IMPLEMENTATION OF SCHOOL-BASED VISION SCREENING

A QUALITATIVE DESCRIPTION OF STAKEHOLDER PERCEPTIONS OF FACTORS INFLUENCING IMPLEMENTATION OF SCHOOL-BASED VISION SCREENING IN ONTARIO

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LAY ABSTRACT

In Canada, nearly 25% of school-aged children have vision problems. In 2018, the Ontario Ministry of Health and Long-Term Care passed a law requiring that all senior kindergarten students have their vision screened. This study used a qualitative descriptive approach to explore the perceptions of key informants regarding factors influencing implementation of school-based vision screening in Ontario, and the role of nurses in supporting implementation of this practice. The Consolidated Framework for Implementation Research was used to frame the analysis. The results of this study suggest that a comprehensive and coordinated approach is necessary when implementing school-based vision screening programs. Furthermore, participants reported that public health nurses' knowledge and skills, and their position within schools, communities, and the health system, facilitated vision screening implementation. Therefore, public health units are encouraged to strategically utilize public health nurses when implementing vision screening. Practice, policy, education, and future research implications are discussed.

Keywords: vision, screening, school, implementation, public health, nurse

ABSTRACT

In Canada, nearly 25% of school-aged children have vision problems. Common childhood vision disorders include amblyopia, refractive errors, and strabismus. Early identification and treatment of these disorders can prevent long-term vision loss and improve academic achievement. In 2018, the Ontario Ministry of Health and Long-Term Care legislated universal childhood vision screening of all senior kindergarten students. Although studies have explored the effectiveness of these interventions, few have explored the barriers and facilitators to program implementation. This study used a qualitative descriptive approach to examine the perceptions of key informants regarding the factors influencing the implementation of school-based vision screening in Ontario, and the role of nurses in supporting implementation. Semi-structured interviews were conducted with parents (n = 3), optometrists (n = 3), clinical research personnel (n = 2), public health staff (n = 5), school staff (n =2), and community vision program personnel (n = 2) from across Ontario. The Consolidated Framework for Implementation Research (CFIR) was used to frame the analysis. The following factors were found to influence vision screening implementation: (1) student and parent needs; (2) presence of external partnerships; (3) dedication of tangible resources; (4) presence of internal networks and communications; and (5) the cost, complexity, and perceived quality of the vision screening program. Participants reported that public health nurses' knowledge and skills, and their

position within schools, communities, and the health system, facilitated vision screening implementation. This study suggests that a comprehensive and coordinated approach is necessary when implementing school-based vision screening programs. Future research examining vision screening implementation should consider the use of the CFIR to guide all phases of the implementation process, and explore the experience and perspectives of vision screening implementation of students, non-English speaking families, and those who had experienced failed vision screening.

Keywords: vision, screening, school, implementation, public health, nurse

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TABLE OF CONTENTS

LIST OF TABLES

ABBREVIATIONS

AAO	American Academy of Ophthalmology
AAOPOS	American Association for Pediatric Ophthalmology and Strabismus
AOA	American Optometric Association
CAO	Canadian Association of Optometrists
CFIR	Consolidated Framework for Implementation Research
CHNC	Canadian Health Nurses of Canada
D	Diopter
HRQoL	Health Related Quality of Life
MOHLTC	Ministry of Health and Long-Term Care
OAO	Ontario Association of Optometrists
PHN	Public Health Nurse
PHO	Ontario Agency for Health Protection and Promotion (Public Health Ontario)
PHU	Public Health Unit
QoL	Quality of Life
SE	Spherical Equivalent
USPSTF	US Preventative Services Task Force
VA	Visual Acuity

DECLARATION OF ACADEMIC ACHIEVEMENT

I, Rachael Haalboom, declare this thesis to be my own work. I am the sole author of this document. No part of this work has been published or submitted for publication or for a higher degree at another institution.

To the best of my knowledge, the content of this document does not infringe on anyone's copyright.

My supervisor, Dr Ruta Valaitis, and the members of my supervisory committee, Dr Michelle Butt, Dr Daphne Maurer, and Dr Diana Sherifali have provided guidance and support at all stages of this project. I completed all of the research work.

CHAPTER ONE: INTRODUCTION

1. Introduction

Vision problems are a global issue with approximately 19 million children under 15 years of age having one or more vision disorders (World Health Organization [WHO], 2012). In Canada, nearly 25% of school-aged children have vision problems (Canadian Association of Optometrists [CAO], 2016). Common childhood vision disorders include amblyopia, refractive errors, and strabismus (Association for Pediatric Ophthalmology and Strabismus [AAPOS], 2016a). If undetected and untreated, these vision disorders can lead to life-long visual impairments (AAPOS, 2017). Poor eye health can also impact children's social relationships, literacy and academic achievement (Carlton, Karnon, Czosski-Murray, Smith & Marr, 2008a; Glewwe, West & Lee, 2018; Kulp & Schmidt, 1996; Kulp et al., 2016; Roch-Levcq, Brody, Thomas & Brown, 2007; Shankar, Evans & Bobier, 2007; Toledo et al., 2010). Early identification and treatment of these disorders can prevent long-term vision loss (AAPOS, 2017). Only 14% of Ontario children under six years of age access the government-funded comprehensive eye exams (CAO, 2016; Ontario Association of Optometrists [OAO], 2015). In an effort to promote visual health and identify those children that require further assessment, the Ontario government has added school-based childhood vision screening to the Ministry of Health and Long-Term

Care (2018a) Ontario Public Health Standards. As of August 2018, all Ontario Public Health Units (PHUs) are legislated to collaborate with schools and community partners to provide visual health supports and universal vision screening services for senior kindergarten students (MOHLTC, 2018b). These vision screening programs include: (1) coordination with schools; (2) pre-screen parent notification; (3) provision of vision screening with ministry-specified methods and tools; (4) post-screening notification and follow-up; and (5) visual health navigation to support awareness, access to and utilization of visual health services (MOHLTC, 2018b). Although studies have explored the effectiveness of these childhood vision screening programs, few have explored the factors influencing program implementation. An understanding of these factors will support government, PHUs, schools, and community vision screening programs to establish the structures and processes that facilitate program implementation, and address barriers that impede implementation. This knowledge may also help to ensure that quality programs are implemented and delivered, which may ultimately optimize visual health care for children.

2. Reflective Summary

Qualitative research recognizes the researcher as 'an instrument' and acknowledges the researcher's influence on the process of inquiry (Watt, 2007). The following reflective summary is a demonstration of how my 'self' as a public

health nurse (PHN) may have influenced my 'self' as a researcher, and the inquiry process.

As a PHN working in schools, I have supported numerous families in navigating the health system, and in accessing vision care and treatment for their child. Based on the presence or observations of key clinical indicators for poor vision, some of these students were identified by myself or school staff. I became concerned when I learned that most vision disorders are asymptomatic, and that many of the students sitting in the classrooms had undiagnosed vision disorders. I had listened to educators encourage parents to have their child assessed by an optometrist, but this conversation occurred only after the teacher had identified concerns related to academic performance. I began asking parents whether they had taken their child for a comprehensive eye exam and was surprised to learn that many caregivers were unaware of the need to have their child's eyes routinely checked. Several families reported barriers to accessing vision care and treatment for their child including the high cost of eyeglasses. The Canadian Community Health Nursing Discipline Specific Competencies (Community Health Nurses of Canada [CHNC], 2009) and the Ontario Public Health Standards of Practice (MOHLTC 2018a), guide PHNs to facilitate access and equity by addressing the social determinants of health. Therefore, my observations, experiences, and PHN role sparked my desire to study school-based vision screening and the role of the nurse in supporting its implementation. This academic research gave me the

opportunity to provide consultation to both the MOHLTC Child Visual Health and Vision Screening Protocol Working Group, and my PHU's vision screening workgroup.

My background as a PHN in the School Program within a PHU is important to recognize as it has influenced the collection, selection and interpretation of data (Finlay, 2002; Sword, 1999; Watt, 2007). As per the tenets of qualitative result, the results of this thesis are understood to be a co-created product, developed between the myself and the participants of this research study (Finlay, 2002). Throughout the study process, I reflected upon my influence and this reflexivity fostered a personal awareness of how I shaped the research, thereby supporting me to assure rigor and trustworthiness (Sword, 1999).

3. Purpose of the Thesis

The purpose of this thesis was to explore and describe the perceptions of parents, optometrists, clinical research personnel, public health and school staff, and community vision program personnel, about factors influencing the implementation of school-based vision screening in Ontario, and of the role of nurses in vision screening implementation using a qualitative descriptive approach (Sandelowski, 2000). Damschroder et al.'s (2009) Consolidated Framework for Implementation Research (CFIR) was used to guide the content analysis and the presentation of results in this study.

4. Implementation Framework

Damschroder et al.'s (2009) CFIR was used as the organizing framework for this study. According to Kirk et al.'s (2016) systematic review, the evidence-based domains and constructs of Damschroder et al.'s (2009) CFIR have been most widely applied in health settings to examine health-related intervention implementation. Therefore, the CFIR was deemed suitable for use in this study's analysis and as a method of presenting the study results as it provided a comprehensive, determinant framework that enabled identification and classification of factors that facilitated and impeded the implementation of vision screening programs in schools.

Damschroder et al.'s (2009) CFIR consists of five major domains: (1) intervention characteristics; (2) outer setting; (3) inner setting; (4) characteristics of individuals; and (5) process. Each domain includes associated constructs and subconstructs: (1) eight constructs are related to intervention characteristics; (2) four constructs are associated with the outer setting; (3) five constructs and nine subconstructs are related to the inner setting; (4) five constructs are associated with characteristics of individuals; and (5) four constructs and four sub-constructs are associated with process. See Appendix A for a full listing of the 39 constructs and subconstructs associated with each of Damschroder et al.'s (2009) CFIR domains.

5. Overview of Subsequent Chapters

Chapter Two provides background knowledge regarding common childhood vision disorders, and vision screening programs around the world. The chapter also includes a review of the literature examining the impact, effectiveness, and implementation of vision screening in schools, as well as the role of nurses in vision screening implementation. Chapter Three is a presentation of the qualitative descriptive approach used in this thesis and a presentation of the ethical considerations applied in this thesis. Chapter Four presents the content analysis of the factors influencing implementation of school-based vision screening using the Damschroder et al.'s (2009) CFIR to frame the analysis. Finally, Chapter Five is a discussion of the results and implications of the study findings, the strategies used to increase methodological rigor and trustworthiness, and of the strengths and limitations of Damschroder et al.'s (2009) CFIR and of this thesis study.

CHAPTER TWO: LITERATURE REVIEW

1. Introduction

This chapter begins with background information regarding common childhood vision disorders, their prevalence, risk factors, and an account of vision screening programs around the globe. Next, a review of the literature critically examining the current body of knowledge regarding the impact of childhood vision disorders, the effectiveness of childhood vision screening, implementation of school-based vision screening, and the role of nurses in vision screening is presented. An examination of the effectiveness of vision screening tools and tests was beyond the scope of this review. The chapter ends with a summary of the gaps in the literature.

2. Childhood Vision Disorders

Vision screening programs in Australia, New Zealand, Britain, Europe, South Korea, the United States, and Canada, screen for the following common childhood vision problems: amblyopia, refractive errors, strabismus; and reduced stereopsis (American Optometric Association [AOA], 2017; Jonas et al., 2017; PHO, 2016; Sloot et al., 2015). Comparisons between prevalence rates of childhood vision disorders among, and within, countries are difficult to make due to the use of different cut-off points for diagnosis. Drover, Kean, Courage and Adams (2008) collated Canadian prevalence estimates obtained from

epidemiology and vision screening studies conducted in Ontario, Saskatoon, New Brunswick, and British Columbia, and these values have been reported throughout the following section to demonstrate the frequency and significance of these childhood disorders.

2.1. Amblyopia. In normal vision, the brain and eyes work together to produce vision. Light focused on the retina results in retinal nerve cells triggering signals along the optic nerve to the brain. Amblyopia, sometimes called lazy eye, is the term used when the vision of one eye is decreased because it fails to work properly with the brain; although the eye itself appears normal, the brain favours the other eye (AAPOS, 2017). Any condition that prevents the eye from focusing clearly, or that prevents the two eyes from working together, can result in amblyopia, even after it is treated (National Eye Institute [NEI], 2013). The prevalence estimates of amblyopia of Canadian children range from 0.83% to 4.7% (Drover et al., 2008).

If left untreated, early childhood amblyopia usually persists into adulthood and is the most common cause of monocular visual impairment among adults (Jonas et al., 2017; NEI, 2013; Ontario Agency for Health Protection and Promotion (Public Health Ontario) [PHO], 2016). Vision screening includes tests for visual acuity (VA) and stereo acuity to directly test for the presence of amblyopia, as well as tests for other vision disorders that are risk factors for amblyopia (e.g., refractive error) (AOA, 2017). Treatment for amblyopia

involves correction of the underlying predisposing factor, usually eye misalignment and/or unequal refractive error. Once the underlying problem is addressed, the use of the weaker eye is encouraged by patching or pharmacological blurring of vision of the "good" eye (AAPOS, 2017). Treatment generally results in full recovery if treatment is not delayed (AAPOS, 2017). However, optimal timing of treatment remains under debate. Schmucker et al.'s (2010) systematic review comparing the effectiveness of early amblyopia treatment under two years of age, to later treatment deferred to three years or older, was unable to determine the age at which treatment for amblyopia or its risk factors is most effective, citing methodological weaknesses of available studies and a general lack of understanding of visual system development as reasons for the uncertainty. There is general agreement, however, that amblyopia treatment should begin before 5 to 7 years of age, as delays in treatment have been associated with poorer outcomes. Rahi, Logan, Timms, Russell-Eggitt and Taylor (2002) reported an approximate three-fold increase for vision impairment, and an estimated lifetime risk of vision loss in the non-amblyopic eye of at least 1.2% (95% CI: 1.1% - 1.4%).

2.2. Refractive errors. Refractive errors are one of the most prevalent vision disorders in developed countries and these increase children's risk for developing amblyopia (PHO, 2016). In normal vision, light passes through the lens of the eye and is focused onto the retina. Refractive errors occur when light

is no longer focused on the retina; in children refractive errors include: (a) myopia (i.e., nearsightedness); (b) hyperopia (i.e., farsightedness); and (c) astigmatism (AAPOS, 2016b). Photoscreening and autorefractors are used in vision screening to quickly detect refractive errors. Treatment for refractive errors is not always necessary as many children outgrow the condition, however, corrective lenses can be used to treat for those refractive errors that persist or are too large to outgrow (AAPOS, 2016b; Gwiazda, 2009).

2.2.1. Myopia. Myopia, or nearsightedness, occurs when light is focused in front of the retina, making objects at a distance appear blurry. Myopia may occur at any age, though the onset age is typically after 8 years, with the condition progressing through adolescence and finally stabilizing by the late teens to early twenties (AAPOS, 2016b). Canadian prevalence estimates of childhood myopia (< – 1.0 diopter [D]) range from 1.1% to 6.0% (Drover et al., 2008). Recently, Yang et al. (2016) conducted an observational study of students aged six to eight years living in Waterloo, Ontario, and reported a 6% prevalence of myopia (defined as SE ≤ – 0.50 D) that increased to 28.9% in children 11 to 13 years of age. These results indicate that prevalence of myopia may be increasing, lending further support to vision screening at younger ages. Some studies indicate variation in prevalence among different ethnic and racial groups. Ying et al. (2014) conducted a multicenter, multiphase, cross-sectional study of three to five-year-old children participating in the United States-based Vision in Preschoolers

(VIP) study and compared the prevalence of common childhood visual disorders among African-American, American Indian, Asian, Hispanic, and non-Hispanic White children. Wen et al. (2013) completed a population-based, cross-sectional study (Multi-Ethnic Pediatric Eye Disease Study [MEPEDS]) in California involving children aged six months to 6 years. The authors explored the prevalence of childhood vision disorders between genders, ages and ethnicities (i.e., Asian and non-Hispanic White children). Both the (2014) VIP Study and the (2013) MEPEDS found that prevalence of myopia (defined as SE > + 2.00 D in any meridian and SE ≤ –1.00 D respectively) varied with ethnicity. Ying et al.'s (2014) VIP Study reported the lowest rate of myopia in American Indians (0.2%) and the highest rate in Asians (1.9%). Wen et al.'s (2013) MEPEDS also reported higher prevalence in Asians (3.98%) and a lower prevalence in non-Hispanic White children (1.20%).

2.2.2. Hyperopia. Hyperopia, or farsightedness, is normal during childhood and occurs when light is focused behind the retina, causing images to appear blurry, especially objects that are closer (AAPOS, 2016b). Limited data is available regarding the prevalence of hyperopia among Canadian children. Woodruff's (1986) observational study of 10,464 children in New Brunswick reported the prevalence of hyperopia of 4.6% of children in Grade 1 (defined as SE ≥ +1.50 D), while Drover et al. (2008) reported a prevalence estimate of 4.8% (defined as SE > + 3.00 D for 2-5 years of age). Several studies report differences

in the frequency of hyperopia among ethnicities. Ying et al. (2014) reported the prevalence of hyperopia (defined as SE > 3.25 D) to be lowest in Asians (5.5%), and highest in non-Hispanic White children. Wen et al. (2013) found similar results, reporting the overall prevalence of hyperopia (defined as SE ≥ 2.0 D) to be highest among Hispanic children (26.9%), followed by non-Hispanic White children (25.65%), and lowest among Asian children (13.47%). Castagno, Fassa, Carret, Vilela, and Meucci (2014) conducted a high-quality meta-analysis of 40 cross-sectional studies examining the prevalence of hyperopia and its associated factors among school-aged children. Castagno et al.'s (2014) meta-analysis also reported that Caucasian children were more hyperopic than African-American, Black, and Asian children. Castagno et al. (2014) also found an association between hyperopia and age, with the prevalence of hyperopia decreasing as age increased. Significant differences in the prevalence of hyperopia among genders has also been cited. Wen et al. (2013) reported the prevalence of hyperopia among Asian girls (16.2%) was higher than that among Asian boys (10.8%) (p = 0.0002). Woodruff's (1986), study of children in New Brunswick, also reported that male children had a relative risk 1.2 times that of females of having a refractive error requiring correction. However, Castagno et al.'s (2014) meta-analysis reported most studies did not demonstrate a statistically significant association between hyperopia and gender. Correction of hyperopia is not always required as children are able to compensate using accommodation, and many

cases of hyperopia resolve without intervention; however, the condition remains a risk factor for amblyopia (AAPOS, 2016b).

2.2.3. Astigmatism. Astigmatism occurs when the cornea is curved asymmetrically, causing light rays to focus at several points in front and/or behind the retina, resulting in blurred vision for certain meridians, at all distances (AAPOS, 2016b). The prevalence of astigmatism is highest during infancy and childhood, and decreases with age. Children with myopia or hyperopia are more likely to have astigmatism (Wen et al., 2013). Prevalence estimates of Canadian children range from 3.1% to 7.2% (Drover et al., 2008). The prevalence of astigmatism also varies among ethnic and age groups. Wen et al. (2013) reported the overall prevalence of astigmatism to be highest among Asian children (8.29%%). Ying et al. (2014) reported the highest prevalence of astigmatism among Hispanic children of 11.1%; prevalence among Asians was the third highest (7.62%); and prevalence among American Indians was the lowest (4.28%). Wen et al. (2013) also reported a significant, decreasing trend by age in the prevalence of astigmatism in non-Hispanic White children and in Asian children. Treatment for astigmatism involves corrective lenses that have a greater strength in one direction of the lens than in the opposite direction (AAPOS, 2016b).

2.3. Strabismus. Strabismus is also a risk factor for amblyopia. Strabismus typically develops prior to age six and is characterized by

misalignment of the eyes that manifests as turning of one or both eyes outwards, upward or inwards, resulting in poor vision development in the affected eye(s) (AAPOS, 2018). When the eyes are oriented in different directions, two different visual images are received by the brain. To avoid double vision, the brain may ignore the image from the misaligned eye, resulting in poor vision development of that eye (i.e., amblyopia) (AAPOS, 2018). Photoscreening and autorefractors are used to detect strabismus during vision screening. Strabismus has not been shown to self-correct over time (AOA, 2017). Treatment for strabismus may include corrective lenses, eye exercises, prism, and/or or ocular muscle surgery (AAPOS, 2018). Early identification and treatment of strabismus in children may prevent amblyopia. Canadian prevalence estimates of strabismus range from 2.0% to 4.5% (Drover et al., 2008).

2.4. Reduced stereopsis. Stereopsis, or depth perception, results from the combination of the two slightly different images received by the brain from each eye. Stereopsis first appears at three to four months of age and continues to develop through the first two years of life (AOA, 2017). Stereopsis requires accurate alignment of the eyes and appropriate unification of the two images by the brain (AOA, 2017). Stereoacuity, a threshold measure of the acuteness of depth perception, indicates an individual's level of sensory binocularity, and reduced stereoacuity can be associated with vision disorders including amblyopia, significant refractive error, and strabismus (Ciner et al., 2014). Stereopsis testing

such as random-dot stereotesting is used in vision screening to detect reduced stereopsis and to indirectly test for other vision disorders (Ciner et al., 2014). Drover et al. (2008) reported a prevalence estimate of reduced stereoacuity and reduced VA of 0.7% among Newfoundland children (mean age 4.2 years, SD 1.1).

3. Risk Factors for Childhood Vision Disorders

Risk factors for vision problems include prematurity, small for gestational age, genetic predisposition (e.g., first-degree relative with amblyopia), neurodevelopmental delay, and maternal smoking, and drug or alcohol use during pregnancy (Cotter, Cyert, Miller & Graham, 2015). There is some evidence to suggest that differences in gender and ethnicity may influence prevalence of childhood vision impairments (Castagno et al., 2014; Wen et al., 2013; Woodruff, 1986; Ying et al., 2014); further research examining the origin of these differences is needed.

4. Childhood Vision Screening Programs

Vision screening is not a diagnostic procedure and cannot determine whether correction of a possible defect is indicated. Screening is useful, however, in separating those children who most likely do not have vision problems from those who require further assessment by an eye care professional (Wilson, Jungner & WHO, 1968). The following section describes vision screening programs in New Zealand, Australia, the U.K., Europe, South Korea, the US, and

Canada. A historical perspective of vision screening in Ontario is also presented to provide contextual background for the newly introduced MOHLTC (2018b) Child Visual Health and Vision Screening program.

4.1. New Zealand. The New Zealand Association of Optometrists (2019) recommends all children have two vision screenings between three and six years of age. New Zealand's National Vision and Hearing Screening Programme was developed as a component of the B4School Check, a universal early identification and intervention program that includes free hearing and vision checks for four-year-old children prior to school entry (Ministry of Health, 2014). The purpose of the B4School Check vision screening test is to identify children with amblyopia and VA impairments, and to refer these children for further testing and assessment (Ministry of Health, 2014). Vision screening is completed at early childhood education centers, schools, doctors' offices or community centers, and is conducted by certified Vision Hearing Technicians (VHT) or trained health practitioners who have met the training competencies (Ministry of Health, 2014). Follow-up to failed vision screens includes a referral to a community vision care provider and access to the Spectacle Subsidy, a ministry-funded eyeglass subsidy program for families in need of financial support (Ministry of Health, 2014). The New Zealand Ministry of Health requires that providers of the National Vision and Hearing Screening Programme meet the Ministry of Health requirements as specified in the National Service Specification and National Protocols, that

screeners use ministry-specified screening tools, and that vision screening results be recorded onto the national reporting database.

