA Leader, 9*(14), 10-28. doi:10.1044/leader.ftr5.09142004.10

Margolis, R. H. (2004b). *In one ear and out the other - what patients remember*. https://www.audiologyonline.com/articles/in-one-ear-and-out-1102

Martin, F., Krueger, S., & Bernstein, M. (1990). Diagnostic information transfer to hearing-impaired adults. *Texas Journal of Audiology and Speech Pathology, 16*(2), 29-32.

Martin-Carreras, T., Cook, T. S., & Kahn Jr, C. E. (2019). Readability of radiology reports: Implications for patient-centered care. *Clinical Imaging, 54*, 116-120. doi:10.1016/j.clinimag.2018.12.006

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. https://doi.org/10.3109/17538157.2010.542529

McKenna, K., & Tooth, L. (2006). *Client education: A partnership approach for health practitioners*. UNSW Press.

McLaughlin, G. H. (1969). SMOG grading – A new readability formula. *Journal of Reading, 12*(8), 639-646.

Meterko, M., Wright, S., Lin, H., Lowy, E., & Cleary, P. D. (2010). Mortality among Patients with acute myocardial infarction: The influences of patient-centered care and evidence-based medicine. *Health Services Research, 45*(5p1), 1188-1204. doi:10.1111/j.1475-6773.2010.01138.x

Michie, S., Miles, J., & Weinman, J. (2003). Patient-centredness in chronic illness: What is it and does it matter? *Patient Education and Counseling, 51*(3), 197-206. https://doi.org/10.1016/S0738-3991(02)00194-5

Ministry of Health Manatū Hauora. (2010). *Kōrero mārama: Health literacy and Māori results from the 2006 Adult Literacy and Life Skills Survey*. https://www.health.govt.nz/publication/korero-marama-health-literacy-and-maori-results-2006-adult-literacy-and-life-skills-survey

Ministry of Health Manatū Hauora. (2015). *Health literacy*. https://www.health.govt.nz/our-work/making-services-better-users/health-literacy

Ministry of Health (2016). *Your rights*. https://www.health.govt.nz/your-health/services-and-support/your-rights

Montano, J. J., & Spitzer, J. B. (2014). *Adult audiologic rehabilitation* (2nd ed.). Plural Pub.

Mueller, H. G., Ricketts, T., & Bentler, R. A. (2014). *Modern hearing aids*. Plural Publishing, Inc.

Mulrow, C. D., Aguilar, C., Endicott, J. E., Tuley, M. R., Velez, R., Charlip, W. S., Rhodes, M. C., Hill, J. A., & DeNino, L. A. (1990). Quality-of-life changes and hearing

impairment: A randomized trial. *Annals of Internal Medicine, 113*(3), 188-194. doi:10.7326/0003-4819-113-3-188

Nair, E. L., & Cienkowski, K. M. (2010). The impact of health literacy on patient understanding of counseling and education materials. *International Journal of Audiology, 49*(2), 71-75. doi:10.3109/14992020903280161

Nandhra, H., Murray, G., Hymas, N., & Hunt, N. (2004). Medical records: Doctors' and patients' experiences of copying letters to patients. *Psychiatric Bulletin, 28*(2), 40-42. doi: 10.1192/pb.28.2.40

Nunez, L., Koehnke, J., & Williams, A. L. (2019). Interprofessional collaboration: How audiologists contribute to population health. *The Hearing Journal, 72*(7), 12-13. doi:10.1097/01.hj.0000575356.37456.6c

Nutbeam, D. (2000). Health Literacy as a Public Health Goal: A challenge for contemporary health education and communication strategies into the 21st Century. *Health Promotion International, 15*(3), 259-267. doi:10.1093/heapro/15.3.259

O'Mahony, E. A., & Kalk, N. J. (2011). More can be done to improve readability of patient letters. *The Psychiatrist, 35*(1), 30-31. doi:10.1192/pb.35.1.30b

O'Reilly, M., Cahill, M. R., & Perry, I. J. (2006). Writing to patients: A randomised controlled trial. *Clinical Medicine, 6*(2), 178. doi:10.1186/isrctn82986307

Parnell, T. A. (2014). *Health literacy in nursing: Providing person-centered care*. Springer Publishing.

Planey, A. M. (2019). Audiologist availability and supply in the United States: A multi-scale spatial and political economic analysis. *Social Science & Medicine, 222*, 216-224. doi:10.1016/j.socscimed.2019.01.015

Pothier, D. D., Nakivell, P., & Hall, C. E. (2007). What do patients think about being copied into their GP letters? *Annals of the Royal College of Surgeons of England, 89*(7), 718. doi:10.1308/003588407x205413

Pryce, H., & Hall, A. (2014). The role of shared decision-making in audiologic rehabilitation. *Perspectives on Aural Rehabilitation and Its Instrumentation, 21*(1), 15-23. doi:10.1044/arri21.1.15

Ratzan, S., & Parker, R. (2000). Health literacy. *National Library of Medicine Current Bibliographies in Medicine.* Bethesda: National Institutes of Health.

