

Constructing an Inclusive Web Design Checklist for Health-Related Sites for Older Adults with Complex Chronic Disease

by

Lester Leung

Submitted to OCAD University
in partial fulfillment of the requirements for the degree of

Master of Design
in
Inclusive Design

Toronto, Ontario, Canada, April 2014

 Lester Leung, 2014

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International license. To see the license, go to <http://creativecommons.org/licenses/by-nc-sa/4.0/> or write to Creative Commons, 171 Second Street, Suite 300, San Francisco, California 94105, USA

Copyright Notice

This document is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International license. To see the license, go to <http://creativecommons.org/licenses/by-nc-sa/4.0/>.

You are free to:

- **Share** — Copy and redistribute the material in any medium or format
- **Adapt** — Remix, transform, and build upon the material

Under the following conditions:

- **Attribution** — You must give the original author credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.
- **Non-Commercial** — You may not use the work for commercial purposes.
- **ShareAlike** — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original.

With the understanding that:

- **Waiver** — Any of the above conditions can be waived if you get permission from the copyright holder.
- **Public Domain** — Where the work or any of its elements is in the public domain under applicable law, that status is in no way affected by the license.
- **Other Rights** — In no way are any of the following rights affected by the license:
 - Your fair dealing or fair use rights, or other applicable copyright exceptions and limitations;
 - The author's moral rights;
 - Rights other persons may have either in the work itself or in how the work is used, such as publicity or privacy rights.
- **Notice** — For any reuse or distribution, you must make clear to others the license terms of this work.

Author's Declaration

I hereby declare that I am the sole author of this MRP. This is a true copy of the MRP, including any required final revisions, as accepted by my examiners.

I authorize OCAD University to lend this MRP to other institutions or individuals for the purpose of scholarly research.

I understand that my MRP may be made electronically available to the public.

I further authorize OCAD University to reproduce this MRP by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

Signature _____

Lester Leung

Abstract

Health-related sites are not optimally usable by older adults (aged 50 and over) who live with complex chronic disease (CCD) because most sites do not deliver online information with these users in mind. While the current literature explains how to design Web sites for older adults, it lacks guidance in how to design Web sites for older adults with CCD that have diverse abilities. My research examined the Web design features that provide this user population a better Web experience. This research paper started with the synthesis of current checklists that target older adult Web users and findings from an empirical study of the online experiences of older adults living with CCD. The results led to the construction of a checklist of inclusive Web design features that support designers in creating more usable and accessible health-related sites. The final Inclusive Web Design Checklist is comprised of 16 categories and 55 criteria.

Acknowledgments

I would like to thank my Supervisory Committee for their time and guidance in the development of my Major Research Paper:

- Principal Advisor: Jutta Treviranus, Professor at OCAD University and Director of the Inclusive Design Research Centre.
- External Advisors: Sambhavi Chandrashekar, Adjunct Professor at OCAD University, and Paula Gardner, Assistant Professor at Brock University and Research Scientist at Bridgepoint Health.

I would also like to thank my classmates and professors at OCAD University for a memorable learning experience.

Lastly, and most importantly, I wish to thank my parents for their endless love, support and encouragement.

Dedication

To my grandmother, for her many sacrifices
so her children and grandchildren could live a better life.

Table of Contents

| | |
|----------------------------------------------------------------|-----------|
| List of Figures | x |
| List of Tables | xi |
| 1 Introduction | 1 |
| 1.1 Context | 1 |
| 1.2 Challenge | 7 |
| 1.3 Approach..... | 8 |
| 1.4 Significance | 10 |
| 1.5 Summary | 11 |
| 2 Concepts | 12 |
| 2.1 Who are older adults?..... | 12 |
| 2.2 What is complex chronic disease? | 13 |
| 2.3 What is disability?..... | 15 |
| 2.4 What is personalization? | 16 |
| 2.5 What is user-centered design?..... | 16 |
| 2.6 What is inclusive design? | 17 |
| 2.7 What is usability? | 18 |
| 2.8 What is accessibility?..... | 19 |
| 2.9 What is adaptive technology? | 20 |
| 2.10 Summary..... | 20 |
| 3 Literature Review | 21 |
| 3.1 Web Design Guidelines and Checklists for Older Adults..... | 21 |
| 3.2 Discussion of Current Work | 24 |
| 3.3 The Web Designer..... | 25 |
| 3.4 Summary | 28 |
| 4 Design Approach | 29 |
| 4.1 Step 1 – Establish the Foundational Criteria..... | 29 |
| 4.2 Step 2 – Develop the Preliminary Checklist..... | 31 |
| 4.3 Step 3 – Create the Final Checklist..... | 31 |

| | | |
|-----------|-----------------------------------------------------------------------------------|-----------|
| 4.4 | Summary | 32 |
| 5 | Establish the Initial Criteria..... | 33 |
| 5.1 | Establish the Foundational Criteria | 33 |
| 5.2 | Develop the Preliminary Checklist | 39 |
| 5.3 | Summary | 44 |
| 6 | Construction of the Inclusive Web Design Checklist..... | 45 |
| 6.1 | Overview | 45 |
| 6.2 | New Criteria..... | 47 |
| 6.3 | Final Checklist | 61 |
| 6.4 | Summary | 68 |
| 7 | Conclusion..... | 70 |
| 7.1 | Research and Design Summary | 70 |
| 7.2 | Contributions | 71 |
| 7.3 | Limitations and Implications for Future Research..... | 72 |
| 7.4 | Final Remarks | 73 |
| 8 | Bibliography..... | 74 |
| 9 | Appendix A – REB Approval Letter..... | 84 |
| 10 | Appendix B – The Responsibilities of Web Designers and Developers..... | 88 |
| 11 | Appendix C – Examples of School Curriculum..... | 89 |
| 12 | Appendix D – Demographic Details of the BCRI Study..... | 92 |
| 13 | Appendix E – Fluid Infusion - User Interface Options..... | 93 |

List of Figures

| | |
|-----------------------------------------------------------------------|----|
| Figure 1. The Chances of Developing a Disability Increases with Age.. | 4 |
| Figure 2. My Research Space..... | 9 |
| Figure 3. My Design Approach | 29 |

List of Tables

| | |
|------------------------------------------------------------------------------------------------------------------------------|----|
| Table 1. Prevalence of disability by sex and age group, Canada, 2012 | 13 |
| Table 2. NIA/NLM Checklist | 34 |
| Table 3. Research-Derived Web Design Guidelines for Older People.. | 35 |
| Table 4. Digital Inclusion: Improving access to online health information for people with complex chronic conditions..... | 38 |
| Table 5. Developing the Preliminary Checklist | 40 |
| Table 6. Table Legend: Inclusive Web Design Checklist | 47 |

1 Introduction

My research paper explores the construction of an inclusive Web design checklist (IWDC) that guides Web designers in creating more usable and accessible health-related sites for older adults with complex chronic disease (CCD).

This chapter explains the research context, discusses the design challenge and approach, explains the research significance, and closes with an overview of the chapters to come.

1.1 Context

The following section provides background to this study by examining the relationships among the aging population, complex chronic disease, and the World Wide Web (hereafter “Web”).

1.1.1 The Aging Population

Over the next few decades older adults will be the fastest growing demographic worldwide (World Health Organization, 2011). Authors often refer to this phenomenon as the “silver tsunami” (Fox, 2004) where the aging population is building momentum like a tidal wave that will cause major disruptive changes to society. Statistics Canada (2013a) and the World Health Organization (2011) explain that this event is the result of the aging baby boomers, increased life

expectancy and falling fertility rates. The following statistics illustrate its effects.

According to Statistics Canada (2013a), the median age of Canadians in 2011 is 39.9, or roughly 5 million Canadians. By 2036, in the next 25 years, they predict this demographic to double in size to 10 million. By 2051, in the next 40 years, one in four Canadians will be aged 65 and older (Statistics Canada, 2013a). Chadwick-Dias (2004), Becker (2004) and Archer (2009) noted similar findings in other countries, such as the United States, France, England, and Japan, in which the older population is growing significantly. On a global scale, between 2000 and 2050, the older population aged 60 and over will double in size to 2 billion (World Health Organization, 2011), or one out of every five people will be aged 60 and older (United Nations, 2012). Furthermore, the current older population is getting even older as people are living longer (Czaja & Lee, 2007); the fastest growing demographic among older adults is the "oldest old" population that is aged 85 and older (Hiltz & Czaja, 2006).

1.1.2 Aging and Chronic Disease

There is strong evidence that as a person ages, the chances of developing a chronic disease or multiple chronic diseases increases (Ministry of Health and Long-Term Care, 2007; Ontario Medical

Association, 2009). The likelihood of developing a disability as people grow older is also evident, as seen in Figure 1 (Statistics Canada, 2006). With the growing aging population, it should not be a surprise to see an increase in the rate of reported health conditions among older adults, provided the signs are not already showing as revealed by the following. In 2009, the Ontario Medical Association Policy on Chronic Disease Management reported that 80% of Canadians aged 65 and over are living with at least one chronic disease and 56% of them have two or more chronic diseases (Ontario Medical Association, 2009). The Health Council of Canada reported similar findings in which roughly half of all Canadians are living with at least one chronic disease, and one in four is reported as having two or more chronic diseases (Health Council of Canada, 2012).

From an economic standpoint, the treatment and management of chronic diseases have translated to significant costs to the healthcare system. Mirolla's 2004 report shows that chronic disease costs the Canadian economy more than 90 billion a year in lost productivity and healthcare costs (as cited in Health Council of Canada, 2012). Similar findings are also reported at the provincial level where chronic disease accounts for 55% of both direct and indirect costs in Ontario (Ministry of Health and Long-Term Care, 2007).

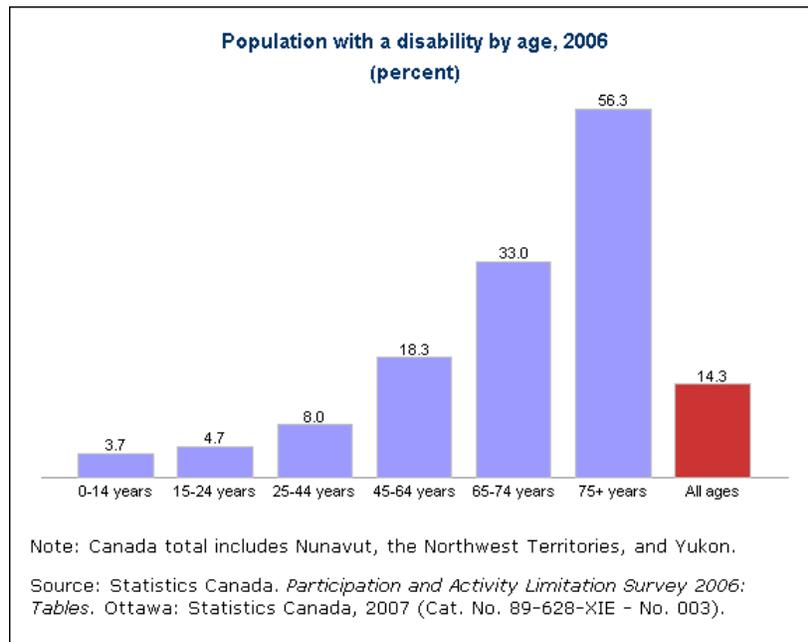


Figure 1. The Chances of Developing a Disability Increases with Age

1.1.3 Older Adults, Complex Chronic Disease and the Web

On top of becoming the fastest growing demographic, older adults are also becoming the fastest growing group of Web users (Hanson, 2008; Kurniawan & Zaphiris, 2005; Morris, 2007). One reason for this growth is that older adults are often alone and have more free time to use the Web (Becker, 2004). Another reason is that the popularity of the Internet has become an integral part of daily life (Czaja & Lee, 2007), especially since many traditional brick-and-mortar activities have moved online. Examples of these activities include, but are not limited to, banking, shopping, government services (Arch, 2009), education, communications, entertainment, job-related tasks (Czaja & Lee, 2007;

Hiltz & Czaja, 2006), travel services, job searching (Hanson, 2008), and healthcare (Becker, 2004).

Expanding on the healthcare perspective, older adults have been increasingly turning to the Web for health information. According to Morrell et al., searching for health information is one of the primary reasons older adults use the Internet (Morrell, Mayhorn, & Echt, 2004). In a more recent survey by the PEW Internet & American Life Project, 58% of adults aged 50-64 and 47% of adults aged 65 and older turned to a medical professional after performing a self-diagnosis using the Internet (Fox & Duggan, 2013). However, despite the convenience of having health information and services available on the Internet, many older adults are having difficulty accessing these resources. A challenge is that older adults lack the skill and knowledge that can help them find the information they need (Xie, 2008). Another challenge is that younger people are designing Web sites for younger Web users without considering other user populations, such as older adults (Morrell et al., 2004; Xie, 2008). And a last challenge is that older adults face age-related changes in abilities (Czaja & Lee, 2007), such as deteriorating eye-sight, that can affect how they use the computer.

From the perspective of people living with complex chronic disease, the ability to access health information and resources is often a need. The reason being that information can provide a means of social and medical support, which can improve a person's health and quality of life (Ministry of Health and Long-Term Care, 2007). Such support can simply come across as having access to up-to-date, relevant and vetted healthcare information. For example, a person might need to find more information about how to receive a personalized assistive device in Ontario, where to get help to modify a house to accommodate physical limitations, or where to find accessible swimming pools for exercise. Other forms of support include online health communities (van der Eijk et al., 2013), such as online social networks, where people can share and receive information about experiences and care knowledge. While many online resources and services are available, the ability for people with CCD to access these resources can sometimes be challenging. Similar to the barriers older adult Web users face, chronic disease can also create functional barriers that prevent people from using the computer effectively (Health Council of Canada, 2012). An example is having shoulder pain that can affect a person's mobility in using the computer mouse effectively, resulting in the need for an alternative access method, such as keystroke alternatives for mouse actions.

