EARLY CHILDHOOD SCREENING
RESEARCH & EVALUATION UNIT

BC Early Childhood Vision Screening Program

FINAL EVALUATION REPORT

HUMAN EARLY LEARNING PARTNERSHIP

UBC a place of mind

HUMAN
EARLY LEARNING
PARTNERSHIP

a place of mind

This document was prepared by the Human Early Learning Partnership's Screening Research and Evaluation Unit at the University of British Columbia.

August, 2012

Principal Investigator
Brenda Poon

Co-Principal Investigator
Clyde Hertzman

Research and Evaluation Manager
Paul Holley

Research and Evaluation Coordinator
Amber Louie

Research Assistants
Celina Vergel de Dios, Deborah Heard, Declan Hsu, Allyson Rayner and Jannie Wing-sea Leung

Data Analyst
Anna Krasnova

Spatial Data Analyst and Cartographer
Anthony Smith

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABOUT THE EVALUATION TEAM

Brenda Poon, Principal Investigator, is an Assistant Professor at HELP, School of Population and Public Health at UBC.

Clyde Hertzman, Co-Principal Investigator, is Director of HELP; Canada Research Chair in Population Health and Human Development; and Professor in the School of Population and Public Health at UBC.

Paul Holley, Research and Evaluation Manager, holds a doctorate in Sociology and specializes in program evaluation, grant writing, and statistical analysis. Paul's current research interests relate to early childhood development issues and teen suicide prevention.

Amber Louie, Research and Evaluation Coordinator, holds an MSc in Population Health. She brings experience in qualitative methods, questionnaire design, statistical analysis, systematic literature reviews, and health services evaluation.

The evaluation team also includes five research assistants and one data analyst. The five research assistants are Celina Vergel de Dios (MA), Deborah Heard (BA&Sc), Declan Hsu (BA), Allyson Rayner (MA), and Jannie Wing-sea Leung (MSc), each of whom have a background in early child development and developmental psychology. The data analyst is Anna Krasnova (BSc) who has a background in data processing methodologies. Anthony Smith (BA) is the data analyst and cartographer, his research interests include sustainable urban design, spatial statistics and geographic data visualization.

ABOUT THE HUMAN EARLY LEARNING PARTNERSHIP

The Human Early Learning Partnership (HELP) is a consortium of five major universities in BC that fosters innovation through networking and collaboration amongst researchers at the University of British Columbia, the University of Victoria, Simon Fraser University, University of Northern British Columbia, and Thompson Rivers University. It is the focal point for early child development research in British Columbia. HELP conducts research that aims to help children and families thrive. To achieve its goals, HELP works closely with communities across BC to draw on their expertise about local factors that determine children's outcomes.

HELP's research approach integrates behavioural and social sciences with the biomedical sciences. Research conducted at HELP shows how the environments that children spend their time in during their early years "sculpt" their brains. This sculpting process affects life-long health, well-being, learning and behaviour. With its interdisciplinary approach, HELP aims to make a unique international research contribution to understanding the biological, psychological and societal factors that influence children's health and development. In pursuit of this mission, HELP will:

- Highlight the importance of the early years on health & development.
- Utilize a longitudinal, life-course perspective.
- Facilitate cell-to-society research collaborations and discourse.
- Foster inter-disciplinary, inter-institutional, inter-cultural and inter-sectoral partnerships.
- Facilitate knowledge exchange capable of transforming lives and communities.

HELP is the world's first consortium of researchers interested in bringing a population-based perspective to early child development. Over the last decade, through analysis of developmental trajectories of entire populations of children, HELP has produced research that documents systematic differences in children's long term health and development and the social determinants that account for these differences.

BACKGROUND AND OVERVIEW

In 2005, BC's Ministry of Health (MoH) established a province-wide goal to screen and detect vision disorders in children before they reach six years of age.

To determine progress toward this provincial goal, the MoH approached HELP at UBC in 2006 to conduct a systematic four-year evaluation of the BC Early Childhood Vision Screening Program. The overall purpose of this evaluation was to assess the ability of the program to identify young children with possible vision conditions, with the goal to improve the vision health status of young children in BC. As a leader in population-based early child development research in BC, HELP was well-positioned to investigate BC's early childhood vision program's population-level dataset in relation to factors that can promote or undermine healthy child development.

In April 2007, the BC Early Childhood Vision Screening Evaluation Subcommittee formed to provide recommendations for the development and implementation of the evaluation plan for BC's early childhood vision screening services.[1] The Subcommittee is comprised of representatives from each of the province's five regional Health Authorities (HAs), the MoH, the HELP evaluation team from UBC, the BC Association of Optometrists, an Ophthalmology representative, and the National Collaborating Centre for Aboriginal Health (NCCAH). The NCCAH Preschool Visual Screening (PVS) initiative is another subset of the provincial early childhood vision strategy focusing on the development of innovative, culturally safe, and holistic approaches to vision screening for Aboriginal preschool children in BC.[2] Other individuals and organizations were consulted on an ad hoc basis to enhance the diversity of experience and expertise in the group (e.g., the First Nations Health Council). A key function of the Subcommittee was to ensure the evaluation plan reflected program objectives and key stakeholder input, and that it would inform program planning and monitoring. The committee focused on components of the plan that had shared relevance and significance across HAs and across various stakeholders.

The Subcommittee met regularly to develop an evaluation framework to guide the four-year study.[3] Nine overarching evaluation questions were established:

---

[1] For further details, see the *BC Early Childhood Dental and Vision Evaluation Subcommittee Terms of Reference*.

[2] Donna L. Atkinson, *Preschool Vision Screening and Aboriginal Eye Health: An Environmental Scan and Literature Review* (Prince George, BC: National Collaborating Centre for Aboriginal Health, the University of Northern British Columbia, 2007).

[3] Human Early Learning Partnership, Early Childhood Screening Research and Evaluation Unit, *BC Early Childhood Vision Screening Program: Evaluation Framework Overview* (Vancouver, BC: University of British Columbia, 2009).

1. Is screening reaching the target populations (by age, by community, by vulnerability)?
2. Is screening identifying children with the key vision conditions (i.e., amblyopia, strabismus, refractive errors)? Are screening referral criteria appropriate?
3. What public health follow-up activities are associated with children's visits to an eye doctor following referral?
4. Are children referred from screening seeing an eye doctor? What are reasons that children may not be seeing an eye doctor? What are lessons learned from the program that could be applied in the future?
5. What case-finding activities/strategies have been developed and adopted to support regional and provincial objectives? What factors or conditions have facilitated or served as barriers to case-finding activities?*
6. What types of services and strategies might facilitate screening three-year-old children? (e.g., marketing strategy, program planning and organization, implementation and roll out of services) What factors or conditions have facilitated or served as barriers to pilot screening activities?
7. How satisfied were parents/guardians whose children were screened through the 3-year-old screening program with the way in which services were delivered?*
8. To what extent are parents/guardians, allied health professionals and the larger community aware of the three-year-old vision screening program? How satisfied are service providers (e.g., screeners and eye doctors) and their community partners with the delivery of the 3-year old screening program? What could be improved?*
9. What lessons have been learned from three-year-old pilots that could be helpful to screening and case-finding initiatives in the future? What worked? What did not work? What are some critical success factors? How could the program be improved?

*Note that this evaluation was unable to address questions #5, #7, and #8 due to a combination of factors, including delays in establishing an Information Sharing Agreement, shifting priorities, and the timeline required for increasing the reach of the program to a three-year-old population.

The BC Early Childhood Vision Screening Evaluation Subcommittee constructed a logic model (see Appendix A) of early childhood vision programs in the province, which was used to develop a multi-phase evaluation plan. An evaluation matrix was developed to guide data collection and analyses (see Appendix B). This matrix linked the evaluation questions to outcome measures, data sources, and a timeline. The matrix was completed in collaboration with the MoH and regional HAs as a key tool in understanding each partner's roles and responsibilities.

This report responds to the evaluation questions by synthesizing the qualitative and quantitative findings generated during this four-year evaluation project. The report begins with an overview of the data sources and methodologies used in the evaluation process then proceeds into a summary of the 2007/08, 2008/09 and 2009/10 vision screening results for kindergarten

children and three-year-olds. Results are presented for the province, HAs, and Health Service Delivery Areas (HSDAs). Following a discussion of program coverage, screening referral rates and diagnostic outcomes, is a review of the results drawn from the provincial staff questionnaires. These findings are presented in relation to barriers to program coverage and lessons learned for both the kindergarten and the three-year-old vision screening programs. The report concludes with an overview of the key themes that have emerged from the evaluation findings, and recommendations for the BC Early Childhood Vision Screening Program.

Scope of Project

The initial evaluation framework included evaluation questions pertaining to case-finding, parent/caregiver awareness and satisfaction, as well as satisfaction of eye doctors and community partners. The evaluation of case-finding was deferred, as it was decided that HAs could develop their own monitoring processes using electronic child health records available. It was also felt that obtaining data regarding awareness of and satisfaction with the three-year-old program would best occur when the program was more established and widely implemented.

Over the course of the four-year project, the Evaluation Subcommittee decided to prioritize the evaluation of population-level vision screening results and diagnostic data, and also to promote the sharing of information between public health and BC eye doctors. This dataset was established as the key data source of interest to the Evaluation Subcommittee, which aligned well with HELP's programs of research examining population-level data across geographical areas.

The following questions are the focus of this report:

- Is screening reaching the target populations?
- Are screening referral criteria appropriate?
- Is screening identifying children with the key vision conditions? What public health follow-up activities are associated with children's visits to an eye doctor following referral?
- Are children referred from screening seeing an eye doctor?
- What are reasons that children may not be seeing an eye doctor?
- What are lessons learned from the program that could be applied in the future?
- What lessons have been learned from three-year-old pilots that could be helpful to screening and case-finding initiatives in the future?
- What factors or conditions have facilitated or served as barriers to pilot screening activities?

While this project provides preliminary information about the referral criteria and screening tools, it does not provide the results of detailed validity testing of individual tools by vision condition. It is important to note that to meet the World Health Organization (WHO) criteria for evaluating

universal screening programs,[4] additional data would be needed to assess the validity of these screening tools in a BC context.

Early Childhood Vision Conditions

Vision health is a fundamental part of early child development and of overall health and well-being. Early childhood is a sensitive period for the development of the visual system, and ocular disorders are one of the most common disabilities in children.[5,6] Vision conditions in early childhood can lead to vision loss, visual impairment, or blindness,[7,8] and may impact an individual's health, educational achievements, employment options and social functioning across the lifespan.[9,10,11] If identified early, many vision conditions can be corrected and others prevented.[12,13,14,15]

Amblyopia is a leading cause of visual loss in children.[16] It develops in the early years of life when the brain suppresses visual input from one eye and relies more heavily on the other, stronger eye. The visual system of the child's underused eye is unable to develop in a typical way, resulting in decreased visual acuity (clearness of vision). The two most common causes of amblyopia are strabismus (misalignment of the visual axes of the eyes) and major refractive errors (nearsightedness, farsightedness and astigmatism).[17,18] If amblyopia is not treated, the brain will lose the ability in the weaker eye, posing a significantly increased risk of blindness.[19,20]

---

[4] J.M.G. Wilson and G. Jungner, *Principles and Practice of Screening for Disease. Public Health Paper No. 34* (Geneva: World Health Organization, 1968), http://whqlibdoc.who.int/php/WHO_PHP_34.pdf.

[5] Elise B. Ciner et al., "Vision Screening of Preschool Children: Evaluating the Past, Looking Toward the Future," *Optometry and Vision Science* 75, no. 8 (1998): 571–584.

[6] American Optometric Association Community Health Center Committee, M. Proser and P. Shin, "The role of community health centers in responding to disparities in visual health," *Optometry - Journal of the American Optometric Association* 79, no. 10 (2008): 564-575.

[7] M.J. Reed and S.P. Kraft, "Vision health care providers' attitudes and experiences with preschool vision screening in Ontario," *Optometry & Vision Science* 81, no. 7 (2004): 548.

[8] E.C. Marshall, R.E. Meetz, and L.L. Harmon, "Through Our Children's eyes--The Public Health Impact of the Vision Screening Requirements for Indiana School Children," *Optometry - Journal of the American Optometric Association* 81, no. 2 (2010): 71–82.

[9] S. Davidson and G.E. Quinn, "The Impact of Pediatric Vision Disorders in Adulthood," *Pediatrics* (2011): peds.2010–1911.

[10] B. Chua and P. Mitchell, "Consequences of Amblyopia on Education, Occupation, and Long Term Vision Loss," *British Journal of Ophthalmology* 88, no. 9 (2004): 1119 –1121.

[11] G.G.W. Adams and M. Karas, "Effect of Amblyopia on Employment Prospects," *The British Journal of Ophthalmology* 83, no. 3 (1999): 378–378.

[12] Community Paediatrics Committee, Canadian Paediatric Society, "Vision Screening in Infants, Children and Youth," *Paediatrics & Child Health* 14, no. 4 (2009): 246–248.

[13] C. Green Health Info, *A Review of the Science Underlying Preschool Vision Screening with Implications for BC* (Victoria, BC: Healthy Children, Women, and Seniors, BC Ministry of Health Services, 2005).

[14] D.D. Colburn et al., "Longitudinal Follow-up of Hypermetropic Children Identified During Preschool Vision Screening," *Journal of American Association for Pediatric Ophthalmology and Strabismus* 14, no. 3 (2010): 211–215.

[15] R.G. Teed et al., "Amblyopia Therapy in Children Identified by Photoscreening," *Ophthalmology* 117, no. 1 (2010): 159–162.

[16] G. Cools et al., "Literature Review on Preschool Vision Screening," *Bulletin De La Société Belge d'Ophtalmologie* 313 (2009): 49–64.

[17] American Academy of Ophthalmology, Pediatric Ophthalmology/Strabismus Panel, *Preferred Practice Pattern Guidelines* (San Francisco, CA: American Academy of Ophthalmology, 2007), Available at: http://www.aao.org/ppp.

[18] C. Green Health Info, *A Review of the Science Underlying Preschool Vision Screening with Implications for BC*.

[19] American Academy of Ophthalmology, Pediatric Ophthalmology/Strabismus Panel, *Preferred Practice Pattern Guidelines*.

Individuals with amblyopia have a lifetime risk of bilateral vision impairment almost double that of non-amblyopic individuals.[21] Recent studies suggest that amblyopia can be treated later in life but is most effectively treated, and can only be prevented, in early childhood.[22,23] See Appendix C for more information on vision conditions.

Prevalence of vision conditions in children. Vision problems, including amblyopia, strabismus, and significant refractive error, are some of the most common disabling childhood conditions; they are estimated to occur in 2% to 5% of preschool children.[24,25,26] Amblyopia or "lazy eye" is the most common cause of visual loss in children, affecting around 2%-4% of preschoolers.[27] Estimates of the number of children with amblyopia range from 1%-5% of individuals depending on the population and study.[28] Studies estimate that strabismus affects approximately 4% of the population, and that 5% to 7% of preschool children have visually significant refractive errors.[29] In the Vision in Preschoolers Study Group,[30] among the 2,588 three- to five-year-old children enrolled in Head Start, 20.8% had significant refractive error and 9.5% had reduced visual acuity. In BC, the Vision First Check Program screened 383 children ages 2 and 3 using the Modified Clinical Technique in 1998[31] and, consistent with other studies for this age group, found the incidence of amblyopia at 1%, strabismus at 1.8%, astigmatism at 2.6% and hyperopia at 5.5%.

Preschool vision screening is intended to assist in identifying children who may have undetected vision problems such as amblyopia and strabismus in order to refer them for further evaluation and treatments.[32] A report prepared by C Green Health Info in 2005 projects that, of the 40,000 children born in BC each year, universal preschool vision screening could enable the

---

[20] R. van Leeuwen et al., "Risk of Bilateral Visual Impairment in Individuals with Amblyopia: The Rotterdam Study," *British Journal of Ophthalmology* 91, no. 11 (2007): 1450 –1451.
[21] Ibid.
[22] American Academy of Ophthalmology, Pediatric Ophthalmology/Strabismus Panel, *Preferred Practice Pattern Guidelines*.
[23] C. Green Health Info, *A Review of the Science Underlying Preschool Vision Screening with Implications for BC*.
[24] S. Adhikari and U. Shrestha, "Validation of Performance of Certified Medical Assistants in Preschool Vision Screening Examination," *Nepalese Journal of Ophthalmology: A Biannual Peer-Reviewed Academic Journal of the Nepal Ophthalmic Society: NEPJOPH* 3, no. 6 (July 2011): 128–133.
[25] Centers for Disease Control and Prevention, *Improving the Nation's Vision Health: A Coordinated Public Health Approach* (Atlanta, GA: CDC Centers for Disease Control and Prevention, 2007), http://www.visionandhealth.org/documents/ReportImprovingtheNationsVisionHealth.pdf.
[26] E.E. Hartmann et al., "Preschool Vision Screening: Summary of a Task Force Report. Behalf of the Maternal and Child Health Bureau and the National Eye Institute Task Force on Vision Screening in the Preschool Child," *Pediatrics* 106, no. 5 (November 2000): 1105–1116.
[27] Centers for Disease Control and Prevention, *Improving the Nation's Vision Health: A Coordinated Public Health Approach*.
[28] C. Green Health Info, *A Review of the Science Underlying Preschool Vision Screening with Implications for BC*.
[29] American Academy of Ophthalmology, Pediatric Ophthalmology/Strabismus Panel, *Preferred Practice Pattern Guidelines*.
[30] Paulette Schmidt et al., "Comparison of Preschool Vision Screening Tests as Administered by Licensed Eye Care Professionals in the Vision In Preschoolers Study," *Ophthalmology* 111, no. 4 (April 2004): 637–650.
[31] Lorie J. Bradley and Mary Lou Riederer, "The Vision First Check Program in British Columbia: a Preschool Vision Screening Program for Children Age Two and Age Three," *Can.J.Public Health* 91, no. 4 (July 2000): 252–255.
[32] Alex R. Kemper and Sarah J. Clark, "Preschool Vision Screening by Family Physicians," *Journal of Pediatric Ophthalmology and Strabismus* 44, no. 1 (2007): 24.

identification and care of 2,800 children with visual deficits before school entry and lead to the effective treatment of 960 children with amblyopia per age cohort.[33]

Commonly used screening tools. Preschool screening tests commonly include checking the appearance of the eyes through observation, variations of the visual acuity test, the cover test, and a depth perception or stereopsis test.[34] The visual acuity test evaluates the sharpness of central vision for detail (as is required for reading), and identifies amblyopia[35,36] while the cover test is used to detect strabismus. Visual acuity tests to screen for amblyopia alone (using the Snellen Chart and its adaptations) generally have high specificity at 95% (the test will correctly identify the absence of amblyopia) and low sensitivity at 30% (the test will correctly identify a case of amblyopia).[37] This means that vision screeners will miss a lot of cases (i.e., a high false negative rate). Stereopsis tests help to detect amblyopia by assessing the depth perception of the two eyes working together to distinguish the relative distance and physical displacement between objects.[38,39] There are many screening tests available that have been adapted for preschool children. For example, the Lea symbols test, which is a variation of the HOTV wall chart, matches symbols from a response card to symbols on the wall.[40]

The SureSight Vision Screener is a handheld autorefractor commonly used to measure refractive error. In studies assessing its diagnostic accuracy, sensitivity and specificity rates (using the manufacturer's referral criteria) varied considerably (Table 1).

TABLE 1	Sensitivity and specificity rates of the SureSight Vision Screener			
Age group	Vision conditions	Sensitivity	Specificity	Reference
3-5	amblyogenic risk factors and nonamblyogenic refractive error	62%	85%	Vision in Preschoolers Study Group[41]
3-5	amblyogenic risk factors	78-88%	56-59%	David L. Rogers et al.[42]
1-6	amblyogenic risk factors	97%	38%	Alex R. Kemper et al.[43]

[33] C. Green Health Info, *A Review of the Science Underlying Preschool Vision Screening with Implications for BC*.
[34] Ibid.
[35] Ibid.
[36] BC Ministry of Health, *Provincial Vision Screening Training Manual* (Victoria, BC: BC Ministry of Health, 2008).
[37] K. Bassett and I. Forbes, *Vision Screening for Strabismus and Amblyopia: a Critical Appraisal of the Evidence* (Vancouver, BC: BC Office of Health Technology Assessment, April 1995).
[38] C. Green Health Info, *A Review of the Science Underlying Preschool Vision Screening with Implications for BC*.
[39] BC Ministry of Health, *Provincial Vision Screening Training Manual*.
[40] R. Chou, T. Dana, and C. Bougatsos, "Screening for Visual Impairment in Children Ages 1-5 Years: Update for the USPSTF," *Pediatrics* (2011): peds–2010.
[41] Ibid.
[42] David L. Rogers et al., "Comparison of the MTI Photoscreener and the Welch-Allyn SureSight™ Autorefractor in a Tertiary Care Center," *Journal of American Association for Pediatric Ophthalmology and Strabismus* 12, no. 1 (February 2008): 77–82.
[43] A.R. Kemper, L.M. Keating, J.L. Jackson, and E.M. Levin, "Comparison of Monocular Autorefraction to Comprehensive Eye Examinations in Preschool-aged and Younger Children," *Archives of Pediatrics & Adolescent Medicine* 159, no. 5 (May 1, 2005): 435.