4.2. Australia. In 2008, the Centre for Community Child Health (CCCH) implemented a National Children's Vision Screening Project (NCVSP). This project resulted in an organized, national childhood vision screening program for children aged four. In an effort to decrease the wide variation in vision screening programs across the country, the CCCH NVCSP (2008) recommended that vision screening programs be conducted by trained nurses and orthoptists, provide referrals to community ophthalmologists, and incorporate follow-up programs to ensure compliance with evaluation and treatment. There is little evidence, however, to indicate that these recommendations have been implemented, and there is high heterogeneity amongst programs in terms of the type of program offered (i.e., private and federally-funded), the age of screening, screening personnel, and screening tests (PHO, 2016)

4.3. Europe. National and regional childhood vision screening programs are available in thirty-five European countries, with the latter found in Belgium, Bulgaria, Estonia, France, Romania, Spain and Switzerland (Sloot et al., 2015). Most vision screening programs in Europe are fully government-funded, though some are partially funded through private health insurance or municipal subsidy (Sloot et al., 2015). VA is tested at least once in all countries, however, the age of first VA test ranges from three to seven years, and most countries repeat testing as

children mature. Screening is conducted most often by ophthalmologists, nurses, and/or paediatricians using VA charts, and follow-up assessments for failed screens are generally completed by eye professionals, though some programs refer to general practitioners (Sloot et al., 2015).

4.3.1. Britain. Government-supported preschool vision screening programs were terminated in Britain in the late 1990's as a result of the National Health Service (NHS) (1997) Centre for Reviews and Dissemination report. This report recommended all screening programs be discontinued due to a lack of rigorous empirical evidence demonstrating the effectiveness of screening (Snowden & Stewart-Brown, 1997). The UK National Screening Committee (NSC) has since recognized the potential for vision screening programs to reduce long-term harm through the early detection of disease, and has since endorsed the development of a national vision screening program for all four to five-year-old children (Solebo, Cumberland, & Rahi, 2015). Despite these recommendations, vision screening programs are highly variable throughout Britain, and standard, well-established preschool vision testing programs exist only in certain regions of the country (PHO, 2016).

4.3.2. Sweden. A national, comprehensive childhood vision screening program was established in Sweden in 1981 to detect visual and ocular disorders (Kvarnström, Jakobsson & Lennerstrand, 2001). Nurses at Child Health Care Centers test monocular vision at four years of age using the HVOT-chart. School

nurses repeat VA testing at seven years of age using a line E-chart, and again at age 10, using the Monoyer's linear letters. Outcomes of vision test results are recorded in students' school health records (Kvarnström et al., 2001).

4.4. South Korea. An organized model of preschool vision screening was implemented in Seoul, South Korea in 2001 to detect various visual disorders in children aged three to five years of age (Lim et al., 2004). The first step of the universal screening program consists of a home screening: the VA test is performed by parents using a set of picture cards and a parent questionnaire (Lim et al., 2004). Children who fail first screening are re-tested with regular vision charts at regional public healthcare centers, and children with failed retests scores are referred to ophthalmologists for diagnosis and treatment (Lim et al., 2004).

4.5. United States. Vision screening recommendations released by the U.S. Preventive Services Task Force (USPSTF) recommend vision screening at least once in all children three to five years of age (Jonas et al., 2017). Current joint screening recommendations from the American Association for Pediatric Ophthalmology and Strabismus (AAPOS) and the American Academy of Ophthalmology (AAO), endorse community and school-based screening programs involving trained screeners, and as a result, the vast majority of American states require vision screening for school-aged children (Jonas et al., 2017). Several states have adopted school-based vision programs that include on-site vision screening, comprehensive eye exams and eyeglass dispensing, and

integrate students' vision test results with their school health records (Johnson, Majzoub, Lyons, Martirosyan, & Tattersall, 2016; Nelson & Rajan, 2018; Preslan & Novak, 1998).

4.6. Canada. Based on Robinson, Mairs, Glenny, and Stolee's (2012) evidence-based guidelines regarding the frequency of childhood eye exams, the Canadian Association of Optometrists (CAO) recommends that children have an eye examination between six and nine months of age, at least one comprehensive eye exam for children between the ages of two and five years, and annually from age six to nineteen years of age. Similarly, the OAO (2017) recommends that children have a complete eye exam at six months, then again prior to school entry, and annually after beginning school. Although the Canadian Pediatric Society (2016) recommends eye exams and VA testing conducted by primary care providers at well-child visits, the CAO (2014) advocates that comprehensive eye exams be conducted solely by optometrists or ophthalmologists. The CAO states that neither school-based vision screening programs, nor vision screening conducted by primary care practitioners, can be trusted to effectively identify vision disorders in young children due to false positive and false-negative screening results (CAO, 2014). The Canadian vision screening recommendations have been implemented in varied forms across the country. In Nunavut, Alberta, Saskatchewan and Quebec, opportunistic vision screening is provided by optometrists, primary care providers, and PHNs during routine well-child visits.

All other provinces have implemented organized, government-funded vision screening programs; these programs are highly variable with regards to their target age ranges, settings, modes of program delivery, screening personnel and qualifications, and funding and delivery models (PHO, 2016).

4.6.1. Ontario. In the late 1980's and 1990's, mandated public health vision and hearing programs existed throughout Ontario, and were included in the Ontario Mandatory Health Programs and Services Guidelines (MHPSG) (1989). These programs were omitted in subsequent versions of the public health standards (MHPSG, 1997; MOHLTC, 2008). In the absence of government-supported programs, ad-hoc vision screening programs located in schools, hospitals or community centers, have arisen throughout Ontario in an attempt to address the gap in service (PHO, 2016). These programs are highly heterogeneous in their approach, often targeting vulnerable populations and depending on grant funding and volunteer screeners. To mitigate this variability and adequately address visual health disparities, the MOHLTC introduced the Child Visual Health and Vision Screening Protocol (MOHLTC, 2018b) in August 2018. PHUs across the province are now mandated to ensure senior kindergarten students have access to school vision screening conducted by trained screeners, using ministry-specified tools and methods (MOHLTC, 2018b).

5. School-based Vision Screening: Impact, Effectiveness, Implementation and Nursing Role

5.1. Search methods. The search focused on finding published, peer-reviewed articles regarding: (1) the impact of childhood vision disorders; (2) the effectiveness of vision screening programs; (3) implementation of school-based vision screening; and (4) the role of nurses in supporting the implementation of school-based vision screening. The search strategy for the literature review involved combining electronic searches from CINAHL, Web of Science, ERIC, Google Scholar, MEDLINE, EMBASE, PubMed and the Cochrane Library databases, for relevant literature written in English, between 1980 and 2018 as the majority of the literature on visual screening was found during this time period. Searches of the reference lists of included studies and grey literature were also conducted. A combination of the following search terms was used: *preschool, child, vision, school, screening, amblyopia, refractive errors, strabismus, impact, effectiveness, reading, outcomes, public health, nurse.* Unpublished manuscripts, editorials, and dissertations were excluded from the literature review. Fifteen studies were included in this literature review: seven systematic reviews and eight primary studies. Critical appraisals of key primary studies and systematic reviews were completed using the appropriate CASP Appraisal Checklist (CASP UK, 2018); strengths and limitations of the studies are discussed as the literature is presented. Two systematic reviews (Carlton et al., 2008a; Carlton & Kaltenthaler,

2011) and eight primary studies (Kulp & Schmidt, 1996; Kulp et al., 2016; Glewwe, West, & Lee, 2018; Roch-Levecq, Brody, Thomas & Brown, 2008; Shankar, Evans, & Bobier, 2007; Simons & Gassler, 1988; Toledo et al., 2010; Wilson & Welch, 2013) that evaluated the impact of childhood vision disorders on social functioning, reading skills and academic achievement were reviewed. One systematic review (Jonas et al., 2017) and one systematic review of reviews (PHO, 2016) discussed the effectiveness of vision screening, while another systematic review (Carlton et al., 2008b) discussed the cost-effectiveness of vision screening. One systematic review was found examining the barriers and facilitators related to vision screening implementation (Nelson & Rajan, 2018). One systematic review was found that evaluated the impact of nurses in vision screening (Lineberry & Ickes, 2014).

5.2. Impact of childhood vision disorders. There is agreement in the literature that untreated childhood amblyopia is the leading cause of monocular blindness among adults in developed countries (Jonas et al., 2017; PHO, 2016). While there is some literature examining the impact of childhood vision disorders on psychological, social, and financial outcomes, there is substantial literature demonstrating the impact of these disorders on children's reading ability and educational outcomes. The following is a discussion of the literature review findings examining associations between childhood visual disorders and short- and long-term outcomes.

Carlton et al. (2008a) conducted a systematic review of the literature examining the impact of childhood amblyopia and strabismus on quality of life (QoL) in relation to the presence of the vision disorder and the impact of treatment. The authors' examined 12 quasi-experimental studies that included prospective and cohort designs: 10 studies examined the impact of amblyopia and its treatment on QoL and bullying, and two studies assessed the impact of strabismus on QoL (Carlton et al., 2008a). Measures used to assess the impact of the vision disorders on QoL included validated self-report questionnaires administered to: (1) parents of children who were diagnosed with either vision disorder, and/or who were undergoing treatment for either visual disorder; (2) children with amblyopia, and/or strabismus and/or who were undergoing treatment for either condition; and (3) adults who, as children, had amblyopia, and/or strabismus, and/or who had undergone treatment for either condition (Carlton et al., 2008a). The authors described conflicting findings in the literature that examined the impact of amblyopia on QoL. Some studies indicated that eyeglass wear and occlusion therapy were reported by children as factors that predisposed them to verbal and physical bullying (Carlton et al., 2008a). However, other literature indicated that children with amblyopia were no more likely to be bullied or have significant behaviour problems when compared to their peers, nor were they less likely to participate in social activities in either child- or adulthood (Carlton et al., 2008a). Only two articles related to the

psychological impact of childhood strabismus, therefore, the findings are limited. Satterfield, Keltner and Thomas (1993), indicated that adult subjects with a history of childhood strabismus reported strabismus negatively impacted self-image, friendships, and relationships with others, and Archer, Musch, Wren, Guire and Del Monte (2005) reported that surgical intervention for strabismus led to improvements in QoL (Carlton et al., 2008a). The small number of studies reviewed, and the use of retrospective data collection methods used to measure the impact of childhood vision disorders on QoL, limit the strength of Carlton et al.'s (2008a) systematic review. Longitudinal studies examining the psychosocial impacts of vision disorders as reported by children, using multiple validated data collection methods would foster an improved understanding of the psychosocial impacts of these disorders and lend strength to the findings.

Wilson and Welch's (2013) nested longitudinal observational study of 1,037 New Zealand children failed to find an association between amblyopia and poorer motor development, decreased self-esteem, or adult socioeconomic status (assessed by occupation, education, reading ability and income). The authors compared participants of a longitudinal study of health and behaviour in a single birth cohort born in Dunedin, New Zealand between April 1972 to March 1973 (Wilson & Welch, 2013). Follow-up checks, consisting of multiple comprehensive questionnaires and assessments involving psychological, visual health and educational testing, were done every two years beginning at age three

until fifteen, and subsequently at ages 18, 21, 26, and 32 years (Wilson & Welch, 2013). At ages three to fifteen years of age, visual measures were obtained from vision testing and vision questionnaires at follow-up checks. Wilson and Welch (2013) used two definitions for amblyopia, classic and modern, to address the lack of consensus of the exact definition of the condition. Within each definition, children were categorized into four groups: (1) no amblyopia (i.e., amblyopia never detected); (2) recovered amblyopia (i.e., amblyopia detected, treated and recovered); (3) amblyopia (i.e., amblyopia detected and not recovered); and (4) possible amblyopia (i.e., fluctuating VA and did not meet criteria for other categories) (Wilson & Welch, 2013). Associations of the four amblyopia groups were assessed with childhood motor ability, teenage self-esteem, and adult socioeconomic status. Childhood motor ability was measured using age-appropriate standardized motor skills assessments at 3, 5, 7, 9, and 11 years of age (i.e., Bayley Motor Scale, McCarthy Motor Scale, Basic Motor Ability Test, and motor assessments developed within the Dunedin Multidisciplinary Health and Development Study) (Wilson & Welch, 2013). Self-esteem was measured at ages 11 and 13 years using the Rosenberg Self-Esteem Scale (Wilson & Welch, 2013). Childhood socioeconomic status was measured using the average of the highest Elley-Irving socioeconomic status rating of either parent, and was repeatedly assessed between birth and age 15 years (Wilson & Welch, 2013). The authors measured adult socioeconomic status using: (1) participants' self-reported

occupational status at ages 21, 26, and 32 years; (2) participants' highest educational qualification obtained by 32 years; (3) reading ability using the Burt Word Reading Test scores at 11, 13, 15, and 18 years; and (4) pre-tax income at 26 and 32 years (Wilson & Welch, 2013). Data analyses adjusted for confounders such as sex, stereoacuity, and childhood and adult socioeconomic status for each of the two definitions of amblyopia (i.e., classic and modern). Results of the analyses failed to find associations with poorer motor development (classic: $F_{(3,911)} = 1.69$, $p = 0.17$; modern: $F_{(3,911)} = 1.47$, $p = 0.22$). Teenage self-esteem data were non-normally distributed therefore the authors compared the amblyopia groupings at the two ages: no differences were found at age 11 between the classic groupings at age 11 years ($\chi^2 = 3.91$, $p = 0.27$) or 13 years ($\chi^2 = 0.18$, $p = 0.98$); nor was there a difference found between the modern groupings at age 11 years ($\chi^2 = 2.2$, $p = 0.53$) or 13 years ($\chi^2 = 2.6$, $p = 0.5$) (Wilson & Welch, 2013). No association was found between participants with amblyopia and those without for either definition ($p > 0.1$), nor for highest educational qualification (classic: $\chi^2 = 7.28$, $p = 0.06$; modern: $\chi^2 = 6.31$, $p = 0.71$), nor reading ability (classic: $F_{(3,721)} = 0.17$, $p = 0.92$; modern: $F_{(3,721)} = 0.70$, $p = 0.55$ (Wilson & Welch, 2013). The authors did find an association between poorer stereoacuity and poorer childhood motor development (classic: $F_{(6,860)} = 2.37$, $p = 0.03$; modern: $F_{(6,860)} = 2.08$, $p = 0.05$) (Wilson & Welch, 2013). No significant effects were found for pre-tax income though no statistics were reported (Wilson & Welch (2013). Strengths of

the Wilson and Welch's (2013) study include its longitudinal design, large sample size, and analytical methods, however, a critical weakness of the study was the absence of standardized testing used to measure academic performance during follow-up checks as the authors conclusions were based solely upon participants' socioeconomic status at age 32 years.

Carlton and Kaltenthaler (2011) conducted a systematic review of 35 qualitative studies examining the impact of amblyopia and/or its treatments on individuals' QoL, measured as health related QoL (HRQoL). This systematic review included results from Carlton et al.'s (2008) systematic review of the literature examining the impact of amblyopia and its treatment on QoL. The HRQoL implications of amblyopia and/or its treatment were considered across four broad categories: (1) impact on family life; (2) social interactions; (3) impact on daily living activities, educational achievement, and career choice; and (4) feelings and behaviour. The majority of the studies reviewed reported HRQoL from a parental perspective (n = 22), some from adults who had amblyopia as a child (n = 9), one study provided both parents' and children's perspectives, and a few studies included results from solely the perspective of children (n = 3). Findings from Carlton & Kaltenthaler's (2011) systematic review reported that the main HRQoL implication of amblyopia was related to treatment of the condition rather than to the condition itself. The authors also reported that increased stress and anxiety for parents negatively impacted the relationship

between parents and children, and that bullying and teasing by siblings resulted in strained sibling relationships (Carlton & Kaltenthaler, 2011). Carlton and Kaltenthaler's (2011) systematic review also reported that low self-esteem, negative self-image, and feelings of depression, frustration, and embarrassment occurred as a result of amblyopia and/or its treatment. Although the authors stated that amblyopia had an impact on daily living activities, they did not discuss the details of this impact. The authors also reported a negative impact of amblyopia on educational achievement and career choice, however, the evidence was limited; one study indicated an absence of association between amblyopia and educational achievement, another reported a borderline significant effect of amblyopia on the completion of a university degree, and two others did not find a statistically significant association between amblyopia and occupational classification (Carlton & Kaltenthaler, 2011). Carlton and Kaltenthaler's (2011) systematic review was limited by the literature's use of proxy measures to determine the impact of amblyopia and/or treatment on HRQoL, the influence of confounding factors on HRQoL, and the potential for bias as a result of the data collection methods.

There are numerous studies demonstrating a correlation between childhood refractive errors and lower reading skills and academic achievement. Simons and Gassler (1988) conducted a meta-analysis of 34 studies examining the relation of visual disorders and reading skill. Analyses included the number of

independent effect sizes derived from each study, the pooled effect size, a Z test of the significance of the pooled effect size, and a homogeneity test for each of the vision disorders examined (Simons & Gassler, 1988). A positive pooled effect size indicated that the average poor reader exhibited the vision disorder more often than did the average good reader, and conversely, a negative pooled effect size indicated that the average good reader displayed the vision disorder more often than did the average poor reader (Simons & Gassler, 1988). Results of Simons and Gassler's (1988) meta-analysis indicated that some vision disorders are associated with reading skill, while others are not. Hyperopia was associated with below-average reading achievement in school-aged children ($Z = 4.66$ $p < 0.05$), whereas myopia was associated with average or above average reading ($Z = –2.67$, $p < 0.05$), and neither strabismus ($Z = 1.33$, $p > 0.05$), nor astigmatism were associated with reading skill (i.e., both hyperopic and myopic astigmatism exhibited non-statistically significant pooled effect sizes: $Z = 0.10$, $p > 0.05$ and $Z = – 0.95$, $p > 0.05$ respectively) (Simons & Gassler, 1988). The use of pooled effect sizes strengthened the findings from the meta-analysis, however, the authors cautioned that these did not indicate a causal relationship between vision anomalies and below average reading performance as the studies reviewed were correlational, therefore causation could not be inferred.

Kulp and Schmidt's (1996) single blind, observational study of Grade 1 students ($n = 91$) attending a middle-income, suburban elementary school in

Cleveland Ohio, examined the association between vision problems (i.e., VA, refractive error, and coordination) and reading ability. Standardized tests were used to assess: (1) vision and visual health using the Modified Clinical Technique (MCT); (2) reading ability using the Metropolitan Achievement Test 6 primer level (MAT6)); (3) academic performance level using stanines; and (4) intelligence using the Stanford Reading Test Complete Battery (Kulp & Schmidt, 1996). Results of Kulp and Schmidt's (1996) study indicated that failure on the MCT was significantly associated with decreased reading skill in five-year old children ($p = 0.0431$), and logistic analyses determined that decreased reading skill could be predicted with: (1) stereoacuity worse than 100 sec arc ($p = 0.0316$); (2) failure on the MCT plus stereoacuity worse than 50 sec arc ($p = 0.0316$); and (3) decreased accommodative facility ($p = 0.0155$), in children of average intelligence (Kulp & Schmidt, 1996). A limitation of this study was the small sample size however the study methods including the use of comprehensive vision exams to identify visual disorders, and the use of standardized and validated reading and intelligence testing, increased the strength of the findings.

Kulp et al.'s (2016) cross-sectional Vision in Preschoolers – Hyperopia in Preschoolers (VIP – HIP) study, of 492 four- and five-year-old children, compared early literacy of uncorrected hyperopic children ($n = 244$) with that of emmetropic (i.e., normal refractive condition of the eye) children ($n = 248$). Results indicated that preschoolers and kindergarteners with uncorrected

hyperopia (defined as ≥ 4.0 D) (– 6.8, $p < 0.01$) and those with hyperopia with binocular near VA of 20/40 or worse) (– 8.5, $p < 0.001$ for total score) or reduced near stereoacuity (240 seconds of arc or worse) (– 8.6, $p < 0.001$ for total score), performed significantly lower on the Test of Preschool Early Literacy (TOPEL) than did emmetropic children (Kulp et al., 2016). The large sample size and study methodology lend strength to this investigation, though findings may not be transferable to students in a higher socioeconomic status as a high percentage of the participants were from low SES families (Kulp et al., 2016).

Shankar et al. (2007) conducted a pilot study of thirty-two four to seven-year old children living in Oxford County, a rural community located in Southern Ontario. The pilot study compared emergent literacy skills in uncorrected hyperopic children ($n = 13$) with emmetropic children ($n = 19$). Literacy testing was completed one month after VA testing using four literacy skills tests: (1) letter and word recognition using the reading component of the standardized Wide Range Achievement Test (WRAT-III); (2) receptive vocabulary using the standardized Peabody Picture Vocabulary Test-III (PPVT); (3) phonological awareness using the standardized Rosner Test of Auditory Analysis (TAAS); and (4) emergent orthography using an experimental test - the Emergent Orthography test (Shankar et al., 2007). Visual cognitive testing was also conducted using two standardized tests: (1) visual motor skills was assessed using the Visual-Motor Integration (VMI 4th edition revised); and (2) visual perceptual skills were tested

using two subtests of the Test of Visual Perceptual Skills-Revised (TVPS-R) including the Visual Spatial Relations (TVPS-VSR) and the Visual Figure-Ground (TVPS-VFG) (Shankar et al., 2007). Results of Shankar et al.'s (2007) study indicated reduced performance on letter and word recognition tests (p = 0.049), receptive vocabulary ($F_{(1,30)} = 9.64$, $p = 0.004$), and emergent orthography ($F_{(1,29)} = 5.43$, $p = 0.03$) in the hyperopic children (≥ 2.00 D) compared to the emmetropic children (≤ 1.50 D). The groups did not differ in phonological awareness skills ($F_{(1,29)} = 0.39$, $p = 0.54$), and there were no statistically significant differences found between the two groups for visual motor integration ($F_{(1,30)} = 0.01$, $p = 0.92$), or for either of the two visual perceptual skills tests (TVPS-VSR skills: $F_{(1,30)} = 0.04$, $p = 0.85$, and TVPS-VFG ($F_{(1\text{-}30)} = 0.30$, p = 0.59 (Shankar et al., 2007). The small sample size of this study was a limitation, and findings may not be generalizable to children in urban communities. The authors suggested longitudinal studies comparing hyperopic children wearing eyeglasses to those who do not would further enhance their pilot's findings (Shankar et al., 2007).

Interestingly, Roch-Levecq et al. (2008) investigated whether spectacle correction improved the cognitive abilities of low-income preschoolers with uncorrected ametropia. Eye exams and baseline testing, using the Beery-Buktenica Developmental Test of Visual-Motor Integration (VMI) and the Wechsler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R)

performance scale, were completed on 70 children from 3 to 5 years of age (Roch-Levecq et al., 2008). Children with previously uncorrected ametropia (n = 35) were then provided corrective lenses, and six weeks after corrective lens wearing was completed, a second assessment was conducted with both the ametropic children and a control group (n = 35) (Roch-Levecq et al., 2008). The results of the study indicated that at baseline, the uncorrected ametropic children scored significantly lower on the VMI (p = 0.005) and on the WPPSI-R performance scale (p = 0.01). After six weeks of correction, Roch-Levecq et al. (2008) found the ametropic group significantly improved on the VMI compared to the emmetropic control group (p = 0.02). The ametropic group also improved on the WPPSI-R performance scale, however the change was not statistically significant (p = 0.17). Further research with a larger, more diverse socioeconomic sample, and over a longer period of time would strengthen these findings.

Toledo et al.'s (2010) cross-sectional study of Brazilian third graders (n = 220) found an association between low VA and poor academic performance. The authors reported that 25% of students with fair or poor academic performance also had low VA compared with students with only 10.5% of those with normal VA. The significance of these findings was diminished, however, by the outcome measure used for academic performance; the measure of students' academic performance was based on average grades on the last school year rather than validated standard test scores. Additionally, the authors did not account for

confounding variables such as cognitive deficits, or the influence of school and family environments.