In recent years, government agencies, nongovernment organizations, for-profit organizations (Xie, 2008), non-profit organizations and healthcare providers have increasingly moved health information online. This move supports the notion of self-management, giving people the ability to become active participants in managing their own care (Health Council of Canada, 2012). Although people have greater access to health information and services, the current challenge is that these Web-based solutions are not considering the outcomes that affect the areas of "acceptability" or "usability" of the Web interface (Stellefson et al., 2013). This is problematic especially for older adult Web users and people with complex chronic disease that may have limited abilities. The heterogeneity of both these user populations requires designers to consider diversity in design due to different user abilities, such as: visual, motor, cognitive and auditory abilities; as well as a range of user needs or computer experiences, among other factors. Clearly a user-centered Web design approach is necessary and essential to ensure more people can access these systems.

1.2 Challenge

The current challenge of health-related Web sites is that they are not optimally usable by older adults who live with complex chronic disease because most sites do not deliver online information with these users in mind. While the current literature explains how to design Web sites

for older adults, it lacks guidance in how to design Web sites for older adults with complex chronic disease that have diverse abilities.

My research will explore the Web design features that will provide older adults with complex chronic disease a better Web experience. In doing so the challenge is to introduce a checklist of inclusive Web design features for health-related sites that are best suited or designed according to the abilities of this user population. This checklist will serve as a starting point for Web designers in the design of usable and accessible Web sites.

Included in this design challenge is the challenge to create a checklist that is easy-to-use and simple-to-understand. The lack of these characteristics is a major weakness of design guidelines and checklists (Kurniawan & Zaphiris, 2005). The Web Content Accessibility Guidelines 2.0 is an example of such a set of guidelines that authors have criticized as having poor usability and readability (Clark, 2006).

1.3 Approach

My research will introduce an Inclusive Web Design Checklist (IWDC). This will involve examining the intersection of nine areas, as seen in Figure 2: inclusive design, Web usability, Web accessibility, user-centered design, personalization, adaptive technology, disability,

complex chronic disease and older adults. Chapter 2 will further explain each concept.



Figure 2. My Research Space

My method in constructing the IWDC encompasses a three-step design approach: (1) establish the foundational criteria, (2) develop the preliminary checklist, and (3) create the final checklist.

The first step establishes the foundational criteria that form the basis of the IWDC through the synthesis of current checklists and findings from an empirical study on older adults with complex chronic disease and their online experiences. The results lead to the second step that develops the preliminary checklist that serves as the method to analyze and compare the similarities and differences of each criterion. And the third step is to take those results and create a final design checklist.

1.4 Significance

The outcome of my research will contribute to improved Web design practices in creating health-related sites for older adults living with complex chronic disease. In turn this will improve the usability and accessibility of such sites that will allow more people to access health information and services. To this end, this will lead to better opportunities to improve the health and quality of life of individuals.

From an academic and industry-level perspective, my research will add new knowledge to the current literature on Web design that researchers and designers have not yet considered. Additionally, my research can provide the starting point of more research to further validate, improve and expand on this knowledge.

While my research focuses specifically on health-related sites, the Inclusive Web Design Checklist will also benefit all types of Web sites as the current literature shows the pervasiveness and universality of the Web touches all aspects of our life.

1.5 Summary

This chapter described the context that prompted the need to create an Inclusive Web Design Checklist (IWDC) that will guide Web designers in making health-related sites more usable and accessible for older adults who live with complex chronic disease. It also provided an overview of my design approach in creating the IWDC and explained its significance.

The next chapter discusses the key concepts of my research. Chapter 3 examines current checklists that target older adult Web users, and explores the characteristics of the Web designer who is the primary audience of the IWDC. Chapter 4 explains my design approach in creating the IWDC. Chapter 5 begins the construction of the IWDC by establishing the initial criteria that form the basis of the design. Chapter 6 presents new design criteria that are not present in current research, and introduces the complete and final checklist. And Chapter 7 closes this research paper.

2 Concepts

This chapter defines key terms and concepts used in the context of my research space, as seen in Figure 2. The concepts here will serve as the foundation in the design of the IWDC.

2.1 Who are older adults?

The notion of being “old” is highly subjective because old age depends on the context of social and cultural influences (World Health Organization, 2010). For example, based on the chronological age, most developed countries have accepted individuals with a chronological age of 65 as being an older person, whereas in less developed countries where life expectancy is shorter, the WHO has recognized a chronological age of 50 as being elderly (World Health Organization, 2010). From a social role perspective, a change in adult status, such as when a parent becomes a grandparent, can symbolize reaching old age (World Health Organization, 2010). And from a decline in functional abilities perspective, such as when a person suffers from hearing loss, that could lead to the notion of being old. These examples show that it is necessary to reflect on the individuals’ context before we can determine what it means to be old. And as such defining the meaning of “old” is often a challenge.

Although being “old” is subjective, for the purpose of this research project, older adults are recognized as individuals greater or equal to the chronological age of 50. There are two reasons for selecting this age. The first reason is that it allows us to accommodate older adults in both developing and developed countries as recognized by the WHO. And the second reason is the significant increase in the prevalence of disability in both men and women in Canada moving from the age group of 25-44 to 45-64, as seen in Table 1.

Table 1. Prevalence of disability by sex and age group, Canada, 2012

| Age groups | Total | Men | Women |
|--------------------------|--------------|------------|--------------|
| Total - aged 15 and over | 13.7 % | 12.5 % | 14.9 % |
| 15 to 64 | 10.1 % | 9.5 % | 10.7 % |
| 15 to 24 | 4.4 % | 4.5 % | 4.3 % |
| 25 to 44 | 6.5 % | 6.0 % | 7.1 % |
| 45 to 64 | 16.1 % | 15.2 % | 17.1 % |
| 65 and over | 33.2 % | 30.8 % | 35.2 % |
| 65 to 74 | 26.3 % | 25.0 % | 27.5 % |
| 75 and over | 42.5 % | 39.8 % | 44.5 % |

Note. Reproduced from Statistics Canada (2013b).

2.2 What is complex chronic disease?

To understand a complex chronic disease, we must first understand a chronic disease. A chronic disease is a health condition that lasts more than three months and is not self-limiting (Sainfort, Jacko, Edwards, & Booske, 2007). More specifically, a chronic disease is an illness that is long-term and develops slowly (World Health Organization, n.d.), is

often progressive and incurable (Vancouver Island Health Authority, n.d.), and requires individuals to receive continued medical care (Bridgepoint Health, n.d.). Common examples include heart disease, stroke, cancer, chronic respiratory diseases and diabetes.

A complex chronic disease is a chronic disease that has multiple and mixed inputs and as a result is difficult to treat and manage. Such conditions can range from having two or more chronic diseases or multiple morbidities concurrently (Boyd & Fortin, 2010; Tsasis & Bains, 2008); having non-traditional disease such as disability, migraines, falls, and hearing impairment (Boyd & Fortin, 2010); having conditions such as emotional, psychological and even existential or spiritual distress (Mercer, Smith, Wyke, O'Dowd, & Watt, 2009); and among others. The result of multiple and mixed inputs creates complexity¹. This complexity affects a person's social, educational, cultural, behavioral, economic and environmental condition (Boyd & Fortin, 2010). Furthermore, based on my observations at the Bridgepoint Hospital, individuals often have episodes in which symptoms appear and disappear at varying degrees, or symptoms that physically appear in one person are invisible in others.

¹ Complexity is "the intricate entanglement of two or more systems (e.g., body-diseases, family-socioeconomic status, therapies)" (Nardi, Giovanni, Iori, Mathieu, & Amatrian, 2007).

While a formal definition of complex chronic disease is still in debate within the healthcare community, the common theme is that people living with complex chronic disease have distinct and individual needs. This means that healthcare providers, researchers and designers need to consider patient-centered and individualized healthcare solutions (Bayliss, Edwards, Steiner, & Main, 2008; Boyd & Fortin, 2010).

2.3 What is disability?

This study recognizes disability as “*a mismatch between the needs of the individual and the experience or service delivered*” (Treviranus, Stolarick, Denstedt, Fichten, & Ascunsion, n.d.). Treviranus and Roberts describe this framing of disability not as a personal trait, but as a relative condition resulting from the configuration or design of the environment, such as a lack of personalization (as cited in Treviranus et al., n.d.). For example, a person may be disabled in one environment (e.g., a door that is too low for a tall person), but not another environment because of the configuration (e.g., a door that is high enough to accommodate a tall person). The insights drawn here illustrate that Web interfaces need to be flexible enough to meet the characteristics of each person.

2.4 What is personalization?

In reflecting on the framing of a disability, personalization then requires an understanding of the user, the goal and the context (Treviranus et al., n.d.). When these dimensions are known, and with the right architecture in place, the users should be able to configure the system to meet their individual needs. In doing so, configuring a particular instance of a system will fundamentally be accessible to a specific group of users, but inaccessible to others (Treviranus et al., n.d.). Through this design approach, the system moves from mass production of “one-size-fits-all” to a personalized experience of “one-size-fits-one” (Treviranus, 2014).

2.5 What is user-centered design?

In her book *Just ask: integrating accessibility throughout design*, Henry defines user-centered design (UCD) as “a user interface design process that focuses on usability goals, user characteristics, environment, tasks, and workflow in the design of an interface. UCD follows a series of well-defined methods and techniques for analysis, design, and evaluation of mainstream hardware, software, and web interfaces” (Henry, 2007). Drawing from this definition, user-centered design is a design approach that puts the user as the center of focus at each design stage from research, design and development to testing.

Through this design approach, the final product will then better reflect the users of the system.

User-centered design was the design approach used in the research at the Bridgepoint Collaboratory for Research and Innovation that studied the online experiences of older adults living with complex chronic disease (Leung, Punshon, & Crosskey, 2013). The results from this study will inform the design decisions in the construction of the Inclusive Web Design Checklist. Chapter 4 describes this study further.

2.6 What is inclusive design?

The Inclusive Design Research Centre explains that inclusive design has three dimensions (Treviranus, 2014):

- The first dimension focuses on the diversity and uniqueness of individuals through a “one-size-fits-one” design approach that allows users the freedom to personalize the environment to suit their needs and preferences.
- The second dimension recognizes the importance of having an inclusive design process by creating diverse teams and including users in the design process, while also ensuring the design tools themselves are inclusive.

- The third dimension encourages designers to introduce designs that can trigger a “virtuous cycle of inclusion” that not only benefits the intended user, but also benefits as many people as possible.

Another perspective of inclusive design is from the British Standard Institute (BS 7000:25) that defines inclusive design as “*Design of mainstream products and/or services that are accessible to, and usable by, people with the widest range of abilities within the widest range of situations without the need for special adaptation or design*” (British Standards Institute, 2005).

It is clear from these definitions that the aim of inclusive design is to create Web sites that are accessible and usable to as many people as possible of all abilities and disabilities. And at the same time, create a unique and personalized Web experience. Insights drawn here will be the foundation of my research and the design of the IWDC.

2.7 What is usability?

The International Organization for Standardization defines usability (ISO 9241-11) as “*the extent to which a product can be used by a specified group of users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use*” (ISO/IEC, 1998). Insights drawn from this definition when applied to the concept

of usability testing then allows the researcher to test the effectiveness, efficiency and satisfaction of a Web site on a specific user population. This concept of usability testing was the approach used in the study at the Bridgepoint Collaboratory for Research and Innovation to understand how older adults living with complex chronic disease interact with the Web and search for health information and services (Leung et al., 2013).

2.8 What is accessibility?

This study recognizes accessibility as an inherent part of usability. In other words, usability and accessibility are not mutually exclusive. Henry's explanation of accessibility brings this notion into light: the design of interfaces that are "*effective, efficient, and satisfying for more people — especially people with disabilities, in more situations — including with assistive technologies*" (Henry, 2007). From a Web accessibility perspective, the Web Content Accessibility Guidelines 2.0 describes Web accessibility as having four key principles (W3C, 2008): Perceivable (i.e., Web content that is available to the senses), operable (i.e., the user can operate the interface), understandable (i.e., the user can understand the Web content and interface), and robust (i.e., Web content that is available to a wide variety of user agents).

2.9 What is adaptive technology?

Adaptive technology, also known as assistive technology, is any hardware or software that adapts the interaction interface to make computer access possible or easier for users with sensory, cognitive or motor constraints. Common adaptive technologies include, but are not limited to, screen readers, screen magnifiers and speech recognition software. Considering adaptive technologies during the design of the IWDC will help to reflect on the “usable-accessible” (Henry, 2006) Web experience of adaptive technology users.

2.10 Summary

This chapter defined key terms and concepts in my research space. It discussed the notion of being “old” and who older adults are in the context of my research, the meaning of complex chronic disease, the framing of disability and its reflection in personalization, the concepts of user-centred design and inclusive design, and the definitions of usability, accessibility and adaptive technology.

The next chapter examines current Web design guidelines and checklists that target older adult Web users. It also explores the Web designer who is the primary audience of the Inclusive Web Design Checklist.

3 Literature Review

This chapter examines current Web design guidelines and checklists that target older adult Web users, and discusses where the Inclusive Web Design Checklist (IWDC) can address identified gaps. It also explores the characteristics of the Web designer, the target audience of the IWDC, to understand who they are and what their needs are.