The impact of childhood vision conditions. Major refractive errors in infants and preschool-aged children have been associated with atypical development, particularly vision, muscular movement and academic skill challenges.[44,45,46,47] These findings are supported by evidence that parental concerns about development during the preschool years have been associated with significant refractive errors.[48] Vision conditions in school-aged children have been linked to reading problems, learning difficulties, and compromised academic performance.[49,50,51,52,53,54,55] Amblyopia, especially in school-aged children with a history of strabismus, has also been associated with loss of depth perception[56] and fine motor skill development issues, particularly with manual dexterity tasks requiring speed and accuracy.[57,58] As a result, in adults, vision conditions can influence quality of life, affect job opportunities and performance, increase risk of physical injury, and contribute to mental health concerns such as social isolation, depression and psychological distress.[59,60,61,62,63]

---

[44] Jeanette Atkinson et al., "Infant Vision Screening Predicts Failures on Motor and Cognitive Tests up to School Age," *Strabismus* 10, no. 3 (2002): 187–198.
[45] Jeanette Atkinson et al., "Refractive Errors in Infancy Predict Reduced Performance on the Movement Assessment Battery for Children at 3 1/2 and 5 1/2 Years," *Developmental Medicine & Child Neurology* 47, no. 4 (2005): 243–251.
[46] Jeanette Atkinson et al., "Infant Hyperopia: Detection, Distribution, Changes and Correlates-outcomes from the Cambridge Infant Screening Programs," *Optometry and Vision Science* 84, no. 2 (2007): 84–96.
[47] A. Roch-Levecq et al., "Ametropia, Preschoolers' Cognitive Abilities, and Effects of Spectacle Correction," *Arch Ophthalmol* 126, no. 2 (2008): 252–258.
[48] J.O. Ibironke et al., "Child Development and Refractive Errors in Preschool Children," *Optometry and Vision Science* 88, no. 2 (2011): 181–187.
[49] W.R. Williams et al., "Hyperopia and Educational Attainment in a Primary School Cohort," *Archives of Disease in Childhood* 90, no. 2 (2005): 150 –153.
[50] I. Krumholtz, "Results from a Pediatric Vision Screening and Its Ability to Predict Academic Performance," *Optometry* 71, no. 7 (2000): 426–430.
[51] W.C. Maples, "Visual Factors That Significantly Impact Academic Performance," *Optometry* 74, no. 1 (2003): 35–49.
[52] S. Goldstand, K.C. Koslowe, and S. Parush, "Vision, Visual-information Processing, and Academic Performance Among Seventh-grade Schoolchildren: A More Significant Relationship Than We Thought?," *The American Journal of Occupational Therapy* 59, no. 4 (2005): 377 –389.
[53] M.T. Kulp and P.P. Schmidt, "Visual Predictors of Reading Performance in Kindergarten and First Grade Children," *Optometry and Vision Science* 73, no. 4 (1996): 255–262.
[54] E. Stifter et al., "Monocular and Binocular Reading Performance in Children with Microstrabismic Amblyopia," *British Journal of Ophthalmology* 89, no. 10 (2005): 1324 –1329.
[55] H.S. Shin, S.C. Park, and C.M. Park, "Relationship Between Accommodative and Vergence Dysfunctions and Academic Achievement for Primary School Children," *Ophthalmic and Physiological Optics* 29, no. 6 (2009): 615–624.
[56] Ciner et al., "Vision Screening of Preschool Children."
[57] A.L. Webber et al., "The Effect of Amblyopia on Fine Motor Skills in Children," *Investigative Ophthalmology & Visual Science* 49, no. 2 (2008): 594 –603.
[58] S. Houwen et al., "Motor Skill Performance of Children and Adolescents with Visual Impairments: A Review," *Exceptional Children* 75, no. 4 (2009): 464–492.
[59] Martha Muzychka, *Environmental Scan of Vision Health and Vision Loss in the Provinces and Territories of Canada* (Toronto, ON: National Coalition for Vision Health, 2009).
[60] American Optometric Association Community Health Center Committee, Proser, and Shin, "The Role of Community Health Centers in Responding to Disparities in Visual Health."
[61] Ciner et al., "Vision Screening of Preschool Children."
[62] Muzychka, *Environmental Scan of Vision Health and Vision Loss in the Provinces and Territories of Canada*.
[63] American Optometric Association Community Health Center Committee, Proser, and Shin, "The Role of Community Health Centers in Responding to Disparities in Visual Health."

Socioeconomic disparities in vision health. Vision health disparities among children reflect the important role of the social environment in determining children's ocular health and access to vision care. Socioeconomic status is strongly associated with vision health disparities, as children from lower-income households are at greater risk of visual impairment than children from higher-income households.[64,65,66] For example, HELP's prior research in Vancouver, BC indicated a ten-fold gradient across disadvantaged and more privileged neighborhoods in the proportion of children who required referral to a specialist for vision problems.[67] This suggests that families in more privileged neighborhoods have increased access to health care and are able to diagnose vision problems in their children earlier.[68,69,70,71] Students at inner-city schools, rural schools, and schools in low income neighborhoods tend to be at greater risk for undetected vision problems and, therefore are also identified as subgroups with a strong need for vision care screening and services.[72,73,74]

Race/ethnicity and child vision health. Racialized populations are overrepresented in terms of undiagnosed and uncorrected vision disorders in children,[75,76] a finding that is particularly salient for Aboriginal communities. One Canadian study found that 1 in 4 Aboriginal people reported a vision problem, compared with 1 in 10 in the general population.[77] Atkinson's review found that there were limited data available on the incidence or nature of eye health for Aboriginal people in Canada, but pointed to anecdotal evidence that rates of amblyopia, refractive error, and strabismus were higher in Aboriginal children than the general population.[78] Limited data are available on the numbers of Aboriginal children currently being screened, but more generally, the information available indicates that there are a number of existing barriers to health services for

---

[64] Marshall, Meetz, and Harmon, "Through Our Children's eyes--The Public Health Impact of the Vision Screening Requirements for Indiana School Children."
[65] Muzychka, *Environmental Scan of Vision Health and Vision Loss in the Provinces and Territories of Canada*.
[66] American Optometric Association Community Health Center Committee, Proser, and Shin, "The Role of Community Health Centers in Responding to Disparities in Visual Health."
[67] Clyde Hertzman, *Leave No Child Behind! Social Exclusion and Child Development*. (Vancouver, BC: University of British Columbia, 2002), http://www.cccabc.bc.ca/res/pubs/pdf/hertzman.pdf.
[68] Ibid.
[69] Marshall, Meetz, and Harmon, "Through Our Children's eyes--The Public Health Impact of the Vision Screening Requirements for Indiana School Children."
[70] Hertzman, *Leave No Child Behind! Social Exclusion and Child Development*.
[71] Marshall, Meetz, and Harmon, "Through Our Children's eyes--The Public Health Impact of the Vision Screening Requirements for Indiana School Children."
[72] American Optometric Association Community Health Center Committee, Proser, and Shin, "The Role of Community Health Centers in Responding to Disparities in Visual Health."
[73] Marshall, Meetz, and Harmon, "Through Our Children's eyes--The Public Health Impact of the Vision Screening Requirements for Indiana School Children."
[74] Ibid.
[75] Ibid.
[76] American Optometric Association Community Health Center Committee, Proser, and Shin, "The Role of Community Health Centers in Responding to Disparities in Visual Health."
[77] Muzychka, *Environmental Scan of Vision Health and Vision Loss in the Provinces and Territories of Canada*.
[78] Atkinson, *Preschool Vision Screening and Aboriginal Eye Health: An Environmental Scan and Literature Review*.

Aboriginal peoples,[79] including but not limited to challenges of accessing vision care in rural and remote communities.[80]

There are similar data limitations concerning other ethnic or racialized populations and, where data are available, they are seldom disaggregated by different ethnicities.[81] Findings from the Canadian Community Health Survey indicated that visible minorities have a higher degree of uncorrected vision loss in the younger years than the general population.[82] Studies commonly rely on US statistics to illustrate racialized health disparities, with findings that minoritized populations have higher rates of vision loss and undiagnosed eye disease than the general population.[83] Barriers to vision care faced by racialized and immigrant populations include cost, transportation/distance to services, the paucity of multi-lingual services and resources, and the lack of awareness and skills of health providers in relation to race, ethnicity and intercultural dynamics. With respect to vision screening programs, barriers exist that not only affect universal access to screening, but also families' follow-through with referrals and/or recommended follow-up care.[84]

BC Early Childhood Vision Programs

In March 2005, the government of BC committed to developing an integrated cross-ministry strategy over three years to provide dental, hearing and vision screening in BC for all children before their sixth birthday. The BC Early Childhood Vision Screening Program is a product of this initiative. Its mandate is to provide universal vision screening and case finding in an effort to improve vision health through the identification and referral for diagnostic assessment of young children with possible visual deficits. The target age for screening is three years of age; however, vision screening continues to be provided to children in kindergarten until three-year-old universal screening can be realized. It is anticipated that the early identification, intervention and treatment of vision conditions will optimize the capacity of children in BC to adapt and learn throughout childhood and into adulthood.

Periodic vision screening for preschool- and school-aged children occurred throughout BC in the mid-1990s and early 2000s, with screening conducted by public health nurses using an eye chart. Discontinuation of these screening programs was largely attributed to: 1) lack of evidence of benefit; 2) insufficient resources to provide mass screening given other public health priorities; and 3) budget cuts.[85] Despite termination of these programs, screening was still carried out on an ad hoc basis by various health professionals and Early Childhood Educators (ECE) across the province and in a wide variety of settings. Although the HOTV eye chart has been used by BC public

---

[79] Muzychka, *Environmental Scan of Vision Health and Vision Loss in the Provinces and Territories of Canada.*

[80] Atkinson, *Preschool Vision Screening and Aboriginal Eye Health: An Environmental Scan and Literature Review.*

[81] Access Economics Pty Limited, *The Cost of Vision Loss in Canada* (CNIB and the Canadian Ophthalmological Society, 2009).

[82] Ibid.

[83] Ralf Buhrmann et al., "Appendix 17: Vision Health: Evidence Review for Newly Arriving Immigrants and Refugees," *Cmaj* 6, no. 7 (2010): 1–10.

[84] Reed and Kraft, "Vision Health Care Providers' Attitudes and Experiences with Preschool Vision Screening in Ontario."

[85] C. Green Health Info, *A Review of the Science Underlying Preschool Vision Screening with Implications for BC.*

health nurses for decades, 2007 marked the first year using the SureSight Vision Screener (a handheld automated Autorefractor) device.

BC Ophthalmology and Optometry Steering Committee representatives recommended that HAs use an objective tool for screening vision in preschool children. An autorefractor was one of the objective tools recommended by the Steering Committee ophthalmologist and optometrists to screen preschool- and kindergarten- aged children for refractive errors (hyperopia, myopia, astigmatism, and anisometropia). These representatives also recommended that the Randot Preschool Stereotest be used as the screening tool for stereopsis.

To fulfill its mandate, the BC Early Childhood Vision Screening Program set forth guidelines for universal screening of three-year-olds and kindergarten children in BC, developed the Provincial Vision Screening Training Manual[86] as a basis for teaching basic vision screening techniques, completed a Privacy Impact Assessment, and developed an evaluation framework in collaboration with the Human Early Learning Partnership (HELP). In 2007, 100 SureSight Vision Screener devices and Randot Preschool Stereotests were purchased and universal screening of kindergarten children began.

Universal vision screening for kindergarten children was carried out by HAs over the 2007/2008, 2008/2009 and 2009/2010 school years and continues on an annual basis. In spring 2008, HAs implemented targeted three-year-old vision screening at select pilot sites, including licensed day care facilities. This pilot was initiated in order to determine how best to find and offer screening to the three-year-old population, whether the new screening tools could be effectively used with the younger cohort, what barriers exist when accessing or screening this age group, and the resource requirement needed to screen this younger population.[87] The pilot was expanded in 2009, with the goal of reaching at least 20% of the three-year-old population.[88]

---

[86] British Columbia Ministry of Health, *Provincial Vision Screening Training Manual*, 2008.

[87] Women's Healthy Living Secretariat Ministry of Health Living and Sport, *Vision Screening Pilots for Three-Year-Olds 2008 and 2009 Provincial Summary Report* (Victoria, BC: Ministry of Healthy Living and Sport, 2009).

[88] Ibid.

EVALUATION MEASURES AND METHODS

Vision Screening, Referral and Follow-Up Data

Vision screening was administered by public health staff who performed screening tests of each child to identify possible vision concerns. Vision screeners received training, including a training manual, to ensure consistent technique. The following screening tools were selected for vision screening of three-year-old and kindergarten children in BC:

- The SureSight Vision Screener® to test refractive error (including nearsightedness, farsightedness and astigmatism) in combination with the Randot Preschool Stereotest to assess stereopsis issues (including amblyopia and strabismus); or,
- The H.O.T.V vision chart in combination with the Randot Preschool Stereotest;

For additional information on these screening tools, please consult the provincial vision screening training manual.[89] It is important to note that although both tests have established validity and reliability,[90,91] vision screening is not a diagnostic exam by an ophthalmologist or optometrist. Rather, vision screening identifies those individuals that may have a vision condition and refers them for further diagnostic testing.

Screening results and diagnostic data collected by HA staff were compiled into three datasets based on the following data sources:

1. *Vision Screening Results Forms* completed by vision screeners on class list/appointment lists for all children screened at the time of screening.[92]

2. *Vision Screening Referral and Follow-up Forms* completed by eye doctors. For each child referred for a comprehensive eye examination by an ophthalmologist or optometrist, a referral form was provided to the parent/guardian advising to have an eye doctor complete the form and fax the result to the Health Unit. From September 2007 to December 2010, an honorarium was offered to eye doctors who provided diagnostic outcome data for children referred from screening. Data elements included the doctors' diagnosis and recommended treatment (e.g., corrective lenses, patching).

3. *Electronic Child Health Records*: Data sharing agreements were signed with five HAs and the MoH to ensure that Medical Services Plan (MSP) optometry and ophthalmology fee code information could be matched to HA vision screening records in iPHIS (the Public

---

[89] BC Ministry of Health, *Provincial Vision Screening Training Manual*.
[90] Lesley Dunfield and Tamara Keating, *Preschool Vision Screening* (Ottawa: Canadian Agency for Drugs and Technologies in Health, 2007).
[91] C. Green Health Info, *A Review of the Science Underlying Preschool Vision Screening with Implications for BC*.
[92] This database includes results of only those Aboriginal children screened by the BC Early Childhood Vision Program. The vision screening results were provided in aggregate form and cannot distinguish between Aboriginal or non-Aboriginal children. Although vision screening included Aboriginal children, the program was implemented at some but not all on-reserve schools, depending on the HA.

Health Information System)[93] and PARIS (in Vancouver Coastal HA). The data were aggregated by health service delivery area (HSDA), and subsets of the dataset were also aggregated by three-digit postal code and Local Health Area (LHA) prior to transfer to HELP.

Information recorded on the paper-based forms originated primarily from screening data collected in 2007/08 and 2008/09. The iPHIS/PARIS-MSP dataset included data from each of the three screening years (2007/08, 2008/09, 2009/10). Also, it is important to note that the MSP data were originally collected for administrative purposes, and used in this project as part of a secondary analysis of a linked iPHIS/PARIS-MSP dataset. Because the MSP dataset includes data that were collected for purposes other than the present evaluation project, the MSP coding practices and codes were not entirely consistent with those of the public health vision screening programs – under- or over-estimates of rates are possible. Therefore, the findings presented in this report should be reviewed with these limitations in mind. HA emails also provided supplementary comparative data at an aggregate level.

Questionnaires with Public Health Vision Screening Staff

Staff questionnaires were administered in 2007-08 and 2008-09 to collect feedback from HA staff. The online questionnaire was intended to be a vehicle for collecting information about staff experiences in relation to training, documentation, use of equipment, follow-up with families, communications with schools, working with eye doctors, and lessons learned. Two cross-sectional questionnaires were developed in consultation with the Evaluation Subcommittee. The *2007/2008 Staff Experience Questionnaire for Kindergarten Vision Screening Programs* focused on kindergarten screening programs (120 participants). The one-year follow-up questionnaire (Appendix D) examined both kindergarten and three-year-old vision screening programs for 2008/2009 (114 participants). Chi-square tests were used to compare proportions of staff responses to closed-ended questions across HAs. Comments in response to open-ended questions were summarized by theme. Results were presented at multiple Evaluation Subcommittee meetings, and overall, the findings were consistent with HA managers' experiences and expectations. For further details, see *Staff Experience Questionnaire for Vision Screening Programs 2007/2008 Results*[94] and *Staff Experience Questionnaire for Vision Screening Programs 2008/2009 Results.*[95]

Three-Year-Old Pilot Planning Template

A series of five worksheets were developed in 2007 as a tool to aid HAs in planning and reviewing their 2008 three-year-old vision screening pilot projects. Worksheets focused on five

---

[93] Interior, Northern, Vancouver Island and Fraser Health Authorities participated in MSP data match. Vancouver Coastal Health Authority did not participate in MSP matching due to data sharing issues.

[94] Human Early Learning Partnership, Early Childhood Screening Research and Evaluation Unit, *Staff Experience Questionnaire for Vision Screening Programs, 2007/2008 Results* (Vancouver, BC: University of British Columbia, 2008).

[95] Human Early Learning Partnership, Early Childhood Screening Research and Evaluation Unit, *Staff Experience Questionnaire for Vision Screening Programs, 2008/2009 Results* (Vancouver, BC: University of British Columbia, 2009).

themes: (1) Purpose & Population, (2) Services & Strategies, (3) Resources & Program Partners, (4) Expected Outcomes, and (5) Post-Implementation Preschool Screening Outcomes. These were intended to assist in program planning as well as to gather descriptive information about the contexts, processes, and outcomes of the vision screening programs. Use of these worksheets was optional, with eleven planning templates completed by vision screening leads in three HAs. Information collected through these worksheets was compiled into tables and summarized by theme.

Provincial and Regional Mapping

Mapping provides the ability to visually portray regional variation in the distribution of vision concerns. Provincial maps were created to visually represent the distribution of vision screening referrals across BC. The maps were colour-coded according to 'quintiles'. Geocoding was used in the mapping process by assigning a geographical coordinate (latitude-longitude) to an address, and then displaying the address on a map or using it in a spatial search.

EVALUATION FINDINGS

The findings from the evaluation are organized according to the overarching evaluation questions under the following key themes:

1. Program Coverage,
2. Referral Criteria,
3. Follow-up and Diagnosis; and
4. Three-Year-Old Population.

Program Coverage

1) Is screening reaching the target populations?

Yes, screening had near universal coverage for the kindergarten population. For three-year-olds, no, the majority of HAs had not yet met the 20% target for the expanded pilots.

Key findings:

- In 2007/08, 35,544 of 38,366 (92.6%) kindergarten students in BC were screened
- In 2008/09, 37,170 of 39,523 (94.0%) kindergarten students were screened, and
- In 2009/10, 36,478 of 39,868 (91.5%) kindergarten students were screened.
- Implementation of the new three-year-old screening program occurred incrementally between the 2007/08 and 2009/10 screening years. While only 796 children were screened in 2007/08, more than 5,000 children were screened in each subsequent year

The BC Early Childhood Vision Screening Program was conducted with three annual cohorts of kindergarten children and three-year-olds. Screenings were conducted during the 2007/08, 2008/09, and 2009/10 school years. The program reached over 35,000 kindergarten students annually, which is equivalent to roughly 9 out of 10 enrolled students.[96] Fraser HA, with the largest number of enrolled kindergarten students, correspondingly screened the most students over the three school years, averaging over 15,000 students screened per year. The source of the data is HA e-mails and correspondence.

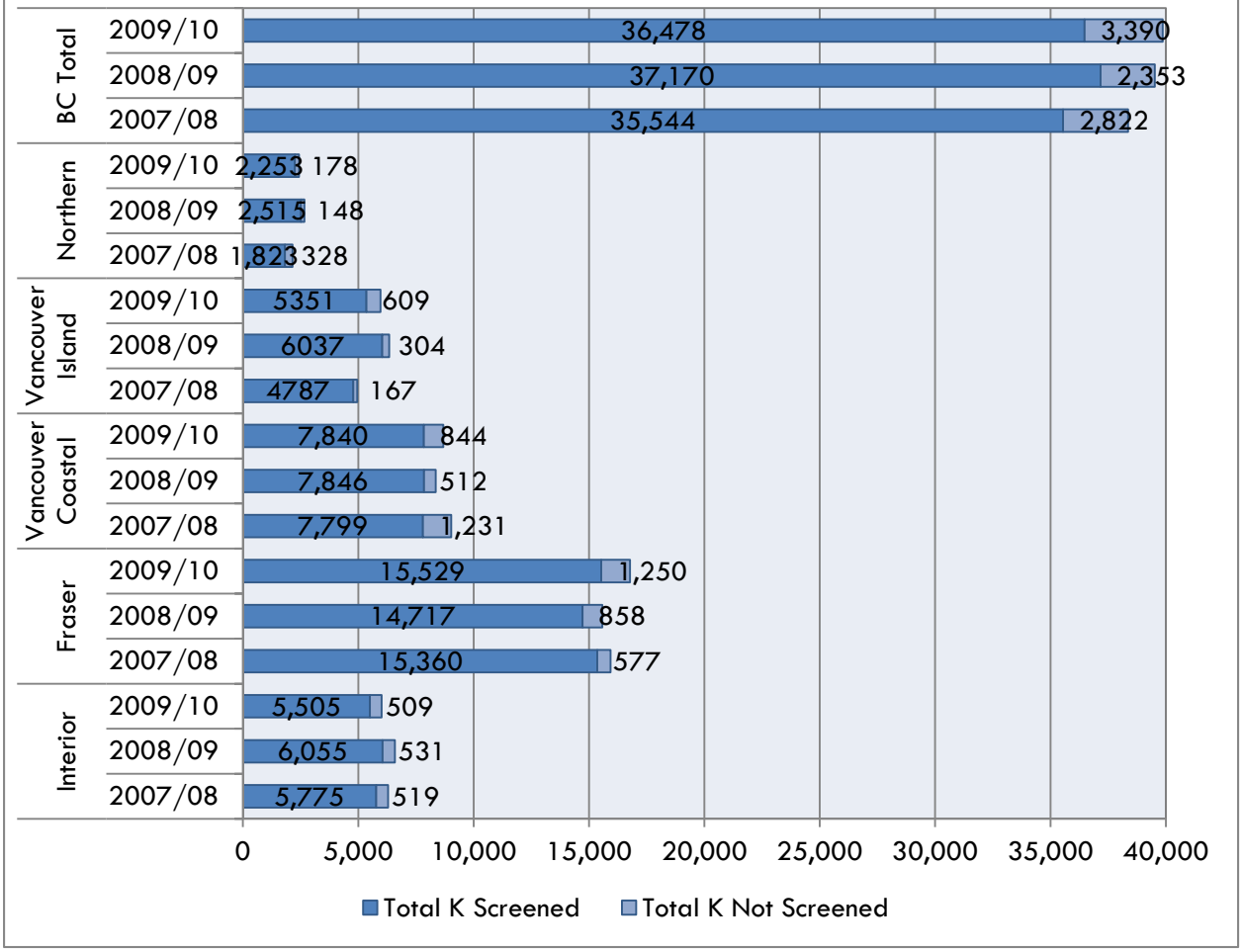
TABLE 2.1	Total Kindergarten Children Screened				Total Kindergarten Children Enrolled				% Kindergarten Children Screened			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	5,775	6,055	5,505	17,335	6,294	6,586	6,014	18,894	91.8	91.9	91.5	91.7
Fraser	15,360	14,717	15,529	45,606	15,937	15,575	16,779	48,291	96.4	94.5	92.6	94.4
Vancouver Coastal	7,799	7,846	7,840	23,485	9,030	8,358	8,684	26,072	86.4	93.9	90.3	90.1
Vancouver Island	4,787	6,037	5,351	16,175	4,954	6,341	5,960	17,255	96.6	95.2	89.8	93.7
Northern	1,823	2,515	2,253	6,591	2,151	2,663	2,431	7,245	84.8	94.4	92.7	91.0
BC Total	**35,544**	**37,170**	**36,478**	**109,192**	**38,366**	**39,523**	**39,868**	**117,757**	**92.6**	**94.0**	**91.5**	**92.7**

Source: BC Health Authorities

Table 2.1 presents the number of kindergarten students screened and enrolled by HA and HSDA in 2007/08, 2008/09, and 2009/10. Figure 1 presents the number of kindergarten students screened versus not screened by year and location.