Finally, a recent multi-armed randomized controlled trial was conducted by Glewwe et al. (2018) of fourth and fifth grade students (n = 15,422) in 76 elementary schools located in three districts located in central Florida. The authors compared the impact of two school-based vision screening models on student achievement scores as measured by the Florida Comprehensive Achievement Tests (FCATs) in reading and math: (1) screening-only; and (2) full treatment (i.e., received a comprehensive eye exam plus eyeglasses). Results of the study were impacted by three methodological errors that occurred in one of the three school districts in which the intervention was implemented. Firstly, during program implementation in District 1, parent notification letters of students in the screen-only group mistakenly indicated that free eyeglasses would be provided to their child. An automated phone message informed parents of the error, however the authors note that this message may have failed to reach most parents. Secondly, vision screening data for the screen-only group, including the number of students screened and the number of students who failed screening, were not recorded due to human error. Thirdly, students' screening results were misinterpreted at most of the full-treatment schools and some of the screen-only schools resulting in false negative and false positive outcomes (Glewwe et al., 20017). These three problems impacted the analysis and reporting of the study's

results, therefore, data analysis was done with, and without, District 1 data. In Districts 2 and 3, additional/enhanced screening alone was generally insufficient to improve students' test scores on the FCATs. However, providing free vision exams and free eyeglasses improved scores ($p = 0.05$). Glewwe et al. (2017) also reported that, when the sample was restricted to Districts 2 and 3, students in the full-treatment schools were approximately 2.6 percentage points ($p < 0.01$) more likely to pass the reading test, and 3.6 percentage points ($p < 0.01$) more likely to pass the math test. However, the authors also noted that the effects of the full intervention appeared to fade out quickly from the first to the second year (Glewwe et al., 2017). The lack of control group, methodological errors, and estimates of large spillover effects of the full intervention onto students without vision problems, warrant further research to confirm these findings. Future research that includes sampling of students from a variety of socioeconomic groups could explore why the effects of the full intervention appeared to fade out quickly from the first to the second year, and may help to determine if the authors' findings can be generalized to other student populations.

Though there is limited literature demonstrating a negative association between some vision disorders and psychosocial and financial outcomes, there is evidence in the published literature indicating the negative relationship between refractive errors and reading skills and academic achievement in both preschoolers and school-aged children. These findings are important as they

demonstrate the value of early identification and treatment of childhood vision disorders, thereby legitimizing governmental and municipal policy-makers' decision to implement vision screening in schools.

5.3. Effectiveness of childhood vision screening programs. Wide variation exists among vision screening programs regarding populations screened, screening methods and measures, and availability of data. This heterogeneity has made rigorous analyses of these programs difficult and has limited researchers' abilities to draw definitive conclusions. As such, there is inconclusive evidence regarding the effectiveness of vision screening programs. PHO's (2016) moderate-quality systematic review of reviews examined seven systematic reviews of the literature regarding the effectiveness of vision screening in children aged one to six years. Effectiveness was defined as decreased prevalence of vision disorders, improved treatment outcomes, cost-effectiveness, post-amblyopia treatment outcomes, and accuracy of screening tools in detecting visual disorders. Findings from PHO's (2016) review indicated that there is some weak evidence demonstrating lower prevalence of amblyopia of children who received preschool vision screening compared to those who received no screening prior to school entry. The authors also reported decreased prevalence of amblyopia in preschool children with increased frequency of screening, although these outcomes were not always statistically significant (PHO, 2016). Treatment outcomes were also reported to have improved in preschoolers and school-aged

children who received intensive screening compared to less frequently screened children; however high heterogeneity among programs limited these findings (PHO, 2016). Strengths of PHO's (2016) review of systematic reviews included its methodological strengths such as the appropriateness of the literature reviewed and quality appraisals of included studies, however, limitations included the absence of a discussion regarding the precision of findings and the potential for publication bias.

In 2017, the U.S. Preventative Services Task Force (USPSTF) commissioned a systematic review examining childhood vision screening for children ages six months to five year including the benefits, accuracy, and harms of screening, the benefits and harms of treatment. The resulting high-quality systematic review conducted by Jonas et al. (2017) was strong in its methodology as the authors conducted quality assessments of the studies reviewed, and reported consistency of results between studies, precision of studies' findings, and presented the risk of reporting bias for the studies reviewed. Forty studies were examined comprised of RCTs, prospective cohort studies with an eligible comparator, controlled cohort studies, cross-sectional studies, and case-control studies (Jonas et al., 2017). The majority of the literature reviewed by Jonas et al. (2017) evaluated diagnostic test accuracy (n = 34), and provided information on the harms of screening (n = 17), while a few studies examined the effectiveness of screening (n = 2), reported benefits of treatment (n = 3), and described harms of

treatment (n = 3). All included studies that evaluated the effectiveness of screening or treatment reported VA outcomes; none assessed school performance, functioning, or quality of life (Jonas et al., 2017). While the results of Jonas et al.'s (2017) high-quality systematic review indicated a lack of direct evidence that screening in preschool-age children is better than no screening, the authors did find limited evidence indicating a reduction in bullying with vision screening, as well as evidence supporting: (1) the accuracy of multiple screening tests for identifying preschool-aged children at higher risk for amblyopia risk factors or other visual disorders; and (2) the effectiveness of some treatments for improving VA outcomes, albeit improvements were small.

The cost-benefit of childhood vision screening may be useful for government and municipal policy-makers when making decisions regarding implementation of vision screening programs. There is limited evidence, however, demonstrating the cost effectiveness of vision screening programs. In addition to their (2008a) systematic review examining the impact of amblyopia and strabismus on QoL, Carlton et al. (2008b) also conducted a systematic review examining the prevalence of amblyopia and strabismus, screening methods used for detection of the two conditions, and the effectiveness of treatment options for amblyopia and strabismus. The authors then used the data derived from these two systematic reviews to develop a decision-analytic model to estimate the cost-effectiveness of screening for amblyopia and strabismus in children up to the age

of four to five years (Carlton et al., 2008b). Carlton et al.'s (2008b) economic analysis demonstrated that, although cases of amblyopia could be prevented at a low absolute cost through childhood vision screening at three or four years of age, the estimated cost per quality-adjusted life year gained was not cost-effective unless there was unilateral vision loss (Carlton et al., 2008b). The authors cautioned, however, that the evidence of such an effect was limited, and that the utility effect would likely be minimal, though small utility decrements from bullying would improve the cost-effectiveness of early screening significantly (Carlton et al., 2008b). Future research using the utility effects of bullying to inform the economic analysis are suggested using a prospective study design.

5.3. Implementation of vision screening programs. The literature examining how best to implement vision screening programs in schools is limited. Only Nelson and Rajan's (2018) low-quality systematic review of the literature examining the implementation of school-based vision, hearing, and oral screenings was found. The review was limited to US-based research and included 22 peer-reviewed journal articles related to vision screening that included both quantitative and qualitative study designs and focused on preschool or elementary-aged children (Nelson & Rajan, 2018). Findings from Nelson and Rajan's (2018) systematic review indicated several barriers to vision screening for both schools and parents including: (1) logistical issues; (2) ideological barriers; and (3) persistent ambiguity regarding screening standards and best practices for

screening protocols and techniques. For schools, logistical issues included time, space, effective staffing, adequate training, experience working with children, cultural competence and language abilities (Nelson & Rajan, 2018). Logistical barriers for parents included time, cost, transportation, availability of providers, healthcare system navigation, and availability of insurance (Nelson & Rajan, 2018). Nelson and Rajan (2018) also noted that parents' lack of understanding regarding the benefits of early intervention and of the long-term impact of vision disorders, acted as barriers to vision screening, and indicated a need for screening-relevant parent education and improved parent notification of screening results. The literature emphasized the use of low-literacy materials, available in multiple languages, and the importance of employing multi-lingual and/or culturally competent staff when working with non-English speaking families (Nelson & Rajan, 2018). The absence of consistent state-wide screening recommendations, protocols, and best practices regarding screening tools was noted as a systems-level barrier to vision screening implementation (Nelson & Rajan, 2018). Facilitators to successful screenings included: (1) collaboration between school staff to minimize school and classroom disruptions; (2) parent support from trusted school staff to navigate the healthcare system and access resources for follow-up care; and (3) teacher engagement to enhance students' adherence to the vision treatment plan (Nelson & Rajan, 2018). The main weakness of this systematic review was its lack of methodological rigor: the authors did not

perform quality appraisals of the literature reviewed, nor did they discuss the precision of results or the risk for publication bias. Further, the authors examined research conducted solely in the United States; findings are therefore limited to the United States and may not be transferable to the Canadian context due to differences in health care coverage between the two countries.

5.4. Role of nurses in vision screening. The literature indicates that nurses are involved in vision screening programs throughout the world including Australia, Europe, the US, Britain and Canada (CCCH NVCSP, 2008; Kvarnström et al., 2001; PHO, 2016; Sloot et al., 2015, Solebo et al., 2015). The literature indicates that nurses are well-positioned to facilitate the implementation of vision screening in schools. School nurses support vision screening programs in various ways: they conduct vision testing, provide visual health promotion and vision screening resources, and support children and families to navigate visual health services and access follow-up care (Chu, Huang, Barnhardt & Chen, 2015; Johnson et al., 2016; Kimel, 2006; Kvarnström et al., 2001; Nelson & Rajan, 2018; PHO, 2016; Sloot et al., 2015, Solebo et al., 2015). However, only one low-quality systematic review was found that assessed the impact of nurses' activities on vision screening. Lineberry and Ickes' (2014) systematic review of the literature reviewed thirty descriptive and quasi-experimental studies' findings regarding the effects of school nurses in American elementary schools on outcomes including health screenings, health knowledge, academic achievement,

school staff and parent satisfaction, and administrator time savings. The authors categorized school nurses' activities into four themes: (1) health promotion and disease prevention; (2) triage and treatment of acute health issues; (3) management of chronic conditions; and (4) psychosocial support (Lineberry & Ickes, 2014). The authors noted a general absence of rigorous methodology among the studies reviewed, however, the literature did indicate that school nurses effectively identified abnormal vision screening results, completed student referrals to follow-up care, and collaborated successfully with eye care professionals to ensure students received recommended services (Lineberry & Ickes, 2014). This systematic review had several methodological limitations: (1) only one researcher conducted the literature search and extracted all data; (2) the search strategy relied on studies published in four databases and did not include follow-up from reference lists; (3) the authors did not discuss the potential for publication bias; and (4) the literature focused on research of American elementary school nurses. These limitations weaken the findings of Lineberry and Ickes' (2014) systematic review and the authors' findings may not be generalizable to other countries and populations with different educational and health care systems due to the restrictive study inclusion criteria.

Despite the limitations of Lineberry and Ickes' (2014) systematic review, the authors' findings offer some understanding of the role and impact of school nurses on the implementation of school-based vision screening and visual health

promotion. The knowledge and skills possessed by school nurses support their involvement in school-based vision screening implementation. Further empirical evidence demonstrating the role and impact of these nurses in school-based vision screening implementation is needed.

6. Conclusion

While there is limited evidence indicating an association between vision disorders and psychosocial and financial outcomes, there is evidence demonstrating the negative association of childhood vision disorders with literacy and academic achievement. This evidence lends support for the introduction of childhood vision screening in schools to address visual health disparities and prevent harm. The heterogeneity of vision screening programs has resulted in an absence of high-quality evidence demonstrating efficacy of vision screening programs. However, the lack of robust evidence supporting these programs does not indicate that they are ineffective; rather further rigorous examination of these programs is required. Literature examining the barriers and facilitators to vision screening implementation in schools is limited, and research regarding nurses' roles in vision screening implementation is sparse. Expanding on the evidence of these factors would be useful to the MOHLTC, PHUs, schools, and community vision screening programs in Ontario to assist them in establishing structures and processes necessary to facilitate implementation of vision screening in schools.

Improved implementation may lead to better access to optometry care and treatment, and ultimately, to improved visual outcomes.

CHAPTER THREE: METHODOLOGY

1. Rationale for Qualitative Descriptive Approach

A qualitative descriptive approach was used to examine the factors that influence implementation of school-based vision screening, and the role of nurses in the implementation of these programs. This thesis study aimed to describe the perceptions of stakeholders of factors influencing school-based vision screening based on their previous experiences. Therefore, the purpose of this thesis aligned with the function of qualitative description as defined by Sandelowski (2000): qualitative description is a useful approach when low-inference, straightforward descriptions are sought by the researcher. Consequently, the study methodology was aligned with Neergaard, Olesen, Anderson and Sondergaard's (2009) description of qualitative descriptive methods and included: (1) maximum variation sampling; (2) open-ended interviews with individuals and focus groups; (3) content analysis that remained close to the data; and (4) straightforward descriptions of data presented in language similar to that of the participants' language.

2. Research Questions

This qualitative research study asked: What do parents, optometrists, clinical research personnel, public health and school staff, and community vision program personnel in Ontario perceive to be: (1) the factors influencing the

implementation of school-based vision screening, and (2) the role of nurses in supporting implementation of vision screening programs?

3. Methodology

3.1. Sampling procedures. Purposive sampling targeting a broad cross-section of stakeholders with varied knowledge of, and experience with, vision screening was completed to obtain a comprehensive perspective of the factors that influence implementation of vision screening programs in schools. As indicated by Sandelowski (1995), maximum variation sampling was used as a strategy to obtain a wide variety of perspectives and experiences from a small number of participants. Demographic variation of participant characteristics was sought to explore individuals' experiences of vision screening. Participant characteristics varied according to: (1) the geographic settings in which they had experienced vision screening (i.e., urban vs rural); (2) poverty or vulnerability levels of the communities in which they had experienced vision screening (i.e., high vs low); (3) profession (i.e., optometrist, clinical researchers, public health staff, school staff, and community vision program personnel); (4) role (i.e., frontline, researcher, manager/supervisor/coordinator, or independent practitioner); and (5) years of experience in vision screening (i.e., less than 1 year, 1 to 5 years, more than 5 years).

3.2. Sample size. In total, 28 individuals were contacted by the researcher about this study and 18 consenting participants were interviewed. The

sample size was determined by the limited time and resources available for this thesis study. The sampling and data collection methods promoted the acquisition of a broad range of perspectives, from a wide variety, but limited number, of stakeholders.

4. Data Collection Procedures

4.1. Participant recruitment. Once ethics approval had been obtained, recruitment began of professionals known to the researcher through professional contacts, as well as individuals whose names and contact information were found on websites or in publicly-available vision screening program reports. These contacts included personnel from community agencies, public health unit staff, and optometrists, all of whom were involved in the implementation of school-based vision programs in Ontario. Clinical research personnel involved in the provision of vision programs throughout Ontario were also contacted. The researcher contacted key informants by telephone, explained the study, then emailed the Letter of Information/Consent to those who expressed interest in participating in the study (see Appendix D for the Telephone/Email Recruitment Script for Providers and Appendix E for the Letter of Information/Consent for Providers). Interested individuals were instructed to contact the researcher to schedule an interview.

Sampling of parents was done solely through snowball sampling whereby willing study participants shared the study information with personal or

professional contacts who were parents of children who had completed vision screening in schools. The researcher emailed a recruitment script and the appropriate Letter of Information/Consent to key informants who were willing to share these documents with parents (see Appendix F for the Email Recruitment Script for Providers Sent on Behalf of the Researcher by the Holder of the Participants' Contact Info). Parents then contacted the researcher directly to schedule an interview.

The researcher recruited school staff by contacting individuals suggested by key informants, and through the researcher's professional contacts. The researcher emailed the Letter of Information/Consent for Providers to receptive individuals and those individuals interested in participating in the study contacted the researcher directly to schedule an interview.

The researcher reviewed the Letter of Information/Consent with all potential participants prior to scheduling an individual face-to-face or telephone interview. When two or more participants with similar roles were available, a focus group session was offered and consenting participants were scheduled for a face-to-face focus group. Consenting participants were asked to scan and return the completed consent forms directly to the researcher using a secured email server. For participants who did not have access to a fax machine or secure email server, verbal consent was obtained and logged on the Oral Consent Log (see Appendix G for the Oral Consent Log).

4.2. Semi-structured interviews. In accordance with the qualitative descriptive approach, participants' perceptions were collected during semi-structured interviews using open-ended questions and probes (see Appendix H for the Interview Guide for Providers, Appendix I that includes the Interview Guide for Parents, and Appendix J for the Focus Group Interview Guide). These interviews lasted between 45 minutes to 1 hour in length. Focus group participants were asked to complete the Focus Group Background sheet that included the demographic questions posed during individual interviews (see Appendix K for the Focus Group Background). Four face-to-face interviews and one face-to-face focus group with two participants was conducted in conveniently located private rooms in the community (e.g., library, optometry office or community center). Twelve telephone interviews were completed at the request of participants.

4.3. Field notes and recording. Consent was obtained from study participants for interviews to be audio-taped and field notes to be recorded during and/or after interviews and the focus groups. Field notes were maintained for all interviews and were used to document points emphasized by participants during their interview. Reflexive memos highlighting participants' key ideas were recorded after each interview and were used during the analysis phase to ensure the perceived meanings described by participants were captured in the codes. Three initial interviews recordings were shared via Transfer Big Files with an external source, who had signed a confidentiality agreement, and who transcribed

the recordings verbatim (See Appendix L for confidentiality agreement). However, the externally transcribed interviews yielded transcripts with many errors as the vocabulary used by participants was specific to the subject matter and background knowledge was needed to transcribe the interviews accurately. Therefore, the researcher completed verbatim transcription of the remaining fourteen audio recorded interviews. Transcribed interviews and focus groups were stripped of identifying data by the researcher and saved to NVivo Pro (version 11) software in a password protected file, on a password protected personal computer. All audio recordings and digital versions of the transcripts were destroyed.

5. Ethical Considerations

The Tri-Council Policy Statement (Canadian Institutes of Health Research [CIHI], Natural Sciences and Engineering Research Council of Canada [NSERC], and Social Sciences and Humanities Research Council of Canada [SSHRC], 2010) requires that research involving humans be conducted ethically, and adhere to three core principles: (1) respect for persons; (2) concern for welfare; and (3) justice. This thesis study demonstrated adherence to each of these tenets and received ethics approval from the Hamilton Integrated Research Ethics Board (HIREB) (project ID#: 4202).

5.1. Respect for persons. During recruitment and prior to the start of each individual interview and focus group, the researcher reviewed the

appropriate Letter of Information/Consent, including participant withdrawal procedures. This allowed individuals the autonomy to deliberate and make an informed decision to participate in the study. Individuals were encouraged to ask questions at any point in the study process and were aware that they would not receive incentives for participating in this study.

5.2. Concern for welfare. Study information, including the study purpose, risks and benefits, risks and benefits to study participation, permission to withdraw from the study, and consent were reviewed and signed prior to scheduling interviews and again prior to the start of each interview. Verbal consent was obtained for participants who completed telephone interviews and these were maintained on the Verbal Consent Log (see Appendix I). There were no foreseeable discomforts to participating in this study; rather, participants may have felt empowered and/or validated when sharing their experiences with myself and/or other participants. Participants were offered the option of receiving a summary of the study results via email or postal service. Participants were assured that all interactions and personal information would remain confidential and would not be shared with anyone. Data collection and storage procedures complied with the Ontario privacy legislation, thereby ensuring the privacy and confidentiality of participants' personal information. Confidentiality was maintained through the development of an anonymized protocol. Electronic data was stored in password protected files on an encrypted USB flash drive. This

USB flash drive and all hard copy data were stored in a locked cabinet by the researcher. Long-term storage of these study materials will be in a locked cabinet within McMaster University. To manage the risk for a breach of privacy during the focus group interview, focus group members were asked to make only those comments that they were comfortable making in a public setting. To prevent power imbalances among focus group participants, focus groups did not include individuals from different hierarchies within an organization. Focus group participants were encouraged to contact the researcher after completion of the interview to schedule a follow-up interview to share data they may have withheld during the focus group. Neither of the two participants contacted the researcher post-focus group interview.

5.3. Justice. Inclusion criteria for this study stipulated that participants spoke English, and had knowledge of, or experience with, school-based vision programs. The latitude of these criteria allowed individuals with varying levels of experience with vision programs, and those living in rural and urban communities, and in neighbourhoods with high and low vulnerability, to participate in the study. However, the inclusion criteria did exclude newcomers to Canada with limited English skills.

6. Data Analysis

A directed qualitative content analysis was conducted using Damschroder et al.'s (2009) CFIR to organize the nodes (Hsieh & Shannon, 2005). Directed

content analysis was appropriate as this approach has been widely used in qualitative nursing research to examine complex phenomenon through rich descriptions of participants' experiences (Neergaard et al., 2009; Vaismoradi, Turunen, & Bondas, 2013). The analysis was directed (i.e., deductive) as Damschroder et al.'s (2009) CFIR was used to structure the examination of barriers and facilitators to vision program implementation (Bengtsson, 2016; Elo & Kyngäs, 2008; Hsieh & Shannon, 2005). This method was consistent with other studies examining barriers and facilitators related to health care intervention implementation (Légaré et al., 2006; McGinn et al., 2011). The analysis of data involved four stages: (1) decontextualization; (2) recontextualization; (3) categorization; and (4) compilation (Bengtsson, 2016).

During the first phase of analysis or the decontextualization phase, transcribed interviews were read in full to gain an understanding of participants' overall experience (Vaismoradi et al., 2013). Open coding then began during which meaning units were labelled with descriptive codes and organized into deductive codes based on the constructs and sub-constructs of Damschroder et al.'s (2009) CFIR (Hsieh & Shannon, 2005). The analysis was conducted on the manifest content only, remained at a low level of interpretation and abstraction, and the descriptive codes remained as close to the data as possible (Bengtsson, 2016; Elo & Kyngäs, 2008). Each new meaning unit was compared with previous codes to ensure that similar segments of data were labelled with analogous codes,

thus the analysis process was not linear. Due to the structure of the CFIR, some data belonged to more than one domain or construct. Therefore, some codes were applied to more than one meaning unit. Although this resulted in some data segments being coded and analyzed multiple times, it was deemed necessary so as not to lose different meanings of data segments. For example, when participants described 'cost' as a barrier to vision screening, they indicated two meanings. The first meaning described cost as a factor relating to the intervention (i.e., the cost of eyeglasses), coded under the *cost* construct in the *intervention characteristics* domain. The second meaning also described the cost barrier but as a factor of the *outer setting* (i.e., the cost barrier as perceived by parents to obtain eyeglasses). To have coded data segments in one category only, would have lost one of the meanings. When data did not fit under Damschroder et al.'s (2009) CFIR constructs, new codes were inductively created as suggested by Elo and Kyngäs (2008). For example, a *relationship between inner and outer settings* code was created during the initial coding phase as this determinant did not initially seem to be identified in the CFIR. Constructs of Damschroder et al.'s (2009) CFIR that were not reflected in the data were removed from the codebook (Bengtsson, 2016).

During the recontextualization stage of analysis, the meaningful units of text that had been identified and the constructs under which each meaning unit had been coded were examined for consistency. The transcribed texts were also

checked to ensure that all aspects of the content were covered in relation to the purpose of the study (Bengtsson 2016).

The categorization stage involved collapsing sub-categories of codes into broader categories (Bengtsson, 2016). For example, data coded into a *relationships between inner and outer setting* code was collapsed into the *outer setting* domain under *cosmopolitism* after consulting with the original author of the CFIR (L. Damschroder, personal communication, September 24, 2018).

An objective assembling of the data was completed during the final compilation stage of analysis and included realistic conclusions that remained close to the meanings and contexts derived from the text (Bengtsson, 2016). Thesis committee members reviewed selected portions of text from anonymized transcriptions and compared these with the codes assigned to the text to determine their agreement with the way in which data had been sorted and labelled (Bengtsson, 2016; Graneheim & Lundman, 2004; Vaismoradi, Turunen & Bondas, 2013).