3.1 Web Design Guidelines and Checklists for Older Adults

The approach used to find current Web design guidelines and checklists was through the search of academic journal databases and the Internet. The search returned two resources that closely align with the context of this study: Making Your Web Site Senior Friendly - A Checklist (hereafter "NIA/NLM checklist") and the Research-Derived Web Design Guidelines for Older People. The next two sections will further explore these resources.

3.1.1 NIA/NLM Checklist

The United States National Institute on Aging (NIA) and the National Library of Medicine (NLM) introduced an empirically-derived checklist (NIA/NLM) to help designers create accessible Web sites for older adults over 60 (NIA/NLM, 2002). The NIA/NLM checklist has its roots in the study of aging, cognition, and human factors (Morrell et al. as

cited in Becker 2004), and specifically addresses barriers to Web access in the areas of vision, cognitive and motor impairments (Becker, 2004). The NIA/NLM checklist has 25 criteria in 4 categories (NIA/NLM, 2002), as displayed in Table 2 in Chapter 5. The four categories are: designing readable text for older adults, presenting information to older adults, incorporating other media, and increasing the ease of navigation.

Several studies have adopted the NIA/NLM checklist as a research framework. In her paper, *A Study of Web Usability for Older Adults Seeking Online Health Resources*, Becker applied the checklist to evaluate the usability of 125 Web sites that provide health information and resources (Becker, 2004). Her study concluded that most healthcare sites had low levels of compliance to the NIA/NLM checklist and were not senior-friendly. Hart, Chaparro and Halcomb conducted another study of 40 Web sites using the NIA/NLM checklist as evaluation criteria. They found that Web sites with high levels of compliance to the NIA/NLM checklist produced "*higher task success*", but lacked efficiency and satisfaction (Hart, Chaparro, & Halcomb, 2008).

These studies reveal that accessibility and usability are not mutually exclusive, but go hand-in-hand, particularly in the design of guidelines

and checklists. Becker (2004) recognizes the need to further improve the NIA/NLM checklist because the guidelines do not provide enough detail to overcome usability barriers. Hart et al. (2008) had a similar view and stated that it is necessary for Web designers to understand the relationship between best practice guidelines and usability to ensure users are “productive and satisfied”. These insights suggest that both usability and accessibility are important factors to consider when designing Web guidelines or checklists.

3.1.2 Research-Derived Web Design Guidelines for Older People

In their paper, *Research-derived web design guidelines for older people*, Kurniawan and Zaphiris (2005) put forth a set of Web design guidelines that targets older adult Web users. They produced these guidelines through an extensive review of over 100 academic papers in the areas of aging and human-computer interaction (HCI). The preliminary results of the literature review presented a checklist with 52 criteria. The authors later refined this list through card sorting and a focus group with five HCI experts. From this exercise, the authors derived a final checklist comprised of 38 criteria in 11 categories. The guidelines were then further tested (with 6 student researchers in HCI and 16 older adults) to confirm its validity and usefulness.

This study reveals two key features for the design of successful guidelines and checklists. The first feature is to decide on the content that will be part of the artifact. The second feature is to consider the usability of the artifact in areas such as readability and usefulness. In Scapin et al.'s study, they recognize that guidelines that are too long or that do not provide enough details will require designers to spend additional time interpreting their meaning (as cited in Kurniawan & Zaphiris, 2005). Zajicek had a similar view in that having vast amounts of research available requires designers to first assimilate that information and determine how that knowledge applies to the context of their work (as cited in Kurniawan & Zaphiris, 2005). These examples suggest that the success of a checklist lies in its inherent ability to be comprehensive, well-organized and useful (Kurniawan & Zaphiris, 2005).

3.2 Discussion of Current Work

From examining the current Web guidelines and checklists that target older adult Web users, it is clear the IWDC can address the following three challenges. The first challenge is to create a resource that can encompass Web usability and accessibility best practices, as well as "usable-accessibility" (Henry, 2006) practices that touch on the interactions of adaptive technologies, such as screen readers and screen magnifiers. The second challenge is to create a resource that is

simple-to-understand and easy-to-use, and provides just enough details to the reader. This involves considering features such as the length of the checklist, the grouping of the criteria, the layout of the checklist and the description of each criterion, among others. The third challenge is to improve the criteria through the lens of inclusive design principles that can trigger a “virtuous cycle of inclusion” (Treviranus, 2014) that not only benefits Web sites for older adults with CCD, but also benefits all Web sites in general.

3.3 The Web Designer

The target audience of the IWDC is the Web designer. This section will describe who these individuals are and what their needs could be.

According to the Human Resources and Skills Development Canada (2013), Web designers “*research, design, develop and produce Internet and Intranet sites*”. To enter the Web design field, most Web designers need a bachelor’s or associate’s degree, or need to have completed a community college program in Web design or in a related field (Human Resources and Skills Development Canada, 2013; U.S. Bureau of Labor Statistics, 2014). Given the pervasiveness and universality of the Web, Web designers can work in both the public and private sector and in nearly any industry.

In the United States, there are 141,400 Web designers, as of 2012 (U.S. Bureau of Labor Statistics, 2014). The U.S. Bureau of Labor Statistics forecasts that the Web designer position will grow 20% from 2012 to 2022 compared to the average growth rate of all occupations at 11% during the same period (U.S. Bureau of Labor Statistics, 2014). In Ontario, Canada, Employment Ontario forecasts a higher growth of new jobs for Web designers from 2013 to 2017, compared to all occupations during the same period (Queen's Printer Ontario, 2013).

Appendix B shows the main duties of a Web designer. When we compare these duties with the Web design curriculum of community colleges and continuing education programs, the results show that current training programs in general do prepare students for this role. However, both the job responsibilities (Appendix B) and curriculum of many school programs (Appendix C) lack a fundamental aspect of Web design: digital accessibility. While there are programs that teach disability studies at a post-graduate level, most classes within these programs are theoretical (Appendix C) and lack the hands-on and technical expertise that Web accessibility often requires. Furthermore, even some career books, such as the "*The Web Design Job Description Handbook and Career Guide*" (Klipp, 2009a) and "*The Web Developer Job Description Handbook and Career Guide*" (Klipp, 2009b), that are

dedicated to explain the Web design profession lack or fail to provide sufficient details to support individuals in understanding accessibility. Clearly a major knowledge gap exists in the industry and academia to prepare students and Web designers for the accessible design challenges ahead.

Literature has revealed that most graduates will not have a full understanding of digital accessibility until they reach the workforce. And when these individuals need to learn about accessibility they will often turn to the Web Content Accessibility Guidelines, a resource noted as too difficult to read and understand (Clark, 2006). In my own experience, Web accessibility is a field that requires a combined understanding of design, technology, disabilities studies and usability. It is a field that requires both theoretical and practical knowledge that Web designers gain through time and experience. A checklist that can support Web designers during this journey can help build Web accessibility knowledge and skill. Additionally, it can save time for Web designers in researching accessible design solutions for older adults with CCD, an area of Web design that researchers and designers have yet to explore.

3.4 Summary

This chapter reviewed current Web design guidelines and checklists that target Web sites for older adults. It discussed two checklists, the NIA/NLM checklist and the Research-Derived Web Design Guidelines for Older Adults, and showed where challenges exist that the Inclusive Web Design Checklist can address. This chapter also explored the Web designer who is the target audience of the IWDC. It showed that Web designers are not prepared to meet the accessible design challenges ahead, and that a checklist of inclusive Web design features can help designers get started on Web accessibility.

The next chapter explains the design method that my research used to create the IWDC.

4 Design Approach

This chapter discusses my design approach in constructing the Inclusive Web Design Checklist (IWDC). It involves three main steps: establish the foundational criteria, develop the preliminary checklist, and create the final checklist. Figure 3 illustrates this approach.

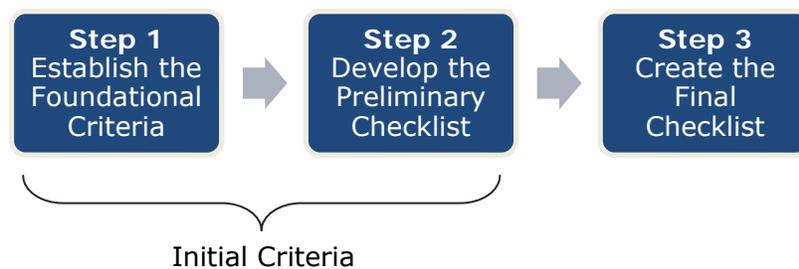


Figure 3. My Design Approach

4.1 Step 1 – Establish the Foundational Criteria

The first step establishes the foundational criteria that serve as the basis of the design of the IWDC, which involves the synthesis of two data sources.

The first data source consists of analyzing current Web guidelines and checklists that target older adult Web users. Two checklists presented in the previous chapter, the NIA/NLM checklist and the Research-Derived Web Design Guidelines for Older People, serve as the foundation for this analysis. The reason this study uses these two

particular resources is because both of these studies are based on extensive research on older adults. In contrast, other resources like the Web Content Accessibility Guidelines have general principles that do not target any particular user population.

The second data source draws from a study on older adults living with complex chronic disease (CCD) and caregivers of people with CCD. This research was part of my Mitacs-Accelerate internship at the Bridgepoint Collaboratory for Research and Innovation (BCRI) with two other graduate students in the Master of Inclusive Design program. The purpose of this study was to understand how these users interact with the Web and search for health information and services. During the six month internship, the research team performed two rounds of usability testing with older adults (aged 50 or over) living with complex chronic disease and their caregivers. Methods included semi-structured interviews and computer tasks, think aloud and A/B testing. This research resulted in a final report entitled, "*Digital Inclusion: Improving access to online health information for people with complex chronic conditions*" (Leung et al., 2013). Appendix D shows the demographics of the final participants. Also included in Appendix A is the research ethics approval for this study.

4.2 Step 2 – Develop the Preliminary Checklist

The second step establishes the preliminary checklist through the synthesis of the foundational criteria. The purpose of the preliminary checklist is to provide a method to analyze and compare the similarities and differences of each criterion. The conclusion to this step and the combined results of Step 1 and Step 2 lead to producing the initial criteria that are the foundation for the design of the final checklist.

4.3 Step 3 – Create the Final Checklist

The final step involves critiquing each criterion and category in the preliminary checklist to derive a final checklist. Also, this critique involves structuring and organizing the checklist so it is easy-to-use and simple-to-understand. Furthermore, part of this analysis involves categorizing the criteria into usability, accessibility and health site specific outcomes to show how the criteria relate to one another and to provide an understanding of the Web experience users will encounter.

The final checklist is provided in two versions, a paper-based version in Chapter 6, and a Web-based version located on a disc at the back of this report. Both the paper-based IWDC and Web-based IWDC are identical. The Web-based IWDC also includes additional Web design

advice and examples to support the reader in understanding each principle.

4.4 Summary

This chapter explained my design approach in constructing the IWDC. The first step is to establish the foundational criterion from two sources. The first source consists of analysis of current Web guidelines and checklists that target older adult Web users. The second source draws from a study of the online experiences of older adults living with CCD and their caregivers. The results here lead to the second step by assembling a preliminary checklist that serves as a method to analyze and compare the similarities and differences of each criterion. And the third step is to critique each criterion and category to derive a final checklist.

Chapter 5 establishes the initial criteria for the Inclusive Web Design Checklist as described in steps one and two. And Chapter 6 presents the final and complete checklist as described in step three.

5 Establish the Initial Criteria

This chapter establishes the initial criteria of the Inclusive Web Design Checklist (IWDC), which involves establishing the foundational criteria and creating the preliminary checklist.

5.1 Establish the Foundational Criteria

To reiterate, the foundational criteria consist of assembling two data sources. The first data source draws from two current checklists that are based on extensive research targeting older adult Web users namely, the NIA/NLM checklist and the Research-Derived Web Design Guidelines for Older People. The second data source draws from my research internship with two other graduate students at the Bridgepoint Collaboratory for Research and Innovation (BCRI). This research studied how older adults living with complex chronic disease (CCD) and caregivers of people with CCD interact with the Web and search for health information and services.

5.1.1 NIA/NLM Checklist

The National Institute on Aging (NIA) and the National Library of Medicine (NLM) introduced the NIA/NLM checklist. The NIA/NLM checklist consists of 4 core headings and 25 criteria (NIA/NLM, 2002). This checklist is reproduced in Table 2 (NIA/NLM, 2002) as reference.