[96] Student enrollment totals are based on HA data, which may not include children attending school on-reserve.

Figure 1. Kindergarten Children Screened for Vision vs. Not Screened
(Source: BC Health Authorities)



With respect to the three-year-old vision screening program, 796 three-year-old children were screened for vision problems during the 2007/08 school year as part of an initial vision screening pilot for three-year-olds. As the pilots expanded in scope, this number increased to 5,274 screened in 2008/09 and 5,453 screened in 2009/10. The number of three-year-olds screened by HAs was obtained from iPHIS/PARIS, but the actual number of three-year-olds in the population was obtained from BC Stats. Table 2.2 presents the number of three-year-old children screened (numerator) as a function of the total population of three-year-olds in BC (denominator). The goal of the expanded pilots was to reach at least 20% of the three-year-old children in the pilot site locations.[97] Province-wide coverage rates in 2008/09 fell short of this goal with 12.4% of three-year-olds screened; however, one HA, Vancouver Coastal, was able to surpass this goal

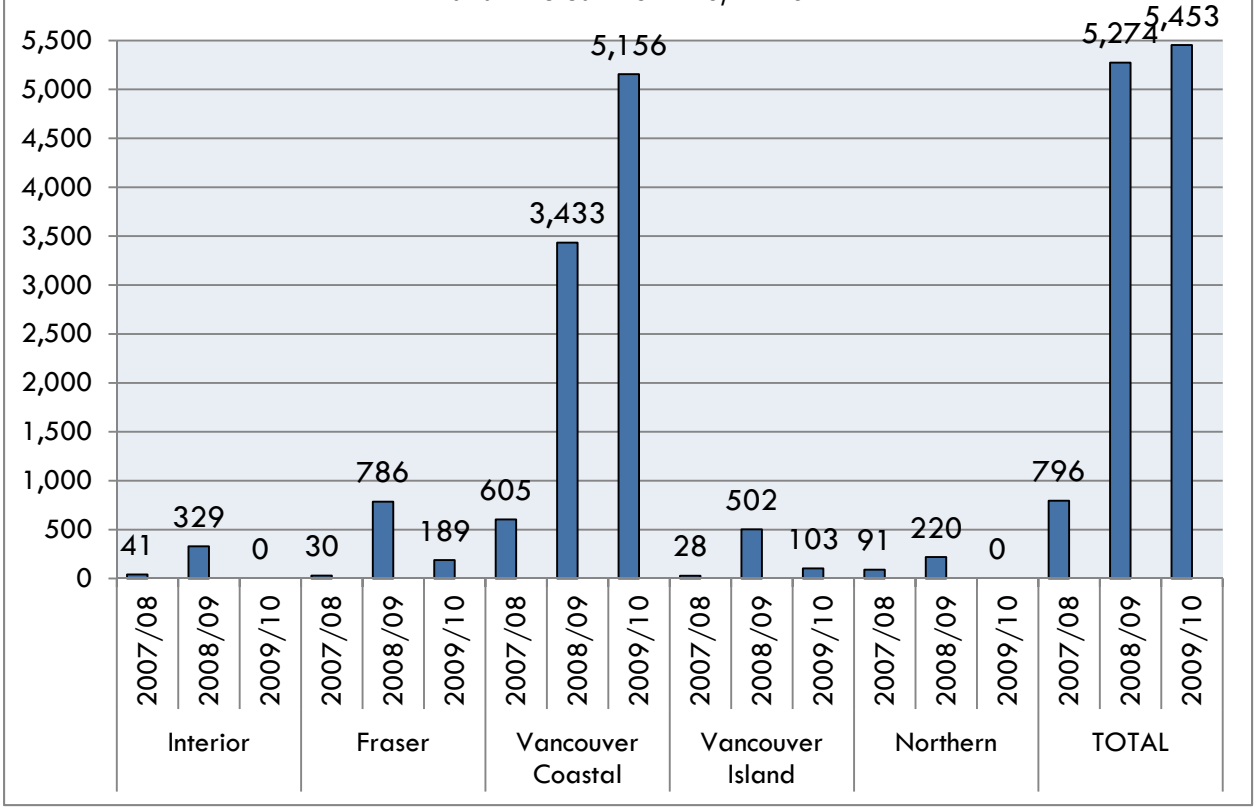
[97] Ministry of Health Living and Sport, *Vision Screening Pilots for Three-Year-Olds 2008 and 2009 Provincial Summary Report.*

with 36.9% screened. It is important to note that there are likely differential coverage rates within HAs and HSDAs given their broad and diverse geographic reach.

TABLE 2.2	3-Year-Olds Screened and Entered into iPHIS/PARIS				3-Year-Olds (BC Stats)				% 3-Year-Olds Screened			
HA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	41	329	0	370	6,325	6,330	6,528	19,183	0.6	5.2	--	1.9
Fraser	30	786	189	1,005	16,679	16,944	17,117	50,740	0.2	4.6	1.1	2.0
Vancouver Coastal	605	3,433	5,156	9,194	9,330	9,305	9,805	28,440	6.5	36.9	52.6	32.3
Vancouver Island	28	502	103	633	6228	6392	6534	19154	0.4	7.9	1.6	3.3
Northern	91	220	0	311	3,526	3,476	3,401	10,403	2.6	6.3	--	3.0
Total	**796**	**5,274**	**5,453**	**11,523**	**42,088**	**42,447**	**43,385**	**127,920**	**1.9**	**12.4**	**12.6**	**9.0**

Figure 2 presents the number of three-year-old children screened (passes and referrals) by year and region. Please see Appendix E for a methodological note related to denominators used for the analysis.

Figure 2. Three-Year-Olds Screened for Vision and Entered into iPHIS/PARIS



The iPHIS/PARIS dataset was consulted to determine the eligible proportion of children who were absent during the time of public health vision screening.

*Note: Not all screened children were entered into the iPHIS/PARIS database. HAs recorded both passes and referrals for all three-year-old children screened. However, this information was not consistently available for kindergarten students as HAs were asked to record electronically only those kindergarten-aged children who were referred following screening.

Overall, 11.8-12.1% of kindergarten students and 4.8-8.8% of three-year-olds were absent during the time of screening (see Tables 3.1 and 3.2). The highest rate of absence was found in Interior HA, at 22.6-30.9% of kindergarten students, depending on the screening year.

TABLE 3.1	Kindergarten Children Screened and Entered into iPHIS/PARIS				Kindergarten Children Absent During Screening				% Kindergarten Children Absent During Screening			
HA/HSDA	07/08	08/09	09/10	07/10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**1,752**	**1,691**	**1,599**	**5,042**	**462**	**522**	**362**	**1,346**	**26.4**	**30.9**	**22.6**	**26.7**
East Kootenay	223	197	194	614	52	43	36	131	23.3	21.8	18.6	21.3
Kootenay/Boundary	173	158	176	507	48	37	26	111	27.7	23.4	14.8	21.9
Okanagan	723	680	661	2,064	199	208	96	503	27.5	30.6	14.5	24.4
Thompson/Cariboo	633	656	568	1,857	163	234	204	601	25.8	35.7	35.9	32.4
Fraser	**2,721**	**3,187**	**3,558**	**9,466**	**253**	**372**	**449**	**1,074**	**9.3**	**11.7**	**12.6**	**11.3**
Fraser East	509	580	917	2,006	64	43	121	228	12.6	7.4	13.2	11.4
Fraser North	887	1,014	1,163	3,064	40	165	211	416	4.5	16.3	18.1	13.6
Fraser South	1,325	1,593	1,478	4,396	149	164	117	430	11.2	10.3	7.9	9.8
Vancouver Coastal	**4,181**	**5,898**	**6,006**	**16,085**	**431**	**512**	**615**	**1,558**	**10.3**	**8.7**	**10.2**	**9.7**
Richmond	176	1,386	1,458	3,020	15	88	105	208	8.5	6.3	7.2	6.9
Vancouver	3,728	3,912	3,814	11,454	405	419	494	1,318	10.9	10.7	13.0	11.5
North Shore/Coast Garibaldi	277	600	734	1,611	11	5	16	32	4.0	0.8	2.2	2.0
Vancouver Island	**2,429**	**2,218**	**1,840**	**6,487**	**120**	**180**	**189**	**489**	**4.9**	**8.1**	**10.3**	**7.5**
South Vancouver Island	522	707	330	1,559	37	43	54	134	7.1	6.1	16.4	8.6
Central Vancouver Island	1,006	951	945	2,902	70	85	91	246	7.0	8.9	9.6	8.5
North Vancouver Island	901	560	565	2,026	13	52	44	109	1.4	9.3	7.8	5.4
Northern	**1,712**	**2,042**	**1,841**	**5,595**	**240**	**240**	**162**	**642**	**14.0**	**11.8**	**8.8**	**11.5**
Northwest	116	121	121	358	4	2	8	14	3.4	1.7	6.6	3.9
Northern Interior	988	1,206	1,053	3,247	233	235	119	587	23.6	19.5	11.3	18.1
Northeast	608	715	667	1,990	3	3	35	41	0.5	0.4	5.2	2.1
Total	**12,795**	**15,036**	**14,844**	**42,675**	**1,506**	**1,826**	**1,777**	**5,109**	**11.8**	**12.1**	**12.0**	**12.0**

Source: iPHIS/PARIS

TABLE 3.2	3-Year-Olds Screened and Entered into iPHIS/PARIS				3-Year-Olds Absent During Screening				% 3-Year-Olds Absent During Screening			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**41**	**329**	**0**	**370**	**9**	**45**	**0**	**54**	**22.0**	**13.7**	**--**	**14.6**
East Kootenay	2	23	0	25	1	0	0	1	50.0	--	--	4.0
Kootenay/Boundary	1	43	0	44	0	10	0	10	--	23.3	--	22.7
Okanagan	9	66	0	75	2	7	0	9	22.2	10.6	--	12.0
Thompson/Cariboo	29	197	0	226	6	28	0	34	20.7	14.2	--	15.0
Fraser	**30**	**786**	**189**	**1,005**	**0**	**36**	**19**	**55**	**--**	**4.6**	**10.1**	**5.5**
Fraser East	9	168	0	177	0	15	0	15	--	8.9	--	8.5
Fraser North	7	336	163	506	0	8	15	23	--	2.4	9.2	4.5
Fraser South	14	282	26	322	0	13	4	17	--	4.6	15.4	5.3
Vancouver Coastal	**605**	**3,433**	**5,156**	**9,194**	**27**	**289**	**455**	**771**	**4.5**	**8.4**	**8.8**	**8.4**
Richmond	78	880	1,004	1,962	10	152	165	327	12.8	17.3	16.4	16.7
Vancouver	138	1,313	2,827	4,278	16	124	252	392	11.6	9.4	8.9	9.2
North Shore/Coast Garibaldi	389	1,240	1,325	2,954	1	13	38	52	0.3	1.0	2.9	1.8
Vancouver Island	**28**	**502**	**103**	**633**	**1**	**31**	**5**	**37**	**3.6**	**6.2**	**4.9**	**5.8**
South Vancouver Island	1	208	68	277	0	29	5	34	--	13.9	7.4	12.3
Central Vancouver Island	0	189	34	223	0	1	0	1	--	0.5	--	0.4
North Vancouver Island	27	105	1	133	1	1	0	2	3.7	1.0	--	1.5
Northern	**91**	**220**	**0**	**311**	**1**	**6**	**0**	**7**	**1.1**	**2.7**	**--**	**2.3**
Northwest	65	35	0	100	1	4	0	5	1.5	11.4	--	5.0
Northern Interior	21	84	0	105	0	2	0	2	--	2.4	--	1.9
Northeast	5	101	0	106	0	0	0	0	--	--	--	--
Total	**795**	**5,270**	**5,448**	**11,513**	**38**	**407**	**479**	**924**	**4.8**	**7.7**	**8.8**	**8.0**

Source: iPHIS/PARIS

Tables 4.1 and 4.2 present the number of kindergarten-aged and three-year-old children screened for stereopsis and entered into iPHIS/PARIS by year and HSDA. The tables also present the number and percent of children who could not be tested.

TABLE 4.1	Kindergarten Children Tested for Stereopsis		Could Not Test for Stereopsis		% Kindergarten Could Not Test for Stereopsis	
HA/HSDA	07/08	08/09	07/08	08/09	07/08	08/09
Interior	**5,690**	**5,823**	**78**	**88**	**1.4**	**1.5**
East Kootenay	671	931	3	24	0.4	2.6
Kootenay/Boundary	164	702	1	0	0.6	--
Okanagan	2,771	3,107	40	42	1.4	1.4
Thompson/Cariboo	2,084	1,083	34	22	1.6	2.0
Fraser	**16,525**	**16,036**	**121**	**159**	**0.7**	**1.0**
Fraser East	3,161	3,132	18	73	0.6	2.3
Fraser North	5,370	5,196	53	54	1.0	1.0
Fraser South	7,994	7,708	50	32	0.6	0.4
Vancouver Coastal	**7,858**	**N/A**	**127**	**N/A**	**1.6**	**--**
Richmond	1,568	N/A	24	N/A	1.5	--
Vancouver	4,454	N/A	86	N/A	1.9	--
North Shore/Coast Garibaldi	1,836	N/A	17	N/A	0.9	--
Vancouver Island	**6,382**	**5,020**	**83**	**166**	**1.3**	**3.3**
South Vancouver Island	2,743	2,953	31	131	1.1	4.4
Central Vancouver Island	2,160	1,944	35	34	1.6	1.7
North Vancouver Island	1,479	123	17	1	1.1	0.8
Northern	**2,223**	**2,708**	**46**	**38**	**2.1**	**1.4**
Northwest	373	508	9	15	2.4	3.0
Northern Interior	1,056	1,350	17	21	1.6	1.6
Northeast	794	850	20	2	2.5	0.2
Total	**38,678**	**29,587**	**455**	**451**	**1.2**	**1.5**

Note: 2008/09 data was not available for Vancouver Coastal HA.
Source: Paper-based classroom lists database.

TABLE 4.2	3-Year-Olds Tested for Stereopsis		Could Not Test for Stereopsis		% 3-Year-Olds Could Not Test for Stereopsis	
HA/HSDA	07/08	08/09	07/08	08/09	07/08	08/09
Fraser	**33**	**864**	**5**	**54**	**15.2**	**6.3**
Fraser East	23	184	3	13	13.0	7.1
Fraser North	3	299	2	26	66.7	8.7
Fraser South	7	381	0	15	--	3.9
Vancouver Coastal	**1,034**	**N/A**	**61**	**N/A**	**5.9**	**--**
Richmond	340	N/A	13	N/A	3.8	--
Vancouver	237	N/A	22	N/A	9.3	--
North Shore/Coast Garibaldi	457	N/A	26	N/A	5.7	--
Northern	**N/A**	**407**	**N/A**	**24**	**--**	**5.9**
Northwest	N/A	50	N/A	11	--	22.0
Northern Interior	N/A	73	N/A	11	--	15.1
Northeast	N/A	284	N/A	2	--	0.7

Note: Data not available for the Interior and Northern HAs; 2007/08 data for Northern HA and 2008/09 data for Vancouver Coastal HA was not available.
Source: Paper-based classroom lists database.

Referral Criteria

2.1) Are screening referral criteria appropriate?

The answer to this question depends on the results of primary concern to the program. Yes, the referral criteria resulted in referral rate consistency across HAs. Approximately one-quarter of referral cases for both age groups resulted in identification of a vision problem requiring treatment by an eye doctor. However, our best available estimates indicated that the proportion of false positives obtained with the current criteria ranged from 61.7 to 75.1%. This could be minimized to reduce the impact of follow-up on HAs (see section 2.2 for further information).

Key findings:

- Among the kindergarten and three-year-old children who received vision screening, approximately 1 in 5 were referred to an eye doctor for key vision conditions.
  - Approximately 6% of kindergarten children were referred for stereopsis.
  - The referral rates based on SureSight screening results were similar across HAs and age groups, according to the iPHIS/PARIS-MSP dataset, with approximately 15-19% of kindergarten and three-year-old children referred.

BC Early Childhood Vision Screening – Overall Rates of Referral

There were three sources of data used to calculate kindergarten referral rates for key vision conditions: (1) Health Authority e-mails and correspondence, (2) paper-based classroom/appointment lists of screening results, and (3) the linked iPHIS/PARIS-MSP dataset. The latter two sources were also used to estimate rates of referral for three-year-olds. Note: Screening and referral rates will differ slightly based on the source of data used. Multiple rates are presented for comparative purposes.

According to Health Authority e-mails/correspondence, BC's Early Childhood Vision Screening Program identified 6,527 out of 35,544 (18.4%) kindergarten children during the 2007/08 school year that did not pass screening for key vision conditions. These children were referred to an eye doctor for additional screening and treatment services according to provincial guidelines. In the following school year (2008/09), 7,085 out of 37,170 (19.1%) kindergarten children were referred, and in the most recent year of data collection, 2009/10, 6,903 out of 36,478 (18.9%) kindergarten children were referred (See Table 5.1 for more information). Rates of referral were relatively similar across HAs, with a low of 16.6% to a high of 22.8% in 2007/08.

TABLE 5.1	Total Kindergarten Screened				Total Kindergarten Referred				% Kindergarten Referred			
HA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	5,775	6,055	5,505	17,335	1,281	1,297	1,117	3,695	22.2	21.4	20.3	21.3
Fraser	15,360	14,717	15,529	45,606	2,556	2,630	2,948	8,134	16.6	17.9	19.0	17.8
Vancouver Coastal	7,799	7,846	7,840	23,485	1,334	1,360	1,404	4,098	17.1	17.3	17.9	17.4
Vancouver Island	4,787	6,037	5,351	16,175	940	1,320	946	3,206	19.6	21.9	17.7	19.8
Northern	1,823	2,515	2,253	6,591	416	478	488	1,382	22.8	19.0	21.7	21.0
BC Total	**35,544**	**37,170**	**36,478**	**109,192**	**6,527**	**7,085**	**6,903**	**20,515**	**18.4**	**19.1**	**18.9**	**18.8**

Source: BC Health Authorities.

The paper-based classroom/appointment lists (the second data source) provided us with estimates for the first two screening years (2007/08 and 2008/09). According to this source, 7,066 out of 39,350 (18.0%) kindergarten children screened for vision were referred to an eye doctor in 2007/08. In the following school year, 7,072 out of 37,609 (18.8%) kindergarten students screened based on the classroom/appointment list data were referred for vision conditions.

The first two data sources were congruent in terms of kindergarten referral rates; for example, the referral rate based on the first data source (HA emails) in 2008/09 is 19.1% and the rate is 18.8% based on the second data source (paper-based classroom/appointment lists) (see Tables 5.1 and 5.2 for comparison).

The paper-based classroom/appointment list data for three-year-old referral rates are presented in Table 5.3. The rates of referral were relatively consistent, at 20.1% (251 out of 1,249 children screened) in 2007/08 and 24.3% (1,096 out of 4,511 children screened) in 2008/09.

TABLE 5.2	Kindergarten Children Screened		Kindergarten Children Referred		% Kindergarten Children Referred	
HA/HSDA	07/08	08/09	07/08	08/09	07/08	08/09
Interior	**6,318**	**5,826**	**1,307**	**1,151**	**20.7**	**19.8**
East Kootenay Kootenay/Boundary	1,463	1,633	3,02	368	20.6	22.5
Okanagan Thompson/Cariboo	4,855	4,193	1,005	783	20.7	18.7
Fraser	**16,526**	**16,083**	**3,069**	**3,003**	**18.6**	**18.7**
Fraser East	3,161	3,138	551	525	17.4	16.7
Fraser North	5,370	5,210	834	873	15.5	16.8
Fraser South	7,995	7,735	1,684	1,605	21.1	20.7
Vancouver Coastal	**7,859**	**7,846**	**1,163**	**1,360**	**14.8**	**17.3**
Richmond	1,569	1,416	345	369	22.0	26.1
Vancouver	4,454	4,098	527	627	11.8	15.3
North Shore/Coast Garibaldi	1,836	2,332	291	364	15.8	15.6
Vancouver Island	**6,413**	**5,146**	**1,213**	**1,039**	**18.9**	**20.2**
South Vancouver Island	2,754	3,079	536	578	19.5	18.8
Central Vancouver Island	2,173	1,944	415	440	19.1	22.6
North Vancouver Island	1,486	123	262	21	17.6	17.1
Northern	**2,234**	**2,708**	**314**	**519**	**14.1**	**19.2**
Northwest	373	508	80	118	21.4	23.2
Northern Interior	1,063	1,350	148	246	13.9	18.2
Northeast	798	850	86	155	10.8	18.2
Total	**39,350**	**37,609**	**7,066**	**7,072**	**18.0**	**18.8**

Notes: HSDA figures for VCHA in 2008/09 are actual values. Interior HSDAs are grouped into two regions due to overlapping school district boundaries.
Source: Paper-based classroom lists.

TABLE 5.3	3-Year-Olds Screened		3-Year-Olds Referred		% 3-Year-Olds Referred	
HA/HSDA	07/08	08/09	07/08	08/09	07/08	08/09
Interior	**0**	**114**	**0**	**26**	**--**	**22.8**
East Kootenay Kootenay/Boundary	0	7	0	3	--	42.9
Okanagan Thompson/Cariboo	0	107	0	23	--	21.5
Fraser	**33**	**865**	**8**	**184**	**24.2**	**21.3**
Fraser East	23	184	2	36	8.7	19.6
Fraser North	3	300	1	75	33.3	25.0
Fraser South	7	381	5	73	71.4	19.2
Vancouver Coastal	**1,034**	**3,098**	**199**	**805**	**19.2**	**26.0**
Richmond	340	866	86	266	25.3	30.7
Vancouver	237	907	46	216	19.4	23.8
North Shore/Coast Garibaldi	457	1,325	67	323	14.7	24.4
Vancouver Island	**0**	**0**	**0**	**0**	**--**	**--**
South Vancouver Island	0	0	0	0	--	--
Central Vancouver Island	0	0	0	0	--	--
North Vancouver Island	0	0	0	0	--	--
Northern	**0**	**407**	**0**	**76**	**--**	**18.7**
Northwest	0	50	0	16	--	32.0
Northern Interior	0	73	0	27	--	37.0
Northeast	0	284	0	33	--	11.6
Total	**1,249**	**4,511**	**251**	**1,096**	**20.1**	**24.3**

Notes: HSDA figures for VCHA in 2008/09 are actual values. Interior HSDAs are grouped into two regions due to overlapping school district boundaries. Unknown n=209.
Source: Paper-based classroom lists.