CHAPTER FOUR: RESULTS

1. Introduction

Chapter Four presents the results of the data analysis, organized into three main sections. The first section describes the characteristics of participants. The second section is a presentation of participants' descriptions of the structures and processes that influence implementation of school-based vision screening, and the barriers and facilitators to implementing school-based vision programs. The factors are organized according to the domains, constructs and subconstructs of the Damschroder et al.'s (2009) CFIR. The third section presents the role of nurses in the implementation of school-based vision screening programs as perceived by participants. An overall summary of the results concludes the chapter.

2. Characteristics of Participants

Participants included parents and interventionists (i.e., individuals who had a role in implementing the school-based vision screening). Interventionists (i.e., individuals who were involved in vision screening implementation) included optometrists, clinical research personnel, public health unit staff, school staff, and community vision program personnel (i.e., staff from non-profit organizations). Inclusion criteria for the study required that participants spoke English and had knowledge of, or experience with, school-based vision screening in Ontario. Table 1 includes a high-level description of the characteristics of participants (N =

18). A total of three parents participated. All parents described the community in which their child experienced school-based vision screening as being urban (*n* = 3). None of the parents reported having taken their child for a comprehensive eye exam prior to the vision screening program. There was a total of 15 interventionists who held various positions in organizations classified as either frontline provider (*n* = 5), clinical researcher (*n* = 2), manager/supervisor/coordinator (*n* = 5), and independent practitioner (*n* = 3). Most interventionists reported having between 1 and 5 years of experience with vision screening in schools (*n* = 8) and had experience with vision screening in both urban and rural settings (*n* = 11). Almost all interventionists described having implemented vision programs in neighbourhoods with high and low degrees of vulnerability (i.e., low-income) (*n* = 9). Quotes from participants are included in the findings below to support the results and were labelled as follows: (1) parents - PAR-1, PAR-2, PAR-3; (2) optometrists - OPT-1, OPT-2, OPT-3; (3) clinical research personnel - RES-1, RES-2; (4) PHU staff - PHU-1, PHU-2, PHU-3, PHU-4, PHU-5; (5) school staff - SCH-1, SCH-2; and (6) community vision program personnel - CVP-1, CVP-2, CVP-3.

Table 1

Participant characteristics (N = 18)

Characteristic	Number
Parents (*n* = 3)	
Community setting of child's vision screening	
Urban	3 (1.00)
Rural	0 (0.00)
Both	0 (0.00)
Comprehensive eye exam completed pre-screening	
Yes	0 (0.00)
No	3 (1.00)
Interventionists (*n* = 15)	
Optometrist	3 (0.20)
Clinical research personnel	2 (0.13)
Public Health Unit staff	5 (0.33)
School staff	2 (0.13)
Community vision program personnel	3 (0.20)
Type of position	
Frontline provider	5 (0.33)
Manager/supervisor/coordinator	5 (0.33)
Clinical researcher	2 (0.13)
Independent practitioner	3 (0.20)
Years of experience with vision screening	
< 1 year	3 (0.20)
1-5 years	8 (0.53)
> 5 years	4 (0.27)
Community setting of vision screening program	
Urban	3 (0.20)
Rural	1 (0.07)
Both urban and rural	11 (0.73)
Community vulnerability level of vision screening program	
Low	1 (0.07)
High	5 (0.33)
Both high and low	9 (0.60)

3. Factors Influencing Implementation

The domains, constructs and subconstructs of Damschroder et al.'s (2009) CFIR provided an overarching structure to support the exploration of factors described by participants as facilitating or impeding vision screening implementation. The frequency of participant descriptions was counted and used, with caution, as a proxy for significance, a process that is supported by the analytic methods of content analysis (Vaismoradi et al., 2013). Therefore, domains and constructs containing factors most frequently described as exerting influence on vision screening implementation have been presented first, while those described less often are presented last. It is important to note that the frequencies were considered first at the level of the domain; therefore, the importance of some factors within a construct may not have been described with the same number of occurrences.

3.1. Domain: outer setting. Damschroder et al.'s (2009) CFIR differentiates factors found to exert influence on the external contexts of an organization implementing an intervention (i.e., the *outer setting*), from those that are found to exert influence on the internal contexts (i.e., the *inner setting*). Social, political, economic, and structural factors described by participants as exerting influence external to organizations implementing vision screening included those influencing parents and students, and external partners. As Table 2

indicates, these factors were organized into two constructs: (1) *patient needs and resources*; and (2) *cosmopolitism*.

Table 2

Outer Setting Domain Factors That Influence Vision Screening Implementation

Construct	**Factor**
Patient needs and resources	1. Patients' access to optometry care and treatment (−) 2. Parents' low visual health literacy (−) 3. Varied communication techniques used with parents (+) 4. Translated materials and interpreters available to parents and students (+) 5. Screening methods and tools appropriate for age and developmental stage of students (+)
Cosmopolitism	1. Strong networks between organizations implementing vision programs and external partners (+) 2. High social capital (+)

Note. + and −signs at the end of each factor indicate whether the construct exerted a positive (e.g., presence) or negative (e.g., lack of) influence on implementation

3.1.1. Construct: patient needs and resources. *Patient needs and resources* refers to the extent to which parent and student needs, including barriers and facilitators to meet those needs, are accurately known and prioritized by the organizations implementing the intervention (Damschroder et al., 2009). All participants described factors within this construct as exerting influence on the success of implementation. Five factors described as influencing the external context of organizations were related to parent and student needs and included:

(1) patients' access to optometry care and treatment; (2) parents' low visual health literacy; (3) varied communication techniques used with parents; (4) translated materials and interpreters available to parents and students; and (5) screening methods and tools appropriate for age and developmental stage of students.

1. *Factor: patients' access to optometry care and treatment.* All participants reported that parents required support with system navigation or the "*what's next?*" once vision screening has been completed. Assistance with accessing optometry care was the most often cited parental need. Parents, optometrists, public health and school staff reported the greatest barriers to be finding optometrists and their office location to obtain optometry care and treatment (i.e., eyeglasses). Some interventionists reported sending home a list of local optometrists with the screening results. A parent described the need for school-based vision screening programs to include information regarding the location of optometry clinics.

> *I would hope that if [screening result] did say 'refer[al]'… that there would be another paper attached to suggest here are some places that you can follow up with […] Some people might not even know […] and might be overwhelming for… a parent.* (PAR-2)

Many interventionists and parents also described transportation, and finding the time to schedule and attend optometry appointments as barriers to

accessing follow-up care. The following quote captured the challenges faced by some parents:

> *…the barrier would be, 'can I get the time off?' depending on what they do, or they can't get access to a vehicle or, even if they have a bigger family and multiple kids and they have to drag all the kids on the bus to the optometrist, that could be quite difficult for a bigger family that may not have access to a car.* (PAR-3)

Almost all participants described the cost of glasses as a barrier to vision program implementation. Some interventionists noted that parents were reluctant to have their child participate in vision screening due to the prohibitive cost of glasses should their child fail screening. All participants described that parents would not adhere to screening recommendations if they could not afford to purchase glasses. A clinical researcher described how the cost of glasses influenced parents' decisions:

> *…With the lenses and everything [cost of eyeglasses] comes up to $300 … As a parent you would think: 'Of course I can't afford glasses' … 'so why would I take my child to an optometrist if I can't do what they are going to tell me to do?'* (RES-2)

2. *Factor: parents' low visual health literacy.* Low parental visual health literacy and lack of awareness regarding the purpose and processes of screening programs were described as barriers to vision program implementation. Many

interventionists described that parents lacked awareness regarding the recommended timing and frequency of comprehensive visual exams, as well as their child's eligibility for these free visual health exams. None of the parents interviewed were aware of the recommended timing and frequency of childhood vision testing, and one parent was unaware that these exams were government-funded. Interventionists described a concern that parents would not adhere to vision screening program recommendations if they believed that they would have to pay out of pocket for the comprehensive exams. Additionally, many interventionists also noted that parents were confused as to the purpose and processes related to vision screening programs. Parents indicated that the vision screening program parent information letters had little or no information regarding childhood vision disorders, yearly childhood visual exam recommendations, and that comprehensive eye exams were free for children. Parents also noted that the letters did not provide clear instructions for a child who passed the vision screening and parents were unaware of the difference between a comprehensive eye exam and vision screening. None of the parents interviewed reported having taken their child for a comprehensive eye exam following the school-based screening. The following quote demonstrates a parent's description of the visual health information that would be helpful:

> *Information is helpful…it's covered by OHIP, how often, how many appointments, what does it look like and who is involved […] that vision is important for school and success in school.* (PAR-2)

Almost all participants described that parents lacked knowledge regarding the signs and symptoms of common childhood vision disorders. They also reported that parents waited for their child to complain of headaches or display behavioural or academic challenges before accessing optometry care. An optometrist described how parents' lack of knowledge regarding the asymptomatic nature of childhood vision disorders negatively influenced parents' readiness to adhere to vision screening recommendations, thus negatively influencing vision screening implementation. One participant reported that a mom, who accessed regular optometry care for other members of the family, was unaware that vision disorders in children were not easily recognizable and that it is recommended that children have an annual eye exam. The participant described this mom as being surprised when she learned that her youngest child failed the vision screening conducted at the school:

> *…. her son didn't express anything like difficulty seeing, headaches, you know there is no sort of sign or signal and … life gets busy and no one really thinks 'do I have to get my children's eyes tested?'… it wasn't until [vision screening] was offered and then detected something wrong and then signal[ed] to her that she should follow up.* (PAR-1)

3. *Factor: varied communication techniques used with parents*. Many participants noted that using different modes of communication such as face-to-face and telephone interactions, facilitated their ability to communicate visual health and vision screening program information with parents. Several interventionists reported that principals or staff from the vision screening program telephoned parents who had not yet returned their child's consent form or whose child had failed the vision screening. During these calls the importance, purpose, results of vision screening and need for follow-up with an optometrist were explained. This increased the rate of consent form return and adherence to screening recommendations as noted in this quote from a community vision program provider:

> *…even when we were sending home [a] letter… only 50% of [parents]… br[ought] their kids to the school [for follow-up]…[based on]that experience…once we knew that the child need[ed] a follow-up appointment … we called the parents…and then the rate went up to 80% or 90%.* (CVP-1)

Several interventionists, both at the management/supervisor/coordinator and frontline levels, also described that principals and teachers reinforced the importance of vision screening and adherence to screening recommendations during informal face-to-face interactions with parents at school. Several interventionists described that these face-to-face interactions also facilitated

student participation in the screening and parents' adherence to the screening outcomes. The following quote demonstrated a school staff member's perception regarding the importance of interactions with parents:

> *The recommendations go home on a piece of paper but there is no conversation with the parents…it needs to be a face-to-face conversation with the parents…when it comes from a person, it is more real.* (SCH-1)

4. Factor: translated materials and interpreters available to parents and students. Many participants also described that translated visual health promotion materials, screening reports and follow-up recommendations increased non-English speaking parents' visual health literacy levels and their understanding of the need to adhere to screening recommendations. Additionally, these participants perceived that having multi-lingual vision program staff and/or interpreters for non-English speaking students during screening facilitated students' willingness to participate in vision screening. These participants also described that having multi-lingual vision program staff and/or interpreters to assist in relaying screening results to non-English speaking parents increased parents' adherence to screening recommendations. A community vision program staff member described how the needs of non-English speaking families can be met by vision screening programs:

> *…sometimes the parents don't speak English so we have the help of people at the school who can speak other languages than English… we try to get*

> *the optometrists that speak other languages … we try to get some variety and have many languages on board so it will be easier to communicate to the parent.* (CVP-1)

5. Factor: screening methods and tools appropriate for age and developmental stage of students. PHU staff and community vision program personnel described students' age and developmental stage as an important consideration for vision screening. These interventionists reported that students were easily distracted and occasionally difficult to engage due to their cognitive, emotional or social development. They perceived that screeners' flexibility and use of age and developmentally appropriate screening methods and tools facilitated vision screening in order to encourage students to willingly participate. The following quote from a public health unit staff member described the influence of students' cognitive, emotional, social and developmental needs on the success of vision screening:

> *When you go into a school you have to be flexible because… there will be temper tantrums or moods or lack of cooperation and different learning spectrums to deal with.* (PHU-1)

3.1.2. Construct: cosmopolitism. Damschroder et al. (2009) describe cosmopolitism as the degree to which the implementing organization is networked with external organizations and the quality of the networked relationships. The two key factors in this construct identified as facilitators to program

implementation included: (1) strong networks exist between organizations implementing vision programs and external partners; and (2) high social capital.

1. Factor: strong networks between organizations implementing vision programs and external partners. Almost all participants described the importance of strong, collaborative relationships between the individuals and organizations implementing the vision program (i.e., optometrists, community vision programs, public health units, and schools) and with number of other external providers and organizations such as optometrists, the OAO, schools of optometry, community service organizations (e.g., Rotary club), family physicians, eye glass retailers and eye glass manufacturers who supported vision screening program implementation. Nearly all interventionists, in all organizational positions, described partnerships with optometrists as a key factor in facilitating parents and students to access the follow-up component of vision screening programs. An optometrist described how these collaborative partnerships would facilitate support for parents:

> *…[need] more communication between the schools and the optometrist […] We have no idea who is doing the screening… who trained them, who set them up, what types of tools they were using. The parents would come in [asking about vision screening] … You can't comment on the screening because you don't know… and the parents are all confused.* (OPT-2)

Some interventionists described that partnerships between parents, schools and optometrists would support communication of the treatment plan with

teachers and would improve students' adherence to treatment given that students spend a large portion of their day at school:

> *…teachers need to be aware [of the treatment plan] because [….] if the teachers know the child has glasses and they are expected to wear them all the time, then they're more likely to enforce that […] someone might need to remind [students] to put [their glasses] back on… the optometrist clearly needs to tell the parent, the parent needs to pass that onto the teacher.* (OPT-1)

Despite the fact that most interventionists described partnerships with community optometrists as facilitators to vision screening program implementation, only interventionists involved with vision programs that included comprehensive eye exams had developed such partnerships. Furthermore, only a few public health unit staff reported that building relationships with optometrists was part of their implementation plan for the newly mandated vision screening program.

Interventionists described that vision screening program implementation was facilitated by partnerships with schools of optometry and the Ontario Association of Optometrists (OAO). They reported having partnered with schools of optometry and utilized optometry students to conduct the vision screening tests. Many interventionists noted that partnerships with the OAO were critical to the success of vision screening program implementation as the association exerted

strong influence on its membership and on policy makers. One interventionist reported the OAO to have positively influenced its members to collaborate with the vision program. Several interventionists, including most optometrists, suggested that the OAO could increase students' access to eyeglasses by using existing partnerships with eye glass manufacturers to obtain low cost eyeglass frames for vision screening programs. Conversely, interventionists described that resistance or opposition from the OAO to vision screening was a barrier to program implementation. The following quote from a clinical research staff demonstrated the strong influence of the OAO on the success of vision screening programs:

> *My understanding was that [the OAO] were always against [vision screening] because they want everyone to be examined by the optometrist… vision screening is wasting time and money because the parent should just be going to be optometrist… they were the ones who lobbied to have vision screening demolished back in the seventies and eighties…they could be working hard now to squash this new mandate.* (RES-2)

PHU staff and community vision program personnel reported that partnerships with community service organizations such as Lions Clubs or Rotary Clubs, eyeglass retailers and eye glass manufacturers facilitated vision screening program implementation by providing volunteer screeners, program funding or

low-cost eyeglasses. A community vision program staff member explained how a collaborative partnership with eye glass retailers facilitated the procurement of free eyeglasses for children:

> *…for families with low income, we have a partnership with [name of eye glass retailer] so we are trying to help parents to get the glasses for free for their child…We issue a letter and the parents go with that letter…along with the prescription… to get glasses for free for their child.* (CVP-1)

An optometrist and a parent suggested that partnerships with primary care providers would facilitate parental awareness of the need for comprehensive pediatric vision exams and would also support adherence to vision screening follow-up recommendations. The following quote from an optometrist demonstrated how collaborations between family physicians and local optometrists support families accessing optometry care:

> *We have good relationships with local [family] physicians and we will often ask them to send kids if they think to ask or if they notice a problem […] The family doctor will say 'why don't you take your child to go see the optometrist down the street'.* (OPT-3)

2. Factor: high social capital. Social capital refers to the quality of the interconnected relationships both inside and outside the implementing organization, the levels of trust that characterize these ties and the benefits that are

both gained and transferred due to social ties (Damschroder et al., 2009). High social capital within implementing organizations, and with external partners facilitated vision program implementation. Most public health staff reported that dental staff, health promoters, and school nurses established networks and communication pathways with principals, school secretaries and teachers to facilitate program coordination. The following quote from a public health staff member explained how effective communication between partnered organizations such as public health and schools, facilitated vision screening implementation to prevent scheduling problems:

> *All of that has to be really well planned out and then back up plans for everything because … bus delays and cancellations… that can throw off your whole day.* (PHU-5)

Both interventionists and parents reported that trusting relationships between parents and school and public health staff facilitated parent education and parental adherence to vision screening recommendations. These participants noted that parents turned to trusted sources with questions regarding vision screening and screening recommendations and identified school and public health staff as these trusted sources. A school staff member reported that the relationship between teachers and parents was important as parents valued teachers' perceptions of their children given the amount time spent with students,

and the classroom activities that allow a teacher to comment on a student's visual skills such as reading a blackboard or reading charts from a distance.

3.2. Domain: inner setting. Factors described as exerting influence within the organizations implementing vision screening such as optometry offices, PHUs, schools, and community vision programs, included those influencing these organizations' social, political, economic, and structural contexts. The inner setting factors differ from the outer setting factors as these contextual factors are internal rather than external to the organization. As Table 3 illustrates, these factors were organized into two constructs of the inner setting: (1) readiness for implementation; and (2) networks and communications.

Table 3

Inner Setting Domain Factors That Influence Vision Screening Implementation

Construct	**Factor**
Readiness for implementation	1. Availability of physical space (−) 2. Availability of funding for free eyeglasses (−) 3. Engaged and committed leaders (+ / −) 4. Screener training (+) 5. School staff visual health literacy (+)
Networks and communications	1. Strong internal networks and communications (+ / −)

Note. + and −signs at the end of each factor indicate whether the construct exerted a positive (e.g., presence) or negative (e.g., lack of) influence on implementation

3.2.1. Construct: readiness for implementation. Readiness for implementation refers to the tangible and immediate indicators demonstrating that the organization implementing the intervention is committed to its decision to move forward with implementation (Damschroder et al., 2009). Therefore, factors that demonstrate the organization is ready to implement vision screening are included in this domain. Factors that emerged from the data included: (1) availability of physical space; (2) availability of funding for free eyeglasses; (3) engaged and committed leaders: (4) screener training; and (5) staff visual health literacy. Data coded in this construct were also coded within *the evidence strength and quality* and *cost* constructs in the *intervention characteristics* domain and in the *engagement* construct of the *process* domain as they each described concepts with multiple meanings.

1. Factor: availability of physical space for vision screening. A school's inability to provide the physical space requirements for vision screening in schools was identified by all interventionists as a barrier to vision screening implementation. Space for vision screening in schools was difficult to secure as schools rarely had rooms that were not being used by teaching staff. Interventionists all explained the unique challenges created by the physical space requirements for the vision screening tools including the need for both light and dim areas, the need for sufficient space for measured distances and equipment such as tables and chairs, and the need for areas with minimal distractions to maintain student focus. A public health staff member described how physical space was a barrier to vision screening program implementation:

> *We did find that space in the schools was a big challenge. We were in some change rooms, libraries, gyms, we were all over the place…. [vision programs need] to have something planned out specifically… so that we're not in an area that's not conducive for the testing. That was the consistent complaint from all the different schools that we when into, that it just wasn't appropriate areas where we were. (PHU-4)*

2. Factor: availability of funding for free eyeglasses. All participants identified the cost of eyeglasses as a barrier for parents. These participants also described the inability of organizations implementing vision screening to provide funding for free or low-cost eyeglasses was a barrier to parents' adherence to

failed screening recommendations. Participants suggested that implementing organizations explore sources of funding sources such as community service organizations, public health units, and the MOHLTC and the Ministry of Education.

3. Factor: engaged and committed leaders. Commitment, involvement and accountability of leaders within the organization implementing the intervention can have a significant influence on the success of program implementation (Damschroder et al., 2009). Data coded in this sub-construct was initially coded as an inductive code generated from participants' descriptions of principals as 'gatekeepers', however, data under this was eventually collapsed into the *readiness for implementation* construct. This data was also coded under the *networks and communications* construct within the *inner setting* domain as this factor is conceptually relational, therefore, the strength of leadership engagement and commitment greatly influenced the networks and the communication within implementing organizations.

Many interventionists referred to principals as 'gatekeepers' within schools and these participants described principals' support for school-based vision screening programs as facilitating implementation of the programs. However, most interventionists also indicated that obtaining support from principals could be challenging if the principal did not prioritize the program. Without the principal's support and assistance, conducting vision screening in

schools was exceedingly difficult. Therefore, poor principal engagement and lack of principal buy-in was a barrier to implementation as expressed by an optometrist:

> *...you need agreement at the principal level for every single school and some are going to be more enthusiastic about [vision screening] than others […] It could fall apart critically… if you don't get a cooperative principal or principals change.* (OPT-3)

Several interventionists highlighted commitment at the school board level as a facilitator to vision program implementation. Superintendents determined whether vision programs could be conducted in schools and directed whether passive or active consent was required for screening. A clinical research staff member illustrated the authority of school boards over school-based vision program implementation:

> *...for sure [the school board] can break [the screening program implementation] … if the superintendent of the school board is not a champion for it, they will kill the thing right there.* (RES-2)

A few interventionists indicated that leadership engagement at the ministry level was also influential to the success of school-based vision screening programs, as these top-level system leaders could network with other decision makers, increase buy-in at middle-management and frontline levels and negotiate for resources. A clinical research staff member demonstrated their perception of

the impact resulting from a lack of high-level leadership commitment and engagement:

> *The Ministry of Education had reps, I think, on a working group to formulate the public health standard…and participation was mostly absent… [school staff] had not been informed that public health will be coming in and doing this next year… there was an opportunity to educate in advance, which I believe has been missed.* (RES-1)

4. Factor: Screener training. Interventionists' ease of access to useable information about the various elements of vision programs and how best to incorporate these elements into work tasks is critical to vision program implementation (Damschroder et al., 2009). Damschroder et al. (2009) note that training is one source of information and knowledge, and implementation is more likely to be successful when timely, on-the-job training is available to interventionists. Several interventionists suggested that implementing organizations ensure screeners were adequately trained. These interventionists suggested these organizations such as PHUs and community vision programs ensure screener training in standard vision screening protocols, including the correct use of screening tools and accurate interpretation of screening tests, facilitated implementation of vision screening. A public health staff member described the necessary components of vision screener training:

> *…[screeners] all need to be trained in many ways; trained on the actual screening tools, trained on the distinctive vision problems so that they have a good sense of what this is about, and trained in dealing with young children because that…takes some skill* (PHU-5)

5. Factor: School staff visual health literacy. School staff members described that educators are knowledgeable regarding the link between childhood vision problems and academic performance. However, several interventionists described that implementation of school-based vision screening would be facilitated if educators were also knowledgeable regarding the signs and symptoms of childhood vision disorders, the Ontario childhood vision exam guidelines and coverage, and the rationale for implementing vision screening program in schools. A clinical research staff explained who could ensure that educators had access to this information and why this knowledge and information is important:

> *It would be really nice if the school board was giving instruction to the principal and the teachers about the kinds of eye problems kids have, why the screen is occurring, why the eye exams are important, all the financing piece. Because teachers are the ones who have the contact with the parent […] [School staff] had no idea that probably 10% of the kids sitting in the classroom need glasses.* (RES-1)

3.2.2. Construct: networks and communications. The networks and communications construct refers to the nature and quality of social networks and of formal and informal communication within an organization implementing vision screening (Damschroder et al., 2009).