Table 2. NIA/NLM Checklist

| # | Criteria | Description |
|-------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Designing Readable Text for Older Adults | | |
| 1 | Typeface | Use a sans serif typeface, such as Helvetica, that is not condensed. Avoid the use of serif, novelty, and display typefaces. |
| 2 | Type Size | Use 12 point or 14 point type size for body text. |
| 3 | Type Weight | Use medium or bold face type. |
| 4 | Capital and Lowercase Letters | Present body text in upper and lowercase letters. Use all capital letters and italics in headlines only. Reserve underlining for links. |
| 5 | Physical Spacing | Double space all body text. |
| 6 | Justification | Left justified text is optimal for older adults. |
| 7 | Colour | Avoid yellow and blue and green in close proximity. These colors and juxtapositions are difficult for some older adults to discriminate. Ensure that text and graphics are understandable when viewed on a black and white monitor. |
| 8 | Background | Use dark type or graphics against a light background, or white lettering on a black or dark-colored background. Avoid patterned backgrounds. |
| Presenting Information to Older Adults | | |
| 9 | Style | Present information in a clear and familiar way to reduce the number of inferences that must be made. Use positive statements. |
| 10 | Phrasing | Use the active voice. |
| 11 | Simplicity | Write the text in simple language. Provide an online glossary of technical terms. |
| 12 | Organization | Organize the content in a standard format. Break lengthy documents into short sections. |
| Incorporating Other Media | | |
| 13 | Illustrations and Photographs | Use text-relevant images only. |
| 14 | Animations, Video and Audio | Use short segments to reduce download time on older computers. |
| 15 | Text Alternative | Provide text alternatives such as open-captioning or access to a static version of the text for all animation, video, and audio. |
| Increasing the Ease of Navigation | | |
| 16 | Navigation | The organization of the web site should be simple and straightforward. Use explicit step-by-step navigation procedures whenever possible to ensure that people understand what follows next. Carefully label links. |

| | | |
|----|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17 | The Mouse | Use single mouse clicks to access information. |
| 18 | Consistent Layout | Use a standard page design and the same symbols and icons throughout. Use the same set of navigation buttons in the same place on each page to move from one web page or section of the web site to another. Label each page in the same location with the name of the web site. |
| 19 | Style and Size of Icons and Buttons | Incorporate text with the icon if possible, and use large buttons that do not require precise mouse movements for activation. |
| 20 | Menus | Use pull down menus sparingly. |
| 21 | Scrolling | Avoid automatically scrolling text. If manual scrolling is required, incorporate specific scrolling icons on each page. |
| 22 | Backward / Forward Navigation | Incorporate buttons such as Previous Page and Next Page to allow the reader to review or move forward. |
| 23 | Site Maps | Provide a site map to show how the site is organized. |
| 24 | Hyperlinks | Use icons with text as hyperlinks. |
| 25 | Help and Information | Offer a telephone number for those who would prefer to talk to a person or provide an e-mail address for questions or comments. |

5.1.2 Research-Derived Web Design Guidelines for Older People

Kurniawan and Zaphiris (2005) introduced a set of Web design guidelines for older people comprised of 38 criteria in 11 categories. These guidelines are reproduced in Table 3 (Kurniawan & Zaphiris, 2005) as reference.

Table 3. Research-Derived Web Design Guidelines for Older People

| # | Description |
|-------|------------------------|
| H1. | Target Design |
| H1.1. | Provide larger targets |

| | |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| H1.2. | There should be clear confirmation of target capture, which should be visible to older adults who should not be expected to detect small changes |
| H1.3. | Older adult should not be expected to double click |
| H2. Use of Graphics | |
| H2.1. | Graphics should be relevant and not for decoration. No animation should be present |
| H2.2. | Images should have alt tags |
| H2.3. | Icons should be simple and meaningful |
| H3. Navigation | |
| H3.1. | Extra and bolder navigation cues should be provided |
| H3.2. | Clear navigation should be provided |
| H3.3. | Provide location of the current page |
| H3.4. | Avoid pull down menus |
| H3.5. | Do not use a deep hierarchy and group information into meaningful categories |
| H4. Browser Window Features | |
| H4.1. | Avoid scroll bars |
| H4.2. | Provide only one open window e.g., pop-up/ animated advertisements or multiple overlapping windows should be avoided |
| H5. Content Layout Design | |
| H5.1. | Language should be simple and clear |
| H5.2. | Avoid irrelevant information on the screen |
| H5.3. | Important information should be highlighted |
| H5.4. | Information should be concentrated mainly in the centre |
| H5.5. | Screen layout, navigation and terminology used should be simple, clear and consistent |
| H6. Links | |
| H6.1. | There should be differentiation between visited and unvisited links |
| H6.2. | Links should be clearly named and no link with the same name should go to a different page |
| H6.3. | Links should be in a bulleted list and not tightly clustered |
| H7. User Cognitive Design | |
| H7.1. | Provide ample time to read information |
| H7.2. | Reduce the demand on working memory by supporting recognition rather than recall and provide fewer choices to the user |

| | |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H8. Use of Colour and Background | |
| H8.1. | Colours should be used conservatively |
| H8.2. | Blue and green tones should be avoided |
| H8.3. | Background screens should not be pure white or change rapidly in brightness between screens. Also, a high contrast between the foreground and background should exist, for example, coloured text on coloured backgrounds should be avoided. |
| H8.4. | Content should not all be in colour alone (colour here is denoted by all colours other than black and white) |
| H9. Text Design | |
| H9.1. | Avoid moving text |
| H9.2. | Text should be left justified and text lines should be short in length |
| H9.3. | There should be spacing between the lines |
| H9.4. | Main body of the text should be in sentence case and not all capital letters |
| H9.5. | Text should have clear large headings |
| H9.6. | Use san serif type font i.e., Helvetica, Arial of 12-14 point size. Avoid other fancy font types. |
| H10. Search Engine | |
| H10.1 | Search engines should cater for spelling errors |
| H11.1 User Feedback & Support | |
| H11.1 | Provide a site map |
| H11.2 | An online help tutorial should be provided |
| H11.3 | Support user control and freedom |
| H11.4 | Error messages should be simple and easy to follow |

5.1.3 Research on Older Adults with Complex Chronic Disease

As part of the foundational criteria are the results of my research internship at the Bridgepoint Collaboratory for Research and Innovation. Table 4 summarizes the results of how older adults living with CCD and the caregivers of individuals with CCD (who are all over the age of 50) interact with the Web and search for health information

and services (Leung et al., 2013). More background information about this research can be found in Chapter 4 and Appendix D.

Table 4. Digital Inclusion: Improving access to online health information for people with complex chronic conditions

| # | Criteria | Characteristic(s) |
|-------------------|---------------------|------------------------------------------------------------------------------------------------------------------------|
| Navigation | | |
| 1 | Home button | Include a homepage button. |
| 2 | Breadcrumbs | Include location-based breadcrumbs on all pages. |
| 3 | Sitemap | Include a sitemap. |
| 4 | Pagination controls | Include pagination controls before and after the content to minimize vertical scrolling when navigating between pages. |
| Search | | |
| 5 | Search engine | Use a simple search over an advanced search. |
| 6 | Search index | Include a search index as an alternative search method. |
| Content | | |
| 7 | Presentation | Do not hide important content (e.g., dropdown menus). |
| 8 | Length | Make content short and concise. |
| 9 | Page length | Place the most important content above the page fold. |
| 10 | Videos | Keep videos short (i.e., 3 to 5 minutes). |
| 11 | Layout | Place main content on the left column and the secondary content on the right column. |
| 12* | Difficult terms | Include a directory of technical terms, or provide an easy method to learn the terms. Use conventional terminology. |
| 13 | Placement | Place the most important content at key areas of the page (i.e., above the fold). |
| Visuals | | |
| 14 | Font size | Use 12 or 14 point type size as the default body text size (NIA/NLM, 2002). |
| 15 | Typeface | Use a sans serif typeface that is not condensed to increase legibility (NIA/NLM, 2002). |

* New themes identified from further data analysis, not present in final report.

| | | |
|-----------------|----------------------------------|----------------------------------------------------------------------------------------------|
| 16 | Font contrast | Use medium or bold face type to allow for sufficient font contrast (NIA/NLM, 2002). |
| 17 | Background and foreground colour | Use black text on a white background, or white text on a black background. |
| Accessibility | | |
| 18 | Pop-up windows and tabs | Inform the user that a pop-up window or tab will open. |
| 19 | Skip navigation | Include visible or invisible skip navigation. |
| 20 | Focus indicator | Enhance the visual focus indicator. |
| Personalization | | |
| 21* | Personalized content | Provide personalized health content. |
| 22 | Interface options | Allow users to personalize the interface (e.g., change the font size, colour contrast, etc.) |
| Cognitive | | |
| 23* | Memory | Guide users through complicated tasks. |
| 24* | Conventions | Use standard conventions. |
| Trust | | |
| 25* | Last modified content date | Include a last modified content date. |
| 26 | Credibility | Display recognizable symbols and names in prominent locations. |
| Feedback | | |
| 27 | Contact | Include an online form and telephone contact. |
| Hyperlinks | | |
| 28 | Appearance | Make hyperlinks underlined and blue. |
| 29 | Text | Make hyperlink text descriptive. |

5.2 Develop the Preliminary Checklist

This section analyzes and compares the foundational criteria. Table 5 brings together the foundational criteria to create the preliminary checklist to compare the similarities and differences of each criterion. The output of this step will be the foundation of the final checklist in the next chapter.

Table 5. Developing the Preliminary Checklist

| Table Legend | |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | NIA/NLM Checklist |
| 2 | Research-Derived Web Design Guidelines for Older People |
| 3 | Digital Inclusion: Improving access to online health information for people with complex chronic conditions (Research at the Bridgepoint Collaboratory for Research and Innovation) |
| * | New criterion from further data analysis, not present in final BCRI report |
| x | Criterion is present in checklist |

| # | Criteria | Characteristic | 1 | 2 | 3 |
|------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------|---|---|---|
| Text | | | | | |
| 1 | Typeface | Use sans serif typeface. Avoid novelty or fancy fonts. | x | x | x |
| 2 | Type size | Use 12 point or 14 point type size. | x | x | x |
| 3 | Type weight | Use medium or bold face type. | x | | x |
| 4 | Capital and lowercase letters, and italics | Use upper and lowercase letters in body text. Reserve all uppercase letters and italics for headings. | x | x | |
| 5 | Underline | Reserve underline for hyperlinks. | x | | x |
| 6 | Spacing | Double space body text. | x | x | |
| 7 | Justification | Left justify text. | x | x | |
| 8 | Headings | Use clear large headings. | | x | |
| 9 | Moving text | Avoid moving text. | | x | |
| Colour and Background | | | | | |
| 10 | Colours | Limit colour use. | | x | |
| 11 | Colour combinations | Avoid certain colour combinations in close proximity. | x | x | |
| 12 | Background | Avoid a pure white background. | | x | |
| 13 | Foreground and background | Use dark text on a light background, or white text on a dark background. | x | | x |
| 14 | Patterned background | Avoid patterned backgrounds. | x | | |
| 15 | High contrast | Use high contrast between the foreground and background. | | x | |

| Content | | | | | |
|-------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------|---|---|---|
| 16 | Style | Use simple, familiar and clear language. | x | x | |
| 17 | Phrasing | Write in active voice. | x | | |
| 18 | Simplicity | Use simple and conventional terms, and provide a method to discover technical and medical terms (e.g., glossary). | x | | * |
| 19 | Organization | Break long documents into shorter paragraphs. | x | | x |
| 20 | Content Placement | Place content in prime locations (e.g., centre of the screen) | | x | x |
| 21 | Irrelevant content | Avoid unnecessary content. | | x | |
| 22 | Important information | Place important information in prominent locations (e.g., above the page fold). | | x | x |
| 23 | Coloured text | Avoid coloured text for all content, except for black and white. | | x | |
| Graphics and Multimedia | | | | | |
| 24 | Graphics | Use graphics that are relevant to the content. | x | x | |
| 25 | Icon image | Use simple and meaningful icons. | | x | |
| 26 | Icons | Add text with icons. | x | | |
| 27 | Audio size | Make audio content short to reduce the file size. | x | | x |
| 28 | Video size | Make video content short to reduce the file size. | x | | x |
| 29 | Animation size | Make animations short to reduce the file size. | x | | |
| 30 | Animations | Avoid animations. | | x | |
| 31 | Text alternative | Include a text alternative for images. | | x | |
| 32 | Captions or transcripts | Include a text alternative for video, audio and animations. | x | | |
| Navigation | | | | | |
| 33 | Navigational procedures | Use explicit step-by-step navigation with clear links to show what follows next. | x | | |
| 34 | Pull down menus | Avoid or use dropdown menus sparingly. | x | x | |

| | | | | | |
|--------------------|----------------------------------|--------------------------------------------------------------------------------------------------|---|---|---|
| 35 | Navigational buttons | Include next and previous navigational buttons. | x | | |
| 36 | Site Map | Include a site map to show the organization of the site. | x | x | x |
| 37 | Bold | Use bold as a navigational cue (e.g., bold current location). | | x | |
| 38 | Current location | Indicate the current page location. | | x | x |
| 39 | Navigational structure | Use a simple navigational structure. Group information into meaningful categories. | | x | |
| 40 | Home button | Include a homepage button. | | | x |
| Target Area | | | | | |
| 41 | Mouse behaviour | Ensure single mouse clicks to operate the interface. | x | x | |
| 42 | Larger buttons | Use larger buttons for easier activation. | x | | |
| 43 | Larger targets | Provide larger target areas. | | x | |
| 44 | Focus indicator | Ensure the focus indicator is clearly visible. | | x | x |
| Layout | | | | | |
| 45 | Consistency | Use consistent layouts, labels, symbols, buttons, icons and terminology throughout the Web site. | x | x | |
| Browser | | | | | |
| 46 | Automatic scrolling text | Avoid text that automatically scrolls. For manual text scrolling, include scroll icons. | x | | |
| 47 | Scroll bars | Avoid using scroll bars. | | x | |
| Hyperlinks | | | | | |
| 48 | Hyperlink icons | Include accompanying text with icons for hyperlinks. | x | | |
| 49 | Visited and unvisited hyperlinks | Differentiate between visited and unvisited hyperlinks. | | x | x |
| 50 | Hyperlink text | Make hyperlink text descriptive and meaningful. | | x | x |
| 51 | Consistent hyperlink behaviour | Make hyperlinks with the same text go to the same place. | | x | |
| 52 | Hyperlink lists | Use lists for a group of hyperlinks. | | x | |

| Support | | | | | |
|-----------------------|------------------------------|-----------------------------------------------------------------------------------------|---|---|---|
| 53 | Contact information | Provide a contact method for support, such as a telephone number, email or online form. | x | | x |
| 54 | Help tutorial | Include help tutorials. | | x | x |
| 55 | Error messages | Ensure error messages are easy to understand and follow. | | x | |
| Pop-up Windows | | | | | |
| 56 | Pop-up windows | Allow only one pop-up window at a time. | | x | |
| 57 | Window alert | Inform the user that a pop-up window or tab will open. | | | x |
| Cognitive | | | | | |
| 58 | Time out | Give users sufficient time to read information. | | x | |
| 59 | Recognition | Design for recognition rather than recall. And include fewer choices. | | x | |
| 60 | Standard conventions | Use standard conventions (e.g., reserve underline for links). | | | * |
| 61 | Memory | Include a step navigation to guide users through complicated tasks. | | | * |
| Search | | | | | |
| 62 | Spelling | Ensure the search engine considers spelling mistakes. | | x | |
| 63 | Multiple search methods | Provide multiple search methods to find the same information. | | | x |
| Personalization | | | | | |
| 64 | Interface features | Allow users to control how information is presented (e.g., change font size). | | x | x |
| 65 | Personalized content | Provide users with personalized content. | | | * |
| Trust and Credibility | | | | | |
| 66 | Last modified content date | Include a last modified content date. | | | * |
| 67 | Recognizable names and logos | Display recognizable symbols and names in prominent locations. | | | x |

5.3 Summary

This chapter established the initial criteria for the final checklist. The first step established the foundational criteria that involved assembling two current checklists that target older adult Web users namely, the NIA/NLM checklist and the Research-Derived Web Design Guidelines for Older People. This step also included assembling the results of my research internship on how older adults living with CCD and caregivers of people with CCD interact with the Web and search for health information and services. The second step brought together these results to create a preliminary checklist that compared the similarities and differences of each criterion.