The third source of data relied on a special dataset prepared by information management staff at the MoH, which linked individual-level screening data in iPHIS/PARIS to MSP diagnostic records of service based on billing codes. This was the only source of data that could produce estimates of the number of children referred for both age groups (kindergarten and three-year-olds) as well as all screening years. According to the iPHIS/PARIS dataset, 15.1% (5,370 out of 35,544), 16.4% (6,091 out of 37,170), and 16.1% (5,885 out of 36,478) of kindergarten children were referred for vision conditions in 2007/08, 2008/09, and 2009/10. In terms of three-year-olds, the cumulative referral rate across all three screening years was 19.1% (2,198 out of 11,523 children screened). Tables 5.4 and 5.5 present the number of children screened as well as the number and percent of children (kindergarten and three-year-olds) who received a refer result. See Appendix F for maps of kindergarten referral rates by school district for all three screening years.

TABLE 5.4	Total K Screened (BC Health Authorities)				Kindergarten Children Referred in iPHIS/PARIS				% Kindergarten Children Referred (iPHIS/PARIS)			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**5,775**	**6,055**	**5,505**	**17,335**	**1,151**	**1,087**	**1,066**	**3,304**	**19.9**	**18.0**	**19.4**	**19.1**
East Kootenay	674	711	659	2,044	160	147	152	459	23.7	20.7	23.1	22.5
Kootenay/Boundary	626	640	585	1,851	81	102	134	317	12.9	15.9	22.9	17.1
Okanagan	2,656	2,826	2,511	7,993	464	450	440	1,354	17.5	15.9	17.5	16.9
Thompson/Cariboo	1,818	1,878	1,750	5,447	446	388	340	1,174	24.5	20.7	19.4	21.6
Fraser	**15,360**	**14,717**	**15,529**	**45,606**	**2,296**	**2,571**	**2,619**	**7,486**	**14.9**	**17.5**	**16.9**	**16.4**
Fraser East	3,006	2,869	3,098	8,972	439	452	476	1,367	14.6	15.8	15.4	15.2
Fraser North	5,159	4,957	5,265	15,380	724	753	867	2,344	14.0	15.2	16.5	15.2
Fraser South	7,196	6,891	7,167	21,253	1,133	1,366	1,276	3,775	15.7	19.8	17.8	17.8
Vancouver Coastal	**7,799**	**7,846**	**7,840**	**23,485**	**711**	**999**	**1,039**	**2,749**	**9.1**	**12.7**	**13.3**	**11.7**
Richmond	1,489	1,416	1,446	4,350	82	294	260	636	5.5	20.8	18.0	14.6
Vancouver	4,130	4,098	4,229	12,457	414	455	472	1,341	10.0	11.1	11.2	10.8
North Shore/Coast Garibaldi	2,180	2,332	2,166	6,677	215	250	307	772	9.9	10.7	14.2	11.6
Vancouver Island	**4,787**	**6,037**	**5,351**	**16,175**	**986**	**1,095**	**810**	**2,891**	**20.6**	**18.1**	**15.1**	**17.9**
South Vancouver Island	2,218	2,832	2,583	7,633	430	545	254	1,229	19.4	19.2	9.8	16.1
Central Vancouver Island	1,658	2,100	1,808	5,566	345	406	379	1,130	20.8	19.3	21.0	20.3
North Vancouver Island	911	1,105	960	2,976	211	144	177	532	23.2	13.0	18.4	17.9
Northern	**1,823**	**2,515**	**2,253**	**6,591**	**226**	**339**	**351**	**916**	**12.4**	**13.5**	**15.6**	**13.9**
Northwest	479	649	608	1,736	61	58	38	157	12.7	8.9	6.2	9.0
Northern Interior	850	1,167	1,046	3,063	105	186	239	530	12.3	15.9	22.9	17.3
Northeast	493	700	599	1,792	60	95	74	229	12.2	13.6	12.3	12.8
BC Total	**35,544**	**37,170**	**36,478**	**109,192**	**5,370**	**6,091**	**5,885**	**17,346**	**15.1**	**16.4**	**16.1**	**15.9**

Sources: BC Health Authorities and iPHIS/PARIS

TABLE 5.5	3-Year-Olds Screened and Entered into iPHIS/PARIS				3-Year-Olds Referred in iPHIS/PARIS				% 3-Year-Olds Referred			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**41**	**329**	**0**	**370**	**19**	**101**	**0**	**120**	**46.3**	**30.7**	**--**	**32.4**
East Kootenay	2	23	0	25	1	13	0	14	50.0	56.5	--	56.0
Kootenay/Boundary	1	43	0	44	1	8	0	9	100.0	18.6	--	20.5
Okanagan	9	66	0	75	4	28	0	32	44.4	42.4	--	42.7
Thompson/Cariboo	29	197	0	226	13	52	0	65	44.8	26.4	--	28.8
Fraser	**30**	**786**	**189**	**1,005**	**14**	**188**	**30**	**232**	**46.7**	**23.9**	**15.9**	**23.1**
Fraser East	9	168	0	177	3	39	0	42	33.3	23.2	--	23.7
Fraser North	7	336	163	506	2	88	25	115	28.6	26.2	15.3	22.7
Fraser South	14	282	26	322	9	61	5	75	64.3	21.6	19.2	23.3
Vancouver Coastal	**605**	**3,433**	**5,156**	**9,194**	**146**	**586**	**841**	**1,573**	**24.1**	**17.1**	**16.3**	**17.1**
Richmond	78	880	1,004	1,962	63	192	213	468	80.8	21.8	21.2	23.9
Vancouver	138	1,313	2,827	4,278	23	198	407	628	16.7	15.1	14.4	14.7
North Shore/Coast Garibaldi	389	1,240	1,325	2,954	60	196	221	477	15.4	15.8	16.7	16.1
Vancouver Island	**28**	**502**	**103**	**633**	**8**	**124**	**17**	**149**	**28.6**	**24.7**	**16.5**	**23.5**
South Vancouver Island	1	208	68	277	0	18	10	28	--	8.7	14.7	10.1
Central Vancouver Island	0	189	34	223	0	70	7	77	--	37.0	20.6	34.5
North Vancouver Island	27	105	1	133	8	36	0	44	29.6	34.3	--	33.1
Northern	**91**	**220**	**0**	**311**	**66**	**55**	**0**	**121**	**72.5**	**25.0**	**--**	**38.9**
Northwest	65	35	0	100	43	14	0	57	66.2	40.0	--	57.0
Northern Interior	21	84	0	105	20	29	0	49	95.2	34.5	--	46.7
Northeast	5	101	0	106	3	12	0	15	60.0	11.9	--	14.2
BC Total	**796**	**5,274**	**5,453**	**11,523**	**254**	**1,055**	**889**	**2,198**	**31.9**	**20.0**	**16.3**	**19.1**

Source: iPHIS/PARIS

Figures 3A-C present overall kindergarten referral rates for HAs and the province by year and data source for comparability.

Figure 3A. Kindergarten Vision Referral Rates (2007/08)

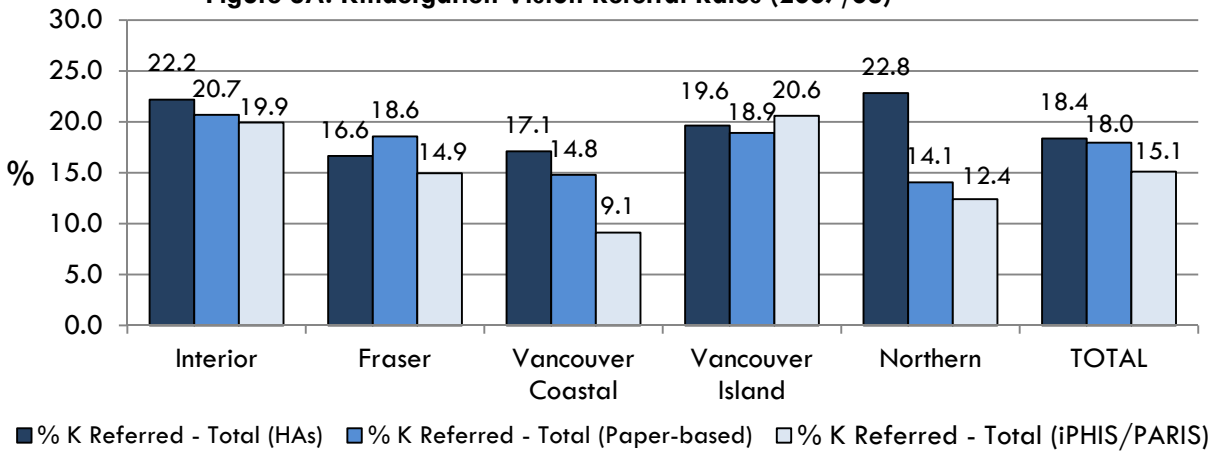


Figure 3B. Kindergarten Vision Referral Rates (2008/09)

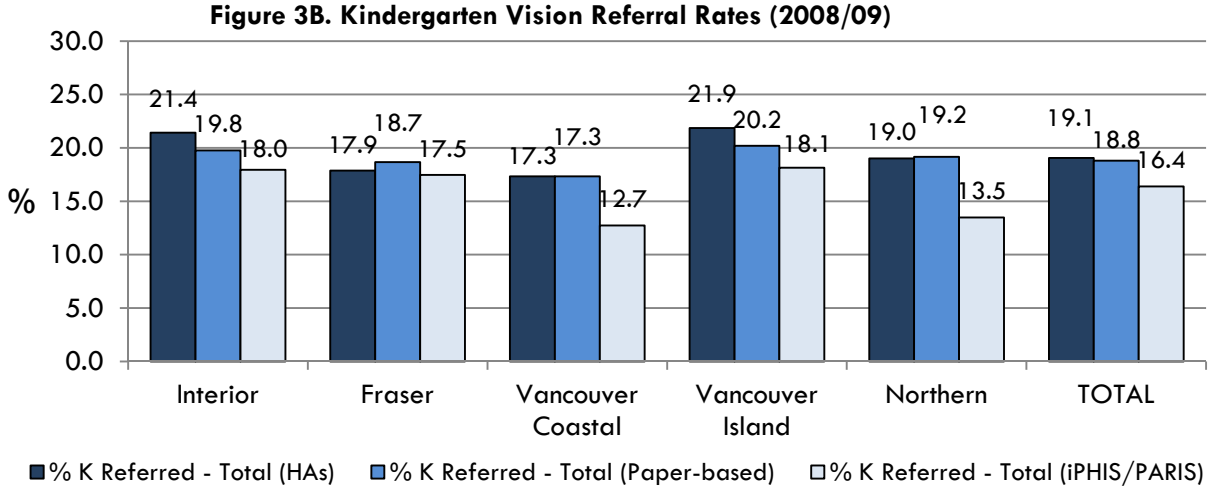
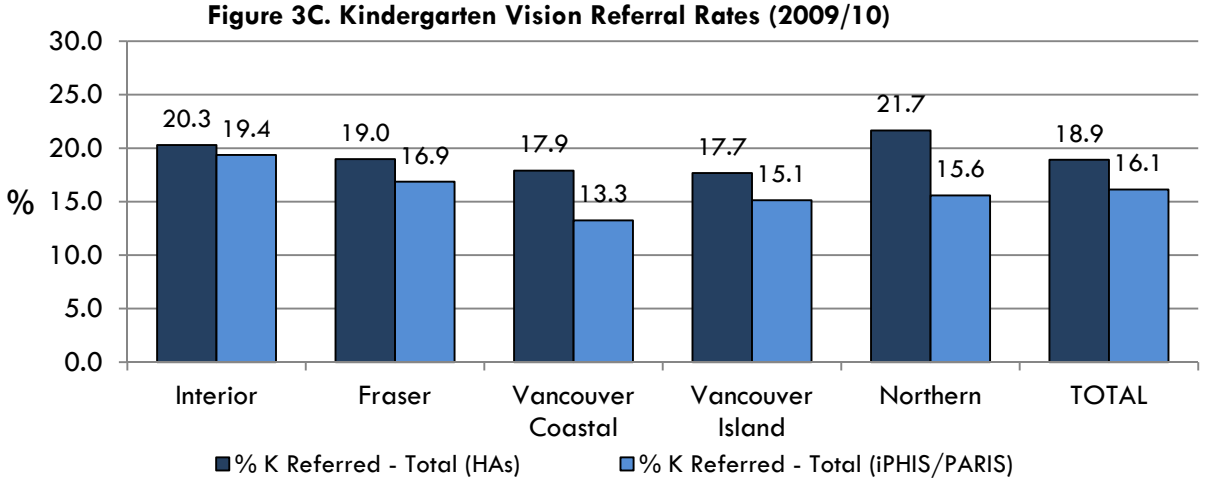


Figure 3C. Kindergarten Vision Referral Rates (2009/10)



SureSight Vision Screener Referral Rates

For the development of program guidelines for the SureSight screeners, a set of provincial referral criteria were required that would:

1. Detect conditions most important to identify and treat early (e.g., amblyopia, anisometropia, astigmatism, and refractive errors).
2. Minimize the impact of high (false positive) referral rates on HA resources and workload.
3. Minimize the number of over referrals (false positives) on parents/guardians.
4. Limit the number of over referrals (false positives) to vision specialists.
5. Ensure program referral consistency across BC.

Ophthalmologist and optometrist representatives on the Vision Screening Steering Committee were asked to establish referral criteria for the Welch Allyn SureSight. The Vision in Preschoolers criteria were selected based on evidence indicating high sensitivity in detecting key vision conditions that required early treatment.

According to BC's provincial vision screening training manual, children 36 months to kindergarten age screened by the Welch Allyn SureSight Screener should be referred to an eye doctor based on the following BC referral criteria:

-1.0 <= Sphere >= +3.0

-1.5 <= Cylinder >= +1.5

-1.5 <= Difference >= +1.5

Note: All values located between these ranges fell within normal limits (i.e., passed screening). Missing values were excluded in calculating referral rates.

For comparative purposes, we also present an example of the rates that would be obtained with the Welch Allyn SureSight criteria in Appendix G.

According to the paper-based classroom/appointment lists database (and based on the BC referral criteria presented above), the vision screening referral rate for kindergarten children in BC was 22.5% (27,346 children passed the screening and 7,480 children received a refer result). The corresponding rate for three-year-olds in 2007/08 was 26.1%. These findings were relatively consistent across HAs and screening years

BC Early Childhood Vision Screening – Referral Rates based on Stereopsis and SureSight Screener

The paper-based classroom/appointment lists were utilized to calculate referral rates based on the stereopsis and SureSight screeners. Information was available for 65,601 children screened for stereopsis, 4,521 (6.9%) of which were referred by vision screening based on stereopsis (i.e., referred if unable to determine stereopsis at 100 seconds of arc). More complete data were available during the first two screening years and are presented below.

- Approximately 1 in 17 kindergarten children (5.0-5.9%) were referred by classroom/appointment vision screeners for stereopsis (i.e., binocular vision/depth perception).
- The rates of referral for stereopsis were relatively similar across HAs, ranging from a low of 5.1% (Northern HA in 2008/09) to a high of 7.7% (Vancouver Island HA in 2008/09).
- Approximately 1 in 7 kindergarten children (12.7-14.6%) were referred based on the SureSight screener. The rates of referral for the SureSight screener were also similar across HAs, ranging from a low of 11.1% in 2007/08 to a high of 17.1% in 2008/09, both in Northern HA.

Table 6 presents the number of kindergarten children referred to an eye doctor from vision screening on the basis of stereopsis and the SureSight screener. Similar rates are not presented for three-year-olds due to small sample sizes.

TABLE 6	Kindergarten Children Referred for Stereopsis		% Kindergarten Children Referred for Stereopsis		Kindergarten Children Referred by SureSight		% Kindergarten Children Referred by SureSight	
HA/HSDA	07/08	08/09	07/08	08/09	07/08	08/09	07/08	08/09
Interior	**477**	**355**	**7.5**	**6.1**	**1,058**	**981**	**16.7**	**16.8**
East Kootenay Kootenay/Boundary	81	78	5.5	4.8	257	329	17.6	20.1
Okanagan Thompson/Cariboo	396	277	8.2	6.6	801	652	16.5	15.5
Fraser	**962**	**977**	**5.8**	**6.1**	**2,560**	**2,506**	**15.5**	**15.6**
Fraser East	113	110	3.6	3.5	503	479	15.9	15.3
Fraser North	283	305	5.3	5.9	681	734	12.7	14.1
Fraser South	566	562	7.1	7.3	1,376	1,293	17.2	16.7
Vancouver Coastal	**382**	**N/A**	**4.9**	**--**	**924**	**N/A**	**11.8**	**--**
Richmond	173	N/A	11.0	--	232	N/A	14.8	--
Vancouver	124	N/A	2.8	--	452	N/A	10.1	--
North Shore/Coast Garibaldi	85	N/A	4.6	--	240	N/A	13.1	--
Vancouver Island	**387**	**397**	**6.0**	**7.7**	**970**	**821**	**15.1**	**16.0**
South Vancouver Island	190	261	6.9	8.5	397	408	14.4	13.3
Central Vancouver Island	105	132	4.8	6.8	356	392	16.4	20.2
North Vancouver Island	92	4	6.2	3.3	217	21	14.6	17.1
Northern	**126**	**137**	**5.6**	**5.1**	**249**	**462**	**11.1**	**17.1**
Northwest	43	37	11.5	7.3	61	112	16.4	22.0
Northern Interior	46	67	4.3	5.0	120	202	11.3	15.0
Northeast	37	33	4.6	3.9	68	148	8.5	17.4
TOTAL	**2,334**	**1,866**	**5.9**	**5.0**	**5,761**	**4,770**	**14.6**	**12.7**

Notes: Interior HSDAs are grouped into two regions due to overlapping school district boundaries. 2008/09 data was not available for Vancouver Coastal Health Authority.
Source: Paper-based classroom lists.

Figures 4A-B present kindergarten referral rates for stereopsis and the SureSight screener for HAs and the province in 2007/08 and 2008/09 for comparability.

Figure 4A. Kindergarten Vision Referral Rates by SureSight and Stereopsis (2007/08)

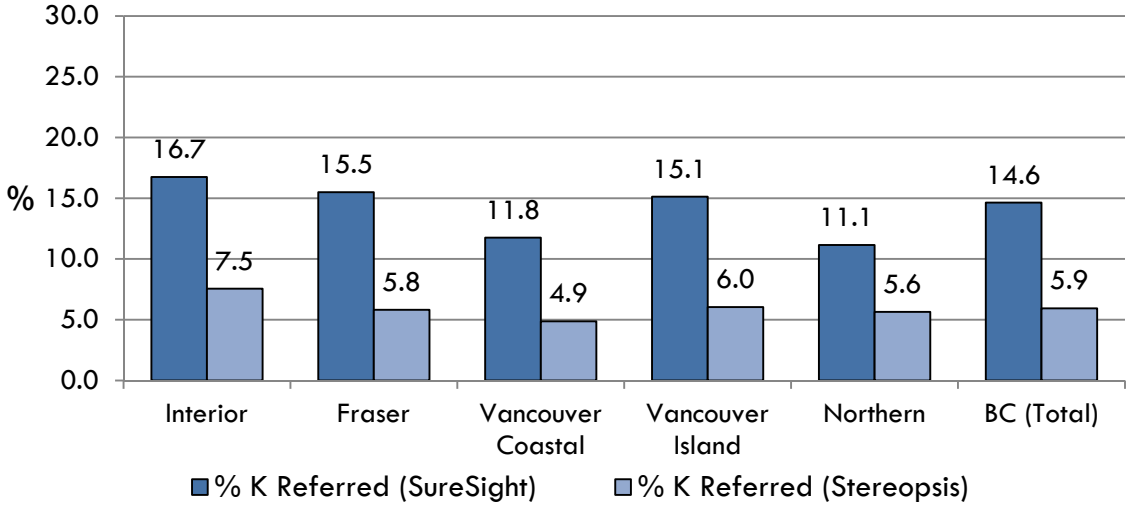
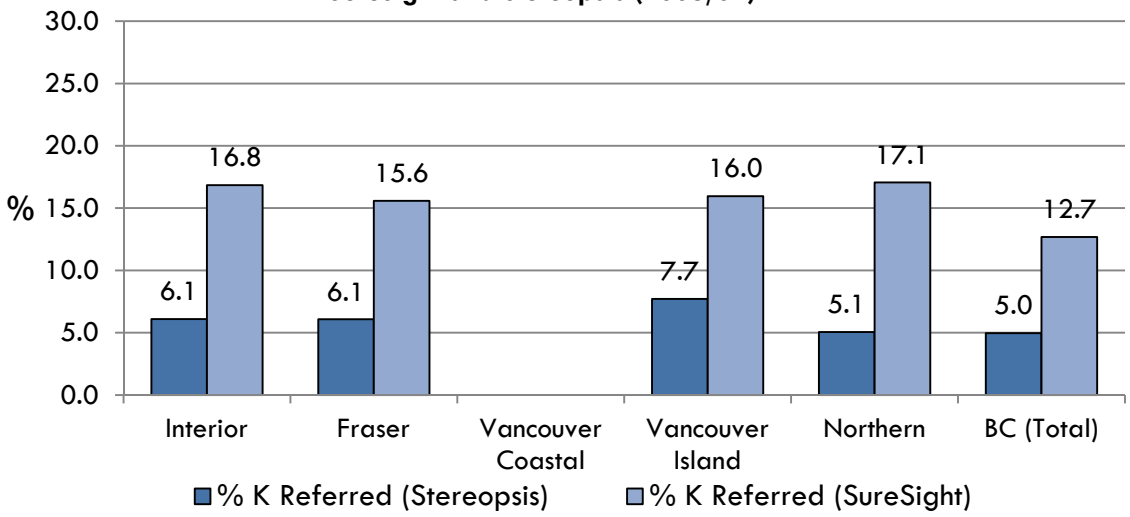


Figure 4B. Kindergarten Vision Referral Rates by SureSight and Stereopsis (2008/09)



2.2) Is screening identifying children with the key vision conditions (i.e., amblyopia, strabismus, refractive errors)?