1. Factor: strong internal networks and communications. All public health staff reported that strong networks and communications within their organization facilitated implementation of vision screening. Strong networks and effective communication were described primarily with respect to dental program staff and school program PHNs. A frontline public health unit staff member commented that networking among staff internal to their organization allowed frontline staff to continue building networks and to guide one another through the implementation process. Some interventionists also explained that effective communication between principals and their staff facilitated the implementation of vision screening programs by ensuring that space for vision screening was secured, and that special events were not scheduled on screening days. A few interventionists described the absence of strong networks and communications within the provincial government (i.e., MOHLTC and the Ministry of Education) negatively influenced implementation of school-based vision screening programs. A clinical research personnel's experience demonstrated weak networks, and ineffective communication at the provincial level were barriers to vision screening program implementation at the local level:

> *I have experienced a huge lack of communication between the Ministry of Education and the Ministry of Health and Long-Term Care. It would be really nice if the Ministry of Education were advocating for … visual health education in school whether it was developing material or at least collaborating with the Ministry of Health [MOHLTC] to encourage school boards to make use of the material provided by public health.* (RES-1)

3.3. Domain: intervention characteristics. Certain qualities of vision screening and follow-up programs influence the success of their implementation. All constructs within this domain were discussed to some degree, however some constructs were described more frequently than others. Data coded within the *trialability* was also coded under the *process* domain within the *executing* construct. Few interventionists discussed the *intervention source* as a factor that influenced the success of implementation. However, they did note that, although guidelines and protocols for the MOHLTC (2018) Child Visual Health and Vision Screening program were determined through consultation with a provincial working group (including selected local public health staff), the mandated protocol was perceived to be externally driven. These interventionists described that Ontario public health units and their municipalities or regions have been challenged with the responsibility for both funding and delivery of these programs. Therefore, they perceived that public health units may not implement the protocol to its fullest potential, especially given that the mandated protocol

includes some flexibility and allows public health units to tailor components of the vision screening program to meet local needs. A clinical research staff member, articulated how this top-down approach may negatively influence implementation:

> *Public health units have been mandated that they have to do [vision screening] so they're going to do it. What they're not mandated to do so forcefully, is the helping parents navigate vision health for your kids' piece… and…hammering home you need to book an eye exam, you need to get that glasses prescription filled. All of those pieces which public health could facilitate.* (RES-1)

Finally, a few public health unit members described vision program *adaptability* as a factor to implementation. Participants highlighted the importance of being able to tailor the level of system navigation support and modes of communication with parents according to local population needs. These descriptions were captured in the *patient needs and resources* construct within the *outer setting* domain. A few interventionists reported that flexibility within the MOHLTC vision screening program protocol would enable rural public health units to adapt the program to meet the unique challenges of providing a universal program across large jurisdictions with limited staffing and resources. However, the mandated programs had not yet been implemented at the time of this study,

and there was an absence of detailed descriptions of these program modifications and of the influence of these adaptations on program implementation.

The four constructs most often described by participants as having the greatest influence in this domain were: (1) complexity; (2) cost; and (3) evidence strength and quality. Several factors were associated with each of these constructs (see Table 4 for the list of factors related to the intervention characteristics domain).

Table 4

Intervention Characteristics Domain Factors That Influence Vision Screening Implementation

Construct	**Factor**
Complexity	1. Number of people and organizations (+/−) 2. Alignment with existing activities (+) 3. Disruptiveness of implementation (−) 4. Active consent to screening (−)
Cost	1. High cost of eyeglasses (−) 2. High cost of operationalizing program (−)
Evidence strength and quality	1. Trained and proficient screeners (+/−) 2. Accurate screening tools (+) 3. Lack of a provincial database (−)

Note. + and −signs at the end of each factor indicate whether the construct exerted a positive (e.g., presence) or negative (e.g., lack of) influence on implementation

3.3.1. Construct: complexity. Damschroder et al. (2009) define complexity as the perceived difficulty of implementing an intervention, and the

authors note that increased complexity can negatively influence intervention implementation. Complexity includes several factors that are closely linked including the number of intervention users, the number of steps or sub-processes required to implement the intervention, the disruptiveness of implementation and the number of changes to the implementing organization's routine practices that are required for implementation (Damschroder et al., 2009). Although participants did not explicitly state that vision screening implementation was complicated, they did speak about factors that influence the complexity of an intervention including: (1) the number of people and organizations required for implementation; (2) alignment of program activities with existing organizational practices; (3) disruptiveness of implementation; and (4) active consent to screening.

1. *Factor: number of people and organizations required for implementation.* Many participants indicated that implementation of school-based vision screening required the coordination of multiple individuals from a variety of disciplines and roles from various organizations. These included school staff (e.g., superintendents, principals, teachers, educational assistants, secretaries and interpreters), community vision program providers, optometrists, PHU staff (e.g., dental hygienists, health promotors, school PHNs and administrative assistants), community service organizations, the OAO, eye glass retailers, and eye glass manufacturers. Participants also noted the high degree of diversity in hierarchical

positions at the organizational and systems level that were required to support the implementation of school-based vision programs including volunteers, frontline staff, managers, supervisors, coordinators, superintendents, directors, and both municipal and provincial level decision-makers. This factor was considered to have a neutral influence on implementation as participants described it as neither a barrier nor a facilitator. An optometrist described the varying roles played by some of the personnel required for vision screening program implementation and how this diversity increased the complexity of program coordination:

> *If you're going to have [vision screening] in a school for all of the schools, that adds a lot of extra people […] So you have to… have a full case of traveling equipment, someone to help set it up and somebody to help run it […] to check people in and go with the kids… a lot more people hired to get it to work at the school.* (OPT-1)

2. Factor: alignment with existing activities. According to Damschroder et al. (2009), interventions that are similar to an organization's existing practices and do not require fundamental changes to the organization's activities, decrease perceived complexity and facilitate implementation. Therefore, alignment of vision program activities with interventionists' existing daily work activities and organizational practices facilitated the implementation of vision programs. Almost all participants perceived that at least some of the activities related to vision screening and follow-up programs aligned with the core roles and

responsibilities of public health units and/or school staff, and this alignment facilitated vision screening implementation. The following core public health activities were described by both interventionists and parents as aligning with, and facilitating, vision screening implementation including: health promotion, dental screening, advocacy, networking, system navigation, program planning and coordination, immunization tracking and public health surveillance. Many participants described that public health staff understood the school context. They explained that nursing and dental staff were working within schools and were ideally positioned to implement school-based vision screening programs. A clinical research staff described how bundling vision screening with public health's dental screening facilitated vision screening program implementation in schools and maximized staff resources:

> *… public health already has a list of the schools, already has a list of all the kids…They already have a system for informing parents about what they're going to do. They've already worked with the school board for whatever kind of consent process… They already have a system for sending home letters about follow up. Kids are already coming out of class to have their mouths looked at. […] As a pilot, tried combining visual and dental screening [...] After a first few hiccups, the blended program actually worked very well.* (RES-1)

One community vision program staff member noted that the bureaucracy inherent to public health units would be a barrier to vision screening implementation. This participant suggested the following role for PHUs:

> *The concern there is the bureaucratic approach [of PHUs] … if they simply oversaw [vision screening] or coordinated with school boards that would be ok… if they kept it at a high level just supervised it, that would be ok, but if they decide to micro manage, that wouldn't be good.* (CVP-2)

Many participants described that existing activities and systems of kindergarten classroom teachers facilitated the operationalization of vision screening in schools. For example, teachers were described as having daily communication with parents during drop-off and pick-up times, and through the parent-teacher communication tools (e.g., zippered bags containing daily parent information that are sent home by teachers and returned to school by parents). These activities are described by a public health staff member:

> *Because [vision screening recommendation] goes home in their communication bag and the teacher is the one that puts it in the bag…give the follow-up to the teachers and then they are very organized and … then the parents see it when it gets home*. (PHU-1)

However, a school staff noted that if the activities required to implement the vision screening resulted in an increase to teachers' workload, teachers would be resistant to vision program implementation:

> *… it was very easy on my part because all of the permission letters and information were already established. I just had to make sure each child took a copy home and then collecting responses… Make [vision screening] easy. If you add work to the teacher, then that can be a barrier because the union would have to be involved.* (SCH-1)

3. Factor: disruptiveness of implementation. Several interventionists described that the changes to school routines, and coordination of school and classroom schedules, increased the difficulty of school-based vision screening implementation. Unexpected changes or problems such as late school bus arrivals, special events, field trips, student absences, broken screening equipment, and screener illness increased the complexity of vision program delivery and were also barriers to vision screening implementation. Some interventionists, including school staff members, explained that when vision screening was disruptive to routine activities and processes within the school context, principals and teachers were less likely to support vision screening. The following quote describes the experience of a clinical research staff person in schools:

> *…minimal school interruption… If [vision screening] can all be finished in one day, [principals] are very supportive, [but] not if it's going to involve back and forth back and forth interrupting the classes. The more you have to interrupt the daily classroom, the less they are likely to cooperate.* (RES-2)

4. Factor: active consent to screening. Interventionists described that obtaining active consent was a barrier to vision screening implementation as many parents did not return the forms. Several interventionists described that some school staff would send reminders to parents, either personally or through robo-calls, thus adding steps and increasing the complexity of the program. Several interventionists noted that school boards' adoption of an opt-out process, whereby parents sent a form back to the school only if they did not wish their child to participate, facilitated vision screening implementation. A clinical research staff member's experience highlights this simplified process:

> *…if you require active consent, our experience is almost no parent, says 'No'. But if that form is not returned then you can't screen those children […] Many school boards allow opt-out so that the parent gets a description of what's going to happen and they're told what to do if they don't want their child not to participate. That facilitates the children being included. Requiring active consent, there are parents who will not return the form* (RES-1)

3.3.2. Construct: cost. The cost of an intervention and those costs associated with program implementation of the programs can affect the success of implementation (Damschroder et al., 2009). As indicated in the *availability of resources* sub-construct under the *readiness for implementation* construct in the *inner setting* domain, the cost of the vision program and the lack of additional

ministry funding were barriers to implementation. Data coded under this construct was also coded under the *patient needs and resources* construct within the *outer setting* domain.

1. Factor: high cost of eyeglasses. As previously noted, the high cost of eyeglasses was described by almost all participants as a barrier to implementation of vision screening programs. Participants explained that the availability of free or subsidized eyeglasses through vision screening programs facilitated program implementation. Interventionists reported that parents allowed their child to participate in screening, and were more likely to adhere to follow-up recommendations, when free eyeglasses were available. Interventionists described that free eyeglasses required external funding sources. A number of interventionists described partnerships that helped to off-set the cost of eyeglasses. An optometrist describes how the OAO's Eye See Eye Learn program could be used as a model:

> *Well the Eye See Eye Learn has been a really good partnership between the Association, and the lens company […]. Industry and the [OAO] have been donating time and money for this program to eliminate some…barriers* (OPT-2)

2. Factor: high cost of operationalizing vision programs. Many interventionists also described struggling to obtain funding for operational costs of school-based vision programs as barriers to implementation. A community

vision program staff member described the human resources, equipment and supply costs associated with the program:

> *[Funding] is the problem. We need [staff], the [computer] software that we use…there is a monthly fee and also paperwork…when we go to the school…we set up a mini-office because we have a printer, three laptops, and paper envelopes. Everything so we can print off the letter right away and fill them with everything ready to give it to the parent…we need money from the government.* (CVP-1)

3.3.3. Construct: evidence strength and quality. According to Damschroder et al. (2009), individuals implementing an intervention are less willing to use the intervention if they perceive the quality of the evidence for the intervention to be poor. The authors also note that evidence may be obtained from peer-reviewed literature, client experiences, clinical experiences (i.e., pilot testing) (Damschroder et al., 2009). None of the participants described empirical evidence as influencing their perception of the quality of the intervention; rather, interventionists based their perception of vision screening program quality on their own clinical experience, while parents' perceptions were rooted in their own personal experience. Factors that influenced the perceived quality of the vision programs included: (1) trained and proficient screeners; (2) accurate screening tools; and (3) lack of a provincial database.

1. Factor: Trained and proficient screeners. Several interventionists explained that screener training facilitated their trust in the screening test results. Conversely, optometrists and parents questioned the credibility of results received from vision screening programs when they were unsure of the level of screener training or competence. Interventionists noted that screeners required training in screening methods and interpretation of results. Community vision program personnel reported that outcomes to vision screening tests could be subjective; judgement calls were sometimes made as to whether a student had failed screening due to shyness, or whether it was due to a vision problem. One interventionist reported having given some shy students a 'pass' on their vision screen, despite having failed testing. This interventionist believed that the student had not answered correctly due to shyness rather than poor vision. A clinical research staff member supported the need for screener training to ensure fidelity of the program:

> *... one test with one person was administering it in a way that allowed the child too much leeway to be correct by guessing […] even though the tests are objective, they are subjective judgements about the testing protocol and doing your job when you're saying the child should be referred or when you're saying the child has passed.* (RES-1)

Parents also reported their trust in the accuracy of vision screening results was associated with the credentials and training of the screeners. One parent

reported that they would have confidence in a referral for follow-up optometry care if the screening was conducted by public health staff because public health was "a reliable" resource. Another parent reported that they had confidence in the accuracy of their children's vision screening results because students from a school of optometry were conducting the screenings, thus, two people, the student and their supervisor, would be reviewing the results to ensure their correctness. The importance of parental confidence and trust in the results of screening were highlighted by a parent:

> *… [screening accuracy] is crucially important […] knowing that it is the school of [optometry]… my perception was…they're going to do this accurately… If it was Joe Schmoe's optometry clinic down the road… I would kind of question 'Is this the business model?'[…] I felt comfortable with the validity, the accuracy, the sensitivity, the specificity, how they've done it.* (PAR-1)

2. Factor: accurate screening tools. Some interventionists reported the validity and trustworthiness of vision screening program results were influenced by the perceived quality and accuracy of the screening tools. Some interventionists stated that some screening tools were more reliable than others due to limitations related to screening tools or to students' cognitive, social, emotional and physical development. An optometrist highlighted the impact of

screener skills and training, and of screening tool accuracy on vision program quality:

> *… you have to make sure the people who are doing it have been trained properly in how to do the test so that you don't influence the results. And then for the other concern with […] the autorefractors aren't necessarily always accurate.* (OPT-1)

3. Factor: lack of a provincial database. All interventionists reported that the non-existence of an integrated system to report, track or surveil vision program outcomes, treatment and trends decreased the perceived quality of vision screening. Many interventionists emphasized the need for a provincial database to report vision screening outcomes, track access to optometry care and treatment, and support surveillance of childhood visual health trends as illustrated by a clinical research staff member:

> *I think [government] would want to keep track of the actual screening results […] You won't protect the quality assurance unless the screening values have documented […] everyone wants some kind of quality assurance where a sample of the screening data are looked at by a second person to try find out what the error rate is, […] how often a child is unable to do a test […] [is] something peculiar… going on that requires investigation.* (RES-1)

Several interventionists noted that existing databases used for dental and immunization programs could be integrated with vision screening programs. A public health staff member described how this integration of tracking and reporting systems could be used to support referral rates, supply and demand of eyeglasses, program evaluation and continuous quality assurance:

> *I think they need a standardized system for all health units in Ontario. We have one for dental that worked very well […] We get the school board class list, it goes into a Panorama Ministry database, and then all the dental stuff is there, all the immunization stuff is there. It would be nice if all the vision was in there as well.* (PHU-2)

3.4. Domain: characteristics of individuals. Damschroder et al. (2009) observe that the success of intervention implementation is rooted in the characteristics of the individuals implementing the intervention. As illustrated in Table 5 interventionists' knowledge and beliefs toward school-based vision programs, and their high self-efficacy of vision program implementation were the most frequently described constructs within this domain.

Table 5

Characteristics of individuals Domain Factors That Influence Vision Screening Implementation

Construct	**Factor**
Knowledge and beliefs	1. Interventionists' knowledge, beliefs and affect (+/−)
Self-efficacy	1. Interventionists' high self-efficacy (+)

Note. + and −signs at the end of each factor indicate whether the construct exerted a positive (e.g., presence) or negative (e.g., lack of) influence on implementation

3.4.1 Construct: Knowledge and beliefs. According to Damschroder et al. (2009), individuals' knowledge and beliefs toward an intervention, including the facts, truths and principles related to the intervention, influence those individuals' affective response to the intervention, their willingness to implement the intervention, and the overall success of intervention implementation. Elements of this construct were closely linked to the *tension for change* sub-construct under the *implementation construct* and the *access to information and knowledge* sub-construct under the *readiness for implementation* construct, both within the *inner setting* domain.

1. Factor: interventionists' knowledge, beliefs and affect. Interventionists noted that knowledge of the link between childhood visual health and disorders, and improved student outcomes increased their willingness to support the implementation of school-based vision screening because they believed in the

value of these programs. Several interventionists described that vision programs were valuable because of the impact they made on the trajectory of students' lives. A community vision program staff member explained the experiences that fostered positive beliefs in vision screening:

> *There was a child who was shy […] the child need[ed] glasses… when the optometrist put in the [eye glass] lenses… and he could see, that child was so outgoing […] Another [student] who was treated because they thought he had [ADHD] because he couldn't concentrate at school…in the end it was his vision; he couldn't see well […] We found a girl in Grade 6 […] Without glasses, she was legally blind…and so screens… are very important.* (CVP-1)

Interventionists' positive affective responses related to their knowledge and beliefs about school-based vision programs facilitated enthusiastic implementation of the vision programs. Conversely, negative beliefs toward the screening programs resulted in active or passive resistance to program implementation. Participants explained how principals' response to vision programs ranged from "excited" to "crazy" and these responses influenced whether the vision program was welcomed or rebuffed in the school.

3.4.2. Construct: self-efficacy. Individuals' belief in their own ability to execute components of implementation can influence the success of implementation (Damschroder et al., 2009).

1. Factor: interventionists' high self-efficacy. A few interventionists perceived that having confidence in their ability to implement the intervention facilitated their motivation to implement vision programs. Both screener training and knowledge facilitated participants' self-efficacy levels. The following quote described how beliefs in personal abilities facilitated a public health unit staff member's confidence to implement components of the vision screening program:

> *I will be doing all the follow-up and I feel very confident that I have the background to do it because of my [professional] background.* (PHU-5)

3.5. Domain: process. The aim of the *process* domain is to support organizations in understanding how implementation should be enacted and understanding why implementations fail (Damschroder et al., 2009). The CFIR includes four constructs of the implementation process: *planning*, *engaging*, *executing*, and *reflecting and evaluating*, which is rooted in a model of quality improvement (Damschroder et al., 2009). These four process constructs are transitory and process activities are conducted incrementally in a cyclical approach, and require many iterations of complete and incomplete cycles to accomplish implementation (Damschroder et al., 2009). Table 6 provides a summary of the process constructs and the factors that facilitated vision screening implementation. All participants from the inner setting described some degree of involvement in activities related to all four constructs. All interventionists, at all organizational levels, described how factors related to *engaging*, *planning* and

executing facilitated vision program implementation. A few participants briefly mentioned processes related to the *reflecting and evaluating* construct.

Table 6

Process Domain Factors That Influence Vision Screening Implementation

Construct	**Factor**
Engaging	1. Engage school boards and principals (+) 2. Engage the OAO (+)
Planning	1. Comprehensive, multi-sector implementation plan (+)
Executing	1. Pilot tests of school-based vision screening (+)
Reflecting and evaluating	1. Feedback opportunities (+)

Note. + and −signs at the end of each factor indicate whether the construct exerted a positive (e.g., presence) or negative (e.g., lack of) influence on implementation

3.5.1. Construct: engaging. Damschroder et al. (2009) indicate the importance of early engagement of key individuals who will positively influence the implementation of an intervention. The authors also note that missing opportunities to engage key individuals can have a negative influence on implementation success (Damschroder et al., 2009). The process of engaging related to vision program implementation involved attracting and engaging key stakeholders who were perceived to be influential to the implementation of vision screening. These included individuals who were internal and external to the

implementing organizations. According to Damschroder et al. (2009), opinion leaders are those individuals within an implementing organization who formally, or informally, influence their colleagues' beliefs and attitudes related to the implementation of an intervention. Data coded within this construct was also coded in the *leadership engagement* sub-construct of the *readiness for implementation* construct in the *inner setting* domain.

1. *Factor: engage school boards and principals.* School boards were viewed as having a positive influence on school principals while principals were perceived as having strong influence on their staff, and both acted as facilitators and barriers to vision screening implementation, depending on whether the influence was in a positive or negative direction. The following quote from a clinical research staff member described the influence of these opinion leaders:

> *I feel like if the principal really believes in the system and that kind of attitude filters down and everybody's on board. And if the principal thinks this is ridiculous then the teachers are also not cooperative and the office staff are not cooperative.* (RES-2)

2. *Factor: engage the OAO.* Some interventionists also mentioned the importance of engaging external change agents, or those individuals affiliated with an outside organization who are trained and knowledgeable about the intervention, and who formally facilitate intervention decisions in a desirable direction. Damschroder et al. (2009) note that implementation is more successful

when key individuals have similar backgrounds to those implementing the intervention. The following quote described how clinical researchers engaged the OAO, knowing that the organization would have a positive influence on their membership and would facilitate implementation of the school-based vision screening program:

> *…the principal investigators made sure they first talked to the Ontario Association of Optometrists: this was our plan, this was our screening strategy and that they vetted the science behind it […] a community optometrist…could contact the Association and say '…is this research actually verified? ... and [the OAO] would say 'yes, we are collaborating'. I think that helped. (*RES-2)

3.5.2. Construct: Planning. Planning refers to the quality and degree to which the structures and processes for implementing an intervention are developed in advance (Damschroder et al., 2009). Even when participants had not participated in the planning process of vision program implementation, these interventionists noted that well-developed plans facilitated vision program implementation.

1. Factor: comprehensive, multi-sector implementation plan. Several interventionists described the planning stage as a key phase during which implementing organizations began to address one or more of the following issues: development of internal networks and external partnerships, identification of

funding sources for free eyeglasses, and elaboration of operational structures and processes required for screening program implementation. A public health staff member explained various processes that required planning, and how the absence of well-defined direction and available resources required for implementation impacted the planning process and created ambiguity:

> *We've already started developing a process… the school board is aware; the parents are aware…that Public Health is back to doing vision screening and this is the importance of it […] Our plan is to say everyone should have a comprehensive eye exam by an optometrist every year […] We did submit for some extra funds […] We have asked for some human resource support. We have no idea how much extra staff [is needed] for this whole thing.* (PHU-2)

3.5.3. Construct: executing. Although Damschroder et al. (2009) state that intervention implementation must follow the implementation plan to be successful, the authors note that the literature does not indicate how to evaluate an organization's fidelity to their plan. The authors do note that dry runs and pilots allow individuals and teams within the implementing organization to train and prepare themselves, test procedures and make adjustments and gain confidence in their skills and abilities to implement the intervention (Damschroder et al., 2009).

1. Factor: pilot tests of school-based vision screening. Optometrists, school staff, and several PHU staff noted that participating in pilot tests enabled

them to test procedures and problem-solve issues. As previously reported in the *self-efficacy* construct of the *characteristics of individuals* domain, PHU staff also described that these pilots helped them to gain confidence in their abilities to implement the program as described in the following quote:

> *Through the pilot project we're thinking 'OK that didn't work so well we're going to try this.' I think every organization is going to run into hiccups or roadblocks, but really keeping that open mind.* (PHU-1)

3.5.4. Construct: reflecting and evaluating. Damschroder et al.'s (2009) CFIR acknowledges the need for individuals to reflect upon and debrief regarding the progress of, and experience with, implementation of an intervention. The authors note that these informal and formal feedback opportunities offered throughout the process of implementation facilitate the creation of an institutional climate of learning where both successes and failures lead to successful intervention implementation (Damschroder et al., 2009).