Using the outcome from this chapter, Chapter 7 presents the construction of the final checklist.

6 Construction of the Inclusive Web Design Checklist

This chapter presents the Inclusive Web Design Checklist (IWDC). It begins by providing an overview of the IWDC and its benefits. Then it introduces 13 new criteria that are not present in current checklists. And finally it presents the complete and final checklist in section 6.3, which comprises of 16 categories and 55 criteria.

6.1 Overview

The IWDC is an improvement over current checklists in that it provides the Web designer an understanding of how the criteria align with one or more of the following outcomes: usability, accessibility and health site specific. While the IWDC shows where each criterion fits in each category, the placement is not always straightforward as a criterion often cuts across boundaries, reconfirming the notion that usability and accessibility are not mutually exclusive, but go hand-in-hand. The objective of categorization, however, is not to prove where a criterion should reside. Rather the intent is to show Web designers how the criterion relates to other categories and the degree of emphasis they need to place on that aspect of design.

The IWDC is a starting point to help Web designers design usable and accessible Web interfaces for older adults with CCD. The intention of the IWDC is not to compete with other guidelines, but to complement those resources, such as the Web Content Accessibility Guidelines that covers a general perspective of Web accessibility.

From the perspective of the older adult Web user, including the IWDC in design will provide a better overall Web experience. When a person has limited abilities, performance of daily activities is often challenging, not to mention using a computer. User-centered design then becomes critical to ensure the Web sites we introduce do not impose additional stress on users. With the introduction of the IWDC, Web designers now have even more opportunities to reduce this stress, so users can focus on the task at hand.

There are two versions of the IWDC. Section 6.3 of this report presents the paper-based version. At the back of this report on a disc is the Web-based version. The criteria in both versions are identical. However, the Web-based version also includes additional design advice and examples to support the reader in understanding each principle.

As a final point, Web designers need to be aware that the IWDC is a resource that will need to evolve and grow as technology progresses.

6.2 New Criteria

This section presents 13 new criteria that are not present in current checklists, namely the NIA/NLM checklist and the Research-Derived Web Design Guidelines for Older Adults. Four of the criteria draw from the final report of my research internship at the Bridgepoint Collaboratory for Research and Innovation (hereafter "BCRI"). Nine of the criteria are from further analysis of the BCRI study data and changes to specific criteria of current checklists to better reflect inclusive design principles. In each case, the data is presented first, followed by the derived criterion and explanation.

Table 6. Table Legend: Inclusive Web Design Checklist

| Table Legend | |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| U | Usability |
| A | Accessibility |
| H | Health Site Specific |
| R | References |
| 1 | NIA/NLM Checklist |
| 2 | Research-Derived Web Design Guidelines for Older People |
| 3 | Digital Inclusion: Improving access to online health information for people with complex chronic conditions (Research at the Bridgepoint Collaboratory for Research and Innovation) |
| New | New Criterion |
| ✓ | Applies to |

6.2.1 Text

"The font is too small and the ink is too light. It is the combination of the two. It makes it all start moving. And then I get dizzy and get nauseated." (P01)

| # | Criteria | Characteristic | U | A | H | R |
|-----|----------|--------------------------------------------------|---|---|---|-----|
| 1.1 | Typeface | Use sans serif or serif as the default typeface. | ✓ | ✓ | | New |

Use a sans serif or serif typeface for the body text. Sans serif typefaces have even width strokes, and plain strokes at the end of each character. Because of the even width strokes, sans serif typefaces appear blockier (WebAim, n.d.). Examples of these typefaces include Arial, Helvetica and Verdana. In contrast, serif typefaces have thick and thin strokes, and extra strokes at the end of each character. The extra strokes on serif typefaces give these fonts a distinctive identity, while inherently making them more complex. Times New Roman and Georgia are two examples of serif typefaces.

The debate about which typeface is better for online reading is still ongoing, and the results are inconclusive (Russell-minda et al., 2007; WebAim, n.d.). Most research however favors sans serif typefaces (Kurniawan & Zaphiris, 2005; NIA/NLM, 2002) over serif types for readability and letter confusion (Russell-minda et al., 2007).

Traditionally, older monitors had more difficulty rendering and displaying serif typefaces, but today's modern monitors have the capabilities to render and display all types of fonts with as much clarity as printed pages (WebAim, n.d.). Given the inconsistent findings of which typeface is better for online reading, we should not limit Web designers to a single typeface. Instead we should allow Web designers to choose the typeface that works best for their design. Most importantly, Web designers need to introduce functionality that allows the user to choose the font that best works for them (criterion 16.1). To this end, both sans serif and serif typefaces are valid, and the accessible nature of the typeface depends on the users' preference. The Fluid Infusion's User Interface Options, an open source accessibility module displayed in Appendix E, is an example of how Web designers can incorporate personalization features.

| # | Criteria | Characteristic | U | A | H | R |
|-----|-----------|--------------------------------------------------------------|---|---|---|-----|
| 1.2 | Type Size | Use 1.2em or 120% to 1.5em or 150% as the default type size. | ✓ | ✓ | | New |

Use 1.2em or 120% to 1.5em or 150% as the default type size. Current research shows that older adults need a minimum of 12 to 14 point type size (NIA/NLM, 2002), while people with low vision need a minimum of 16 to 18 point type size (Russell-minda et al., 2007). In the BCRI study, using a prototype with 1em (12 point type size) for

headings showed that fonts less than this size leads to reading difficulties (Leung et al., 2013). Further, as Web designers introduce serif typefaces, a minimum of 1.2em or greater is necessary.

Another gap in the current research is that it uses point type sizes and not relative type sizes. Relative type sizes are either expressed in em or percentages that give the user the freedom to change the size through the browser or through a site feature (criterion 16.1). Aside from the default type size of 1.2em to 1.5em, Web designers should also include type sizes that are less than 1.2em to accommodate users that want smaller fonts and greater screen real estate.

6.2.2 Colours

"[This Web site] is awful awful awful. The gray on the white, there is no way I can read that. Horrible." (P01)

| # | Criteria | Characteristic | U | A | H | R |
|-----|------------------------------------|-------------------------------------------------------------------------------------------------------------------|---|---|---|-----|
| 2.3 | Foreground and Background Contrast | Provide sufficient contrast between the foreground text and background colour, and avoid a pure white background. | | ✓ | | New |

The foreground text and background colour must have sufficient contrast to ensure the foreground text is legible. This criterion is similar, but slightly different from the current recommendation that suggests a high contrast between the foreground and background

(NIA/NLM, 2002), such as black text on a white background (Kurniawan & Zaphiris, 2005). The key difference here is “sufficient contrast” as opposed to “high contrast.” While high contrast is generally suitable for most people, it may not always be appropriate for everyone, such as people with dyslexia. Bradford explains that dyslexic Web users can be sensitive to the screen brightness caused by the high contrast that can make the text swirl or blur together (as cited in Rello, Kanvinde, & Baeza-Yates, 2012).

Web designers can determine if the foreground text and background colour combination is sufficient by using a colour contrast tool, which measures the contrast ratio. The Web Content Accessibility Guidelines (WCAG) 2.0 requires standard text to have a minimum contrast ratio of at least 4.5:1 to achieve Level AA compliance, and for large text a contrast ratio of 3:1 (W3C, 2008). For Level AAA compliance, standard text needs to have a contrast ratio of 7:1, and large text a contrast ratio of 4.5:1 (W3C, 2008).

Another recommendation is to provide users the ability to change the foreground text and background colours directly from the interface (criteria 16.1) with several preset combinations. An example of a preset combination is a background that is crème in colour, and

foreground text that is black, to provide dyslexic Web users sufficient colour contrast (Rello et al., 2012).

6.2.3 Content

"I rarely go [to the bottom]." (P09)

| # | Criteria | Characteristic | U | A | H | R |
|-----|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----|
| 3.5 | Important and Critical Content | Place content that needs immediate attention at the top of the page (e.g., error and warning messages, and important information). | ✓ | ✓ | | New |

Place content that needs immediate attention at the top of the page. Examples of such content include, but are not limited to, error messages, warning messages and important information. There are several reasons this design is necessary. First, the research at the BCRI found that both experienced and in-experienced users tend not to scroll, and as a result, they often do not go beyond the page fold (Leung et al., 2013). Second, many participants at the BCRI assumed the bottom contained relatively insignificant content, such as contact information and "about us" (Leung et al., 2013). Third, this design addresses a usable-accessibility interaction for screen reader users. When the message is at the top, the screen reader user can reach the message quicker because a screen reader reads the screen linearly from left to right, top to bottom, starting at the browser page title.

Normally, when an error occurs, the page often performs a full page refresh, meaning the screen reader's focus returns to the top of the page. (For a partial page refresh, where only the content refreshes, the Web designer needs to set the focus programmatically by placing the focus on the error message).

"I don't know why we are all so short on time that we have to use acronyms for everything. I don't know what happened that all of a sudden we are all pressed for time." (P01)

| # | Criteria | Characteristic | U | A | H | R |
|-----|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----|
| 3.6 | Acronyms and Abbreviations | Avoid acronyms and abbreviations. If the content contains acronyms and abbreviations, provide an easy way for users to learn the terms. | ✓ | | ✓ | New |

Avoid using acronyms and abbreviations if possible. Acronyms do not speed up reading, but rather slow it down. Half of the participants from the BCRI study did not know the meaning of FAQ (Frequently Asked Questions) (Leung et al., 2013), an acronym that many authors would consider well-known. If the content must contain acronyms provide an easy method for users to learn those terms without having them leave the site. One approach is to include a glossary of terms (NIA/NLM, 2002).

6.2.4 Navigation

"[Web sites are like] a maze of information." (P02)

| # | Criteria | Characteristic | U | A | H | R |
|-----|----------|------------------------------------------------|---|---|---|---|
| 7.1 | Homepage | Include an easy way to return to the homepage. | ✓ | | | 3 |

Make it easy for users to return to the homepage. Common strategies include adding a homepage button, menu item or hyperlink. Web designers also need to ensure the homepage control contains text and describes the interaction. Be cautious of using icons or image hyperlinks alone. In the BCRI study, participants did not use the logo at the top left page corner that contained a hyperlink to return home (Leung et al., 2013). The participants were simply unaware the logo was a hyperlink, unless they had prior learned experience about this. The reason is that, for the sake of aesthetic appeal, hyperlinks seldom include a bordered hyperlink indicator. And with the absence of such visual treatment and explicit labeling, participants simply looked past this feature and used the browser's back button to return home.

| # | Criteria | Characteristic | U | A | H | R |
|-----|----------------|---------------------------------------------------------------------------------------|---|---|---|-----|
| 7.7 | Dropdown Menus | Use dropdown menus with caution. All dropdown menus must use a button for activation. | ✓ | ✓ | | New |

Use dropdown menus with caution. The NIA/NLM checklist advises to

use dropdown menus in moderation (NIA/NLM, 2002), whereas the Research-Derived Web Design Checklist for Older Adults recommends to avoid them altogether (Kurniawan & Zaphiris, 2005). Dropdown menus have a tendency to hide the content from the user. Because of this inherent behaviour, Web designers need to decide carefully if the dropdown menu is a suitable control to use in the given context. An alternative control that Web designers should always consider first is radio buttons.

Another concern of dropdown menus is that these controls can trigger an action after the user makes a selection (e.g., page refresh), resulting in a usable-accessibility concern for screen reader users. When this happens, the focus often changes without the screen reader user knowing, and the user will be lost on the page. To prevent such behaviour from occurring, dropdown menus must use a button as the activating point.

Despite the challenges of dropdown menus, we should give Web designers the freedom to use this control because they do have its place in design. An example is a form that requires the user to pick one of the 50 states in the United States of America. In most designs it is not practical to list all 50 items using radio buttons that can decrease the screen real estate and increase scrolling which can be

problematic (criterion 10.1), whereas a dropdown menu can easily work for this scenario.