Yes, to some extent. Our best available estimates indicated that screening identified children (3-year-olds and kindergarten children) with vision problems that required treatment from an eye doctor in approximately one-quarter of referred cases. The estimated sensitivity of screening for 3-year-old children, which reflects how well the screening was able to pick up cases of children who had vision problems, was 42 to 44%.

Key findings: In 2007-08, approximately 28.6% of referred children in a sample of 5,568 cases were prescribed treatment (and presumed to have had a vision problem) and identified as true positives. In 2008-09, this rate increased slightly, with almost one-third of the children referred in the sample identified as true positives.

Screening Outcomes and Eye Examination Results

In responding to this evaluation question, we recognized the value and appropriateness of a validation study using a gold standard involving a representative sample. However, because a validation study was not within the scope of the current project, we relied upon two data sources to assess screening outcomes: 1) a vision screening referral form database and 2) a special iPHIS/PARIS dataset linked to MSP by the MoH. We describe the outcomes of our analyses in the sections that follow.

Estimates from the Screening Referral Form Database

One method of estimating true/false positives[98] is through the referral form database, which contains a sample of 5,568 children seen by an eye doctor following screening. The database contains a variable indicating whether or not treatment was provided to children. The assumption was that if treatment was not provided, then the referral was a "false positive." On the other hand, all referrals that received treatment would be considered "true positives."

In 2007/08, 35,544 kindergarten children were screened (92.6% of enrolled children), of which 6,527 (18.4% of those screened) were referred. An estimated 2,330 of those 6,527 referred (35.7%) children were seen by an eye doctor and outcome data were collected. The data indicated that 666 (28.6%) of these children received some form of treatment and 1,664 (71.4%) did not (see Table 7.1).

[98] Dr. Ross Kennedy provided feedback and suggestions for determining estimations of true and false positive rates through e-mail correspondence on November 21, 2011.

TABLE 7.1	3-Year-Olds				Kindergarten			
Eye Doctor Treatment Recommendations	2007/08		2008/09		2007/08		2008/09	
(post-screening)	#	%	#	%	#	%	#	%
Child's first eye exam?	57	72.2	266	70.6	1,194	51.2	1,321	53.8
No treatment at this time (false positives)	58	73.4	283	75.1	1,664	71.4	1,655	67.4
Treatment recommended (true positives)	21	26.6	94	24.9	666	28.6	799	32.6
Present lenses adequate	0	--	5	1.3	61	2.6	49	2.0
Corrective lenses	14	17.7	63	16.7	479	20.6	587	23.9
Surgery	0	--	1	0.3	6	0.3	1	--
Eye exercises	0	--	4	1.1	37	1.6	26	1.1
Eye patching	2	2.5	17	4.5	111	4.8	127	5.2
Low vision aids	0	--	0	--	1	--	0	--
Visual impairment program	0	--	0	--	7	0.3	3	0.1
Lenses needed constantly	12	15.2	58	15.4	390	16.7	489	19.9
Lenses needed for distance vision	1	1.3	5	1.3	36	1.5	41	1.7
Lenses needed for reading or close work	0	0.0	9	2.4	60	2.6	61	2.5
Lenses needed except for play activities	0	0.0	8	2.1	86	3.7	121	4.9

Notes: n=94 cases had unknown screening/examination dates. n=53 cases had screening/examination dates prior to 2007 school year. Data not shown for n=13 cases who were screened/examined during 2009-10 school year.
Source: Eye Doctor Referral Form Database

Because the referral form data were de-identified prior to its transfer for data analysis, we did not have background information regarding the precise age, sex, or place of residence for the children in the sample. Therefore, it was not possible to determine whether the range of participants in the sample were representative of the population of referred kindergarten and three-year-old children. If we were to assume that the sample of 5,568 children in the vision screening referral form database was representative of all referred children, then 28.6% of referred children would potentially have a target vision condition (6,527 referred children x 28.6% true positive rate = 1,867 children with a vision condition in 2007/08), which represents an estimated overall vision condition identification rate of 5.3%. This same method of calculation for 2008/09 yields a detection rate of 6.2% amongst kindergarten children and 5.0% amongst three-year-olds.

For the three-year-old groups, we utilized the iPHIS/PARIS follow-up dataset and linked iPHIS/PARIS-MSP database to calculate vision condition prevalence estimates. The estimates were calculated using the number screened (passes and refers), number absent, number with treatment, and number of children who visited an eye doctor 6 months prior to screening (we utilized these values as estimates for children who had received previous treatment). In 2008/09, we estimated that, of the 5,274 children in the sample (including number of children screened and absent from school), 622 children received treatment from an eye doctor. Therefore, the estimated prevalence for the target vision conditions was 11.8%. Using this estimate, we determined that the program

identified 42.2% (5.0% detection rate; 11.8% estimated prevalence) of children with a vision problem of concern to the screening program. Similar calculations yielded a rate of vision condition identification (or screening sensitivity) across all years (2007-2010) of 44.0% (4.8% detection rate; 10.8% estimated prevalence) for three-year-olds screened. Because treatment information was only available in the database for three-year-old children screened (passes and refers), we limited our prevalence and true positive estimates to the three-year-old groups.

In 2008/09, we estimated that approximately 15.0% of all three-year-olds screened in 2008/09 were referred from screening but did not require subsequent treatment from an eye doctor (and thus we presumed did not have a diagnosed vision condition). In other words, for the group of three-year-olds screened in 2008-09, there was a 15.0% false positive rate (screening specificity of 85.0%). For the kindergarten children screened, there was a false positive rate of approximately 11.8% (and 88.2% specificity).

Table 7.2 reports the number and percent of true positives (Treatment Recommended) and false positives (No treatment at this time) by age group for HAs in BC from 2007/08 to 2009/10.

TABLE 7.2		3-Year-Olds		Kindergarten		Total	
07-10 Health Authority		Treatment Recommended	No treatment at this time	Treatment Recommended	No treatment at this time	Treatment Recommended	No treatment at this time
Interior	#	1	1	152	449	153	450
	%	50.0	50.0	25.3	74.7	25.4	74.6
Fraser	#	12	47	780	1,565	792	1,612
	%	20.3	79.7	33.3	66.7	32.9	67.1
Vancouver Coastal	#	78	273	270	564	348	837
	%	22.2	77.8	32.4	67.6	29.4	70.6
Vancouver Island	#	17	18	208	672	225	690
	%	48.6	51.4	23.6	76.4	24.6	75.4
Northern	#	9	9	101	166	110	175
	%	50.0	50.0	37.8	62.2	38.6	61.4
TOTAL	#	117	348	1,511	3,416	1,628	3,764
	%	25.2	74.8	30.7	69.3	30.2	69.8

Note: There were 176 referred children in VCHA with no age identification (kindergartern or three-year-olds). Among these children, 39 (22.2%) received treatment (true positives).
Source: Screening referral form database

Estimates from the iPHIS/PARIS-MSP Database

The other data source for estimating true and false positives was the iPHIS/PARIS-MSP database. The Early Childhood Vision Screening Steering Committee, with the guidance of eye doctor committee members, developed a list of key diagnostic outcomes that would be classified as the target or key vision conditions of concern to the program (including amblyopia, strabismus, and refractive errors). This original list was further refined using additional selection criteria; the MoH then prepared a dataset based on these criteria (see Appendix H for the list of diagnostic

outcomes of interest). Please note that rates were calculated using the original list of diagnostic outcomes as well as the subset that was based on the additional set of selection criteria. Rates were very similar in both cases; therefore, we report the results of the second, updated dataset provided from MoH. The original diagnostic code list and rates obtained from the initial dataset are available upon request.

The MoH-prepared dataset contained information at the HSDA-level on the number of referred children seen by an Optometrist or Ophthalmologist within 4 months after screening with an MSP billing code that was suggestive of diagnosis of a vision problem. Because of reported variability and limitations in eye doctors' MSP billing code practices (e.g., limits to selecting only one diagnostic code item for each case), this database was not used to infer incidences of subsets of vision conditions

Tables 8.1-8.3 report the number and percent of referred kindergarten children with an MSP billing code suggestive of a diagnosis of a vision problem by screening year for HAs and HSDAs. The following is a summary of the key findings:

- In 2007/08, 37.1% of kindergarten children who were referred by vision screening were also seen by an Optometrist or Ophthalmologist within 4 months of vision screening. In subsequent years, up to 42.0% of referred children saw an eye doctor (within 4 months).
- Between 76.5%-79.8% of referred kindergarten children seen at least once by an Optometrist or Ophthalmologist within four months of screening had an MSP billing code that suggested a diagnosis of a vision condition. In the database, these cases were further subdivided into those that involved a single visit to an eye doctor in the 4-month period and those that resulted in two or more visits. (Data for referred children who saw both an Optometrist and Ophthalmologist is available upon request)
    - Depending on the year, approximately 64.8%-69.1% of referred kindergarten children had an MSP billing code that suggested a diagnosis for a vision condition with one visit to an Optometrist or Ophthalmologist within four months of vision screening. Although a single visit to an eye doctor may have resulted in a diagnosis of a vision condition, reported inconsistencies in MSP billing code practices[99] precluded us from equating these values as 'true positives.'
    - Approximately 9.9%-13.1% of kindergarten children who had an MSP billing code and two or more visits to an Optometrist or Ophthalmologist within four months of vision screening (including referred children who subsequently saw both an Optometrist and Ophthalmologist). Children with multiple visits to an eye doctor over the four-

[99] Over the course of the evaluation, consultation with eye doctor advisors on the Evaluation Subcommittee indicated that current MSP billing code practices varied considerably. For example, billing code practices do not distinguish between non-clinically significant results where treatment is unlikely and clinically significant results that require treatment or correction. Also, for billing purposes, ophthalmologists use a MSP code that reflects the reason for referral from a family doctor or optometrist (i.e., a suspected problem) rather than confirmed diagnosis of a condition.

month timeframe provides a very conservative estimate of the number and proportion of children referred with vision problems requiring the care of an eye doctor.

- Less than 1% of kindergarten children were assigned the MSP codes V65.5 or 11A, which indicated no apparent problem. These children would normally be considered "false-positives," however the figures here are likely greatly underestimated owing to inconsistent use of these codes.
- Although speculative, it is more likely that the "true" estimate for our sample of "true positives" lies somewhere in between the two sets of rates (i.e., the rate based on at least one visit to an eye doctor – 76.5% to 79.8% – and the rate based on two or more visits – 9.9 to 13.1%).

TABLE 8.1	# of screened children who were referred (2007/08)	Referred children seen by an Optometrist or Ophthalmologist within 4 months of screening		Referred children seen by an Optometrist or Ophthalmologist within 4 months of screening with a fee code that suggests a diagnosis					
				with 1 or more visits		with 1 visit only		with 2 or more visits	
		#	%	#	%	#	%	#	%
Interior	**1,151**	**354**	**30.8**	**295**	**83.3**	**258**	**72.9**	**40**	**11.3**
East Kootenay	160	42	26.3	34	81.0	32	76.2	2	4.8
Kootenay/Boundary	81	24	29.6	19	79.2	19	79.2	--	--
Okanagan	464	156	33.6	120	76.9	98	62.8	24	15.4
Thompson/Cariboo	446	132	29.6	122	92.4	109	82.6	14	10.6
Fraser	**2,296**	**1,013**	**44.1**	**822**	**81.1**	**685**	**67.6**	**149**	**14.7**
Fraser East	439	184	41.9	158	85.9	132	71.7	26	14.1
Fraser North	724	310	42.8	250	80.6	194	62.6	64	20.6
Fraser South	1,133	519	45.8	414	79.8	359	69.2	59	11.4
Vancouver Coastal	**711**	**208**	**29.3**	**160**	**76.9**	**154**	**74.0**	**6**	**2.9**
Richmond	82	42	51.2	35	83.3	33	78.6	2	4.8
Vancouver	414	99	23.9	68	68.7	66	66.7	2	2.0
North Shore/Coast Garibaldi	215	67	31.2	57	85.1	55	82.1	2	3.0
Vancouver Island	**986**	**355**	**36.0**	**252**	**71.0**	**201**	**56.6**	**58**	**16.3**
South Vancouver Island	430	165	38.4	110	66.7	85	51.5	31	18.8
Central Vancouver Island	345	129	37.4	93	72.1	74	57.4	20	15.5
North Vancouver Island	211	61	28.9	49	80.3	42	68.9	7	11.5
Northern	**226**	**63**	**27.9**	**61**	**96.8**	**52**	**82.5**	**9**	**14.3**
Northwest	61	10	16.4	9	90.0	7	70.0	2	20.0
Northern Interior	105	37	35.2	36	97.3	30	81.1	6	16.2
Northeast	60	16	26.7	16	100.0	15	93.8	1	6.3
BC Total	**5,370**	**1,993**	**37.1**	**1,590**	**79.8**	**1,350**	**67.7**	**262**	**13.1**

Note: MSP fee codes V65.5 or 11A indicate no apparent problem.
Source: Ministry of Health

TABLE 8.2	# of screened children who were referred (2008/09)	Referred children seen by an Optometrist or Ophthalmologist within 4 months of screening		Referred children seen by an Optometrist or Ophthalmologist within 4 months of screening with a fee code that suggests a diagnosis					
				with 1 or more visits		with 1 visit only		with 2 or more visits	
		#	%	#	%	#	%	#	%
Interior	**1,087**	**408**	**37.5**	**325**	**79.7**	**281**	**68.9**	**47**	**11.5**
East Kootenay	147	42	28.6	39	92.9	35	83.3	4	9.5
Kootenay/Boundary	102	49	48.0	44	89.8	39	79.6	5	10.2
Okanagan	450	189	42.0	130	68.8	109	57.7	23	12.2
Thompson/Cariboo	388	128	33.0	112	87.5	98	76.6	15	11.7
Fraser	**2,571**	**1,092**	**42.5**	**865**	**79.2**	**706**	**64.7**	**171**	**15.7**
Fraser East	452	162	35.8	137	84.6	116	71.6	25	15.4
Fraser North	753	329	43.7	251	76.3	197	59.9	57	17.3
Fraser South	1,366	601	44.0	477	79.4	393	65.4	89	14.8
Vancouver Coastal	**999**	**557**	**55.8**	**386**	**69.3**	**342**	**61.4**	**50**	**9.0**
Richmond	294	195	66.3	129	66.2	117	60.0	14	7.2
Vancouver	455	283	62.2	197	69.6	177	62.5	24	8.5
North Shore/Coast Garibaldi	250	79	31.6	60	75.9	48	60.8	12	15.2
Vancouver Island	**1,095**	**411**	**37.5**	**300**	**73.0**	**251**	**61.1**	**54**	**13.1**
South Vancouver Island	545	209	38.3	147	70.3	124	59.3	26	12.4
Central Vancouver Island	406	164	40.4	124	75.6	106	64.6	19	11.6
North Vancouver Island	144	38	26.4	29	76.3	21	55.3	9	23.7
Northern	**339**	**89**	**26.3**	**81**	**91.0**	**78**	**87.6**	**3**	**3.4**
Northwest	58	7	12.1	7	100.0	6	85.7	1	14.3
Northern Interior	186	58	31.2	53	91.4	51	87.9	2	3.4
Northeast	95	24	25.3	21	87.5	21	87.5	--	--
BC Total	**6,091**	**2,557**	**42.0**	**1,957**	**76.5**	**1,658**	**64.8**	**325**	**12.7**

Note: MSP fee codes V65.5 or 11A indicate no apparent problem.
Source: Ministry of Health

TABLE 8.3	# of screened children who were referred (2009/10)	Referred children seen by an Optometrist or Ophthalmologist within 4 months of screening		Referred children seen by an Optometrist or Ophthalmologist within 4 months of screening with a fee code that suggests a diagnosis					
				with 1 or more visits		with 1 visit only		with 2 or more visits	
		#	%	#	%	#	%	#	%
Interior	**1,066**	**375**	**35.2**	**297**	**79.2**	**270**	**72.0**	**30**	**8.0**
East Kootenay	152	55	36.2	46	83.6	43	78.2	3	5.5
Kootenay/Boundary	134	44	32.8	40	90.9	34	77.3	7	15.9
Okanagan	440	166	37.7	114	68.7	104	62.7	11	6.6
Thompson/Cariboo	340	110	32.4	97	88.2	89	80.9	9	8.2
Fraser	**2,619**	**1,178**	**45.0**	**943**	**80.1**	**841**	**71.4**	**119**	**10.1**
Fraser East	476	216	45.4	183	84.7	163	75.5	23	10.6
Fraser North	867	386	44.5	305	79.0	274	71.0	36	9.3
Fraser South	1,276	576	45.1	455	79.0	404	70.1	60	10.4
Vancouver Coastal	**1,039**	**534**	**51.4**	**397**	**74.3**	**360**	**67.4**	**48**	**9.0**
Richmond	260	160	61.5	117	73.1	109	68.1	11	6.9
Vancouver	472	281	59.5	204	72.6	178	63.3	32	11.4
North Shore/Coast Garibaldi	307	93	30.3	76	81.7	73	78.5	5	5.4
Vancouver Island	**810**	**295**	**36.4**	**205**	**69.5**	**173**	**58.6**	**38**	**12.9**
South Vancouver Island	254	97	38.2	72	74.2	57	58.8	17	17.5
Central Vancouver Island	379	156	41.2	107	68.6	93	59.6	18	11.5
North Vancouver Island	177	42	23.7	26	61.9	23	54.8	3	7.1
Northern	**351**	**92**	**26.2**	**75**	**81.5**	**66**	**71.7**	**9**	**9.8**
Northwest	38	5	13.2	3	60.0	3	60.0	--	--
Northern Interior	239	68	28.5	58	85.3	50	73.5	8	11.8
Northeast	74	19	25.7	14	73.7	13	68.4	1	5.3
BC Total	**5,885**	**2,474**	**42.0**	**1,917**	**77.5**	**1,710**	**69.1**	**244**	**9.9**

Note: MSP fee codes V65.5 or 11A indicate no apparent problem.
Source: Ministry of Health

Overall, there were limitations in determining screening detection rates using the screening referral form database and also the linked iPHIS/PARIS-MSP database. We could not assess the representativeness of the sample cases captured in the screening referral form database. We also know that this sample represented only a small subset of the total number of screening referrals. With respect to the linked iPHIS/PARIS-MSP database, the rates obtained from this database are likely underestimates of no apparent problem (or false positives) and overestimates of true positives if based on rates that included single visits to an eye doctor. Of the two data sources, we viewed the screening referral form database as the more credible source of data for calculating screening detection rates and prevalence estimates, because the data included actual outcome data, including types of treatment, for the children referred. For this reason, we have opted to highlight the outcomes from this portion of the analysis in the 'General Themes' section of the report and also use these results as a basis for our conclusions and recommendations.

Follow-up and Diagnosis

3.1) What public health follow-up activities are associated with children's visits to an eye doctor following referral?

Public health staff attempted up to three contacts with parents/caregivers (depending on HA guidelines) by telephone or mail during the three months following the vision screening. While 40.5% of referred kindergarten children saw an eye doctor within 4 months of screening (between 2007-10), there was only a modest increase in eye doctor visits in the subsequent 6 months. Public health follow-up activities were completed for approximately half of the children referred who did not visit an eye doctor within 4 months of screening, which indicates that a large proportion of families of children referred did not receive a follow-up or phone call or letter from public health staff post-screening referral.

Key findings:

- 51.0% of referred kindergarten children (5,269 out of 10,322) between 2007 and 2010 who had not visited an eye doctor in the 4-month period following screening had not received a follow-up call or letter from public health staff.
- At the time of follow-up contact, approximately 1 out of 7 kindergarten children were under continuing care with an eye doctor and 1 in 2 kindergarten children had no apparent vision problems across all years.

Public Health Follow-Up Activities

In 2007/08, 2008/09, and 2009/10, 1,994 (37.1%), 2,557 (42.0%), and 2,474 (42.0%) of kindergarten children who received a refer result were seen by an eye doctor within 4 months of screening.

- Of these children, more than one-third had made the appointment prior to a follow-up reminder phone call or letter from public health staff (see Tables 9.1 and 9.2).
- Of the kindergarten children who had not seen an eye doctor within 4 months of screening, 1,494 children (44.2%) in 2007/08, 1,831 children (51.8%) in 2008/09, and 1,728 children (50.7%) in 2009/10 received a follow-up phone call or letter. The remaining children who had not seen an eye doctor within 4 months of screening received no follow-up from public health staff.
- Subsequent to these follow-up actions, 988 more children (an 18.4% increase) in 2007/08 had seen an eye doctor since the 4-month mark, 653 more children (a 10.7% increase) in 2008/09, and 735 more children (a 12.5% increase) in 2009/10 (see Table 4.3).