1. Factor: feedback opportunities. Some optometrists and PHU staff who had participated in pilot testing of vision screening programs discussed having participated in formal feedback of screening programs. Clinical research personnel reported having integrated formal debriefing sessions of the program into the program evaluation. Participants saw value in providing feedback as they felt their comments would improve the quality of vision screening programs in schools.

4. Role of the Nurse

Participants used the terms *nurse*, *public health nurse*, and *PHN(s)* interchangeably when sharing their knowledge of, and experience with, nurses in relation to vision screening. To represent participants' meaning accurately, the professional designation of the nurses to whom participants were referring is *PHN*; therefore, the term *PHN* has been used in the following sections when referring to nurses described by participants, with the exception of direct quotes from participants. Of note, two optometrists reported never having worked with public health, were unfamiliar with the role of a PHN, and were unable to describe the role of nursing in vision screening.

The perceived role of the nurse in supporting implementation of vision programs in schools varied amongst participants and was influenced by participants' understanding of nurses' knowledge and skills. All five public health staff, two of the parents and a few interventionists including a school staff member, an optometrist, and clinical research personnel, explained how nursing knowledge and skills facilitated implementation of school-based vision programs. These participants described PHNs' nursing education, training and experience as contributing to their knowledge of the social determinants of health, population health, health promotion strategies, health sciences, visual health, child growth and development, and of the contextual needs of parents, schools and communities.

> *...[PHNs] have the background to understand about vision and all the social impacts and all the barriers that parents will face ... You have to understand it before you can help them with that because otherwise it could be a bit frustrating and that's not going to help anyone.* (PHU-5)

Participants also highlighted PHN skills including: individual, community and population assessments, communication, problem-solving, relationship-building with optometrists, schools, and families, service coordination, collaboration, and parent and stakeholder engagement as assets they could bring to the program implementation. An optometrist shared how PHNs' education and skills would facilitate this implementation:

> *... ideally, you would have the Public Health Nurses doing the screenings themselves because then you have a health care professional who understands eyes enough and certainly is educated enough to be trained rather easily and do an adequate screening.* (OPT-3)

Finally, participants listed the actual and potential roles played by PHNs in implementation of school-based vision screening. Actual roles included conducting vision screening tests, delivering visual health promotion and education to parents and school staff, communicating and service coordinating between public health and schools, making recommendations for next steps following failed vision screening, advocating and breaking down barriers to follow-up care and treatment, supporting families in visual health system

navigation. Participants also described potential roles that PHNs could play to facilitate vision screening implementation including: communicating screening results with other providers including optometrists, teachers and other PHU staff, "bridging" between parents, schools, optometrists, and the MOHLTC, providing support in the surveillance of childhood visual health trends, and monitoring quality of local vision programs in schools. A school staff member described the various roles of the PHN in vision program implementation and the value-added of the role:

> *We had more students participate when the Public Health Nurse was involved and supporting the program than when she was not […] She had the expertise…she problem-solved and streamlined the process, she communicated with the school and the [providers], she organized…She knew the community or clients' needs as well as the staff's needs. There was more engagement when she was involved.* (SCH-2)

Public health staff from the dental program were also identified as supporting school-based vision screening implementation. Vision screening was seen as a natural fit with existing dental screening activities in schools. Dental staff's ability to work effectively with young children, and their partnerships with principals, secretaries and teachers were also recognized as supportive to vision screening program implementation. A manager/supervisor/coordinator described

that other public health staff were also able to support implementation providing that they had adequate training:

> *... I have other groups of staff, so the oral health staff to work on this with [a PHN] we've trained, included, other health promotion staff and our students. I feel it doesn't have to be a Public Health Nurse. We've used many variet[ies] of staff and it's been successful… I've been using [the PHN] as a coordinator for her experience.* (PHU-2)

5. Summary of Results

Many factors were described by participants as influencing the implementation of vision screening in schools. These factors were organized into thirteen constructs within the five domains of Damschroder et al.'s (2009) CFIR. Contextual factors that were external to the organization implementing the vision screening were described most often by participants as having the greatest influence on that organization's ability to implement vision screening. Contextual factors internal to the organization that influenced the organization's ability to implement vision screening included the tangible indicators that demonstrated the organization's dedication to implementation, and the strength of the internal networks and efficacy of communication among staff within the organization. Factors related to the intervention itself included the perceived complexity of the intervention, the cost of the intervention, and the evidence strength and quality of the intervention. The characteristics of the individuals implementing vision

screening described by participants as influencing program implementation included the implementing organizations' staff's knowledge and beliefs toward vision screening and their own self-efficacy level. Factors related to the each of the four processes of implementation were also described as influencing vision screening implementation. Participants described that PHNs' knowledge and skills facilitated vision screening implementation, and participants shared their perceptions of actual and potential roles of PHNs in supporting school-based vision screening.

CHAPTER FIVE: DISCUSSION

1. Chapter Overview

Chapter Five includes seven main sections and a concluding statement. First, the chapter begins with a discussion of the main factors described by participants as influencing the implementation of school-based vision screening. The factors are presented organized by Damschroder et al.'s (2009) CFIR domains and constructs. Second, a discussion related to the role of PHNs in vision screening program implementation is presented. The third section is a discussion of the implications for practice, education, policy and research derived from the results of this study. The fourth section presents a discussion of the methodological strategies used in this thesis study to increase rigor and trustworthiness. The fifth section highlights the strengths and limitations of Damschroder's (2009) CFIR as an organizing framework to guide the analysis of this study. The sixth section examines the strengths and limitations of this thesis study, and the seventh final section provides a concluding statement.

2. Factors Influencing Implementation of Vision Programs

The results of the content analysis indicate that participants most often described factors external to an organization implementing vision screening (i.e., the domain - *outer setting*), as influencing its ability to implement the vision screening program. These included factors associated with meeting the needs of

students and parents (i.e., the construct - *patient needs and resources*), and those associated with an organization's degree of networking with external organizations (i.e., the construct - *cosmopolitism*). The second domain of factors most often described by participants were factors that were internal to the organization itself (i.e., the domain - *inner setting).* These factors included those that indicated a tangible commitment by the organization to implement vision screening (i.e., the construct - *readiness for implementation*), and those that facilitated internal networks and communications among the implementing organization's staff (i.e., the construct - *networks and communications*). The third domain of factors most often described by participants were related to the attributes of vision screening (i.e., the domain - *intervention characteristics*). These factors included the perceived difficulty of implementing vision screening in schools (i.e., the construct - *complexity*); the cost of vision screening (i.e., the construct - *cost*), and the perceived quality of the vision screening program (i.e., the construct - *evidence strength and quality*). Factors under each domain will be discussed in the next section.

2.1. Outer setting factors.

2.1.1. Patient needs and resources. In order for organizations implementing vision screening to achieve their mandate, students must be screened, and parents must access the recommended follow-up optometry care. Therefore, these organizations must prioritize and address factors that impede

students' participation in screening, and parents' adherence to follow-up. Participants reported that parents did not access follow-up optometry care because parents did not know how to choose an optometrist, where the closest optometrist office was located, what the contact information was for the optometry office, and how to get to the optometry office. Participants also reported that transportation to the optometry office was a barrier for parents. These findings are supported by Kimel's (2006) qualitative descriptive study examining low-income parents' (n = 55) perceptions of barriers to follow-up care after failed vision screening. The author reported that 58% of parents described experiencing logistical barriers including difficulty with planning and scheduling of optometry appointments, and lack of transportation to the appointment or a telephone to call to book the appointment (Kimel, 2006). Su et al.'s (2013) qualitative descriptive study of barriers to follow-up care after failed vision screening also reported logistic challenges related to scheduling appointments. The authors reported that, of the parents surveyed (n = 58), 41% preferred to receive telephone and/or text message appointment reminders, 14% preferred email reminders, and 26% reported that support scheduling the follow-up appointment from screening staff immediately after a failed screening would be most helpful (Su et al., 2013).

Low parental visual literacy levels were also described as barriers to accessing optometry care in this thesis study. Participants reported many knowledge deficits related to childhood visual health. Parents lacked

understanding regarding: (1) the timing and frequency of recommended comprehensive visual exams; (2) their child's eligibility for these free visual health exams; (3) childhood vision disorders and how these might manifest; and (4) the purpose, process, significance of, and difference between, vision screening and comprehensive eye exams. These findings were corroborated by Nelson and Rajan's (2018) systematic review that reported parents' lack of knowledge and understanding of the long-term effects of untreated vision disorders was often cited as a barrier to follow-up after vision screening. Su et al. (2013) also noted that almost 30% of parents reported not having information sources about eye diseases and eye care of children, the risks of untreated vision disorders, or the difference between screening and comprehensive examination. These findings are concerning given that most cases of refractive errors and amblyopia do not demonstrate obvious signs or symptoms, and if left untreated, these vision disorders can lead to life-long visual impairment (Jonas et al., 2017; NEI, 2013; PHO, 2016).

The use of different communication modes was described as a facilitator in the provision of visual health and vision screening program information to parents and students. Face-to-face interactions and telephone discussions with parents helped to clarify information, reinforce the importance of the screening program and support families in accessing follow-up. This finding is corroborated by Basch (2011) who reported telephone calls and intensive outreach

to parents increased adherence to follow-up recommendations. The results from the BC Early Childhood Vision Screening Program evaluation also reported that telephone or written follow-up from public health coincided with an increase in the number of children with failed screening results accessing follow-up optometry care (Poon et al., 2012). Effective communication includes language translation and interpreter services. Participants reported that the availability of translated materials, multi-lingual screeners, and interpreters supported English Language Learners (ELLs) during the screening process, and supported non-English speaking parents' understanding of the vision screening and follow-up recommendations. Heslin, Casey, Shaheen, Cardenas, and Baker (2006) examined the racial and ethnic differences in unmet need for vision care in children with special needs and found that parents who perceived their health care provider as respectful of their culture, were more likely to have their child's vision health care needs met. Nelson and Rajan's (2018) systematic review of the literature also described the importance of multi-lingual parent notification letters and the employment of bilingual and/or culturally appropriate staff when providing vision screening. These findings suggest that culturally-sensitive care may impact parents' adherence to follow-up care.

Integrating age-appropriate and engaging games and pictures with screening methods, providing incentives, and screener flexibility and skill in managing difficult behaviours, were described as facilitators to student

participation and cooperation in vision screening in this study. Pearson et al.'s (2015) realist review of health promotion program implementation in primary schools also found that health programs were more successful when they engaged students through fun and accommodated their different stages of physical, psychological, and social development.

2.1.2. Cosmopolitism. Partnerships with stakeholders external to the implementing organization were described as facilitating vision screening implementation. Participants described how increased social capital and strong networks with organizations outside of their own, facilitated the sharing of information, communication, and service coordination. Interventionists reported that networks with schools and school boards were especially important as principals were "gatekeepers" to accessing students and parents, and facilitated the operationalization of vision screening programs. PHU staff, clinical research, and community vision program personnel described that networks with principals were key to being able to secure space, schedule vision screening, and coordinate with teachers.

PHU staff, clinical research, and community vision program personnel, also noted that relationships with educators were essential as they had the structures and processes within their daily classroom activities, to distribute parent consents and notification forms home. These findings were supported by Nelson and Rajan's (2018) systematic review that reported difficulty coordinating with

teachers to obtain parent consents and arrange screening schedules were barriers to vision screening implementation. However, the literature also indicated that informing teachers of students' vision treatment plans helped to optimize follow-up success (Nelson & Rajan, 2018). Optometrists and clinical researchers described that partnerships with optometrists were facilitators to vision screening program implementation. Optometrists reported wanting to be notified when schools were offering vision screening to students to be better informed when parents asked questions regarding screening methods and tools. Nelson and Rajan (2018) emphasized the importance of collaboration between school nurses, schools and community stakeholders such as optometrists. Although only a few participants noted that networks with primary care providers might be potential facilitators to parents' visual health literacy and adherence to follow-up recommendations, this finding may be of importance.

A review of the literature by Rowe, MacLean and Shekelle (2004) reported that primary care physicians are key stakeholders in adult vision screening and visual health management, and patient access to optometry care and treatment. Therefore, primary care providers may be useful in educating parents regarding the importance of, and recommendations for, childhood vision exams, in addition to reinforcing the recommended follow-up from vision screening. Although privacy and confidentiality legislation currently prohibit screeners from sharing outcomes of screenings with school staff, parental consent to share

information with the school nurse and teaching staff, and the family's health care providers (e.g., the family physician and/or optometrist) could be obtained prior to screening to increase compliance and student support.

2.2. Inner setting factors.

2.2.1. Readiness for implementation. The presence or absence of factors that demonstrated an organization's tangible commitment toward vision screening implementation either facilitated or impeded implementation of the program. The construct, *readiness for implementation*, includes the sub-construct available resources, such as: space, funding, and training (Damschroder et al, 2009). The lack of available physical space in schools to conduct vision screening was a barrier to implementation. Many participants described securing space was challenging due to the need for both light and dim screening areas, the need for sufficient space for measured distances and equipment such as tables and chairs, and the need for areas with minimal distractions to maintain student focus. Participants reported performing screenings in closets and stairwells, and reported competing with teachers and daycare groups for libraries and gymnasiums. Nelson and Rajan's (2018) systematic review corroborated these findings and also reported that the sudden loss of space for screenings was a barrier to vision program implementation in schools.

The high cost of eyeglasses was described by almost all participants as a barrier to implementation of vision screening. Some interventionists noted that

parents were reluctant to have their child participate in vision screening due to the prohibitive cost of glasses should their child fail screening. Participants emphasized that free eyeglasses were critical features to vision screening implementation as parents would not adhere to screening recommendations if they could not afford to purchase glasses. The literature regarding the impact of providing free eyeglasses is conflicting. Nelson and Rajan's (2018) systematic review also reported that cost issues were consistently described in the literature as barriers to accessing follow-up care. Kimel (2006) reported that 31% of parents indicated that financial barriers prevented them from accessing follow-up care. However, findings from the Baltimore Vision Screening Project reported that adherence to treatment recommendations (i.e., use of corrective lenses) was less than 30% despite the provision of free vision screening, free follow-up exams, and free eyeglasses (Preslan & Novak, 1998). Yet, Johnson et al.'s (2016) descriptive study of the Eyes That Thrive (ETT) in school program offered to preschool children (n = 28) in Boston Massachusetts, reported that the implementation of the intensive program achieved a 93% compliance with the treatment plan throughout the six months study period. The ETT program included two free pairs of eyeglasses, along with individualized vision treatment plan, parental education sessions, optometry support, and on-going classroom teacher support for treatment plans in the classroom (Johnson et al., 2016). Although the study was limited by a small sample size and a lack of control

group, the results suggest that a comprehensive approach that includes the provision of free eyeglasses, parent education, and teacher support may be required to improve access and adherence to follow-up care.

The provision of training is a demonstration of an implementing organization's commitment to its decision to implement an intervention (Damschroder, et al., 2009). Clinical research personnel and optometrists emphasized the need for screener training in standard vision screening protocols, including the correct use of screening tools and accurate interpretation of screening test results. Many vision screening programs include protocols, training and training manuals for teaching basic vision screening techniques to vision screeners as a strategy to ensure consistency and accuracy of results (Crowley, Bains, & Pellico, 2005; Ministry of Health, 2009; and Poon et al., 2012). PHU staff reported that training in vision screening was perceived to be a supportive strategy implemented by their organization to assist them in adopting a new role. These participants reported increased confidence and higher levels of self-efficacy. These findings are supported by Nelson and Rajan's (2018) systematic review results that emphasize the need for vision screeners to meet minimum training qualifications to conduct vision screening proficiently. Participants also suggested that organizations implementing vision screening increase staff visual health literacy. Staff access to information and knowledge regarding the intervention demonstrates an organization's readiness for implementation

(Damschroder et al., 2009). Participants described the importance of teacher education on visual health topics including common childhood vision disorders and how they manifest, the link between academic achievement and vision disorders, and the purpose and processes of vision screening and follow-up exams.

Damschroder et al. (2009) identifies the sub-construct of leadership under *readiness for implementation*. Principals were described as 'gatekeepers' within schools and obtaining their support was critical to implementation of school-based vision programs. These opinion leaders influenced their staff's beliefs and attitudes toward school-based vision screening in either a positive or negative direction, depending on whether or not they prioritized vision program activities. Without principals' support and assistance, conducting vision screening in schools was reported to be exceedingly difficult. These findings are corroborated by a study conducted by Langley, Nadeem, Kataoka, Stein and Jaycox (2010) that found principal support to be critical in implementing mental health programs in schools across the United States. Commitment at the school board level was a facilitator to vision program implementation as school board staff determined whether vision programs could be delivered in schools, directed whether passive or active consent was required for screening and had a positive influence on principal support for vision programs. Leadership commitment, involvement and accountability at the ministry level was also influential to the success of school-

based vision screening programs. These top-level system leaders were responsible for determining public health and education sector priorities, policies and procedures, could network with other key stakeholders and decision-makers, increase buy-in at middle-management and frontline levels, and negotiate for resources.

2.2.2. Networks and communications. Strong networks and effective communication among staff within the organization implementing vision screening was perceived to facilitate the implementation process. This finding was noted primarily by PHU staff who reported supportive relationships that fostered information sharing among individuals from different disciplines in various programs within the organization including dental, child health, and inspection programs. A supportive organizational climate that includes networks among providers has also been reported to facilitate implementation of other school-based health programs such as mental health and physical activity programs (Langley et al., 2010; Naylor et al., 2015). These findings indicate that a collaborative approach to implementation that fosters knowledge translation between staff through effective communication channels is an essential feature of vision screening implementation.

2.3. Intervention characteristics.

2.3.1. Complexity. The amount of time required to schedule and coordinate vision screenings, prepare screening outcome notification letters and

complete screening follow-up processes was noted as a barrier to program implementation. Several systematic reviews of the literature regarding health intervention implementation in schools have reported that competing priorities and lack of time are barriers to other school-based health promotion interventions (Langley et al., 2010; Naylor et al., 2015; Pearson et al., 2015). Lineberry and Ickes' (2015) systematic review also reported that lack of time, heavy workloads, and lack of communication impeded nurses' ability to have a positive influence in schools. Alignment of vision program activities with existing work activities was described as a facilitator to vision program implementation whereas additions to workloads were described as barriers to program implementation. Bundling vision screening with dental screening facilitated vision program implementation as activities performed by dental staff during oral screenings and subsequent follow-up were considered to be similar to the activities required to complete vision screening and follow-up. Bundling vision screening with dental screening was perceived as maximizing staffing resources and minimized classroom disruptions. Participants reported existing tracking and reporting systems used for dental and immunization programs could be integrated with vision screening programs and used to support program evaluation and continuous quality assurance. These findings are consistent with two systematic reviews of the literature that report a positive influence of 'fit' between implementation of health

promotion programs (Pearson et al., 2015) and physical activity interventions (Naylor et al., 2015).

Changes to school routines and schedules, increased workload and lack of clarity regarding benefits of vision screening were described as barriers to vision program implementation in schools and resulted in active or passive resistance to the program implementation. Difficulty coordinating school and classroom schedules, class disruptions, late school bus arrivals, special events, field trips, student absences, broken screening equipment, and screener illness increased the complexity of vision program delivery and were barriers to implementation as school staff's willingness to support implementation was decreased. Active consent was a barrier to vision screening implementation as many parents did not return the forms and needed telephone reminders, thus increasing interventionists' workload. These findings are consistent with Nelson and Rajan's (2018) systematic review findings that obtaining parent permission for screening, difficulty coordinating staff and school schedules, increased class disruptions, and student absenteeism were barriers to vision screening implementation in schools.

2.3.2. Cost. Participants reported funding was needed to support: (1) the costs associated with the operationalization of school-based vision programs including administrative needs such as paper, envelopes, and printers; and (2) the provision of eyeglasses for low-income families. Carlton et al.'s (2008b) systematic review of the cost-effectiveness of amblyopia screening in the U.K

examined the screening, diagnostic and treatment pathway costs. Included in the screening pathway costs were the administrative and equipment costs of screening programs in addition to costs associated with orthoptists' time and room rentals. The authors found the total per case cost of amblyopia screening with an autorefractor to be 12.90£ equivalent to approximately $22.02 CAD (Carlton et al., 2008b). Given that cost estimates would differ due to differences in screening pathways costs, cost-effectiveness studies within the Ontario context are needed.

2.3.3. Evidence strength and quality. Participants' perceptions of the efficacy and accuracy of vision screening were rooted in their own experiences and this anecdotal evidence influenced their belief that screening would result in the desired outcomes. Parents and optometrists reported the credentials and training of the screeners influenced their trust in the results of screenings. This trust had a positive impact on parents' readiness to adhere to the recommendations. This finding is supported by Nelson and Rajan's (2018) systematic review findings that reported studies to have found a lack confidence in screening accuracy impacted the number of students who receive follow-up treatment after school-based screenings.

Interventionists also discussed that screening tool accuracy positively influenced program implementation by enhancing parent and interventionist trust in the results. Nelson and Rajan (2018) reported that research has demonstrated that over-referrals due to poor screening techniques and inaccurate cut-off values,

have contributed to lowered confidence in screening results and decreased compliance. Damschroder et al. (2009) note that internal evidence including experience obtained through pilot testing, may facilitate implementation.

Participants in this thesis study reported that pilot testing facilitated testing of screening and follow-up procedures, promoted program improvements, and supported interventionists in gaining confidence in their abilities to implement vision programs, all of which increased their willingness and readiness to implement the intervention. These findings were supported by Keith, Crosson, O'Malley, Cromp and Taylor's (2017) formative cross-case qualitative study of 21 primary care practices participating in a practice transformation intervention. The authors reported that the use of pilot testing before making practice-wide changes was perceived as a facilitator by participants (Keith et al., 2017).

Finally, participants noted that the lack of a provincial tracking and reporting database decreased the quality of the intervention as there was no structure in place to monitor adherence to follow-up, ensure program quality, and surveil for trends, thus limiting the accountability of both parents and implementing organizations to take action. Nelson and Rajan (2018) reported that data systems for tracking student vision screening and follow-up outcomes would facilitate implementation of screening programs by streamlining processes, and ensuring parental adherence to follow-up recommendations.

3. Role of PHN

Participants in this thesis study perceived nurses as possessing skills in assessments, communication, problem-solving, coordinating, collaborating, engagement and relationship-building. This knowledge and skill facilitated PHNs' ability to implement school-based vision programs. School nurses were reported to support students and parents by delivering visual health promotion and education to parents, conducting vision screening, sharing screening results with teachers and other PHU staff, completing referrals to optometrists, decreasing barriers to access, and supporting families in navigating the visual health system. The evaluation of the BC Early Childhood Vision Screening Program corroborates this thesis study's findings as the report indicated that school nursing activities were facilitators to the implementation of the follow-up component of vision screening (Poon et al., 2012). Participants also reported that PHNs networked internally with other public health staff, and enhanced external partnerships through the provision of visual health information to school staff, and communication and coordination with schools and optometrists. Poon et al. (2012) also noted that school nurses facilitated the vision screening through the development of effective partnerships with key stakeholders in schools and community agencies.