6.2.5 Search

"I never liked [advanced search] because I can't figure out what they want me to put in [the fields]." (P05)

| # | Criteria | Characteristic | U | A | H | R |
|-----|-------------------------|---------------------------------------------------------------|---|---|---|---|
| 8.1 | Multiple Search Methods | Provide multiple search methods to find the same information. | ✓ | | | 3 |

Provide multiple search methods for users to find the same information. The research at the BCRI found that participants liked to search for information in two ways (Leung et al., 2013). The first search method is through a search box. Users preferred a search box when they know exactly what they are looking for, and when they want to find something quickly. In addition, users preferred a simple search box (i.e., single textbox and search button) over an advanced search box (i.e., multiple textboxes and controls to filter the results). This is because users expect the simple search box to accept sentences and phrases, and consider spelling mistakes, criterion 8.2 (Kurniawan & Zaphiris, 2005).

The second search method is through an index search. An index search is similar to a site map (criterion 7.6) that allows users to see the type of content the site offers. Index search works particularly well for new users, or for users that want to explore the site (Leung et al., 2013). Creating an index search goes hand-in-hand with navigational design (criterion 7.2) that requires grouping information into meaningful categories (Kurniawan & Zaphiris, 2005).

6.2.6 Pop-up Windows and Tabs

"Well, yeah it was a little confusing, but then I forgot about these tabs until you reminded me." (P01)

| # | Criteria | Characteristic | U | A | H | R |
|-----|---------------------------------|--------------------------------------------------------|---|---|---|---|
| 9.1 | Pop-up Window and Tab Indicator | Inform the user that a pop-up window or tab will open. | ✓ | ✓ | | 3 |

Include an indicator to set prior expectations to inform the user a pop-up window or tab will open. In the BCRI study, several novice and intermediate participants were stuck and confused after they launched a new tab (Leung et al., 2013). The confusion stems in that opening a new tab is often a seamless visual transition from the original tab to the new tab. Once on the new tab, participants had difficulty navigating and returning home because the browser back button did not function, since new tabs (and windows) lack browsing history. As

participant 7 commented, *"Can I go back? [The back button] is not highlighted."* Adding to this problem, most users were unfamiliar with tabs and lack the knowledge on how to close them to return to the previous page. For this reason, Web designers should include a close button on all pop-up windows they control.

Also worth mentioning is criterion 9.2 that recommends to avoid multiple pop-up windows (Kurniawan & Zaphiris, 2005) or tabs. Using multiple windows or tabs will only increase the complexity of the application and create more user annoyance.

6.2.7 Cognitive

"As I get older I can't remember. My short term memory is not as good and I forget how to do things." (P05)

| # | Criteria | Characteristic | U | A | H | R |
|------|--------------------------|-------------------------------|---|---|---|-----|
| 13.1 | Standard web Conventions | Use standard Web conventions. | ✓ | ✓ | | New |

Use standard Web conventions that users are already familiar with. Breaking conventions increases the cognitive load, requiring users to relearn the task. This criterion draws from the most basic and important usability principle, namely consistency. A system that is consistent is more usable and learnable (Lidwell, Holden, & Butler,

2010). When elements are consistent, users use prior experience to understand the current context.

An example of a standard Web convention is styling hyperlinks. By convention, the browser automatically underlines hyperlinks, and the colour of non-visited hyperlinks is blue, while the colour of visited hyperlinks is purple. By sticking to this convention, users will have less confusion about which element is a hyperlink, and they can have a better understanding of the current state of the hyperlink.

| # | Criteria | Characteristic | U | A | H | R |
|------|---------------|-----------------------------------------------|---|---|---|-----|
| 13.4 | Complex Tasks | Separate complex tasks into simpler subtasks. | ✓ | | | New |

For complex tasks, guide the user through the task using a multistep form or through a wizard. A multistep form simplifies a complex task by grouping and creating subtasks using multiple pages. While the overall task may take longer to complete because of more pages, the individual tasks will be easier to accomplish because of fewer choices (Kurniawan & Zaphiris, 2005).

A multistep approach can also make online forms easier to use. In general, online forms have three main steps: input, review and confirm. In the *input* stage, the user completes the form. Next, the user moves to the *review* stage where they check the input before

submission, or return to the previous step to change the input. Finally, in the *confirm* stage, the user confirms the input by submitting it and the system provides the user a message about success of failure.

6.2.8 Trust and Credibility

"I look for reliable sites, especially anything to do with health." (P02)

| # | Criteria | Characteristic | U | A | H | R |
|------|----------------------------|---------------------------------------|---|---|---|-----|
| 15.1 | Last Modified Content Date | Include a last modified content date. | ✓ | | ✓ | New |

Include a last modified content date in a visible location, such as after the page title. The last modified content date shows how up-to-date the current content is which is particularly important for health-related content. In the BCRI study, several participants searched and asked for this date prior to reading the content (Leung et al., 2013). While including a last modified content date is relatively straightforward, Web designers need to be aware the last modified content date is different from the last modified site date. The last modified content date shows how up-to-date specific content is, whereas the last modified site date shows how up-to-date the overall Web site is.

| # | Criteria | Characteristic | U | A | H | R |
|------|------------------------------|--------------------------------------------------------------|---|---|---|---|
| 15.2 | Recognizable Names and Logos | Display recognizable names and logos in prominent locations. | ✓ | | ✓ | 3 |

Display recognizable names and logos in prominent screen locations to communicate trust. Many Web pages today display the name and logo at the top left page corner. This is an ideal location for English speaking sites because people (and screen readers) read from left to right. Nonetheless, this rule may apply differently in other languages and cultures, where the site layout is from right to left, and Web designers need to adjust accordingly. While placement is important, users must already be familiar with the name or logo, otherwise they will be hesitant to accept the content. This was experienced firsthand in the BCRI research. Several participants questioned the content from the site Health Gateway until they realized the content belonged to a reputable healthcare provider after seeing the Bridgepoint Health logo and the Canadian Working Group on HIV and Rehabilitation logo (Leung et al., 2013). This shows that a reputable name is especially important for sites that provide health information and services. When a name is not recognizable, Web designers should include the “about us” hyperlink at the top of the page in a visible location that users can easily find.

6.3 Final Checklist

This section presents the Inclusive Web Design Checklist in its entirety. The Inclusive Web Design Checklist comprises of 16 categories and 55 criteria. Accompanying this paper-based IWDC at the back of this

report on a disc is a Web-based version that provides further design advice and examples to support readers in understanding each principle. Web designers should use the IWDC as a starting point in design then include other Web guidelines and checklist like the Web Content Accessibility Guidelines that covers a comprehensive view of Web accessibility.

Inclusive Web Design Checklist (IWDC)

| Table Legend | |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| U | Usability |
| A | Accessibility |
| H | Health Site Specific |
| R | References |
| 1 | NIA/NLM Checklist |
| 2 | Research-Derived Web Design Guidelines for Older People |
| 3 | Digital Inclusion: Improving access to online health information for people with complex chronic conditions (Research at the Bridgepoint Collaboratory for Research and Innovation) |
| New | New Criterion |
| ✓ | Applies to |

1.0 - Text

| # | Criteria | Characteristic | U | A | H | R |
|-----|---------------|--------------------------------------------------------------------|---|---|---|-----|
| 1.1 | Typeface | Use sans serif or serif as the default typeface. | ✓ | ✓ | | New |
| 1.2 | Type Size | Use 1.2em or 120% to 1.5em or 150% as the default type size. | ✓ | ✓ | | New |
| 1.3 | Type Weight | Use medium (CSS 500) to bold (CSS 700) as the default type weight. | ✓ | ✓ | | 1,3 |
| 1.4 | Sentence Case | Use capital and lowercase letters in body text. | ✓ | | | 1,2 |
| 1.5 | Line Spacing | Add line spacing within paragraphs and between paragraphs. | ✓ | ✓ | | 1,2 |
| 1.6 | Justification | Left justify the body text. | ✓ | ✓ | | 1,2 |
| 1.7 | Headings | Reserve larger fonts, capital letters and italics for headings. | ✓ | ✓ | | 1,2 |

2.0 - Colours

| # | Criteria | Characteristic | U | A | H | R |
|-----|------------------------------------|-------------------------------------------------------------------------------------------------------------------|---|---|---|-----|
| 2.1 | Page Colours | Minimize the use of colours. Avoid coloured text for all content, except for black and white. | ✓ | ✓ | | 2 |
| 2.2 | Colour Combinations | Avoid certain colour combinations in close proximity, such as blue and green. | | ✓ | | 1,2 |
| 2.3 | Foreground and Background Contrast | Provide sufficient contrast between the foreground text and background colour, and avoid a pure white background. | | ✓ | | New |
| 2.4 | Patterned Background | Avoid a patterned background. | | ✓ | | 1 |

3.0 - Content

| # | Criteria | Characteristic | U | A | H | R |
|-----|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----|
| 3.1 | Style and Simplicity | Use clear, familiar and consistent language. | ✓ | | ✓ | 1,2 |
| 3.2 | Voice | Write in active voice. | ✓ | | | 1 |
| 3.3 | Organization | Keep content short and concise. | ✓ | | ✓ | 1,3 |
| 3.4 | Content Placement | Place content in prime locations (e.g., centre of the screen, above the page fold), and avoid unnecessary content (e.g., advertisements). | ✓ | | | 2,3 |
| 3.5 | Important and Critical Content | Place content that needs immediate attention at the top of the page (e.g., error and warning messages, and important information). | ✓ | ✓ | | New |
| 3.6 | Acronyms and Abbreviations | Avoid acronyms and abbreviations. If the content contains acronyms and abbreviations, provide an easy way for users to learn the terms. | ✓ | | ✓ | New |

4.0 - Hyperlinks

| # | Criteria | Characteristic | U | A | H | R |
|-----|----------------------|------------------------------------------------------------------------|---|---|---|-----|
| 4.1 | Hyperlink Text | Use descriptive and meaningful hyperlink text. | ✓ | ✓ | | 2,3 |
| 4.2 | Hyperlink Appearance | Use a different visual treatment for visited and unvisited hyperlinks. | ✓ | ✓ | | 2,3 |
| 4.3 | Hyperlink Behaviour | Make hyperlinks with the same text go to the same place. | ✓ | | | 2 |
| 4.4 | Hyperlink Group | Group a set of common hyperlinks using a HTML list. | | ✓ | | 2 |

5.0 - Images, Animations and Multimedia

| # | Criteria | Characteristic | U | A | H | R |
|-----|--------------------------|---------------------------------------------------------------------------------------------------------------------|---|---|---|-----|
| 5.1 | Images | Use images that are relevant to the content. | ✓ | | ✓ | 1,2 |
| 5.2 | Text Alternative | Include a text alternative for images. | | ✓ | | 2 |
| 5.3 | Icons | Include text with icons. | ✓ | | | 1 |
| 5.4 | Icon Images | Use simple and meaningful icon images. | ✓ | | ✓ | 2 |
| 5.5 | Animations | Use animations with caution. Avoid moving text. | ✓ | ✓ | | 2 |
| 5.6 | Video and Audio | Use short video and audio segments from 3 to 5 minutes to keep the user's interest and to reduce the download time. | | | ✓ | 1,3 |
| 5.7 | Captions and Transcripts | Add captions and transcripts to all video and audio content. | | ✓ | | 1 |

6.0 - Layout

| # | Criteria | Characteristic | U | A | H | R |
|-----|-------------|------------------------------------------|---|---|---|-----|
| 6.1 | Consistency | Use consistency throughout the Web site. | ✓ | ✓ | | 1,2 |

7.0 - Navigation

| # | Criteria | Characteristic | U | A | H | R |
|-----|---------------------|------------------------------------------------------------------------------------------------|---|---|---|-------|
| 7.1 | Homepage | Include an easy way to return to the homepage. | ✓ | | | 3 |
| 7.2 | Structure | Use a simple and clear navigational structure. Group information into meaningful categories. | ✓ | | ✓ | 1,2 |
| 7.3 | Navigational Labels | Use explicit step-by-step navigation with clear hyperlinks or buttons to show what comes next. | ✓ | | | 1 |
| 7.4 | Current Location | Indicate the current page location. | ✓ | | | 2,3 |
| 7.5 | Bold | Use bold as a navigational cue. | ✓ | | | 2 |
| 7.6 | Site Map | Include a site map to show the contents of the site. | ✓ | | | 1,2,3 |
| 7.7 | Dropdown Menus | Use dropdown menus with caution. All dropdown menus must use a button for activation. | ✓ | ✓ | | New |

8.0 - Search

| # | Criteria | Characteristic | U | A | H | R |
|-----|-------------------------|----------------------------------------------------------------|---|---|---|---|
| 8.1 | Multiple Search Methods | Provide multiple search methods to find the same information. | ✓ | | | 3 |
| 8.2 | Spelling | Ensure the search engine takes into account spelling mistakes. | ✓ | | | 2 |

9.0 - Pop-up Windows and Tabs

| # | Criteria | Characteristic | U | A | H | R |
|-----|---------------------------------|--------------------------------------------------------|---|---|---|---|
| 9.1 | Pop-up Window and Tab Indicator | Inform the user that a pop-up window or tab will open. | ✓ | ✓ | | 3 |
| 9.2 | Pop-up Windows | Avoid multiple pop-up windows. | ✓ | ✓ | | 2 |

10.0 - Scrolling

| # | Criteria | Characteristic | U | A | H | R |
|------|----------------|-----------------------------------------------------------------------------------------|---|---|---|-----|
| 10.1 | Scroll Bars | Avoid scroll bars if possible. | ✓ | | | 2,3 |
| 10.2 | Scrolling Text | Avoid text that automatically scrolls. For manual text scrolling, include scroll icons. | ✓ | ✓ | | 1 |

11.0 - Target Size and Feedback

| # | Criteria | Characteristic | U | A | H | R |
|------|-----------------|------------------------------------------|---|---|---|-----|
| 11.1 | Large Target | Create a large target area. | ✓ | ✓ | | 1,2 |
| 11.2 | Focus Indicator | Use a clear and visible focus indicator. | ✓ | ✓ | | 2,3 |