TABLE 9.1	Referred Kindergarten Children Who Saw an Eye Doctor Prior to Follow-Up Call or Letter (4 Months After Screening)							
	07/08		08/09		09/10		07-10	
HA/HSDA	#	%	#	%	#	%	#	%
Interior	**165**	**46.6**	**224**	**54.9**	**207**	**55.2**	**596**	**52.4**
East Kootenay	21	50.0	31	73.8	32	58.2	84	60.4
Kootenay/Boundary	14	58.3	1	2.0	33	75.0	48	41.0
Okanagan	94	60.3	117	61.9	83	50.0	294	57.5
Thompson/Cariboo	36	27.3	75	58.6	59	53.6	170	45.9
Fraser	**482**	**47.6**	**513**	**47.0**	**498**	**42.3**	**1,493**	**45.5**
Fraser East	112	60.9	105	64.8	136	63.0	353	62.8
Fraser North	187	60.3	111	33.7	126	32.6	424	41.4
Fraser South	183	35.3	297	49.4	236	41.0	716	42.2
Vancouver Coastal	**61**	**29.3**	**8**	**1.4**	**27**	**5.1**	**96**	**7.4**
Richmond	0	--	0	--	1	0.6	1	0.3
Vancouver	0	--	0	--	0	--	0	--
North Shore/Coast Garibaldi	61	91.0	8	10.1	26	28.0	95	39.7
Vancouver Island	**131**	**36.9**	**153**	**37.2**	**137**	**46.4**	**421**	**39.7**
South Vancouver Island	53	32.1	62	29.7	40	41.2	155	32.9
Central Vancouver Island	40	31.0	76	46.3	85	54.5	201	44.8
North Vancouver Island	38	62.3	15	39.5	12	28.6	65	46.1
Northern	**7**	**11.1**	**3**	**3.4**	**9**	**9.8**	**19**	**7.8**
Northwest	0	--	1	14.3	1	20.0	2	9.1
Northern Interior	7	18.9	2	3.4	5	7.4	14	8.6
Northeast	0	--	0	--	3	15.8	3	5.1
BC Total	**846**	**42.4**	**901**	**35.2**	**878**	**35.5**	**2,625**	**37.4**

Source: iPHIS/PARIS

TABLE 9.2	Referred Kindergarten Children Who Did Not See an Eye Doctor 4 months After Screening and Did Not Receive Follow-Up Call or Letter							
HA/HSDA	07/08		08/09		09/10		07-10	
Interior	**367**	**46.0**	**236**	**34.8**	**220**	**31.8**	**823**	**38.0**
East Kootenay	55	46.6	45	42.9	27	27.8	127	39.7
Kootenay/Boundary	29	50.9	51	96.2	21	23.3	101	50.5
Okanagan	86	27.9	55	21.1	93	33.9	234	27.8
Thompson/Cariboo	197	62.7	85	32.7	79	34.3	361	44.9
Fraser	**638**	**49.7**	**475**	**32.1**	**580**	**40.2**	**1,693**	**40.3**
Fraser East	110	43.1	64	22.1	33	12.7	207	25.7
Fraser North	185	44.7	185	43.6	280	58.2	650	49.3
Fraser South	343	55.9	226	29.5	267	38.1	836	40.2
Vancouver Coastal	**377**	**75.0**	**419**	**94.8**	**402**	**79.6**	**1,198**	**82.6**
Richmond	40	--	99	--	100	--	239	--
Vancouver	315	--	172	--	191	--	678	--
North Shore/Coast Garibaldi	22	14.9	148	86.5	111	51.9	281	52.7
Vancouver Island	**355**	**56.3**	**333**	**48.7**	**256**	**49.7**	**944**	**51.6**
South Vancouver Island	156	58.9	187	55.7	89	56.7	432	57.0
Central Vancouver Island	141	65.3	79	32.6	75	33.6	295	43.3
North Vancouver Island	58	38.7	67	63.2	92	68.1	217	55.5
Northern	**146**	**89.6**	**240**	**96.0**	**225**	**86.9**	**611**	**90.9**
Northwest	49	96.1	51	100.0	30	90.9	130	96.3
Northern Interior	55	80.9	121	94.5	153	89.5	329	89.6
Northeast	42	95.5	68	95.8	42	76.4	152	89.4
BC Total	**1,883**	**55.8**	**1,703**	**48.2**	**1,683**	**49.3**	**5,269**	**51.0**

Source: iPHIS/PARIS

In more general terms, a small group of parents and/or caregivers of children referred from screening appeared to take their children to the eye doctor without follow-up action from public health staff. However, for the majority of children referred, the referral rate resulted in a large number of children who required public health follow-up activities. The follow-up actions coincided with an increase in the number of children who subsequently saw an eye doctor, but approximately half of referred kindergarten children who did not visit an eye doctor 4 months after screening also did not receive a follow-up call or letter from public health staff in 2007-10.

Follow-Up Outcome Data

Through public health staff efforts to obtain diagnostic outcome data from parents/caregivers directly, follow-up outcome data were available in iPHIS/PARIS for 2007/08, 2008/09, and 2009/10. The iPHIS/PARIS dataset contained information on follow-up outcomes for a subset of kindergarten children, including those who received a refer result following screening, as well as all three-year-olds (passes and refers) screened. The following outcomes were recorded: total

number of children under continuing care, number of dissents, number of awaiting results, number of no apparent problem, and number of children whose treatment is complete.

- Of the 7,917 kindergarten children in the iPHIS/PARIS dataset in 2008/09 with refer results (n=6,091) and those absent during screening (n=1,826), 3,642 (46.0%) were reported to have 'no apparent problem,' with 3,269 (41.3%) 'awaiting a result.' The category 'no apparent problem' reflects those children without a diagnostic outcome indicating one of the target eye conditions. It also includes the children who were reported to have refused screening or referral to an eye doctor because they had seen an eye doctor within the last 6 months with no problems reported with the child's vision.
- Also, 1,041 (13.1%) children were classified as 'under continuing care,' which included families who declined screening or referral to an eye doctor because the child was under treatment or ongoing follow-up with an eye doctor (i.e., children with corrective lenses with a recall appointment in 6 months or less).
- There were also a small number of children whose families either dissented (n=81; 1.0%) or whose treatment was complete (n=396; 5.0%). Children with treatment completed included children who were treated and under the care of an eye doctor following the eye examination and children who had been prescribed corrective lenses with no recall appointment or recall in a year. It also included those families who declined screening or referral to an eye doctor because the child was previously under the care of an eye doctor within 6 months prior to screening and received and completed treatment.

Tables 10.1 and 10.2 present information on follow-up outcomes for kindergarten children; Tables 10.3 and 10.4 present data for three-year-olds.

TABLE 10.1	iPHIS/PARIS Follow-Up Outcomes: Kindergarten Counts (#)																			
	Total Under Continuing Care				Total Dissent				Total Awaiting for Result				Total No Apparent Problem				Total Treatment Complete			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**224**	**256**	**194**	**674**	**12**	**3**	**6**	**21**	**964**	**853**	**798**	**2,615**	**411**	**481**	**543**	**1,435**	**137**	**94**	**54**	**285**
East Kootenay	27	37	30	94	2	0	0	2	143	110	120	373	40	37	42	119	11	12	2	25
Kootenay/Boundary	19	15	40	74	0	0	2	2	103	115	97	315	46	11	35	92	4	16	2	22
Okanagan	104	107	72	283	7	0	3	10	333	349	316	998	199	202	254	655	79	22	15	116
Thompson/Cariboo	74	97	52	223	3	3	1	7	385	279	265	929	126	231	212	569	43	44	35	122
Fraser	**391**	**531**	**677**	**1,599**	**4**	**14**	**48**	**66**	**1,392**	**1,454**	**1,532**	**4,378**	**697**	**930**	**1,025**	**2,652**	**125**	**157**	**168**	**450**
Fraser East	98	101	118	317	0	1	34	35	324	314	328	966	69	136	417	622	18	27	20	65
Fraser North	152	169	234	555	2	7	8	17	374	437	527	1338	246	297	284	827	12	18	18	48
Fraser South	141	261	325	727	2	6	6	14	694	703	677	2074	382	497	324	1203	95	112	130	337
Vancouver Coastal	**57**	**35**	**41**	**133**	**8**	**57**	**131**	**196**	**56**	**69**	**85**	**210**	**135**	**94**	**120**	**349**	**39**	**14**	**18**	**71**
Richmond	0	0	0	0	0	3	14	17	0	0	0	0	0	0	0	0	2	0	1	3
Vancouver	0	0	0	0	8	54	116	178	0	0	0	0	0	0	0	0	31	5	4	40
North Shore/Coast Garibaldi	57	35	41	133	0	0	1	1	56	69	85	210	135	94	120	349	6	9	13	28
Vancouver Island	**151**	**170**	**189**	**510**	**8**	**6**	**4**	**18**	**497**	**508**	**393**	**1,398**	**1,225**	**842**	**475**	**2,542**	**76**	**88**	**72**	**236**
South Vancouver Island	67	71	84	222	6	1	0	7	199	181	108	488	232	417	100	749	18	36	33	87
Central Vancouver Island	49	57	52	158	1	3	2	6	252	244	187	683	691	269	239	1199	11	39	29	79
North Vancouver Island	35	42	53	130	1	2	2	5	46	83	98	227	302	156	136	594	47	13	10	70
Northern	**197**	**49**	**81**	**327**	**0**	**1**	**13**	**14**	**201**	**385**	**283**	**869**	**1,200**	**1,295**	**1,420**	**3,915**	**24**	**43**	**7**	**74**
Northwest	3	5	10	18	0	0	0	0	30	10	24	64	76	101	85	262	6	2	0	8
Northern Interior	171	26	34	231	0	1	1	2	132	296	239	667	582	616	743	1941	15	1	3	19
Northeast	23	18	37	78	0	0	12	12	39	79	20	138	542	578	592	1712	3	40	4	47
BC Total	**1,020**	**1,041**	**1,182**	**3,243**	**32**	**81**	**202**	**315**	**3,110**	**3,269**	**3,091**	**9,470**	**3,668**	**3,642**	**3,583**	**10,893**	**401**	**396**	**319**	**1,116**

Source: iPHIS/PARIS

TABLE 10.2	iPHIS/PARIS Follow-Up Outcomes: Kindergarten Counts (%)																			
	Total Under Continuing Care				Total Dissent				Total Awaiting for Result				Total No Apparent Problem				Total Treatment Complete			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**3.9**	**4.2**	**3.5**	**3.9**	**0.2**	**--**	**0.1**	**0.1**	**16.7**	**14.1**	**14.5**	**15.1**	**7.1**	**7.9**	**9.9**	**8.3**	**2.4**	**1.6**	**1.0**	**1.6**
East Kootenay	4.0	5.2	4.6	4.6	0.3	--	--	0.1	21.2	15.5	18.2	18.2	5.9	5.2	6.4	5.8	1.6	1.7	0.3	1.2
Kootenay/Boundary	3.0	2.3	6.8	4.0	--	--	0.3	0.1	16.4	18.0	16.6	17.0	7.3	1.7	6.0	5.0	0.6	2.5	0.3	1.2
Okanagan	3.9	3.8	2.9	3.5	0.3	--	0.1	0.1	12.5	12.3	12.6	12.5	7.5	7.1	10.1	8.2	3.0	0.8	0.6	1.5
Thompson/Cariboo	4.1	5.2	3.0	4.1	0.2	0.2	0.1	0.1	21.2	14.9	15.1	17.1	6.9	12.3	12.1	10.4	2.4	2.3	2.0	2.2
Fraser	**2.5**	**3.6**	**4.4**	**3.5**	**--**	**0.1**	**0.3**	**0.1**	**9.1**	**9.9**	**9.9**	**9.6**	**4.5**	**6.3**	**6.6**	**5.8**	**0.8**	**1.1**	**1.1**	**1.0**
Fraser East	3.3	3.5	3.8	3.5	--	--	1.1	0.4	10.8	10.9	10.6	10.8	2.3	4.7	13.5	6.9	0.6	0.9	0.6	0.7
Fraser North	2.9	3.4	4.4	3.6	--	0.1	0.2	0.1	7.2	8.8	10.0	8.7	4.8	6.0	5.4	5.4	0.2	0.4	0.3	0.3
Fraser South	2.0	3.8	4.5	3.4	--	0.1	0.1	0.1	9.6	10.2	9.4	9.8	5.3	7.2	4.5	5.7	1.3	1.6	1.8	1.6
Vancouver Coastal	**0.7**	**0.4**	**0.5**	**0.6**	**0.1**	**0.7**	**1.7**	**0.8**	**0.7**	**0.9**	**1.1**	**0.9**	**1.7**	**1.2**	**1.5**	**1.5**	**0.5**	**0.2**	**0.2**	**0.3**
Richmond	--	--	--	--	--	0.2	1.0	0.4	--	--	--	--	--	--	--	--	0.1	--	0.1	0.1
Vancouver	--	--	--	--	0.2	1.3	2.7	1.4	--	--	--	--	--	--	--	--	0.8	0.1	0.1	0.3
North Shore/Coast Garibaldi	2.6	1.5	1.9	2.0	--	--	--	--	2.6	3.0	3.9	3.1	6.2	4.0	5.5	5.2	0.3	0.4	0.6	0.4
Vancouver Island	**3.2**	**2.8**	**3.5**	**3.2**	**0.2**	**0.1**	**0.1**	**0.1**	**10.4**	**8.4**	**7.3**	**8.6**	**25.6**	**13.9**	**8.9**	**15.7**	**1.6**	**1.5**	**1.3**	**1.5**
South Vancouver Island	3.0	2.5	3.3	2.9	0.3	--	--	0.1	9.0	6.4	4.2	6.4	10.5	14.7	3.9	9.8	0.8	1.3	1.3	1.1
Central Vancouver Island	3.0	2.7	2.9	2.8	0.1	0.1	0.1	0.1	15.2	11.6	10.3	12.3	41.7	12.8	13.2	21.5	0.7	1.9	1.6	1.4
North Vancouver Island	3.8	3.8	5.5	4.4	0.1	0.2	0.2	0.2	5.0	7.5	10.2	7.6	33.2	14.1	14.2	20.0	5.2	1.2	1.0	2.4
Northern	**10.8**	**1.9**	**3.6**	**5.0**	**--**	**--**	**0.6**	**0.2**	**11.0**	**15.3**	**12.6**	**13.2**	**65.8**	**51.5**	**63.0**	**59.4**	**1.3**	**1.7**	**0.3**	**1.1**
Northwest	0.6	0.8	1.6	1.0	--	--	--	--	6.3	1.5	3.9	3.7	15.9	15.6	14.0	15.1	1.3	0.3	--	0.5
Northern Interior	20.1	2.2	3.3	7.5	--	0.1	0.1	0.1	15.5	25.4	22.9	21.8	68.4	52.8	71.1	63.4	1.8	0.1	0.3	0.6
Northeast	4.7	2.6	6.2	4.4	--	--	2.0	0.7	7.9	11.3	3.3	7.7	109.9	82.6	98.8	95.5	0.6	5.7	0.7	2.6
BC Total	**14.8**	**13.1**	**15.4**	**14.4**	**0.5**	**1.0**	**2.6**	**1.4**	**45.2**	**41.3**	**40.3**	**42.2**	**53.3**	**46.0**	**46.8**	**48.5**	**5.8**	**5.0**	**4.2**	**5.0**

Source: iPHIS/PARIS

TABLE 10.3	iPHIS/PARIS Follow-Up Outcomes: 3-Year-Old Counts (#)																			
	Total Under Continuing Care				Total Dissent				Total Awaiting for Result				Total No Apparent Problem				Total Treatment Complete			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**5**	**11**	**0**	**16**	**1**	**0**	**0**	**1**	**19**	**109**	**0**	**128**	**16**	**205**	**0**	**221**	**0**	**4**	**0**	**4**
East Kootenay	0	0	0	0	1	0	0	1	1	9	0	10	0	14	0	14	0	0	0	0
Kootenay/Boundary	0	1	0	1	0	0	0	0	0	17	0	17	1	24	0	25	0	1	0	1
Okanagan	0	1	0	1	0	0	0	0	6	21	0	27	3	43	0	46	0	1	0	1
Thompson/Cariboo	5	9	0	14	0	0	0	0	12	62	0	74	12	124	0	136	0	2	0	2
Fraser	**1**	**29**	**0**	**30**	**0**	**0**	**3**	**3**	**8**	**156**	**0**	**164**	**15**	**522**	**0**	**537**	**1**	**2**	**0**	**3**
Fraser East	0	11	0	11	0	0	0	0	1	45	0	46	7	112	0	119	1	0	0	1
Fraser North	0	10	0	10	0	0	1	1	1	59	0	60	3	200	0	203	0	0	0	0
Fraser South	1	8	0	9	0	0	2	2	6	52	0	58	5	210	0	215	0	2	0	2
Vancouver Coastal	**9**	**22**	**27**	**58**	**0**	**56**	**53**	**109**	**31**	**89**	**110**	**230**	**349**	**1,048**	**1,094**	**2,491**	**0**	**12**	**6**	**18**
Richmond	0	0	0	0	0	48	51	99	0	0	0	0	0	0	0	0	0	1	0	1
Vancouver	0	0	0	0	0	8	1	9	0	0	0	0	0	0	0	0	0	0	0	0
North Shore/Coast Garibaldi	9	22	27	58	0	0	1	1	31	89	110	230	349	1,048	1,094	2491	0	11	6	17
Vancouver Island	**1**	**13**	**0**	**14**	**0**	**2**	**0**	**2**	**6**	**41**	**12**	**59**	**20**	**442**	**91**	**553**	**1**	**4**	**0**	**5**
South Vancouver Island	0	5	0	5	0	0	0	0	0	11	10	21	1	189	58	248	0	3	0	3
Central Vancouver Island	0	3	0	3	0	2	0	2	0	17	2	19	0	167	32	199	0	0	0	0
North Vancouver Island	1	5	0	6	0	0	0	0	6	13	0	19	19	86	1	106	1	1	0	2
Northern	**3**	**1**	**0**	**4**	**0**	**2**	**0**	**2**	**35**	**43**	**0**	**78**	**52**	**171**	**0**	**223**	**0**	**3**	**0**	**3**
Northwest	2	1	0	3	0	0	0	0	28	9	0	37	35	25	0	60	0	0	0	0
Northern Interior	0	0	0	0	0	0	0	0	5	23	0	28	15	61	0	76	0	0	0	0
Northeast	1	0	0	1	0	2	0	2	2	11	0	13	2	85	0	87	0	3	0	3
BC Total	**19**	**76**	**27**	**122**	**1**	**60**	**56**	**117**	**99**	**438**	**122**	**659**	**452**	**2,388**	**1,185**	**4,025**	**2**	**25**	**6**	**33**

Source: iPHIS/PARIS

TABLE 10.4	iPHIS/PARIS Follow-Up Outcomes: 3-Year-Old Counts (%)																			
	Total Under Continuing Care				Total Dissent				Total Awaiting for Result				Total No Apparent Problem				Total Treatment Complete			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**12.2**	**3.3**	**--**	**4.3**	**2.4**	**--**	**--**	**0.3**	**46.3**	**33.1**	**--**	**34.6**	**39.0**	**62.3**	**--**	**59.7**	**--**	**1.2**	**--**	**1.1**
East Kootenay	--	--	--	--	50.0	--	--	4.0	50.0	39.1	--	40.0	--	60.9	--	56.0	--	--	--	--
Kootenay/Boundary	--	2.3	--	2.3	--	--	--	--	--	39.5	--	38.6	100.0	55.8	--	56.8	--	2.3	--	2.3
Okanagan	--	1.5	--	1.3	--	--	--	--	66.7	31.8	--	36.0	33.3	65.2	--	61.3	--	1.5	--	1.3
Thompson/Cariboo	17.2	4.6	--	6.2	--	--	--	--	41.4	31.5	--	32.7	41.4	62.9	--	60.2	--	1.0	--	0.9
Fraser	**3.3**	**3.7**	**--**	**3.0**	**--**	**--**	**1.6**	**0.3**	**26.7**	**19.8**	**--**	**16.3**	**50.0**	**66.4**	**--**	**53.4**	**3.3**	**0.3**	**--**	**0.3**
Fraser East	--	6.5	--	6.2	--	--	--	--	11.1	26.8	--	26.0	77.8	66.7	--	67.2	11.1	--	--	0.6
Fraser North	--	3.0	--	2.0	--	--	0.6	0.2	14.3	17.6	--	11.9	42.9	59.5	--	40.1	--	--	--	--
Fraser South	7.1	2.8	--	2.8	--	--	7.7	0.6	42.9	18.4	--	18.0	35.7	74.5	--	66.8	--	0.7	--	0.6
Vancouver Coastal	**1.5**	**0.6**	**0.5**	**0.6**	**--**	**1.6**	**1.0**	**1.2**	**5.1**	**2.6**	**2.1**	**2.5**	**57.7**	**30.5**	**21.2**	**27.1**	**--**	**0.3**	**0.1**	**0.2**
Richmond	--	--	--	--	--	5.5	5.1	5.0	--	--	--	--	--	--	--	--	--	0.1	--	0.1
Vancouver	--	--	--	--	--	0.6	--	0.2	--	--	--	--	--	--	--	--	--	--	--	--
North Shore/Coast Garibaldi	2.3	1.8	2.0	2.0	--	--	0.1	--	8.0	7.2	8.3	7.8	89.7	84.5	82.6	84.3	--	0.9	0.5	0.6
Vancouver Island	**3.6**	**2.6**	**--**	**2.2**	**--**	**0.4**	**--**	**0.3**	**21.4**	**8.2**	**11.7**	**9.3**	**71.4**	**88.0**	**88.3**	**87.4**	**3.6**	**0.8**	**--**	**0.8**
South Vancouver Island	--	2.4	--	1.8	--	--	--	--	--	5.3	14.7	7.6	100.0	90.9	85.3	89.5	--	1.4	--	1.1
Central Vancouver Island	--	1.6	--	1.3	--	1.1	--	0.9	--	9.0	5.9	8.5	--	88.4	94.1	89.2	--	--	--	--
North Vancouver Island	3.7	4.8	--	4.5	--	--	--	--	22.2	12.4	--	14.3	70.4	81.9	100.0	79.7	3.7	1.0	--	1.5
Northern	**3.3**	**0.5**	**--**	**1.3**	**--**	**0.9**	**--**	**0.6**	**38.5**	**19.5**	**--**	**25.1**	**57.1**	**77.7**	**--**	**71.7**	**--**	**1.4**	**--**	**1.0**
Northwest	3.1	2.9	--	3.0	--	--	--	--	43.1	25.7	--	37.0	53.8	71.4	--	60.0	--	--	--	--
Northern Interior	--	--	--	--	--	--	--	--	23.8	27.4	--	26.7	71.4	72.6	--	72.4	--	--	--	--
Northeast	20.0	--	--	0.9	--	2.0	--	1.9	40.0	10.9	--	12.3	40.0	84.2	--	82.1	--	3.0	--	2.8
BC Total	**2.4**	**1.4**	**0.5**	**1.1**	**0.1**	**1.1**	**1.0**	**1.0**	**12.4**	**8.3**	**2.2**	**5.7**	**56.8**	**45.3**	**21.7**	**34.9**	**0.3**	**0.5**	**0.1**	**0.3**

Source: iPHIS/PARIS

Of the kindergarten children referred with public health follow-up outcome information and who required treatment across screening years (2007-10), approximately 25.6% received this treatment consequential to screening referral (i.e., were not already under continuing care). With respect to the three-year-olds referred in 2007-10, approximately 21.3% who needed treatment received it subsequent to a screening referral. These rates provide an estimate of the increased 21.3 – 25.6% of children in need of vision care who received necessary treatment as a consequence of participation in the screening program. It should be noted that these estimates do not include the results for the large number of children who were still awaiting their results at the time of public health contact.

3.2) Are children referred from screening seeing an eye doctor?

Yes, approximately 50% of kindergarten children referred from screening visited an eye doctor within 12 months of screening. The rate was slightly higher for 3-year-olds referred from screening. In both age groups, however, a large proportion of children did *not* visit an eye doctor within the year following screening referral, particularly among communities that are socioeconomically disadvantaged and/or experience systemic barriers to accessing services.

Key findings:

- Over one-half (9,401 out of 17,346) of referred kindergarten children saw an eye doctor within one year of public health vision screening across all screening years.
- Approximately 60% (1,327 out of 2,198) of referred three-year-old children saw an eye doctor within one year of vision screening across all screening years.
- At twelve months after vision screening, 45.8% (7,945 out of 17,346) of referred kindergarten children and 39.6% (871 out of 2,198) of referred three-year-old children were not seen by an eye doctor.