Potential PHN roles identified by participants in this thesis study included bridging between local and ministerial stakeholders, surveilling for childhood

visual health trends, and monitoring the quality of local vision programs in schools. These findings were corroborated by Lineberry and Ickes' (2015) systematic review findings indicating that school nurses effectively completed vision screening and referrals to eye care professionals, facilitated students' access to follow-up care, and provided health education to teachers. The literature supports these findings and indicates that school nurses play a vital role in facilitating vision program implementation in schools. Nelson and Rajan (2018) reported that school nurses assisted with screening and eyeglass fitting, and communicating with parents. In the ETT study, nurses worked collaboratively with parents, teachers and other healthcare professionals to improve parental adherence to vision treatment plans in schools (Johnston et al., 2016).

Other public health staff, namely from the dental health program, were also identified as having the capacity and ability to support school-based vision program implementation. Vision screening was seen as a natural fit with dental health staff's existing oral screening activities in schools, and these staff members worked effectively with young children and developed partnerships with principals, secretaries and teachers. The literature indicates that, with adequate training, non-nursing health professionals and lay volunteers can also support vision program implementation. The Vision in Preschoolers Study (VIP) Group's (2009) report on the VIP study compared the performance of trained nurses and lay screeners in conducting vision screening with preschoolers (n = 4040). The

results of the study found that trained nurses and lay screeners achieved similar sensitivities for detecting vision disorders in preschool children when using the Retinomax Autorefractor, the SureSight Vision Screener and crowded Linear Lea Symbols VA test (VIP Group, 2009). Additionally, Sabri et al. (2016), conducted a prospective, observational study examining the level of agreement between trainee screeners and an ophthalmologist administering vision screening to school-aged children (n = 1228) in Hamilton, Ontario. The authors reported trainee screeners, using M&S smart systems and Snellen crowed letters for VA, achieved a sample sensitivity of 95.5% and a sample specificity of 70.8% for detecting vision disorders. These findings indicate that lay screeners can be sufficiently trained to perform vision screening with certain tests to a high degree of accuracy (Sabri et al., 2016).

Participants indicated that PHNs' broad nursing knowledge in population health, health promotion, the nursing sciences, and child growth and development, and their nursing skills in health assessments, communication and collaboration, relationship-building, service coordination, and engagement strategies facilitated vision screening implementation. This knowledge and skills, coupled with PHNs' position within schools, communities and the public healthcare sector, and their competencies in community and public health nursing and legislated mandates, lend support to PHNs implementing vision screening in schools. Governments, PHUs, schools, and community vision screening programs are encouraged to

strategically utilize PHNs' expertise in public health and community nursing by assigning them roles that draw upon their unique knowledge and skills.

4. Implications for Practice, Education, Policy and Research

4.1. Practice. The findings of this thesis suggest multiple practice implications for organizations responsible for the implementation of school-based vision programs. First, and foremost, organizations must prioritize the needs of students and parents to facilitate access to screening, optometry care, and treatment. Therefore, organizations implementing vision screening are encouraged to implement varied strategies to support parent and student access to follow-up care after failed vision screening such as: (1) including contact information for local optometry offices with parent notification letters; (2) supporting parents to schedule optometry appointments; (3) providing financial support for transportation to follow-up appointments; and (4) providing free or low-cost eyeglasses.

Vision screening programs are encouraged to increase parents' health literacy levels by providing parent education materials on topics such as: childhood vision disorders and their risks, the purpose and benefits of both childhood vision screening and routine comprehensive eye examinations, and current recommendations regarding childhood visual health. Organizations are also encouraged to use effective and varied modes of communication when providing information to students and parent regarding vision screening. While

parent notification letters may suffice for some families, face-to-face interactions, as well as follow-up telephone calls and texts clarifying results and next steps to screening, may be necessary for others. Providers of vision screening programs might also consider having visual health promotion material and parent notification letters translated into multiple languages to meet local community needs. The availability of interpreters or multi-lingual providers would also benefit English Language Learners (ELL) during screening and would provide the necessary support to non-English speaking parents. To increase student participation and cooperation during screening, screeners must be flexible and skilled in working with children. Organizations are encouraged to integrate games and incentives with screening methods.

Developing and maintaining an organization's social capital via networks within the organization, and partnerships external to the organization, will facilitate implementation of vision screening. The following were described as key stakeholders in vision screening implementation: PHUs, schools, optometrists, community service organizations (e.g., Rotary Club), the OAO, and eyeglass retailers. Engaging external change agents and opinion leaders is a critical element to vison screening program implementation. Therefore, principals, school board staff, and OAO personnel should be involved in the planning phase to obtain their support and endorsement of vision screening in schools.

It is suggested that PHUs consider bundling vision screening with oral and/or hearing screening if operationally feasible to minimize workload increases and align new activities related to vision screening with core practices already in existence. In cases where the implementation of vision programs in schools is new, organizations might consider pilot testing prior to full program implementation. Formal mechanisms for obtaining feedback from staff implementing the screening program and external stakeholders, should be included as part of a program evaluation.

Vision program implementation requires dedicated resources including space, funding, and staff education and training. Organizational and system leaders must prioritize vision programs and commit to allocating the necessary resources if these programs are to be implemented and sustained. Organizations implementing vision screening must consider the local context and the needs of the population and make the necessary program and budgetary modifications to ensure equitable access to optometry care and treatment. Multi-sectoral coordination and collaboration, at both the provincial and local levels will be necessary to alleviate the financial burden of program implementation.

School-based vision screening was noted as a natural fit with the work of dental staff performing oral screening in schools. Participants also described the broad scope of PHNs' nursing practice, and skills, and their various positions held in schools, communities and the health care sector, as "bridges" between the three

systems. PHUs must determine who is best to deliver the screening and follow-up components of school-based vision programs through a deliberate and thoughtful examination of their communities' needs, and by the implementation of quality assurance processes, and an efficient utilization of their workforce. Therefore, PHUs are encouraged to consider PHNs' unique contribution and the benefits to vision screening implementation when PHNs' are strategically utilized.

4.2. Education. Visual health promotion and education is required to increase parents' understanding of the importance and value of vision screening and comprehensive eye exams. Collaboration between the MOHLTC, PHUs and the OAO is required to develop accurate health promotion and parent education materials aimed at increasing parents' visual health literacy. This information should be available in various languages, and should include eligibility criteria for, and recommended timing and frequency of, comprehensive visual exams, the signs, symptoms and treatment of childhood vision disorders, and the purpose and processes of vision screening.

Education is also needed for school staff as teachers' knowledge and beliefs of vision screening influenced their ability to support families in accessing screening and follow-up recommendations. Therefore, organizations implementing vision screening should consider providing teachers education on topics including: (1) child visual health and visual examination guidelines; (2) common childhood visual disorders, their signs, symptoms and treatment options;

(3) the impact of vision disorders on social, cognitive, and academic outcomes; (4) the benefits of school-based vision programs; (5) factors influencing families' access to follow-up care, and treatment; and (6) community resources available to support families and address barriers.

The new MOHLTC (2018b) Child Visual Health and Vision Screening Protocol indicates that screeners must complete ministry-specified training. Some PHUs may use internal staff to act as vision screeners, whereas other PHUs may decide to contract vision screening out to an external organization. Questions have arisen as to who is accountable for ensuring that screeners have the required knowledge, skill, and training necessary to competently conduct the screening, especially as education levels of screeners may range from a lay volunteer to a professional health care provider. Confidence in screener's ability and credentials increased parents' and optometrists' trust in screening results. It is therefore recommended that the MOHLTC consider developing and requiring mandatory certification for vision screeners to ensure program quality and consistency. Given that education and training is also associated with improved intervention implementation and higher degrees of self-efficacy, screener certification may also result in enhanced staff commitment to vision screening implementation. Finally, provincial government and optometry associations might consider comprehensive promotion strategies targeting parents, school staff, public health

units, and community vision program personnel to increase uptake of comprehensive eye exams and access to the OAO's Eye See Eye Learn program.

4.3. Policy. The implementation of school-based vision programs affords both opportunities and challenges. Policies that support evidence-based standards related to screening practices and tools, training and education, and follow-up processes will encourage consistency among programs, and allow for comparisons between populations. However, differences in mandates between the public health and education sectors creates a challenge for PHUs implementing vision programs within the school context. Therefore, the MOHLTC and the Ministry of Education are encouraged to align their policies and guidelines with respect to school-based vision programs to facilitate implementation of the program at the local level. Examples may include school board acceptance of passive consent processes for vision screening, development of policies that address missed screening due to absence, and policies that support data sharing between schools and PHUs. This data could be stored in a provincial database created specifically for vision screening and follow-up outcomes, or in existing databases used for reporting dental and/or immunization data. An integrated database would facilitate tracking and reporting of vision screening and follow-up program outcomes, program evaluation, surveillance of childhood visual health trends, support continuous quality improvement, and develop provincial policy to support the cost of eyeglasses for children.

Policy makers may also wish to consider the benefits of including primary care providers and school staff within the circle of care. It is suggested that the MOHLTC collaborate with the Ontario Privacy Commissioner to address the barriers in sharing health information between organizations to enable communication of screening results with teachers, principals and primary care practitioners with the aim of improving adherence to screening recommendations and treatment plans. Finally, governing bodies are also encouraged to review other countries' implementation of legislated policies requiring a comprehensive exam prior to school entry and/or during school, as this universal and systematic approach may prove to be an effective strategy to address visual health inequities.

4.4. Research. School-based vision screening programs aim to identify students who require further assessment to increase early identification and treatment of vision disorders. Therefore, research exploring the impact of school-based vision screening programs on comprehensive eye exam uptake, the cost-effectiveness of these programs, and short-and-long term visual health outcomes is required. If universal school-based vision screening programs are demonstrated to improve visual outcomes and are cost-effective, government agencies should consider investing in these programs and allocating resources toward developing high-level partnerships with industry to source low-cost eyeglasses.

Future research should also consider examining whether access and adherence to follow-up optometry care is enhanced with the involvement of

multiple stakeholders such as teachers, principals, primary care providers, and/or PHNs. These findings may enhance health system integration, promote parents' adherence to follow-up recommendations and treatment plans, identify the potential value-added of PHN involvement, and promote the strategic utilization of human resources.

5. Methodological Rigor and Trustworthiness

Methodological and analytic processes used in this study incorporated techniques described by Lincoln and Guba (1985) and helped to establish credibility, confirmability, dependability, and transferability, thereby strengthening the study's rigor and trustworthiness.

5.1. Credibility. Credibility refers to the truthfulness of the findings in their depiction of the experiences and perceptions of participants (Lincoln and Guba, 1985). Sampling of participants with different perspectives and varied experiences was conducted to increase the likelihood the research question was explored from a variety of aspects (Patton, 1987). Also, the meaning units used when coding the data were sufficiently narrow to capture a single meaning, yet broad enough to avoid fragmentation, thereby decreasing the chance that meaning could be lost (Graneheim & Lundman, 2004). Although the domains and constructs of Damschroder et al.'s (2009) CFIR were used to organize the data, when the data did not belong in a construct, a code was inductively created using words quoted from the text. This coding strategy served as another way of

strengthening the credibility of this study. Finally, corroboration of codes and categories with committee members ensured that findings were internally coherent and consistent with the participants' meaning. Thesis committee members reviewed segments of the codebook to ensure internal coherence and consistency with participants' meaning.

5.2. Confirmability. Confirmability refers to the degree in which descriptions are grounded in the data, and free from the researcher's personal bias (Lincoln & Guba, 1985). Adherence to the tenets of the analytical method used in this thesis study increased the likelihood that the findings were an accurate representation of participants' meaning. Theoretical assumptions underpinning content analysis include axioms of Watzlawick et al.'s (1967) communication theory (Graneheim & Lundman, 2004). According to Watzlawick et al. (1967), interactions that occurred between the researcher and the participants shaped the text of the transcribed interviews and these are considered communication acts. The researcher must, therefore, explore each text, and determine the message to be described (Graneheim & Lundman, 2004). Watzlawick et al. (1967) also suggest that every communication includes both a content aspect and a relationship aspect (Graneheim & Lundman, 2004). This thesis study remained focused on the manifest content as represented by the textual data, and did not aim to interpret the underlying meaning, or latent content, in the analysis. However, it was recognized that the researcher's self, and the relationship between her "self"

and the participants, influenced the messages communicated, and thus the written words or textual data. Both the interactions and relationships between the researcher and participants were noted to have influenced the textual data collected. It is possible that participants' knowledge of the researcher's role as a PHN influenced their responses and increased the possibility for participant bias. However, many participants in this study reported that the researcher's knowledge and understanding of the contextual factors influencing vision screening implementation facilitated her understanding of their experiences. Additionally, one participant openly criticized public health despite knowing that the researcher worked in a public health unit indicating that participant bias was absent or minimal. The feedback from participants and the critical comment of one participant, suggest that: (1) the researcher's professional nursing role enhanced her understanding of participants' meaning; and (2) the researcher was able to quickly develop rapport with participants that led to trusting relationships which facilitated their willingness to share meaningful rich data. Triangulation of data sources including focus groups, face-to-face and telephone interviews, and field notes also confirmed that the descriptions were grounded in the data and remained free from researcher bias (Lincoln & Guba, 1985).

5.3. Dependability. Dependability refers to the consistency of data over time and is dependent upon the decisions made by researchers during the process of analysis (Graneheim & Lundman, 2004). The use of interview guides

throughout the data collection process ensured that methods of eliciting data were consistent among participants, thereby instilling consistency and dependability. Additionally, the findings from the content analysis conducted in this thesis study were compared to existing vision program implementation literature and determined to be reasonable and logical, indicating the results were dependable. Memos and reflexive journals of decisions made throughout the stages of analysis were recorded and the resulting audit trail also further increased the dependability and consistency of the study's findings (Vaismoradi et al, 2013).

5.4. Transferability. Transferability refers to the extent to which findings from the study can be transferred to other contexts and groups (Graneheim & Lundman, 2004). Clear descriptions of the context, selection and groups to which participants belonged were provided to facilitate the transferability of this thesis study's findings to other settings. However, participant recruitment was limited to a relatively small sample of individuals with knowledge and experience of vision screening program implementation due to the limited number of vision screening programs in existence throughout Ontario. Therefore, distinct descriptions of participants and their contexts were limited by the need to maintain confidentiality. To mitigate this limitation, the results of the analysis were described with quotes from participants to allow for a presentation of the contextual nuances and to promote transferability to other settings.

6. Strengths and Limitations of the Implementation Framework

Damschroder et al.'s (2009) CFIR was used as the implementation framework to guide the directed content analysis of textual data regarding the barriers and facilitators of school-based vision screening implementation. Several strengths and limitations were noted. Firstly, the domains and constructs of Damschroder et al.'s (2009) CFIR were comprehensive; they facilitated a close examination of key informants' perceptions of factors that influenced the process of implementation that were internal and external to organizations implementing vision programs that related to characteristics of the intervention and of the individuals implementing the intervention. However, the constructs were considered too extensive for use in developing the interview questions, therefore the interview questions were kept broad and open-ended such as: "In your experience, are there certain factors that facilitate the implementation of school-based vision screening and follow-up programs?". Therefore, some constructs of the CFIR, did not naturally emerge from the data as factors influencing vision screening implementation. For example, no results emerged within the *culture* or *learning climate* constructs within the *inner setting* domain. However, interview questions and probes did not ask participants about either of these organizational elements and the influence of factors within these constructs may have been missed. The extensiveness of the CFIR constructs and subconstructs also resulted in the generation of a large, multi-levelled, codebook which required close

attention to the quality and consistency of coding during data analysis. Analysis of the results was challenging due to the complexity of the phenomenon under study.

Secondly, the CFIR provided a systematic structure for organizing the facilitators and barriers to program implementation in multiple settings, by various interventionists. As a result, findings from the analysis generated pragmatic strategies useful for both policy-makers and practitioners implementing vision screening. The systematic structure of the framework was helpful in categorizing data segments that were clearly defined and separate, however, factors that exerted influence in several constructs and domains were more difficult to analyse and assemble during the final compilation stage.

Thirdly, coherence of CFIR terminology and construct definitions were generally clear. However, some constructs were vague, had gaps in their descriptions, or were difficult to discern from one another. For example, although the concepts of social capital, within the *cosmopolitism* construct, describe the trusting relationships between the individuals and organizations, the construct does not fully capture the influence of the relationship between those who are directly responsible for implementing an intervention and those who are the target of the intervention. Therefore, the first author of the framework, Laura Damschroder, was contacted to assist with the interpretation of this construct. L.

Damschroder indicated that the gap would be addressed in the next version of the CFIR (L. Damschroder, personal communication, September 24, 2018).

Future research of vision screening implementation should consider the use of Damschroder et al.'s (2009) CFIR in all phases of implementation, as well as the influence of the relationships between factors within, and among, the constructs and domains of the CFIR. Knowledge gained may promote a better understanding of the complex nature of vision screening implementation, and support organizations through the implementation process.

7. Strengths and Limitations of the Thesis Study

There were several strengths in this thesis study. Firstly, the use of the qualitative descriptive approach supported a more fulsome exploration of the participants' perceptions and experiences than would a quantitative survey. Secondly, maximum sampling strategy promoted variability within the groups of participants sampled in terms of roles, discipline, position, and years of experience with vision screening. This heterogeneity among participants (except parents) increased the likelihood that multiple perspectives and meanings were captured and presented, and enhanced the possibility of transferability of the findings to other settings. Thirdly, the findings of this study were actionable and useful to policy-makers and practitioners.

There were some limitations to this study. Firstly, feasibility, time, resources, and the recruitment strategies used to collect parents' perspectives was

limited due to the limited number of parent participants involved. The resulting parent group was highly homogeneous and data saturation was not achieved within this group. All parent participants recruited in this study had access to a telephone, spoke English, lived in an urban community, and had the time and capacity to schedule and maintain the study interview. These parents may not be representative of parents living in other settings, who do not have access to a telephone, are non-English speaking, or have difficulty scheduling and/or maintaining appointments. Furthermore, none of the parent participants had children who had failed vision screening. Although some of these parents reported friends' experiences related to failed vision screening, the first-hand knowledge and experience of a parent whose child had failed vision screening would have strengthened the findings. Therefore, the dimensionality of parent perspectives was limited, and the findings may not be transferable to other parent groups. Future research should consider the use of varied sampling and recruitment strategies to increase the heterogeneity of parent perspectives.

Secondly, this study did not obtain students' experiences and perspectives of vision screening implementation. Future research should consider including students' experiences as their perspectives may help to promote the development and delivery of child-friendly vision screening programs.

8. Conclusion

The purpose of this qualitative descriptive study was to explore the perceptions of key informants regarding the factors that influenced the implementation of school-based vision screening, and the role of nurses in supporting implementation of these programs. The results of the study indicate that multiple factors, both internal and external to an organization, influence the implementation vision screening in schools and included an implementing organization's ability to: (1) prioritize and address the needs of students and parents; (2) develop strong partnerships with external organizations; (3) demonstrate a commitment to vision screening implementation through dedicated resources; (4) foster networks and communications among internal staff; (5) manage the perceived complexity of implementation; (6) address the costs associated with implementation; and (7) establish the quality of the vision screening program. Findings from the study also indicate that PHNs' knowledge and skills and their position in schools, communities, and the healthcare system facilitate vision screening implementation. This study suggests that a comprehensive and coordinated approach is necessary when implementing school-based vision screening programs. Governments, community vision programs, PHUs, and schools are encouraged to explore and address the factors identified in this thesis as they move through the processes of implementation. PHUs consider strategic utilization of PHNs' broad scope of knowledge, skill, and expertise to promote implementation of vision screening programs in schools.

Future research exploring school-based vision screening implementation should consider including children's perspectives and a broader parent perspective.

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Appendix A
Damschroder et al. (2009)'s Consolidated Framework For Implementation Research

Domain	**Constructs and Sub-Constructs**
Intervention Characteristics	A. Intervention Source B. Evidence Strength and Quality C. Relative Advantage D. Adaptability E. Trialability F. Complexity G. Design Quality and Packaging H. Cost
Outer Setting	A. Patient Needs and Resources B. Cosmopolitanism C. Peer Pressure D. External Policy and Incentives
Inner Setting	A. Structural Characteristics B. Networks and Communications C. Culture D. Implementation Climate a. Tension for change b. Compatibility c. Relative priority d. Organizational incentives and rewards e. Goals and feedback f. Learning climate E. Readiness for Implementation a. Leadership engagement b. Available resources c. Access to information and knowledge
Characteristics of Individuals	A. Knowledge and Beliefs about the Intervention B. Self-efficacy C. Individual Stage of Change D. Individual Identification with Organization E. Other Personal Attributes
Process	A. Planning B. Engaging a. Opinion leaders b. Formally appointed internal implementation leaders c. Champions d. External change agents C. Executing D. Reflecting and Evaluating

Appendix B

Telephone/Email Recruitment Script for Providers

Successful Implementation of School-based Vision Screening and Follow-up Programs in Ontario

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E-mail Subject line: McMaster Study: Successful Implementation of School-based Vision Screening and Follow-up Programs in Ontario

Dear _____:

I am a McMaster graduate student and am conducting a research study on school-based vision screening and follow-up programs. This research is part of my Master of Science program in Nursing at McMaster University. The purpose of this research study is to understand what interventions are important for successful implementation of school-based vision screening programs and follow-up programs and how best to implement these interventions. I would like to hear different perspectives including those of vision screening program staff, optometrists/ophthalmologists, public health staff and parents.

I received your name from [**name of personal contact or contact obtained from publicly-available document**] and you have been identified as a person with experience, or knowledge of, vision screening and/or follow-up programs. I am inviting you to take part in a 60 minute-interview that will take place at a time and place in the community that is convenient for you. You may be offered to participate in a focus group, depending on the number of respondents who are similar to you. You can do the interview by telephone if it is easier.

This study will require a one-hour time commitment from you and I understand that there are many reasons why you may not be able to participate in this study. I will not tell anyone who participated and who did not. It is unlikely that there will be any harms or discomforts from/associated with the study. You can withdraw from this study any time, up until the study is completed and findings have been written for publication.

I have attached a copy of a letter of information about the study that gives you full details. This study has been reviewed and approved by the Hamilton Integrated Research Ethics Board (HiREB). The HiREB is responsible for ensuring that participants are informed of the risks associated with the research, and that

participants are free to decide if participation is right for them. If you have any questions about your rights as a research participant, please call the Office of the Chair, HiREB at 905.521.2100, extension 42013.

I would like to thank you in advance for your time and consideration. Please contact me directly at petittra@mcmaster.ca with questions or if you are interested in participating in this study.

Rachael Haalboom, BA, BScN, RN, CCHN (C)
Masters Candidate in Nursing
School of Nursing, McMaster University, Hamilton Ontario

Appendix C

LETTER OF INFORMATION / CONSENT FOR PROVIDERS

Successful Implementation of School-based Vision Screening and Follow-up Programs in Ontario

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Investigators:

Local Principal Investigator:
Dr. Ruta Valaitis
Associate Professor School of Nursing
McMaster University
Hamilton, Ontario, Canada
(905) 525-9140 Ext. 22298

E-mail: valaitis@mcmaster.ca

Student Investigator:
Rachael Haalboom
School of Nursing
McMaster University
Hamilton, Ontario, Canada
E-mail: petittra@mcmaster.ca

Purpose of the Research Study:
The purpose of this research study is to understand what interventions are important for successful implementation of school-based vision screening programs and how best to implement these interventions. We are also interested in learning about the role of the Public Health Nurse in vision screening and follow-up programs. We would like to hear different perspectives including vision screening program staff, optometrists/ophthalmologists, public health staff and parents. You are invited to share your knowledge of, and experience with, school-based vision screening and follow-up programs by participating in this research study.

What will happen during the study?
You will be asked to participate in one interview at a location and time that is convenient for you. You may be offered to participate in a focus group depending on the number of participants who are similar to you. You can decide if you would prefer a telephone interview to a face-to-face interview. During the interview, we will ask you questions about your knowledge and experience regarding vision screening and follow-up programs. We will audio-record the interview and take handwritten notes with your permission. We will also ask you

for some demographic/background information like your experience and your position.