12.0 - Mouse Behaviour

| # | Criteria | Characteristic | U | A | H | R |
|------|--------------|----------------------------------------------------------------------|---|---|---|-----|
| 12.1 | Single Click | Ensure the user can perform functionality with a single mouse click. | ✓ | ✓ | | 1,2 |

13.0 - Cognitive

| # | Criteria | Characteristic | U | A | H | R |
|------|--------------------------|------------------------------------------------------------------------------------------------------|---|---|---|-----|
| 13.1 | Standard Web Conventions | Use standard Web conventions. | ✓ | ✓ | | New |
| 13.2 | Time-out Period | Give users sufficient time to read information and complete tasks. | | ✓ | | 2 |
| 13.3 | Recognition | Design for recognition rather than recall by providing fewer choices to decrease the cognitive load. | ✓ | | | 2 |
| 13.4 | Complex Tasks | Separate complex tasks into simpler subtasks. | ✓ | | | New |

14.0 - Help and Support

| # | Criteria | Characteristic | U | A | H | R |
|------|----------------|-----------------------------------------------------------------------------------------|---|---|---|-----|
| 14.1 | Contact | Provide a contact method for support, such as a telephone number, email or online form. | ✓ | | ✓ | 1,3 |
| 14.2 | Help Tutorials | Include help tutorials. | ✓ | | ✓ | 2,3 |
| 14.3 | Error Handling | Make error messages easy to understand and follow. | ✓ | ✓ | | 2 |

15.0 - Trust and Credibility

| # | Criteria | Characteristic | U | A | H | R |
|------|------------------------------|--------------------------------------------------------------|---|---|---|-----|
| 15.1 | Last Modified Content Date | Include a last modified content date. | ✓ | | ✓ | New |
| 15.2 | Recognizable Names and Logos | Display recognizable names and logos in prominent locations. | ✓ | | ✓ | 3 |

16.0 - Personalization

| # | Criteria | Characteristic | U | A | H | R |
|------|-------------------|--------------------------------------------------------------------------|---|---|---|-----|
| 16.1 | Interface Control | Give users the ability to change how information is presented on screen. | ✓ | ✓ | | 2,3 |

6.4 Summary

This chapter presented the Inclusive Web Design Checklist (IWDC). The IWDC contains 13 new criteria that are not present in current checklists, namely the NIA/NLM checklist and the Research-Derived Web Design Guidelines for Older Adults. Four of the criteria are from the BCRI study. Nine of the criteria are from further analysis of the BCRI study data and changes to specific criteria of current checklists to

better reflect inclusive design principles. The complete and final checklist comprises of 16 categories and 55 criteria.

The next chapter concludes this research paper and discusses about the limitations and future research opportunities.

7 Conclusion

7.1 Research and Design Summary

My research examined the Web design features that will provide a better Web experience to older adult Web users with complex chronic disease (CCD). As healthcare providers move more and more health information online, an initiative that supports the notion of self-management, the challenge is to ensure older adults living with CCD can continually access and use this information, especially since this user population often requires health information to self-manage their health. This challenge has prompted the construction of a checklist of inclusive Web design features that reflects on the abilities of older adults with CCD. This checklist will serve as a starting point for Web designers in the design of usable and accessible Web sites.

The design of the Inclusive Web Design Checklist consisted of the synthesis of two current checklists, the NIA/NLM checklist and the Research-Derived Web Design Guidelines for Older Adults, and findings from an empirical study on older adults with complex chronic disease at the Bridgepoint Collaboratory for Research and Innovation. This analysis led to introducing 13 new criteria that are not present in current checklists, and a complete and final checklist comprising of 16 categories and 55 criteria.

7.2 Contributions

From a health-related perspective, my research contributed to the Web design practices of health-related sites for older adults with complex chronic disease. This knowledge will guide Web designers in creating more usable and accessible Web sites to allow more people to access health information and services. This in turn will lead to better opportunities to improve the health and quality of life of individuals.

From a design perspective, my research introduced a new Web design checklist for Web designers. This checklist will allow the Web designer to better understand how the criterion aligns with usability, accessibility and health site specific outcomes, and where the Web designer needs to place greater emphasis in the design. Additionally, this checklist can save time for Web designers in researching accessible design solutions for older adults with CCD, an area of Web design that researchers and designers have yet to explore.

From an academic and industry-level perspective, my research adds new knowledge in Web design that targets older adults with complex chronic disease. This can be the beginning of more research to further validate, improve and expand on this knowledge.

Finally, from a "virtuous cycle of inclusion" (Treviranus, 2014) perspective, not only will the IWDC benefit health-related sites, but it

will also benefit all Web sites as the pervasiveness of the Web touches every industry and all aspects of our life.

7.3 Limitations and Implications for Future Research

There were some limitations to my study. First, the scope of the Inclusive Web Design Checklist only targeted the desktop Web platform. The popularity and growth of mobile devices, such as smartphones, presents a new opportunity to study how older adults with CCD access and use mobile technologies. This can result in expanding the IWDC, or creating a new Inclusive Mobile Design Checklist. Second, the IWDC originated from the synthesis of current checklists and findings from my research internship at the BCRI. More research to validate this work through an empirical study will further refine and strengthen the overall checklist. And third, my research did not touch on personalized health content. The BCRI study found that most participants preferred personalized content that affects their wellbeing, or that of a family member, than generalized content, such as health definitions (Leung et al., 2013). As participant 01 remarks, *"If I am going to use the site, I want to use it for what I am experiencing and not diabetes or lung disease. All the information is simplistic. Once you got what you got, you move on to something else."* This area of personalized content touches the notion of online community, where participants want to know what others face and

how it reflects their own experiences. While an online community is not a new idea, the ability of older adults with diverse abilities to access and use these communities is worth further investigation.

7.4 Final Remarks

The need for usable and accessible Web sites is essential in today's pervasive and ever growing digital environment. As people live longer, and older adult Web users turn to the Web, usable and accessible design can no longer be an afterthought, but a key component in design. The reality of a Web where everyone needs equal access is more real than ever. As reflected early on by Tim Berners-Lee, the inventor of the World Wide Web:

"The power of the Web is in its universality. Access by everyone regardless of [ability] is an essential aspect." (W3C, 1997)

8 Bibliography

- Arch, A. (2009). Web Accessibility for Older Users - Successes and Opportunities. In *Proceedings of the 2009 International Cross-Disciplinary Conference on Web Accessibility (W4A)* (pp. 1–6). ACM.
- Bayliss, E. a, Edwards, A. E., Steiner, J. F., & Main, D. S. (2008). Processes of care desired by elderly patients with multimorbidities. *Family Practice, 25*(4), 287–93. doi:10.1093/fampra/cmn040
- Becker, S. A. (2004). A study of web usability for older adults seeking online health resources. *ACM Transactions on Computer-Human Interaction, 11*(4), 387–406. doi:10.1145/1035575.1035578
- Boyd, C. M., & Fortin, M. (2010). Future of Multimorbidity Research: How Should Understanding of Multimorbidity Inform Health System Design? *Public Health Reviews, 32*(2), 451–474.
- Bridgepoint Health. (n.d.). What is Complex Chronic Disease? Retrieved December 06, 2013, from <http://bridgepoint.bluelemonmedia.com/aboutccd>
- British Standards Institute. (2005). British Standard 7000-6:2005. Design management systems - Managing inclusive design - Guide.

- Chadwick-Dias, A., Tedesco, D., & Tullis, T. (2004). Older Adults and Web Usability: Is Web Experience the Same as Web Expertise? In *CHI '04 Extended Abstracts on Human Factors in Computing Systems* (pp. 1391–1394). ACM.
- Clark, J. (2006). To Hell with WCAG 2. *A List Apart* 217. Retrieved December 17, 2013, from <http://alistapart.com/article/tohellwithwcag2>
- Czaja, S. J., & Lee, C. C. (2007). Information Technology and Older Adults. In A. Sears & J. A. Jacko (Eds.), *Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications* (2nd ed., pp. 777–792). CRC Press.
- Fox, S. (2004). *Older Americans and the Internet*. Retrieved from http://www.pewinternet.org/files/old-media/Files/Reports/2004/PIP_Seniors_Online_2004.pdf
- Fox, S., & Duggan, M. (2013). Health Online 2013. Pew Internet & American Life Project.
- Hanson, V. L. (2008). Age and Web Access: The Next Generation. In *Proceedings of the 2009 International Cross-Disciplinary Conference on Web Accessibility (W4A)* (Vol. 44, pp. 7–15). ACM.

- Hart, T. a., Chaparro, B. S., & Halcomb, C. G. (2008). Evaluating websites for older adults: adherence to "senior-friendly" guidelines and end-user performance. *Behaviour & Information Technology*, 27(3), 191–199. doi:10.1080/01449290600802031
- Health Council of Canada. (2012). *Self-management support for Canadians with chronic health conditions*. Retrieved from http://www.healthcouncilcanada.ca/rpt_det.php?id=372
- Henry, S. L. (2006). Understanding Web Accessibility. In C. Mills & M. Smith (Eds.), *Web accessibility: Web standards and regulatory compliance* (pp. 1–51). Apress.
- Henry, S. L. (2007). *Just ask: integrating accessibility throughout design*. Lulu.com.
- Hiltz, S. R., & Czaja, S. J. (2006). Introduction to the special issue on information systems for an aging society. *ACM Transactions on Computer-Human Interaction*, 13(3), 309–312.
- Human Resources and Skills Development Canada. (2013). 2175 Web Designers and Developers. Retrieved March 08, 2014, from <http://www30.rhdcc.gc.ca/CNP/English/NOC/2006/Profile.aspx?val=0&val1=2175>

ISO/IEC. (1998). 9241-14 Ergonomic requirements for office work with visual display terminals (VDTs) - Part 14 Menu dialogues.

Klipp, A. (2009a). *The Web Designer Job Description Handbook and Career Guide: The Complete Knowledge Guide you need to Start or Advance your career as Web Designer*. Emereo Publishing.

Klipp, A. (2009b). *The Web Developer Job Description Handbook and Career Guide: The Complete Knowledge Guide you need to Start or Advance your career as Web Developer*. Emereo Publishing.

Kurniawan, S., & Zaphiris, P. (2005). Research-derived web design guidelines for older people. In *Proceedings of the 7th international ACM SIGACCESS conference on Computers and accessibility* (pp. 129–135). ACM.

Leung, L., Punshon, A., & Crosskey, S. (2013). *Digital Inclusion: Improving access to online health information for people with complex chronic conditions*. Unpublished Report, Bridgepoint Collaboratory for Research and Innovation.

Lidwell, W., Holden, K., & Butler, J. (2010). *Universal Principles of Design: 125 Ways to Enhance Usability, Influence Perception, Increase Appeal, Make Better Design Decisions, and Tech Through Design [25 Additional Design Principles]*. Rockport publishers.

- Mercer, S. W., Smith, S. M., Wyke, S., O'Dowd, T., & Watt, G. C. M. (2009). Multimorbidity in primary care: developing the research agenda. *Family Practice, 26*(2), 79–80.
doi:10.1093/fampra/cmp020
- Ministry of Health and Long-Term Care. (2007). Preventing and Managing Chronic Disease : Ontario's Framework, (May).
- Morrell, R. W., Mayhorn, C. B., & Echt, K. V. (2004). Why Older Adults Use or Do Not Use the Internet. In *Gerotechnology: Research and practice in technology and aging* (pp. 70–80). Springer Publishing Company.
- Morris, A. (2007). E-literacy and the grey digital divide : a review with recommendations. *Journal of Information Literacy, 1*(3).
- Nardi, R., Giovanni, S., Iori, I., Mathieu, G., & Amatrian, R. C. (2007). Co-morbidity does not reflect complexity in internal medicine patients. *European Journal of Internal Medicine, 18*(5), 359–368.
- NIA/NLM. (2002). Making Your Web Site Senior Friendly: A Checklist. National Institute on Aging and National Library of Medicine. Retrieved from <http://www.nlm.nih.gov/pubs/checklist.pdf>

Ontario Medical Association. (2009). *Ontario Medical Association Policy On Chronic Disease Management*. Retrieved from <https://www.oma.org/Resources/Documents/2009ChronicDiseaseManagement.pdf>

Queen's Printer Ontario. (2013). Web Designers and Developers. Retrieved April 09, 2014, from http://www.tcu.gov.on.ca/eng/labourmarket/ojf/pdf/2175_e.pdf

Rello, L., Kanvinde, G., & Baeza-Yates, R. (2012). Layout guidelines for web text and a web service to improve accessibility for dyslexics. *Proceedings of the International Cross-Disciplinary Conference on Web Accessibility - W4A '12*, 1. doi:10.1145/2207016.2207048

Russell-minda, E., Jutai, J. W., Strong, J. G., Campbell, K. A., Gold, D., Pretty, L., & Wilmot, L. (2007). The Legibility of Typefaces for Readers with Low Vision : A Research Review, (July), 402–415.

Sainfort, F., Jacko, J., Edwards, P., & Booske, B. (2007). Human-Computer Interaction in Health Care. In A. Sears & J. Jacko (Eds.), *Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications* (pp. 661–678). CRC Press.