Approximately 2 in 5 kindergarten students referred saw an eye doctor within four months of the vision screening. After one year, these proportions increased to approximately 54.2% of all children referred. The source of these data was the iPHIS/PARIS-MSP linked dataset.

The iPHIS/PARIS dataset also contained information on those children who passed the public health vision screening, but were still seen by an eye doctor in the year following the screening. After one year, approximately 1 in 3 kindergarten students with a pass result recorded in iPHIS/PARIS were also seen by an eye doctor across screening years (See Tables 4.3 and 4.4). Please note that only a small proportion of the kindergarten children with pass results were entered into iPHIS/PARIS across the three years (i.e., n = 5,935 in 2007/08; 7,128 in 2008/09; 7,197 in 2009/10). These findings therefore only reflect a small subset of the total number of kindergarten children with pass results.

See Tables 11.1 – 11.4 for more information on the number and percent of kindergarten children seen by an eye doctor within four and twelve months of public health screening; Tables 11.5 – 11.8 present similar information for three-year-olds.

TABLE 11.1	# Referred Kindergarten Children Who Saw Eye Doctor 4 Months After Screening											
	Referred				Passed				Total			
HA/HSDA	07/08	08/09	09/10	2007-10	07/08	08/09	09/10	2007-10	07/08	08/09	09/10	2007-10
Interior	**354**	**408**	**375**	**1,137**	**29**	**14**	**15**	**58**	**383**	**422**	**390**	**1,195**
East Kootenay	42	42	55	139	3	2	3	8	45	44	58	147
Kootenay/Boundary	24	49	44	117	17	5	4	26	41	54	48	143
Okanagan	156	189	166	511	2	3	5	10	158	192	171	521
Thompson/Cariboo	132	128	110	370	7	4	3	14	139	132	113	384
Fraser	**1,013**	**1,092**	**1,178**	**3,283**	**40**	**57**	**111**	**208**	**1,053**	**1,149**	**1,289**	**3,491**
Fraser East	184	162	216	562	5	20	43	68	189	182	259	630
Fraser North	310	329	386	1,025	20	14	18	52	330	343	404	1,077
Fraser South	519	601	576	1,696	15	23	50	88	534	624	626	1,784
Vancouver Coastal	**208**	**557**	**534**	**1,299**	**390**	**451**	**443**	**1,284**	**598**	**1,008**	**977**	**2,583**
Richmond	42	195	160	397	18	117	121	256	60	312	281	653
Vancouver	99	283	281	663	359	303	280	942	458	586	561	1,605
North Shore/Coast Garibaldi	67	79	93	239	13	31	42	86	80	110	135	325
Vancouver Island	**355**	**411**	**295**	**1,061**	**141**	**115**	**86**	**342**	**496**	**526**	**381**	**1,403**
South Vancouver Island	165	209	97	471	19	31	11	61	184	240	108	532
Central Vancouver Island	129	164	156	449	74	54	50	178	203	218	206	627
North Vancouver Island	61	38	42	141	48	30	25	103	109	68	67	244
Northern	**63**	**89**	**92**	**244**	**136**	**178**	**109**	**423**	**199**	**267**	**201**	**667**
Northwest	10	7	5	22	5	7	4	16	15	14	9	38
Northern Interior	37	58	68	163	84	97	70	251	121	155	138	414
Northeast	16	24	19	59	47	74	35	156	63	98	54	215
BC Total	**1,994**	**2,557**	**2,474**	**7,025**	**738**	**815**	**764**	**2,317**	**2,732**	**3,372**	**3,238**	**9,342**

Source: iPHIS/PARIS-MSP

TABLE 11.2	% Referred Kindergarten Children Who Saw Eye Doctor 4 Months After Screening											
	Referred				Passed				Total			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**30.8**	**37.5**	**35.2**	**34.4**	**20.9**	**17.1**	**8.8**	**14.8**	**29.7**	**36.1**	**31.5**	**32.3**
East Kootenay	26.3	28.6	36.2	30.3	--	--	--	33.3	26.3	28.6	36.7	30.4
Kootenay/Boundary	29.6	48.0	32.8	36.9	38.6	--	--	32.9	32.8	44.6	32.0	36.1
Okanagan	33.6	42.0	37.7	37.7	3.3	13.6	4.0	4.8	30.2	40.7	30.3	33.4
Thompson/Cariboo	29.6	33.0	32.4	31.5	29.2	11.8	12.5	17.1	29.6	31.3	31.0	30.6
Fraser	**44.1**	**42.5**	**45.0**	**43.9**	**23.3**	**23.4**	**22.7**	**23.0**	**42.7**	**40.8**	**41.5**	**41.6**
Fraser East	41.9	35.8	45.4	41.1	--	23.5	13.4	16.5	42.5	33.9	32.5	35.4
Fraser North	42.8	43.7	44.5	43.7	16.3	14.6	21.2	17.1	39.0	40.4	42.4	40.7
Fraser South	45.8	44.0	45.1	44.9	34.9	36.5	58.8	46.1	45.4	43.7	46.0	45.0
Vancouver Coastal	**29.3**	**55.8**	**51.4**	**47.3**	**12.8**	**10.3**	**10.2**	**10.9**	**15.9**	**18.7**	**18.1**	**17.8**
Richmond	51.2	66.3	61.5	62.4	22.8	11.7	11.1	11.8	37.3	24.0	20.8	23.2
Vancouver	23.9	62.2	59.5	49.4	12.3	10.0	9.8	10.7	13.8	16.8	16.9	15.8
North Shore/Coast Garibaldi	31.2	31.6	30.3	31.0	25.5	9.0	10.2	10.7	30.1	18.5	18.8	20.6
Vancouver Island	**36.0**	**37.5**	**36.4**	**36.7**	**10.7**	**12.2**	**10.2**	**11.0**	**21.5**	**25.8**	**23.1**	**23.4**
South Vancouver Island	38.4	38.3	38.2	38.3	34.5	26.1	50.0	31.1	37.9	36.1	39.1	37.3
Central Vancouver Island	37.4	40.4	41.2	39.7	12.5	11.7	10.5	11.7	21.7	25.2	24.1	23.6
North Vancouver Island	28.9	26.4	23.7	26.5	7.1	8.2	7.3	7.4	12.3	13.4	12.9	12.7
Northern	**27.9**	**26.3**	**26.2**	**26.6**	**10.9**	**12.2**	**8.2**	**10.5**	**13.5**	**14.8**	**12.0**	**13.5**
Northwest	16.4	12.1	13.2	14.0	9.8	11.5	5.3	8.6	13.4	11.8	8.0	11.0
Northern Interior	35.2	31.2	28.5	30.8	12.9	12.4	10.1	11.8	16.0	16.0	14.8	15.6
Northeast	26.7	25.3	25.7	25.8	8.6	12.0	6.3	9.1	10.4	13.8	8.5	11.0
BC Total	**37.1**	**42.0**	**42.0**	**40.5**	**12.4**	**11.4**	**10.6**	**11.4**	**24.2**	**25.5**	**24.8**	**24.8**

Source: iPHIS/PARIS-MSP

TABLE 11.3	# Referred Kindergarten Children Who Saw Eye Doctor 12 Months After Screening											
	Referred				Passed				Total			
HA/HSDA	07/08	08/09	09/10	2007-10	07/08	08/09	09/10	2007-10	07/08	08/09	09/10	2007-10
Interior	**584**	**508**	**505**	**1,597**	**50**	**23**	**33**	**106**	**634**	**531**	**538**	**1,703**
East Kootenay	81	63	80	224	6	3	4	13	87	66	84	237
Kootenay/Boundary	46	59	57	162	21	6	5	32	67	65	62	194
Okanagan	222	230	209	661	12	5	17	34	234	235	226	695
Thompson/Cariboo	235	156	159	550	11	9	7	27	246	165	166	577
Fraser	**1,371**	**1,322**	**1,468**	**4,161**	**71**	**83**	**162**	**316**	**1,442**	**1,405**	**1,630**	**4,477**
Fraser East	253	197	251	701	5	24	79	108	258	221	330	809
Fraser North	440	400	500	1,340	45	33	30	108	485	433	530	1,448
Fraser South	678	725	717	2,120	21	26	53	100	699	751	770	2,220
Vancouver Coastal	**384**	**733**	**697**	**1,814**	**945**	**1,286**	**1,277**	**3,508**	**1,329**	**2,019**	**1,974**	**5,322**
Richmond	54	249	208	511	30	339	351	720	84	588	559	1,231
Vancouver	207	352	344	903	891	880	800	2,571	1,098	1,232	1,144	3,474
North Shore/Coast Garibaldi	123	132	145	400	24	67	126	217	147	199	271	617
Vancouver Island	**540**	**521**	**395**	**1,456**	**362**	**225**	**216**	**803**	**902**	**746**	**611**	**2,259**
South Vancouver Island	238	273	136	647	22	46	11	79	260	319	147	726
Central Vancouver Island	203	193	194	590	172	100	127	399	375	293	321	989
North Vancouver Island	99	55	65	219	168	79	78	325	267	134	143	544
Northern	**103**	**126**	**144**	**373**	**343**	**315**	**285**	**943**	**446**	**441**	**429**	**1,316**
Northwest	24	12	7	43	14	7	11	32	38	19	18	75
Northern Interior	56	81	109	246	190	195	170	555	246	276	279	801
Northeast	23	33	28	84	139	113	104	356	162	146	132	440
BC Total	**2,982**	**3,210**	**3,209**	**9,401**	**1,775**	**1,933**	**1,974**	**5,682**	**4,757**	**5,143**	**5,183**	**15,083**

Source: iPHIS/PARIS-MSP

TABLE 11.4	% Referred Kindergarten Children Who Saw Eye Doctor 12 Months After Screening											
	Referred				Passed				Total			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**50.7**	**46.7**	**47.4**	**48.3**	**36.0**	**28.0**	**19.3**	**27.0**	**49.1**	**45.4**	**43.5**	**46.1**
East Kootenay	50.6	42.9	52.6	48.8	--	--	--	54.2	50.9	42.9	53.2	49.1
Kootenay/Boundary	56.8	57.8	42.5	51.1	47.7	--	--	40.5	53.6	53.7	41.3	49.0
Okanagan	47.8	51.1	47.5	48.8	20.0	22.7	13.6	16.4	44.7	49.8	40.0	44.5
Thompson/Cariboo	52.7	40.2	46.8	46.8	45.8	26.5	29.2	32.9	52.3	39.1	45.6	45.9
Fraser	**59.7**	**51.4**	**56.1**	**55.6**	**41.3**	**34.0**	**33.1**	**34.9**	**58.4**	**49.9**	**52.4**	**53.3**
Fraser East	57.6	43.6	52.7	51.3	--	28.2	24.7	26.3	58.0	41.2	41.5	45.5
Fraser North	60.8	53.1	57.7	57.2	36.6	34.4	35.3	35.5	57.3	51.0	55.7	54.7
Fraser South	59.8	53.1	56.2	56.2	48.8	41.3	62.4	52.4	59.4	52.6	56.6	56.0
Vancouver Coastal	**54.0**	**73.4**	**67.1**	**66.0**	**31.1**	**29.3**	**29.3**	**29.8**	**35.4**	**37.5**	**36.6**	**36.6**
Richmond	65.9	84.7	80.0	80.3	38.0	33.8	32.1	33.1	52.2	45.3	41.3	43.8
Vancouver	50.0	77.4	72.9	67.3	30.6	29.0	28.1	29.2	33.0	35.3	34.5	34.3
North Shore/Coast Garibaldi	57.2	52.8	47.2	51.8	47.1	19.4	30.7	26.9	55.3	33.4	37.7	39.1
Vancouver Island	**54.8**	**47.6**	**48.8**	**50.4**	**27.4**	**23.9**	**25.7**	**25.8**	**39.1**	**36.6**	**37.0**	**37.7**
South Vancouver Island	55.3	50.1	53.5	52.6	40.0	38.7	50.0	40.3	53.6	48.0	53.3	50.9
Central Vancouver Island	58.8	47.5	51.2	52.2	29.1	21.7	26.7	26.1	40.1	33.8	37.6	37.2
North Vancouver Island	46.9	38.2	36.7	41.2	24.8	21.7	22.7	23.5	30.1	26.4	27.4	28.4
Northern	**45.6**	**37.2**	**41.0**	**40.7**	**27.5**	**21.5**	**21.5**	**23.4**	**30.3**	**24.5**	**25.6**	**26.6**
Northwest	39.3	20.7	18.4	27.4	27.5	11.5	14.7	17.1	33.9	16.0	15.9	21.8
Northern Interior	53.3	43.5	45.6	46.4	29.2	24.8	24.5	26.1	32.6	28.4	29.9	30.1
Northeast	38.3	34.7	37.8	36.7	25.5	18.3	18.6	20.7	26.8	20.5	20.9	22.6
BC Total	**55.5**	**52.7**	**54.5**	**54.2**	**29.9**	**27.1**	**27.4**	**28.0**	**42.1**	**38.9**	**39.6**	**40.1**

Source: iPHIS/PARIS-MSP

TABLE 11.5	# Referred 3-Year-Olds Who Saw Eye Doctor 4 Months After Screening											
	Referred				Passed				Total			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**6**	**42**	**0**	**48**	**1**	**20**	**0**	**21**	**7**	**62**	**0**	**69**
East Kootenay	1	6	0	7	0	0	0	0	1	6	0	7
Kootenay/Boundary	0	3	0	3	0	3	0	3	0	6	0	6
Okanagan	0	13	0	13	0	4	0	4	0	17	0	17
Thompson/Cariboo	5	20	0	25	1	13	0	14	6	33	0	39
Fraser	**8**	**82**	**23**	**113**	**1**	**44**	**12**	**57**	**9**	**126**	**35**	**170**
Fraser East	1	11	0	12	1	4	0	5	2	15	0	17
Fraser North	2	43	18	63	0	22	10	32	2	65	28	95
Fraser South	5	28	5	38	0	18	2	20	5	46	7	58
Vancouver Coastal	**76**	**307**	**467**	**850**	**32**	**195**	**286**	**513**	**108**	**502**	**753**	**1,363**
Richmond	53	130	147	330	3	42	39	84	56	172	186	414
Vancouver	7	129	255	391	3	78	168	249	10	207	423	640
North Shore/Coast Garibaldi	16	48	65	129	26	75	79	180	42	123	144	309
Vancouver Island	**3**	**32**	**6**	**41**	**1**	**26**	**3**	**30**	**4**	**58**	**9**	**71**
South Vancouver Island	0	9	4	13	1	11	3	15	1	20	7	28
Central Vancouver Island	0	14	2	16	0	11	0	11	0	25	2	27
North Vancouver Island	3	9	0	12	0	4	0	4	3	13	0	16
Northern	**12**	**16**	**0**	**28**	**2**	**25**	**0**	**27**	**14**	**41**	**0**	**55**
Northwest	7	3	0	10	2	1	0	3	9	4	0	13
Northern Interior	3	11	0	14	0	12	0	12	3	23	0	26
Northeast	2	2	0	4	0	12	0	12	2	14	0	16
BC Total	**106**	**479**	**496**	**1,081**	**37**	**310**	**301**	**648**	**143**	**789**	**797**	**1,729**

Source: iPHIS/PARIS-MSP

TABLE 11.6	% Referred 3-Year-Olds Who Saw Eye Doctor 4 Months After Screening											
	Referred				Passed				Total			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**--**	**41.6**	**--**	**40.0**	**--**	**10.9**	**--**	**10.7**	**21.9**	**21.8**	**--**	**21.8**
East Kootenay	--	--	--	--	--	--	--	--	--	26.1	--	29.2
Kootenay/Boundary	--	--	--	--	--	12.0	--	12.0	--	18.2	--	17.6
Okanagan	--	46.4	--	40.6	--	12.9	--	11.8	--	28.8	--	25.8
Thompson/Cariboo	--	38.5	--	38.5	--	11.1	--	11.0	26.1	19.5	--	20.3
Fraser	**--**	**43.6**	**76.7**	**48.7**	**--**	**7.8**	**8.6**	**7.9**	**30.0**	**16.8**	**20.6**	**17.9**
Fraser East	--	28.2	--	28.6	--	3.5	--	4.2	--	9.8	--	10.5
Fraser North	--	48.9	72.0	54.8	--	9.2	8.1	8.7	--	19.8	18.9	19.7
Fraser South	--	45.9	--	50.7	--	8.7	--	8.7	--	17.1	31.8	19.0
Vancouver Coastal	**52.1**	**52.4**	**55.5**	**54.0**	**7.4**	**7.6**	**7.4**	**7.5**	**18.7**	**16.0**	**16.0**	**16.2**
Richmond	84.1	67.7	69.0	70.5	60.0	7.8	6.2	7.2	82.4	23.6	22.2	25.3
Vancouver	30.4	65.2	62.7	62.3	3.0	7.9	7.7	7.6	8.2	17.4	16.4	16.5
North Shore/Coast Garibaldi	26.7	24.5	29.4	27.0	7.9	7.3	7.4	7.4	10.8	10.0	11.2	10.6
Vancouver Island	**--**	**25.8**	**--**	**27.5**	**--**	**7.5**	**3.7**	**6.7**	**14.8**	**12.3**	**9.2**	**11.9**
South Vancouver Island	--	--	--	46.4	--	6.8	5.7	7.0	--	11.2	11.1	11.5
Central Vancouver Island	--	20.0	--	20.8	--	9.3	--	7.6	--	13.3	5.9	12.2
North Vancouver Island	--	25.0	--	27.3	--	5.9	--	4.6	11.5	12.5	--	12.2
Northern	**18.2**	**29.1**	**--**	**23.1**	**8.3**	**15.7**	**--**	**14.8**	**15.6**	**19.2**	**--**	**18.1**
Northwest	16.3	--	--	17.5	9.5	--	--	7.9	14.1	12.9	--	13.7
Northern Interior	15.0	37.9	--	28.6	--	22.6	--	22.2	14.3	28.0	--	25.2
Northeast	--	--	--	--	--	13.5	--	13.2	--	13.9	--	15.1
BC Total	**41.7**	**45.4**	**55.8**	**49.2**	**7.3**	**8.1**	**7.4**	**7.7**	**18.9**	**16.2**	**16.0**	**16.3**

Source: iPHIS/PARIS-MSP

TABLE 11.7	# Referred 3-Year-Olds Who Saw Eye Doctor 12 Months After Screening											
	Referred				Passed				Total			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**10**	**43**	**0**	**53**	**5**	**29**	**0**	**34**	**15**	**72**	**0**	**87**
East Kootenay	1	6	0	7	0	1	0	1	1	7	0	8
Kootenay/Boundary	0	3	0	3	0	4	0	4	0	7	0	7
Okanagan	2	13	0	15	2	6	0	8	4	19	0	23
Thompson/Cariboo	7	21	0	28	3	18	0	21	10	39	0	49
Fraser	**9**	**107**	**25**	**141**	**3**	**111**	**22**	**136**	**12**	**218**	**47**	**277**
Fraser East	1	18	0	19	2	21	0	23	3	39	0	42
Fraser North	2	53	20	75	0	49	19	68	2	102	39	143
Fraser South	6	36	5	47	1	41	3	45	7	77	8	92
Vancouver Coastal	**93**	**400**	**549**	**1,042**	**91**	**544**	**573**	**1,208**	**184**	**944**	**1,122**	**2,250**
Richmond	57	163	163	383	4	139	99	242	61	302	262	625
Vancouver	9	150	300	459	18	205	316	539	27	355	616	998
North Shore/Coast Garibaldi	27	87	86	200	69	200	158	427	96	287	244	627
Vancouver Island	**5**	**36**	**6**	**47**	**4**	**34**	**3**	**41**	**9**	**70**	**9**	**88**
South Vancouver Island	0	10	4	14	1	14	3	18	1	24	7	32
Central Vancouver Island	0	17	2	19	0	14	0	14	0	31	2	33
North Vancouver Island	5	9	0	14	3	6	0	9	8	15	0	23
Northern	**22**	**20**	**0**	**42**	**3**	**36**	**0**	**39**	**25**	**56**	**0**	**81**
Northwest	13	5	0	18	2	2	0	4	15	7	0	22
Northern Interior	7	12	0	19	0	16	0	16	7	28	0	35
Northeast	2	3	0	5	1	18	0	19	3	21	0	24
BC Total	**140**	**606**	**581**	**1,327**	**106**	**754**	**598**	**1,458**	**246**	**1,360**	**1,179**	**2,785**

Source: iPHIS/PARIS-MSP

TABLE 11.8	% Referred 3-Year-Olds Who Saw Eye Doctor 12 Months After Screening											
	Referred				Passed				Total			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**--**	**42.6**	**--**	**44.2**	**--**	**15.8**	**--**	**17.3**	**46.9**	**25.4**	**--**	**27.5**
East Kootenay	--	--	--	--	--	--	--	--	--	30.4	--	33.3
Kootenay/Boundary	--	--	--	--	--	16.0	--	16.0	--	21.2	--	20.6
Okanagan	--	46.4	--	46.9	--	19.4	--	23.5	--	32.2	--	34.8
Thompson/Cariboo	--	40.4	--	43.1	--	15.4	--	16.5	43.5	23.1	--	25.5
Fraser	**--**	**56.9**	**83.3**	**60.8**	**--**	**19.8**	**15.7**	**18.9**	**40.0**	**29.1**	**27.6**	**29.2**
Fraser East	--	46.2	--	45.2	--	18.4	--	19.2	--	25.5	--	25.9
Fraser North	--	60.2	80.0	65.2	--	20.4	15.4	18.5	--	31.1	26.4	29.6
Fraser South	--	59.0	--	62.7	--	19.7	--	19.6	--	28.6	36.4	30.2
Vancouver Coastal	**63.7**	**68.3**	**65.3**	**66.2**	**21.1**	**21.3**	**14.8**	**17.6**	**31.8**	**30.0**	**23.9**	**26.7**
Richmond	90.5	84.9	76.5	81.8	80.0	25.9	15.8	20.7	89.7	41.5	31.2	38.2
Vancouver	39.1	75.8	73.7	73.1	18.2	20.7	14.6	16.5	22.1	29.9	23.9	25.7
North Shore/Coast Garibaldi	45.0	44.4	38.9	41.9	21.0	19.4	14.8	17.6	24.7	23.4	19.0	21.6
Vancouver Island	**--**	**29.0**	**--**	**31.5**	**--**	**9.8**	**3.7**	**9.2**	**33.3**	**14.9**	**9.2**	**14.8**
South Vancouver Island	--	--	--	50.0	--	8.7	5.7	8.4	--	13.4	11.1	13.2
Central Vancouver Island	--	24.3	--	24.7	--	11.9	--	9.7	--	16.5	5.9	14.9
North Vancouver Island	--	25.0	--	31.8	--	8.8	--	10.3	30.8	14.4	--	17.6
Northern	**33.3**	**36.4**	**--**	**34.7**	**12.5**	**22.6**	**--**	**21.3**	**27.8**	**26.2**	**--**	**26.6**
Northwest	30.2	--	--	31.6	9.5	--	--	10.5	23.4	22.6	--	23.2
Northern Interior	35.0	41.4	--	38.8	--	30.2	--	29.6	33.3	34.1	--	34.0
Northeast	--	--	--	--	--	20.2	--	20.9	--	20.8	--	22.6
BC Total	**55.1**	**57.4**	**65.4**	**60.4**	**21.0**	**19.8**	**14.6**	**17.4**	**32.5**	**27.9**	**23.7**	**26.3**

Source: iPHIS/PARIS-MSP

Children with eye examinations prior to screening

Based on the iPHIS/PARIS-MSP linked dataset, an estimated 31.9–36.3% of kindergarten children referred (depending on the screening year) saw an eye doctor within the six months prior to the public health vision screening.