The following are some sample questions:

1. Briefly describe your experience in conducting vision screening and/or follow-up.

2. What factors facilitate the implementation of school-based vision screening and follow-up programs?

Are there any costs or risks to doing this study?
This study will require a one-hour time commitment from you to participate in an interview or focus group. It is unlikely that you will experience any harm related to this study. However, if participating in a focus group, there is a risk for breach of privacy should another focus group member not honour the request that group members' views remain confidential. You do not need to answer questions that you do not want to answer or that make you feel uncomfortable. Participants in focus groups will be asked to make only those comments that they would be comfortable making in a public setting; and to hold back making comments that they would not say publicly. If you would like to schedule a one on one telephone interview following the focus group to provide additional information that you did not feel comfortable sharing during the focus group, you can contact Rachael Haalboom directly by email at petittra@mcmaster.ca

Are there any benefits to doing this study?
The research will not benefit you directly. This study will help service providers, vision screening program staff and public health organizations understand what features of vision screening and follow-up programs are necessary. This study will also help in understanding how best to implement vision screening and follow-up programs as well as factors that facilitate or inhibit their implementation.

Who will know what I said or did in the study?
Every effort will be made to protect your confidentiality and privacy. We will not use your name or any information that would allow you to be identified. However, we are often identifiable through the stories we tell and so you do not need to answer questions if you do not want to or make comments that you would not make publicly.

The information/data you provide will be stored in a password-protected file, on an encrypted computer at McMaster University. Once the study is complete, an

archive of the data, without identifying information, will be maintained by McMaster University.

What if I change my mind about being in the study?
Your participation in this study is voluntary. It is your choice to be part of the study or not. You can withdraw from this study by contacting one of the study investigators up until the study is completed and findings have been written for publication.

How do I find out what was learned in this study?
It is projected that this study will be completed by August 2018. If you would like a brief summary of the results, please indicate this below or let one of the study investigators know and a copy will be sent to you.

Questions about the study:
If you have questions or need more information about the study itself, please contact:

Rachael Haalboom
Email: petittra@mcmaster.ca

This study has been reviewed by the Hamilton Integrated Research Ethics Board (HiREB). The HiREB is responsible for ensuring that participants are informed of the risks associated with the research, and that participants are free to decide if participation is right for them. If you have any questions about your rights as a research participant, please call the Office of the Chair, HiREB, at 905.521.2100 x 42013.

CONSENT

- I have read the information presented in the Information Letter about the study being conducted by Rachael Haalboom**,** of McMaster University.
- I have had the opportunity to ask questions about my involvement in this study and to receive additional details I requested.
- I understand that if I agree to participate in this study, I may withdraw from the study at any time or up until the study is completed and findings have been written for publication.
- I agree to participate in the study.
- I have been given a copy of this form.

Signature: _____ Date: _____

Name of Participant (Printed): _____

1. I agree that the interview can be audio recorded. Yes No
2. I agree that the interviewer may take field notes Yes No
3. I agree to have my responses used for this project Yes No
4. I agree to be contacted again by the researcher to clarify any thoughts that I have shared following the interview.
   Yes No
5. I would like to receive a summary of the study results Yes No

   If yes, where would you like the results sent:

   Email: _____

   Mailing address: _____

   _____

   _____

   _____

_____ _____
Name of Participant (Printed) Signature
Date

Consent form explained in person by:

_____ _____
Name and Role (Printed) Signature

Appendix D

Email Recruitment Script for Advisory Group Members
Sent on Behalf of the Researcher
by the Holder of the Participants' Contact Information

Successful Implementation of School-based Vision Screening and Follow-up Programs in Ontario

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Sample E-mail Subject line: McMaster study: School Vision Screening and Follow-up Programs

Dear [**Name of Advisory Group member**]:

Rachael Haalboom, a McMaster student, is doing a research study on vision screening and follow-up programs in schools. This research is part of her Master of Science program in Nursing at McMaster University.

Rachael is doing a research study to understand what is needed for successful school-based vision screening and follow-up programs, and how best to offer these programs. She wants to understand what makes it easier for parents to have their child's vision tested and get the follow-up eye exam and treatment. This information can help vision screening programs, public health staff and eye doctors better plan and deliver vision screening and follow-up programs in schools.
Rachael is interested in hearing different people, including eye doctors, public health staff, vision screening program staff and parents. She is inviting you to take part in a 60-minute interview that will take place at a convenient time and place in the community. If easier, you can do the interview by telephone. She will work out those details with you.

Rachael will not tell me or anyone who participated or who did not. Taking part or not taking part in this study will not affect your status as a member of the McMaster Kindergarten Vision-Testing Programme Advisory Group. You can withdraw from the study at any time, up until the study is completed and findings have been written for publication. A copy of the information letter is attached to this email and gives you full details about Rachael's study.

If you are interested in getting more information about taking part in this study please read the brief description below and contact Rachael directly at petittra@mcmaster.ca

In addition, this study has been reviewed and cleared by the Hamilton Integrated Research Ethics Board (HiREB). The HiREB is responsible for ensuring that participants are informed of the risks associated with the research, and that participants are free to decide if participation is right for them. If you have any questions about your rights as a research participant, please call the Office of the Chair, HiREB at 905.521.2100 extension 42013.

Sincerely,

Primary Investigator, McMaster Kindergarten Vision-Testing Programme

Appendix E

LETTER OF INFORMATION / CONSENT FOR PARENTS

Successful Implementation of School-based Vision Screening and Follow-up Programs in Ontario

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Investigators:

Local Principal Investigator:
Dr. Ruta Valaitis
Associate Professor School of Nursing
McMaster University
Hamilton, Ontario, Canada
(905) 525-9140 Ext. 22298

E-mail: valaitis@mcmaster.ca

Student Investigator:
Rachael Haalboom
School of Nursing
McMaster University
Hamilton, Ontario, Canada
E-mail: petittra@mcmaster.ca

Purpose of the Research Study:
The goal of this research study is to to understand what is needed for successful school-based vision screening and follow-up programs, and how best to offer these programs. We also want to understand makes it easier for parents to have their child's vision tested and get treatment. We are interested in hearing from parents, vision screening program staff, public health staff, and eye doctors. You are invited to take part in this study.

What will happen during the study?
You will be asked to take part in one 60-minute interview at a place and time that is easiest for you. You can decide if you would like a telephone interview or a face-to-face interview. During the interview, we will ask you questions about your experience with vision screening and follow-up programs. With your permission, we will tape-record the interview and write notes. We will also ask you for some background information like your level of education and income so that we can describe the people taking part in the study as a group. You will not be identified in any report of this study.

These are some sample questions:

1. Tell me about your experiences with vision screening for your child?

2. Tell me about your experiences with follow-up eye exams or treatment?

Are there any costs or risks to doing this study?
You will need to make time to take part in the 60-minute interview. It is not likely that there will be any risks or discomforts from this study. You do not need to answer questions that you do not want to answer or that make you feel uncomfortable.

Are there any benefits to doing this study?
The research will not benefit you directly. This study will help eye doctors, vision screening staff and public health staff to understand what is needed for vision screening and follow-up programs to be helpful for parents and children and how best to offer these programs.

Who will know what I said or did in the study?
Every effort will be made to protect your confidentiality and privacy. We will not use your name or any information that would allow you to be identified. However, we are often identifiable through the stories we tell and so you do not need to answer questions if you do not want to.

The information you provide will be stored in a password-protected file on an encrypted computer at McMaster University. Once the study is finished, a record of the data, without identifying information, will be kept by McMaster University.

What if I change my mind about being in the study?
Your participation in this study is voluntary. It is your choice to be part of the study or not. You can stop being part of the study by letting on of the investigators know up until the study is finished and the results have been written for publication.

How do I find out what was learned in this study?
I expect to have this study finished by August 2018. If you would like a short summary of the results, you can give us your contact information or let one of the researchers know and a copy will be sent to you.

Questions about the study:
If you have questions or need more information about the study, please contact:
Rachael Haalboom
Email: petittra@mcmaster.ca

This study has been reviewed by the Hamilton Integrated Research Ethics Board (HiREB). The HiREB is responsible for ensuring that participants are informed of the risks associated with the research, and that participants are free to decide if participation is right for them. If you have any questions about your rights as a research participant, please call the Office of the Chair, HiREB, at 905.521.2100 x 42013.

CONSENT

- I have read the information in the Information Letter about the study being conducted by Rachael Haalboom**,** of McMaster University.
- I have had a chance to ask questions about taking part in this study and about how I can get more information.
- I understand that if I agree to participate in this study, I may withdraw from the study at any time until the study is finished and the results have been written for publication.
- I agree to participate in the study
- I have been given a copy of this form.

Signature: _____
Date: _____

Name of Participant (Printed): _____

1. I agree that the interview can be tape-recorded. Yes No
2. I agree that the interviewer may write notes during the interview
   Yes No

3. I agree to have my answers used for this project Yes No

4. I agree to be contacted again by the researcher to give more information about my answers if needed. Yes No

6. I would like to a summary of the study's results Yes No
   No

If yes, where would you like the results sent:

Email: _____

Mailing address: _____

_____

_____

_____

_____ _____

Name of Participant (Printed) Signature

Date_____

Consent form explained in person by:

_____ _____ _____

Name and Role (Printed) Signature Date

Appendix F

Email Recruitment Script for Providers
Sent on Behalf of the Researcher
by the Holder of the Participants' Contact Information

Successful Implementation of School-based Vision Screening and Follow-up Programs in Ontario

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Sample E-mail Subject line: McMaster study: School Vision Screening and Follow-up Programs

Dear [**Name of Provider**]:

Rachael Haalboom, a McMaster student, is doing a research study on vision screening and follow-up programs in schools. This research is part of her Master of Science program in Nursing at McMaster University.

Rachael is doing a research study to understand what is needed for successful school-based vision screening and follow-up programs, and how best to offer these programs. Rachael is interested in hearing different people, including eye doctors, public health staff, vision screening program staff and parents.

Rachael is inviting you to take part in a 60-minute interview that will take place at a convenient time and place. If easier, you can do the interview by telephone. She will work out those details with you. Rachael will not tell me or anyone who participated or who did not. A copy of the information letter is attached to this email and gives you full details about Rachael's study.

If you are interested in getting more information about taking part in this study please read the brief description below and contact Rachael directly at petittra@mcmaster.ca

This study has been reviewed by the Hamilton Integrated Research Ethics Board (HiREB). The HiREB is responsible for ensuring that participants are informed of the risks associated with the research, and that participants are free to decide if participation is right for them. If you have any questions about your rights as a research participant, please call the Office of the Chair, HiREB at 905.521.2100 extension 42013.

Sincerely,

Name
Position and Organization

Appendix G

Oral Consent Log

Successful Implementation of School-based Vision Screening and Follow-up Programs in Ontario

RESEARCHER'S LOG FOR RECORDING VERBAL CONSENT

Date	Participant's Name

Appendix H

Interview Guide for Providers

Successful Implementation of School-based Vision Screening and Follow-up Programs in Ontario

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[Participant consent to be reviewed and signed prior to start of interview]

The purpose of this research study is to understand what interventions are important for successful implementation of school-based vision screening and follow-up programs, and how best to implement these interventions. I am also interested in learning about the role of the Public Health Nurse in vision screening and follow-up programs. I would like to hear different perspectives including vision screening program staff, optometrists/ophthalmologists, public health staff and parents. The first questions are needed to describe providers participating in this study as a group. You will not be identified in any report of the study.

1. **What is your role in relation to child vision screening or vision screening follow- up?**

2. **How long have you been involved with child vision screening or follow-up programming?**

   a) Less than 1 year
   b) 1 year to 5 years
   c) More than 5 years

3. **How would you describe the communities in which you have been involved with child vision screening and follow-up programs? Select all that apply.**

   a) Urban
   b) Rural
   c) High-priority or high-risk neighbourhood

Questions and Probes:

The following questions are about the school-based vision screening programs and follow-up. By follow-up, I mean the comprehensive eye exam provided on-

site at schools or in community optometry clinics/offices and any case management or treatment that was suggested.

1. **Briefly describe your experience in conducting visions screening and or follow-up.**

2. **In your experience, who needs to be involved and what needs to be in place for the successful implementation of school-based vision screening and follow-up programs?**
   a. Probe: Think about individuals, organizations, and/or sectors.
   b. Probe: Think about policies, resources, and/or programs.
3. **In your experience, are there certain factors that facilitate the implementation of school-based vision screening and follow-up programs?**
   a. Probe: Factors such as:
      - feasibility of program implementation, pressures from other providers or stakeholders, public health policies, community needs, employer / leadership expectations, knowledge of best practices in screening/follow up, clear responsibility and accountability regarding screening and follow-up, public education, availability of training, standardized data system, government support, or evaluation measures and tools

4. **In your experience, are there certain factors that challenge or inhibit the implementation of school-based vision screening and follow-up programs?**
   a. Probe: Factors such as:
      - feasibility of program implementation, pressures from other providers or stakeholders, public health policies, community needs, employer / leadership expectations, knowledge of best practices in screening/follow up, clear responsibility and accountability regarding screening and follow-up, public education, availability of training, standardized data system, government support, or evaluation measures and tools

5. **What advice would you give to other organizations or providers who were planning on implementing the vision screening and follow-up programs?**

a. Probe: What have you seen work well and what you would suggest be done differently?

6. **Is there anything else that you think I should know about implementing school-based vision screening or follow-up programs?**

7. **Is there anyone else that you think I should interview about implementing school-based vision screening or follow-up programs?**

   Name: _____

   Position & Organization: _____

   If I follow up with this person, may I mention that I received his/her name from you? YES ____ NO ____

Appendix I

Interview Guide for Parents

Successful Implementation of School-based Vision Screening and Follow-up Programs in Ontario

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[Participant consent to be reviewed and signed prior to start of interview]

I am interested in understanding your experience with school-based vision screening and follow-up programs. The first questions are needed to describe the people taking part in this research study as a group. You will not be identified in any report of the study.

1. **In what type of community was your child's vision screening done?**
   a. Urban
   b. Rural

2. **Had your child been to an eye doctor before the vision screening program?**
   a. Yes
   b. No

Questions and Probes:
The following questions are about the vision screening program and follow-up that children get after they have their eyes screened in school. By follow-up, I mean the eye exam done by an eye doctor and any treatment your child may have gotten.

3. **Tell me about your experiences with vision screening for your child?**
   a. Probe: When did it happen? Where, how and by whom was it done?

4. **Tell me about your experiences with follow up eye exams or treatment?**
   a. Probe: When did it happen? Where, how and by whom was it done?

5. **What helps parents get their child's eyes checked?**
   a. Probe: Factors such as:
      - Ease of contacting eye doctor, ease of scheduling appointment, ease of travel to eye doctor, understanding of the importance of eye health and of childhood vision problems, financial

assistance, someone to help parents get vision testing done and understanding the results

6. **What makes it hard for parents to have their child's eyes checked?**
    a. Probe: Factors such as:
        - financial barriers, parental mental and physical health issues, difficulty planning and organizing appointments, parental understanding of eye health and childhood vision problems, family living arrangements (e.g., custody), and pressures related unstable housing and lack of transportation

7. **What helps parents get the follow-up eye exam and/or treatment for their child?**
    a. Probe: Factors such as:
        - Ease of contacting eye doctor, ease of scheduling appointment, ease of travel to eye doctor, understanding of the importance of eye health and of childhood vision problems, financial assistance, someone to help parents get vision testing done and understanding the results

8. **What makes it hard for parents to get the follow-up eye exam and/or treatment for their child?**
    b. Probe: Factors such as:
        - financial barriers, parental mental and physical health issues, difficulty planning and organizing appointments, parental understanding of eye health and childhood vision problems, family living arrangements (e.g., custody), and pressures related unstable housing and lack of transportation

9. **What role did, or could, a Public Health Nurse play in vision screening and follow-up programs?**

10. **What would you tell groups that want to offer vision screening and follow- up programs in schools?**
    a. Probe: What do you think works well?
    b. Probe: What should be done differently?
    c. Probe: Are there certain people who could help parents in getting their child's eyes checked and/or the follow-up care?
    d. Probe: Are there certain processes, such as letters, phone calls,

or scheduling of eye appointments, that should be in place to help
parents in getting their child's eyes checked or to get the follow-up
care?

11. Is there anything else that you think I need to know about vision screening or follow-up programs offered in schools?

12. Is there anyone else that you think I should interview about vision screening or follow-up programs offered in schools?

Name: _____

Position & Organization: _____

13. Would you be willing to share the Letter of Information/Consent with other parents whom you think I should speak with about vision screening or follow-up programs offered in schools? YES __ NO __

Appendix J

Focus Group and Interview Guide

Successful Implementation of School-based Vision Screening and Follow-Up Programs in Ontario

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I) INTRODUCTION AND INSTRUCTIONS:

Hello, my name is Rachael Haalboom. Thank you for agreeing to participate in this focus group. Just to remind everyone, I am looking at experiences with, and knowledge of, school-based vision screening and follow-up programs. The purpose of this research study is to understand what interventions are important for successful implementation of school-based vision screening and follow-up programs, and how best to implement these interventions. I am also interested in learning about the role of the Public Health Nurse in vision screening and follow-up programs. By follow-up, I mean parents' and students' access to eye doctors for the comprehensive eye exam and required treatment, as well as case management that may have been necessary to facilitate families' access to treatment and care.

What is a focus group? A focus group is an interactive group discussion where we can gain several perspectives about a topic and members of the group can think about and comment on what others have said in the group. In a minute, we will all introduce ourselves – first names only. But first, I would like to walk you through the consent form that is in front of you.

***C*onfidentiality**: Before we begin our discussion, I want to spend a few moments talking about confidentiality and to go over some basic ground rules for our focus group discussion today:

- Everyone's views are welcomed and important.
- The information which I will collect today will be attributable *(connected or associated)* to you as a group.
- I will not identify quotes or ideas with *any one person* of this group. Because of the nature of small communities or groups, it is possible that people could link participants in this room to quotes in the report. This is why I need to talk about confidentiality.

- I *am* assuming that when we learn about one another's views, they remain confidential. In a small community (group) like this, people are identifiable to some degree by their views and opinions.
- Having said this, and having made these requests, you know that I cannot guarantee that the request will be honoured by everyone in the room.
- I am asking you to make only those comments that you would be comfortable making in a public setting; and to hold back making comments that you would not say publicly.
- If you want to stop being in the focus group you can leave or stay and simply stop talking, but it will not be possible for you to pull out your data from the flow of the conversation because of the interconnected nature of the group discussion where one person's comments can stimulate the sharing of comments made by others in the group.
- Anything heard in the room should stay in the room.
- If there is information that you do not feel comfortable sharing in the focus group but that you would like to share with the researcher, you may contact the student researcher, Rachael Haalboom at petittra@mcmaster.ca, to schedule a one on one telephone follow-up session.
- All voices are to be heard, so I will step in if too many people are speaking at once or to make sure that everyone has a chance to speak.
- I may also step in if I feel the conversation is straying off topic.
- After the discussion, I will invite you to fill in an anonymous "background sheet" to help generally describe the people who were part of the group today.
- You can expect this discussion group to last about 45-60 minutes.

Use of Tape Recorder

- As you will recall, this focus/discussion group will be recorded to increase accuracy and to reduce the chance of misinterpreting what anyone says.
- An external source will transcribe the recording and I will keep the electronic transcripts and field notes in an encrypted, password-protected file. All recordings and field notes will be destroyed once transcribed.
- Names will be removed from transcripts. Participants will have coded numbers attached to their name which only I will know.
- Only I, my thesis supervisor and supervisory committee will have access to transcripts (with your personal names removed) of this focus group.
- I will also ask that when using abbreviations or acronyms, you say the full name at least once to aid transcription.

- I may also use a "flip chart" to write down key points during the focus group and take notes.

[Researcher to ensure participant consent has been signed prior to start of interview]

Questions and Probes:

The following questions are about the school-based vision screening programs and follow-up. By follow-up, I mean the comprehensive eye exam provided on-site at schools or in community optometry clinics/offices, and any case management or treatment that was suggested.

8. **Briefly describe your experience in conducting visions screening and or follow-up.**

9. **In your experience, who needs to be involved and what needs to be in place for the successful implementation of school-based vision screening and follow-up programs?**
   c. Probe: Think about individuals, organizations, and/or sectors.
   d. Probe: Think about policies, resources, and/or programs.

10. **In your experience, are there certain factors that facilitate the implementation of school-based vision screening and follow-up programs?**
    b. Probe: Factors such as:
       - feasibility of program implementation, pressures from other providers or stakeholders, public health policies, community needs, employer / leadership expectations, knowledge of best practices in screening/follow up, clear responsibility and accountability regarding screening and follow-up, public education, availability of training, standardized data system, government support, or evaluation measures and tools

11. **In your experience, are there certain factors that challenge or inhibit the implementation of school-based vision screening and follow-up programs?**
    b. Probe: Factors such as:

- feasibility of program implementation, pressures from other providers or stakeholders, public health policies, community needs, employer / leadership expectations, knowledge of best practices in screening/follow up, clear responsibility and accountability regarding screening and follow-up, public education, availability of training, standardized data system, government support, or evaluation measures and tools

12. **From your experience, what role is there for Public Health Nurses in school-based vision screening and/or follow-up programs?**

13. **What advice would you give to other organizations or providers who were planning on implementing the vision screening and follow-up programs?**
    b. Probe: What have you seen work well and what you would suggest be done differently?

14. **Is there anything else that you think I should know about implementing school-based vision screening or follow-up programs?**

15. **Is there anyone else that you think I should interview about implementing school-based vision screening or follow-up programs?**

Name: _____

Position & Organization: _____

If I follow up with this person, may I mention that I received his/her name from you? YES ____ NO ____

Appendix K

FOCUS GROUP BACKGROUND SHEET

Successful Implementation of School-based Vision Screening and Follow-Up Programs in Ontario

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Please DO NOT put your name on this sheet.

INSTRUCTIONS:

Please fill in this form. Your answers will provide me with some basic background information about you.

1. **What is your role in relation to child vision screening or vision screening follow- up?**

2. **How long have you been involved with child vision screening or follow-up programming?**

   d) Less than 1 year
   e) 1 year to 5 years
   f) More than 5 years

3. **How would you describe the communities in which you have been involved with child vision screening and follow-up programs? Select all that apply.**

   d) Urban
   e) Rural
   f) High-priority or high-risk neighbourhood

Please turn over this brief information sheet and leave it on the table when you leave.

Thank you

Appendix L

CONFIDENTIALITY AGREEMENT

Transcription Services

Successful Implementation of School-based Vision Screening and Follow-up Programs in Ontario

I, _____, transcriptionist, agree to maintain full confidentiality in regards to any and all audiotapes and documentation received from Rachael Haalboom related to her research study on Successful Implementation of School-based Vision Screening and Follow-up Programs in Ontario.

Furthermore, I agree:

1. To hold in strictest confidence the identification of any individual that may be inadvertently revealed during the transcription of audio-taped interviews, or in any associated documents;

2. To not make copies of any audiotapes or computerized files of the transcribed interview texts, unless specifically requested to do so by Rachael Haalboom;

3. To store all study-related audiotapes and materials in a safe, secure location as long as they are in my possession;

4. To return all audiotapes and study-related documents to Rachael Haalboom in a complete and timely manner;

5. To delete all electronic files containing study-related documents from my computer hard drive and any backup devices.

I am aware that I can be held legally liable for any breach of this confidentiality agreement, and for any harm incurred by individuals if I disclose identifiable information contained in the audiotapes and/or files to which I will have access.

Transcriber's name (printed): _____

Transcriber's signature: _____ Date: _____