- Statistics Canada. (2006). Population with a Disability [Chart]. Retrieved from <http://www4.hrsdc.gc.ca/.3ndic.1t.4r@-eng.jsp?iid=40>
- Statistics Canada. (2013a). Canadians in Context - Aging Population Title. Retrieved December 15, 2013, from <http://www4.hrsdc.gc.ca/.3ndic.1t.4r@-eng.jsp?iid=33>
- Statistics Canada. (2013b). Disability in Canada: Initial findings from the Canadian Survey on Disability. Retrieved March 08, 2014, from <http://www.statcan.gc.ca/pub/89-654-x/89-654-x2013002-eng.htm>
- Stellefson, M., Chaney, B., Barry, A. E., Chavarria, E., Tennant, B., Walsh-Childers, K., ... Zagora, J. (2013). Web 2.0 chronic disease self-management for older adults: a systematic review. *Journal of Medical Internet Research, 15*(2), e35. doi:10.2196/jmir.2439
- Treviranus, J. (2014). Leveraging the Web as a Platform for Economic Inclusion. *Behavioral Sciences & the Law*.
- Treviranus, J., Stolarick, K., Denstedt, M., Fichten, C., & Ascunson, J. (n.d.). *Leveraging Inclusion and Diversity as Canada 's Digital Advantage*.

Tsasis, P., & Bains, J. (2008). Management of complex chronic disease: facing the challenges in the Canadian health-care system. *Health Services Management Research : An Official Journal of the Association of University Programs in Health Administration / HSMC, AUPHA*, 21(4), 228–35. doi:10.1258/hsmr.2008.008001

U.S. Bureau of Labor Statistics. (2014). How to Become a Web Developer. Retrieved March 08, 2014, from <http://www.bls.gov/ooh/computer-and-information-technology/web-developers.htm>

United Nations. (2012). Population Ageing and Development 2012. United Nations. Retrieved from http://www.un.org/en/development/desa/population/publications/pdf/ageing/2012PopAgeingandDev_WallChart.pdf

Van der Eijk, M., Faber, M. J., Aarts, J. W., Kremer, J. A., Munneke, M., & Bloem, B. R. (2013). Using Online Health Communities to Deliver Patient-Centered Care to People With Chronic Conditions. *Journal of Medical Internet Research*, 15(6). Retrieved from <http://www.jmir.org/2013/6/e115/>

Vancouver Island Health Authority. (n.d.). What is Chronic Disease?

Retrieved December 06, 2013, from

http://www.viha.ca/phc_cdm/cdm/what_is_chronic_disease.htm

W3C. (1997). World Wide Web Consortium Launches International Program Office for Web Accessibility Initiative. Retrieved February

02, 2014, from <http://www.w3.org/Press/IPO-announce>

W3C. (2008). Web Content Accessibility Guidelines (WCAG) 2.0.

Retrieved February 08, 2014, from

<http://www.w3.org/TR/WCAG20/>

WebAim. (n.d.). Fonts. Retrieved January 01, 2014, from

<http://webaim.org/techniques/fonts/>

World Health Organization. (n.d.). Chronic diseases. Retrieved

December 06, 2013, from

http://www.who.int/topics/chronic_diseases/en/

World Health Organization. (2010). Definition of an older or elderly person. Retrieved October 27, 2013, from

<http://www.who.int/healthinfo/survey/ageingdefnolder/en/index.html>

World Health Organization. (2011). *Global Health and Aging*. Retrieved from http://www.who.int/ageing/publications/global_health.pdf

Xie, B. (2008). Older Adults, Health Information, and the Internet, *15*(4), 44–46.

9 Appendix A – REB Approval Letter

This section includes my research ethics approval letter for the study *“Digital Inclusion: Improving access to online health information for people with complex chronic conditions”*, ethics number 2013-17. I conducted this study with two other graduate students in the Inclusive Design program from April 25, 2013 to October 25, 2013 as a research internship for the Mitacs-Accelerate Project at the Bridgepoint Collaboratory for Research and Innovation in Toronto, Ontario.



Research Ethics Board

May 15, 2013

Dear Jutta Treviranus,

RE: OCADU 110, "Digital Inclusion: Improving access to online health information for people with complex chronic conditions."

The OCAD University Research Ethics Board has reviewed the above-named submission. The protocol dated May 15, 2013 and the consent forms dated May 15, 2013 are approved for use for the next 12 months. If the study is expected to continue beyond the expiry date (May 14, 2014) you are responsible for ensuring the study receives re-approval. Your final approval number is **2013-17**.

Before proceeding with your project, compliance with other required University approvals/certifications, institutional requirements, or governmental authorizations may be required. It is your responsibility to ensure that the ethical guidelines and approvals of those facilities or institutions are obtained and filed with the OCAD U REB prior to the initiation of any research.

If, during the course of the research, there are any serious adverse events, changes in the approved protocol or consent form or any new information that must be considered with respect to the study, these should be brought to the immediate attention of the Board.

The REB must also be notified of the completion or termination of this study and a final report provided. The template is attached.

Best wishes for the successful completion of your project.

Yours sincerely,

A handwritten signature in cursive script, appearing to read "Tony Kerr".

Tony Kerr, Chair, OCAD U Research Ethics Board

OCAD U Research Ethics Board: rm 7520c, 205 Richmond Street W, Toronto, ON M5V 1V3
416.977.6000 x474



Research Ethics Board

August 1, 2013

Dear Jutta Treviranus,

RE: OCADU 110, "Digital Inclusion: Improving access to online health information for people with complex chronic conditions." **AMENDMENT**

The OCAD University Research Ethics Board has reviewed and approved the amendment regarding the revisions requested by Bridgepoint's Research Ethics Board concerning no videotaping of human participants. Your final approval number remains **2013-17**.

If, during the course of the research, there are any serious adverse events, changes in the approved protocol or consent form or any new information that must be considered with respect to the study, these should be brought to the immediate attention of the Board.

Best wishes for the successful completion of your project.

Yours sincerely,

A handwritten signature in cursive script, which appears to read "Tony Kerr".

Tony Kerr, Chair, OCAD U Research Ethics Board

OCAD U Research Ethics Board: rm 7520c, 205 Richmond Street W, Toronto, ON M5V 1V3
416.977.6000 x474



Research Ethics Board

September 24, 2013

Dear Jutta Treviranus,

RE: OCADU 110, "Digital Inclusion: Improving access to online health information for people with complex chronic conditions." AMENDMENT #2

The OCAD University Research Ethics Board has reviewed and approved the amendment regarding the change in venue for interviews. Your final approval number remains 2013-17.

If, during the course of the research, there are any serious adverse events, changes in the approved protocol or consent form or any new information that must be considered with respect to the study, these should be brought to the immediate attention of the Board.

Best wishes for the successful completion of your project.

Yours sincerely,

A handwritten signature in cursive script, appearing to read "Tony Kerr".

Tony Kerr, Chair, OCAD U Research Ethics Board

OCAD U Research Ethics Board: rm 7520c, 205 Richmond Street W, Toronto, ON M5V 1V3
416.977.6000 x474

10 Appendix B – The Responsibilities of Web Designers and Developers

The Human Resources and Skills Development Canada shows that Web designers and developers perform the following duties²:

- Consult with clients to develop and document Web site requirements
- Prepare mock-ups and storyboards
- Develop Web site architecture and determine hardware and software requirements
- Source, select and organize information for inclusion and design the appearance, layout and flow of the Web site
- Create and optimize content for the Web site using a variety of graphics, database, animation and other software
- Plan, design, write, modify, integrate and test Web-site related code
- May lead and co-ordinate multidisciplinary teams to develop Web site graphics, content, capacity and interactivity
- May research and evaluate a variety of interactive media software products

² Human Resources and Skills Development Canada. (2013). *2175 Web Designers and Developers*. Retrieved March 08, 2014, from <http://www30.rhdcc.gc.ca/CNP/English/NOC/2006/Profile.aspx?val=0&val1=2175>

11 Appendix C – Examples of School Curriculum

This section gives examples of school curriculum in Web design and development, and disability studies.

1. McMaster Centre for Continuing Education - Certificate in Web Design & Development ³

Core Courses:

- Animation for the Web
- Building a Website
- Building Interactivity on the Web
- Introduction to Web Graphics

Elective Courses:

- Advanced Photoshop & Design
- Building Database-Driven Websites
- Final Project (Independent Study)
- Web Entrepreneurship
- Web Writing & Visual Web Design
- XML

³ McMaster Centre for Continuing Education. (n.d.). *Certificate in Web Design & Development*. Retrieved March 16, 2014 from <http://www.mcmastercce.ca/web-design/certificate-in-web-design-development>

2. Sheridan - Web Design ⁴

Courses:

- Graphic Systems Studio 1
- Computer Graphics Technology 1
- Professional Topics 1: Career Options
- Design for Interactive Media
- Marketing for Web Designers
- Digital Typography
- Graphic Systems Studio 2
- Design for Interactive Media 2
- Professional Topics 2: Career Planning
- Independent Project

3. University of British Columbia - UBC Certificate in Multimedia and Web Development

Core Courses:

- Adobe Dreamweaver - Level 1
- Adobe Photoshop – Level 1
- Adobe Photoshop – Level 2
- Fundamentals of Multimedia Production

⁴ Sheridan. (n.d.). *Web Design*. Retrieved March 16, 2014 from <http://www.sheridancollege.ca/academics/programs-and-courses/web-design.aspx>

- HTML5 1: Fundamentals of Web Authoring
- Internet Technologies
- Programming Mechanics and Mindset
- Project Management for the Web
- Technical and Design Processes in Digital Media Development
- User Interface Design for the Web
- Writing for Multimedia and the Web

4. York University - Master of Arts in Critical Disability Studies ⁵

Core Courses:

- Disability Studies - An Overview
- Methodology
- Critical Disability Law
- MA Research Seminar
- MA Major Research Paper

⁵ York University. (n.d.). *Master of Arts in Critical Disability Studies*. Retrieved March 16, 2014 from <http://www.yorku.ca/gradcdis/index.html>

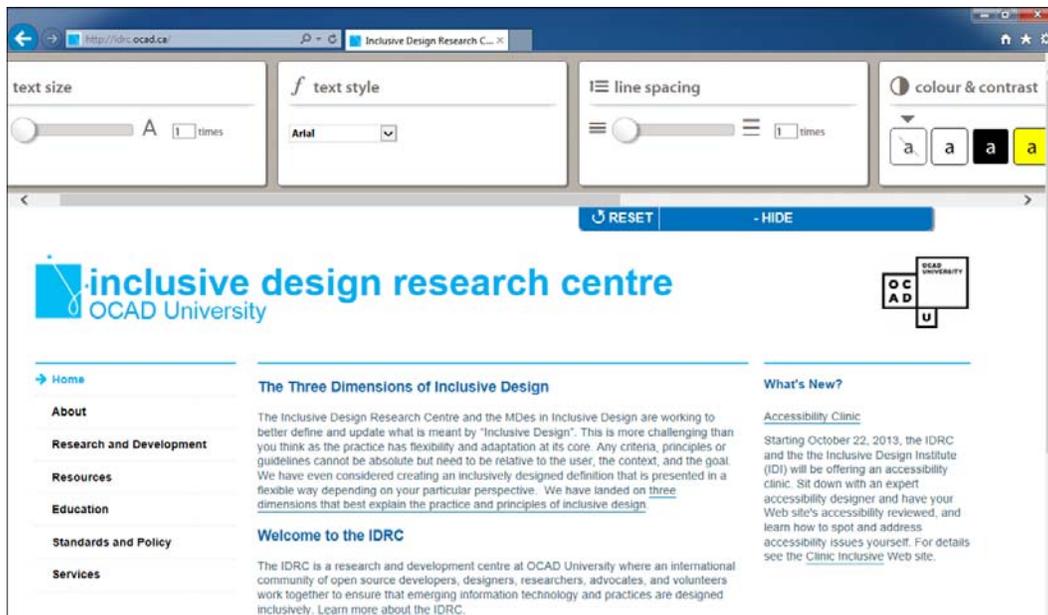
12 Appendix D – Demographic Details of the BCRI Study

The research at the Bridgepoint Collaboratory for Research and Innovation (Leung et al., 2013) had ten participants (n=10) with a median age of 59 (5=male; 5=female). There were 6 people (4=male; 2= female) living with one or more complex chronic disease (CCD) with a median age of 60.5. There were 4 caregivers (1=male; 3=female) with a median age of 57. Three participants with CCD had a visible disability. Through observation, 2 with CCD and 1 caregiver were novice computer users, 3 with CCD and 1 caregiver were intermediate computer users, and 1 with CCD and 2 caregivers were advanced computer users. Six participants took part in both usability tests. Two participants (1=caregiver; 1=person with CCD) were unable to complete the second usability test, so two new participants were recruited. A summary of the demographic details (Leung et al., 2013):

| Role | Sex | Age | Disability | Test | Skill Level |
|-------------|------------|------------|---------------------|-------------|--------------------|
| CCD | Female | 64 | Vision, Mobility | 1 & 2 | Novice |
| CCD | Female | ~80 | Mobility (Legs) | 1 | Intermediate |
| CCD | Male | 56 | | 1 & 2 | Advanced |
| CCD | Male | 59 | | 1 & 2 | Intermediate |
| CCD | Male | 62 | Mobility (Shoulder) | 1 & 2 | Novice |
| CCD | Male | 50 | | 2 | Intermediate |
| Caregiver | Female | 63 | | 1 & 2 | Novice |
| Caregiver | Female | ~55 | | 1 | Intermediate |
| Caregiver | Female | 53 | | 1 & 2 | Advanced |
| Caregiver | Male | 59 | | 2 | Advanced |

13 Appendix E – Fluid Infusion - User Interface Options

The image below shows an example of the Fluid Infusion - User Interface Options module on the Inclusive Design Research Centre homepage⁶. The user has the ability to personalize the interface by changing the text size, font type, line spacing, and foreground and background colours, among other settings.



⁶ Inclusive Design Research Centre. (n.d.). *Fluid Infusion - User Interface Options toolbar*. Retrieved March 16, 2014 from <http://idrc.ocad.ca/>