Redish, J. (2000). Readability formulas have even more limitations than Klare discusses. *ACM Journal of Computer Documentation, 24*(3), 132-137. https://doi.org/10.1145/344599.344637

Redman, B. K. (2004). *Advances in patient education*. Springer.

Richards, T. (2008). Copy them in. *BMJ, 337*, a2324. doi:10.1136/bmj.a2324

Roberts, N. J., & Partridge, M. R. (2006). How useful are post consultation letters to patients? *BMC Medicine, 4*(1), 2. doi:10.1186/1741-7015-4-

Rudd, R. E. (2010). Improving Americans' health literacy. *New England Journal of Medicine, 363*(24), 2283-2285. doi: 10.1056/nejmp1008755

Saunders, N., Georgalas, C., Blaney, S., Dixon, H., & Topham, J. (2003). Does receiving a copy of correspondence improve patients' satisfaction with their out-patient consultation? *The Journal of Laryngology & Otology, 117*(2), 126-129. doi:10.1258/002221503762624576

Schulman, B. A. (1979). Active patient orientation and outcomes in hypertensive treatment: Application of a socio-organizational perspective. *Medical Care*, 267-280. doi:10.1097/00005650-197903000-00004

Shieh, C., & Hosei, B. (2008). Printed health information materials: Evaluation of readability and suitability. *Journal of Community Health Nursing, 25*(2), 73-90. doi:10.1080/07370010802017083

Sorensen, K., Van den Broucke, S., Fullam, J., Doyle, G., Pelikan, J. M., Slonska, Z., Brand, H., & Consortium Health Literacy Project, E. (2012). Health literacy and public health: A systematic review and integration of definitions and models. *BMC Public Health, 12*(1), 80-80. https://doi.org/10.1186/1471-2458-12-80

Spodik, M., Goldman, J., Merli, K., Walker, C., Alpini, B., & Kastenberg, D. (2008). Providing an endoscopy report to patients after a procedure: A low-cost intervention with high returns. *Gastrointestinal Endoscopy, 67*(1), 103-111. doi:10.1016/j.gie.2007.08.035

Stacey, D., Légaré, F., Lewis, K., Barry, M. J., Bennett, C. L., Eden, K. B., Holmes-Rovner, M., Llewellyn-Thomas, H., Lyddiatt, A., & Thomson, R. (2017). Decision aids for people facing health treatment or screening decisions. *Cochrane Database of Systematic Reviews*. doi:10.1002/cca.955

Stark, P., & Hickson, L. (2004). Outcomes of hearing aid fitting for older people with hearing impairment and their significant others. *International Journal of Audiology, 43*(7), 390-398. doi:10.1080/14992020400050050

Steiger, J. R. (2005). Audiologic referral criteria: Sample clinic guidelines. *The Hearing Journal, 58*(5), 38-39. doi:10.1097/01.hj.0000287174.23086.36

Swenson, S. L., Buell, S., Zettler, P., White, M., Ruston, D. C., & Lo, B. (2004). Patient-centered communication. *Journal of General Internal Medicine, 19*(11), 1069-1079.

Tang, P. C., & Newcomb, C. (1998). Informing patients: A guide for providing patient health information. *Journal of the American Medical Informatics Association, 5*(6), 563-570. doi:10.1136/jamia.1998.0050563

The Lancet. (2016). Hearing loss: An important global health concern. *The Lancet, 387*(10036), 2351. doi:10.1016/s0140-6736(16)30777-2

The National Foundation for the Deaf. (2016). *Social and economic costs of hearing loss in New Zealand*. https://www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloitte-au-economics-social-economic-cost-hearing-loss-new-zealand-021216.pdf

Todhunter, S., Clamp, P., Gillett, S., & Pothier, D. (2010). Readability of out-patient letters copied to patients: Can patients understand what is written about them? *The Journal of Laryngology & Otology, 124*(3), 324-327. doi:10.1017/s0022215109991770

Tolisano, A. M., Fang, L. B., Isaacson, B., Kutz Jr, J. W., & Hunter, J. B. (2020). Can you hear me now? The impact of hearing loss on patient health literacy. *Otology & Neurotology, 41*(8), 1027-1032. 1027–1032. doi:10.1097/mao.0000000000002713

Treacy, K., Elborn, J. S., Rendall, J., & Bradley, J. M. (2008). Copying letters to patients with cystic fibrosis: Letter content and patient perceptions of benefit. *Journal of Cystic Fibrosis, 7*(6), 511-514. doi:10.1016/j.jcf.2008.05.007

Vermeir, P., Vandijck, D., Degroote, S., Peleman, R., Verhaeghe, R., Mortier, E., Hallaert, G., Van Daele, S., Buylaert, W., & Vogelaers, D. (2015). Communication in healthcare: A narrative review of the literature and practical recommendations. *International Journal of Clinical Practice, 69*(11), 1257-1267. doi:10.1111/ijcp.12686

Vernon, J. A., Trujillo, A., Rosenbaum, S., & DeBuono, B. (2007). *Low health literacy: Implications for National Health Policy.* Department of Health Policy.

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:10.1016/j.sapharm.2012.05.009

Watermeyer, J., Kanji, A., & Cohen, A. (2012). Caregiver recall and understanding of paediatric diagnostic information and assessment feedback. *International Journal of Audiology, 51*(12), 864-869. doi:10.3109/14992027.2012.721014

Watermeyer, J., Kanji, A., & Mlambo, N. (2015). Recall and understanding of feedback by adult patients following diagnostic audiological evaluation. *International Journal of Audiology, 54*(10), 758-763. doi:10.3109/14992027.2015.1051667

Watermeyer, J., Kanji, A., & Sarvan, S. (2017). The first step to early intervention following diagnosis: Communication in pediatric hearing aid orientation sessions. *American Journal of Audiology, 26*(4), 576-582. doi:10.1044/2017_aja-17-0027

Weiss, B. D. (2007). *Help patients understand: Manual for clinicians.* AMA Foundation.

Wells, J. A. (1994). Readability of HIV/Aids educational materials: The role of the medium of communication, target audience, and producer characteristics. *Patient Education and Counseling, 24*(3), 249-259. doi:10.1016/0738-3991(94)90068-x

White, P., Singleton, A., & Jones, R. (2004). Copying referral letters to patients: The views of patients, patient representatives and doctors. *Patient Education and Counseling, 55*(1), 94-98. doi:10.1016/j.pec.2003.08.003

WHO. (2020). *Deafness and hearing loss*. https://libguides.uthsc.edu/endnote/faq/full-name-abbrev

Win, K. T., Hassan, N. M., Oinas-Kukkonen, H., & Probst, Y. (2016). Online patient education for chronic disease management: Consumer perspectives. *Journal of Medical Systems, 40*(4), 1-13. https://doi.org/10.1007/s10916-016-0438-0

Wu, D. T., Hanauer, D. A., Mei, Q., Clark, P. M., An, L. C., Lei, J., Proulx, J., Zeng-Treitler, Q., & Zheng, K. (2013). Applying multiple methods to assess the readability of a

large corpus of medical documents. *Studies in Health Technology and Informatics*, *192*, 647.

Appendix A

HUMAN ETHICS COMMITTEE

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

Ref: HEC 2020/31/LR-PS

12 June 2020

Rebecca Kelly-Campbell
Psychology, Speech and Hearing
UNIVERSITY OF CANTERBURY

Dear Rebecca

Thank you for submitting your low risk application to the Human Ethics Committee for the research proposal titled "The Readability of Hearing Test Results Provided to Adults With Hearing Loss".

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 email of 12th June 2020.

With best wishes for your project.

Yours sincerely

Dr Dean Sutherland
Chair, Human Ethics Committee

Appendix B

IRB-FY20-248 - Initial: Initial - Exempt - Approved

no-reply@irb.app.lamar.edu <no-reply@irb.app.lamar.edu>
Wed 6/3/2020 12:22 PM
To: Vinaya Manchaiah <vmanchaiah@lamar.edu>

RESEARCH & SPONSORED PROGRAMS ADMINISTRATION
LAMAR UNIVERSITY

Jun 3, 2020 12:21 PM CDT

Vinaya Channapatna Manchaiah

Re: Exempt - Initial - IRB-FY20-248 Accessibility of verbal information during adult hearing evaluations

Dear Dr. Vinaya Channapatna Manchaiah

Lamar University's Institutional Review Board (IRB) for Human Research Participants Protection has completed its review of your submission and has deemed your study to be exempt from further IRB review.

Category 2.(i). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording).
The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects.
Category 2.(ii). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording).
Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation.

As a research investigator, please be aware of the following:

- You will immediately report to the IRB via LU Cayuse any injuries or other unanticipated problems involving risks.
- You acknowledge and accept your responsibility for protecting the rights and welfare of human research participants and for complying with all parts of 45 CFR Part 46, the LU IRB Policy and Procedures.
- You will ensure that legally effective informed consent is obtained and documented if necessary. If written consent is required, the consent form must be signed by the participant or the participant's legally authorized representative. A copy is to be given to the person signing the form and a copy is to be kept for your file.

- Any proposed changes, including changes to your survey, hard copy or in Qualtrics, from previously approved IRB applications must be submitted to the Office of Research and Sponsored Programs via LU Cayuse. The proposed changes cannot be initiated without IRB review and approval.

Once your study is complete, please login to Cayuse and close your study.

Good luck with your research endeavors.

Sincerely,
Lamar University Human Subjects Review Board