Tables 12.1 and 12.2 present information on the number and percent of kindergarten children seen by an eye doctor within six months before the public health screening; Tables 12.3 and 12.4 present similar information for three-year-olds.

Eye examinations before and after screening

Overall, when considering the use of eye doctor services over a 10-month period (6 months prior to screening and 4 months after screening) for kindergarten children, approximately half of the 6,716 visits in 2008/09 and the 6,222 visits in 2009/10 with an eye doctor occurred within the 4-month period following screening. In both 2008/09 and 2009/10, 42.0% of the kindergarten children with a refer result visited an eye doctor within the 4-month period following screening. Over the course of the next 8 months, this proportion increased by 10.7% in 2008/09 (i.e., an additional 653 children with a screening refer result saw an eye doctor) and by 12.5% in 2009/10 (i.e., an additional 735 children saw an eye doctor).

With respect to three-year-olds, 56.9% (789 children) of the 1,386 eye doctor visits in 2008/09 occurred in the 4 months following screening. This proportion was slightly higher in 2009/10, with approximately 60.1% (797 out of 1,326 children) of eye doctor visits over a 10-month period occurring in the 4 months following screening. More specifically, 45.4% of three-year-olds in 2008/09 and 55.8% in 2009/10 with a refer result visited an eye doctor within 4 months of screening. Over the course of the subsequent 8 months, this proportion increased by 12.0% in 2008/09 (i.e., an additional 127 children with a screening referral saw an eye doctor) and by approximately 9.6% in 2009/10 (i.e., an additional 85 children with a screening referral saw an eye doctor). Please see Appendix I for more information.

TABLE 12.1	# Kindergarten Children Seen by Eye Doctor 6 Months Prior to Screening											
	Referred				Passed				Total			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**452**	**445**	**404**	**1,301**	**33**	**20**	**32**	**85**	**485**	**465**	**436**	**1,386**
East Kootenay	65	72	61	198	0	3	2	5	65	75	63	203
Kootenay/Boundary	23	28	60	111	17	4	6	27	40	32	66	138
Okanagan	187	170	135	492	10	7	19	36	197	177	154	528
Thompson/Cariboo	177	175	148	500	6	6	5	17	183	181	153	517
Fraser	**748**	**1,006**	**793**	**2,547**	**45**	**59**	**89**	**193**	**793**	**1,065**	**882**	**2,740**
Fraser East	110	151	135	396	2	14	52	68	112	165	187	464
Fraser North	257	317	280	854	28	27	17	72	285	344	297	926
Fraser South	381	538	378	1,297	15	18	20	53	396	556	398	1,350
Vancouver Coastal	**343**	**265**	**311**	**919**	**432**	**735**	**708**	**1,875**	**775**	**1,000**	**1,019**	**2,794**
Richmond	16	71	62	149	11	184	201	396	27	255	263	545
Vancouver	229	89	89	407	400	492	441	1,333	629	581	530	1,740
North Shore/Coast Garibaldi	98	105	160	363	21	59	66	146	119	164	226	509
Vancouver Island	**313**	**447**	**300**	**1,060**	**150**	**147**	**115**	**412**	**463**	**594**	**415**	**1,472**
South Vancouver Island	150	258	125	533	14	26	7	47	164	284	132	580
Central Vancouver Island	94	116	96	306	62	70	62	194	156	186	158	500
North Vancouver Island	69	73	79	221	74	51	46	171	143	124	125	392
Northern	**34**	**51**	**67**	**152**	**105**	**169**	**163**	**437**	**139**	**220**	**230**	**589**
Northwest	9	7	5	21	8	1	7	16	17	8	12	37
Northern Interior	22	27	47	96	50	87	97	234	72	114	144	330
Northeast	3	17	15	35	47	81	59	187	50	98	74	222
BC Total	**1,890**	**2,214**	**1,875**	**5,979**	**767**	**1,130**	**1,109**	**3,006**	**2,657**	**3,344**	**2,984**	**8,985**

Source: iPHIS/PARIS-MSP

TABLE 12.2	% Kindergarten Children Seen by Eye Doctor 6 Months Prior to Screening											
	Referred				Passed				Total			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**39.3**	**40.9**	**37.9**	**39.4**	**23.7**	**24.4**	**18.7**	**21.7**	**37.6**	**39.8**	**35.2**	**37.5**
East Kootenay	40.6	49.0	40.1	43.1	--	42.9	33.3	20.8	38.0	48.7	39.9	42.0
Kootenay/Boundary	28.4	27.5	44.8	35.0	38.6	21.1	37.5	34.2	32.0	26.4	44.0	34.8
Okanagan	40.3	37.8	30.7	36.3	16.7	31.8	15.2	17.4	37.6	37.5	27.3	33.8
Thompson/Cariboo	39.7	45.1	43.5	42.6	25.0	17.6	20.8	20.7	38.9	42.9	42.0	41.2
Fraser	**32.6**	**39.1**	**30.3**	**34.0**	**26.2**	**24.2**	**18.2**	**21.3**	**32.1**	**37.8**	**28.4**	**32.7**
Fraser East	25.1	33.4	28.4	29.0	33.3	16.5	16.3	16.5	25.2	30.7	23.5	26.1
Fraser North	35.5	42.1	32.3	36.4	22.8	28.1	20.0	23.7	33.6	40.5	31.2	35.0
Fraser South	33.6	39.4	29.6	34.4	34.9	28.6	23.5	27.7	33.7	38.9	29.2	34.0
Vancouver Coastal	**48.2**	**26.5**	**29.9**	**33.4**	**14.2**	**16.8**	**16.3**	**15.9**	**20.7**	**18.6**	**18.9**	**19.2**
Richmond	19.5	24.1	23.8	23.4	13.9	18.3	18.4	18.2	16.8	19.6	19.4	19.4
Vancouver	55.3	19.6	18.9	30.4	13.8	16.2	15.5	15.2	18.9	16.6	16.0	17.2
North Shore/Coast Garibaldi	45.6	42.0	52.1	47.0	41.2	17.1	16.1	18.1	44.7	27.6	31.5	32.2
Vancouver Island	**31.7**	**40.8**	**37.0**	**36.7**	**11.3**	**15.6**	**13.7**	**13.3**	**20.1**	**29.1**	**25.1**	**24.5**
South Vancouver Island	34.9	47.3	49.2	43.4	25.5	21.8	31.8	24.0	33.8	42.8	47.8	40.7
Central Vancouver Island	27.2	28.6	25.3	27.1	10.5	15.2	13.1	12.7	16.7	21.5	18.5	18.8
North Vancouver Island	32.7	50.7	44.6	41.5	10.9	14.0	13.4	12.3	16.1	24.4	24.0	20.4
Northern	**15.0**	**15.0**	**19.1**	**16.6**	**8.4**	**11.6**	**12.3**	**10.8**	**9.4**	**12.2**	**13.7**	**11.9**
Northwest	14.8	12.1	13.2	13.4	15.7	1.6	9.3	8.6	15.2	6.7	10.6	10.8
Northern Interior	21.0	14.5	19.7	18.1	7.7	11.1	14.0	11.0	9.5	11.7	15.4	12.4
Northeast	5.0	17.9	20.3	15.3	8.6	13.1	10.6	10.9	8.3	13.8	11.7	11.4
BC Total	**35.2**	**36.3**	**31.9**	**34.5**	**12.9**	**15.9**	**15.4**	**14.8**	**23.5**	**25.3**	**22.8**	**23.9**

Source: iPHIS/PARIS-MSP

TABLE 12.3	# 3-Year-Olds Seen by Eye Doctor 6 Months Prior to Screening											
	Referred				Passed				Total			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**5**	**21**	**0**	**26**	**3**	**16**	**0**	**19**	**8**	**37**	**0**	**45**
East Kootenay	0	3	0	3	0	1	0	1	0	4	0	4
Kootenay/Boundary	0	2	0	2	0	2	0	2	0	4	0	4
Okanagan	0	6	0	6	0	3	0	3	0	9	0	9
Thompson/Cariboo	5	10	0	15	3	10	0	13	8	20	0	28
Fraser	**1**	**29**	**3**	**33**	**1**	**74**	**15**	**90**	**2**	**103**	**18**	**123**
Fraser East	0	1	0	1	0	13	0	13	0	14	0	14
Fraser North	0	19	3	22	0	41	13	54	0	60	16	76
Fraser South	1	9	0	10	1	20	2	23	2	29	2	33
Vancouver Coastal	**25**	**127**	**154**	**306**	**38**	**277**	**354**	**669**	**63**	**404**	**508**	**975**
Richmond	7	39	27	73	1	70	68	139	8	109	95	212
Vancouver	2	22	51	75	5	89	191	285	7	111	242	360
North Shore/Coast Garibaldi	16	66	76	158	32	118	95	245	48	184	171	403
Vancouver Island	**1**	**20**	**0**	**21**	**0**	**12**	**2**	**14**	**1**	**32**	**2**	**35**
South Vancouver Island	0	6	0	6	0	7	1	8	0	13	1	14
Central Vancouver Island	0	6	0	6	0	4	0	4	0	10	0	10
North Vancouver Island	1	8	0	9	0	1	1	2	1	9	1	11
Northern	**9**	**4**	**0**	**13**	**1**	**16**	**0**	**17**	**10**	**20**	**0**	**30**
Northwest	7	1	0	8	1	1	0	2	8	2	0	10
Northern Interior	2	3	0	5	0	8	0	8	2	11	0	13
Northeast	0	0	0	0	0	7	0	7	0	7	0	7
BC Total	**41**	**202**	**157**	**400**	**43**	**395**	**372**	**810**	**84**	**597**	**529**	**1,210**

Source: iPHIS/PARIS-MSP

TABLE 12.4	% 3-Year-Olds Seen by Eye Doctor 6 Months Prior to Screening											
	Referred				Passed				Total			
HA/HSDA	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10	07/08	08/09	09/10	07-10
Interior	**26.3**	**20.8**	**--**	**21.7**	**23.1**	**8.7**	**--**	**9.7**	**25.0**	**13.0**	**--**	**14.2**
East Kootenay	--	23.1	--	21.4	--	10.0	--	10.0	--	17.4	--	16.7
Kootenay/Boundary	--	25.0	--	22.2	--	8.0	--	8.0	--	12.1	--	11.8
Okanagan	--	21.4	--	18.8	--	9.7	--	8.8	--	15.3	--	13.6
Thompson/Cariboo	38.5	19.2	--	23.1	30.0	8.5	--	10.2	34.8	11.8	--	14.6
Fraser	**7.1**	**15.4**	**10.0**	**14.2**	**--**	**13.2**	**10.7**	**12.5**	**6.7**	**13.7**	**10.6**	**12.9**
Fraser East	--	2.6	--	2.4	--	11.4	--	10.8	--	9.2	--	8.6
Fraser North	--	21.6	12.0	19.1	--	17.1	10.6	14.7	--	18.3	10.8	15.7
Fraser South	11.1	14.8	--	13.3	--	9.6	--	10.0	--	10.8	9.1	10.8
Vancouver Coastal	**17.1**	**15.4**	**10.0**	**14.2**	**6.3**	**13.2**	**10.7**	**12.5**	**6.7**	**13.7**	**10.6**	**12.9**
Richmond	11.1	2.6	--	2.4	--	11.4	--	10.8	--	9.2	--	8.6
Vancouver	8.7	21.6	12.0	19.1	--	17.1	10.6	14.7	--	18.3	10.8	15.7
North Shore/Coast Garibaldi	26.7	14.8	--	13.3	20.0	9.6	11.8	10.0	14.3	10.8	9.1	10.8
Vancouver Island	**12.5**	**21.7**	**18.3**	**19.5**	**8.8**	**10.8**	**9.2**	**9.8**	**10.9**	**12.8**	**10.8**	**11.6**
South Vancouver Island	--	20.3	12.7	15.6	20.0	13.1	10.9	11.9	11.8	15.0	11.3	13.0
Central Vancouver Island	--	11.1	12.5	11.9	5.1	9.0	8.8	8.7	5.7	9.3	9.4	9.3
North Vancouver Island	12.5	33.7	34.4	33.1	9.8	11.4	8.9	10.1	12.4	15.0	13.3	13.9
Northern	**13.6**	**16.1**	**--**	**14.1**	**--**	**3.5**	**2.5**	**3.1**	**3.7**	**6.8**	**2.0**	**5.9**
Northwest	16.3	33.3	--	21.4	--	4.3	1.9	3.7	--	7.3	1.6	5.8
Northern Interior	10.0	8.6	--	7.8	--	3.4	--	2.8	--	5.3	--	4.5
Northeast	--	22.2	--	20.5	--	1.5	100.0	2.3	3.8	8.7	--	8.4
BC Total	**16.1**	**7.3**	**--**	**10.7**	**4.2**	**10.1**	**--**	**9.3**	**11.1**	**9.3**	**--**	**9.9**

Source: iPHIS/PARIS-MSP

First eye examination and time interval between screening and eye examination

A source of data for obtaining screening and eye examination information was the vision screening referral form database, which included 5,568 cases of children who saw an eye doctor post-screening and had a referral form in 2007/08 and 2008/09. Among the 5,568 kindergarten and three-year-old children who received referral forms from eye doctors, 57.2% (3,186) had both screening and exam dates recorded. Since there was a large amount of missing data, this particular data source provided limited information regarding the time interval between screening and follow-up eye examinations. Based on the data available, it appeared that the majority of children represented in the dataset visited an eye doctor within 6 months of screening, with more than three-quarters of these visits occurring within a 2-month period (see Table 13).

TABLE 13	3-Year-Olds			Kindergarten		
Time Interval from Screening to Eye Exam	#	%	% Cumulative	#	%	% Cumulative
Visited eye doctor before screening	4	1.5%	1.5%	111	3.8%	3.8%
… within 1 month of screening	170	63.9%	65.4%	1,568	53.7%	57.5%
1-2 months	46	17.3%	82.7%	636	21.8%	79.3%
2-3 months	19	7.1%	89.8%	283	9.7%	89.0%
3-4 months	15	5.6%	95.5%	132	4.5%	93.5%
4-5 months	9	3.4%	98.9%	64	2.2%	95.7%
5-6 months	1	0.4%	99.2%	34	1.2%	96.8%
6-12 months	1	0.4%	99.6%	47	1.6%	98.5%
>1 year after screening	1	0.4%	100.0%	45	1.5%	100.0%
Total	**266**	**100.0%**		**2,920**	**100.0%**	

Source: Eye Doctor Referral Form Database

According to the referral form database[100]:

- 54.2% of all children seen by an eye doctor received their first eye exam (2,838 out of 5,240).
- 52.6% of kindergarten-aged children received their first eye exam (2,515 out of 4,784).
- 70.8% (323 out of 456) of three-year-olds received their first eye exam.

These results suggest that the screening program has played a supporting role in promoting utilization of early identification and treatment services from eye doctors, particularly for three-year-olds. Approximately 30.3% (i.e., 907 out of 2,997) of children who had their first eye exam following screening referral were identified with a vision problem in which treatment was prescribed. Also, of those children who had previously visited an eye doctor for an eye exam, the program resulted in the identification of 27.0% (694 out of 2,571) of cases of vision problems where a treatment need was identified, which is suggestive of the program's role in supporting early treatment and monitoring of vision health over time.

[100] Due to missing data, the denominator used for these calculations was based on cases with complete data.

Children from the Interior and Northern HAs were significantly less likely to have had a previous eye exam at the time of screening (45% in the Interior and 40% in the North). These results were confirmed by an Analysis of Variance (ANOVA), the results of which are not reported here but available upon request. The provincial average for children who had a previous eye exam at the time of vision screening was 54%.

Completed screening referral and follow-up forms

In 2007/08 and 2008/09, HELP provided honoraria ($21 for each form completed) to eye doctors who recorded children's eye examination results on a 'Screening and Referral Follow-up Results Form.' This form was adapted from forms used in years prior the evaluation project in order to integrate more detailed eye examination outcome data that could not be retrieved from other sources. Anecdotally, we know that eye doctors' completion of the form prior to the evaluation project and honoraria was approximately 14%.[101] During the evaluation project, we were able to analyze 5,568 forms from eye doctors – 44% of 12,770 total referrals across 2007/08 and 2008/09 for both age groups – which is a 30% increase from the reported rate in previous years. Although this level of information sharing and coordination between public health and eye doctors was an increase from previous years, there continued to be a substantial number of children in which it was not possible for public health staff to determine children's diagnostic outcomes following screening. Also, with the paper-based forms that were available, there were data quality issues (i.e., missing data) that influenced the ability to utilize and interpret the information. Notwithstanding these issues, the screening referral form and follow-up database was the best available data source for information regarding the identification of vision conditions that required treatment following screening referral.

Eye examination outcomes

The vision screening referral form database provided us with information on eye doctor treatment recommendations for children referred from screening and diagnosed with a vision condition (i.e., billable MSP code). Table 7.1 (see page 35) and Figure 5 present the main treatment outcomes prescribed by doctors for 2007/08 and 2008/09.

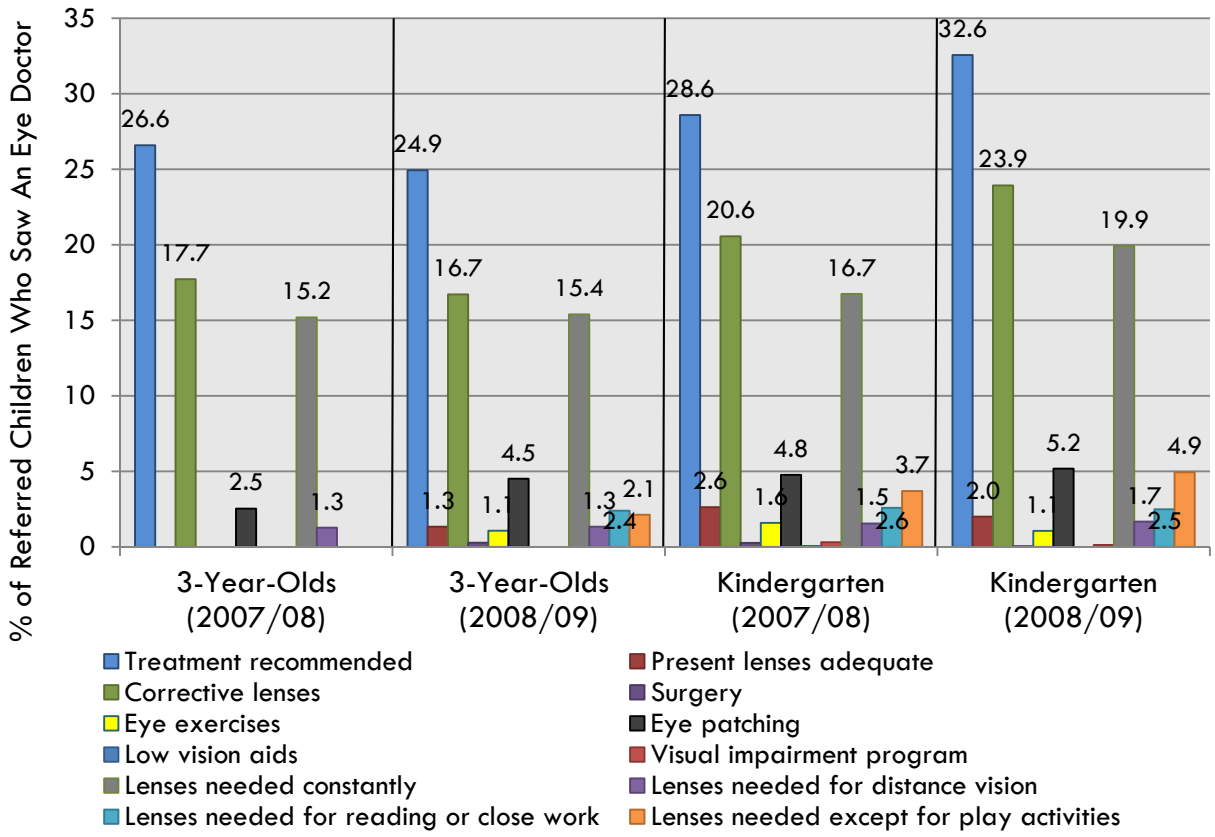
Of the 5,240 paper-based screening and referral outcome forms received with complete data, 4,784 (91.3%) pertained to the results from kindergarten children, with approximately half from each of the first two years of the project (2007/08 and 2008/09). The majority of the forms were from Fraser HA (n=2,404; 43.2%), with 24.4% of forms received from Vancouver Coastal HA, 16.4% from Vancouver Island HA, 10.8% from Interior HA, and 5.1% from Northern HA.

- Approximately 7 out of 10 kindergarten students were not provided treatment at the time of the eye doctor examination. For three-year-olds, 74.8% (341 out of 456 children) in 2007-2009 had this outcome. See Table 7.1 for more information.

[101] Personal communication, Carla Springinotic, November 14, 2011.

- More than 1 in 5 kindergarten students were prescribed corrective lenses. This proportion was 16.9% (77 out of 456 children) for the three-year-old population over both years. Of these children, approximately:
- 4 in 5 kindergarten students needed to wear their lenses constantly.
- Almost 1 in 14 kindergarten children (77 out of 1,066) needed lenses for distance vision.
- Just under 1 in 5 kindergarten students (207 out of 1,066 children) were prescribed glasses (i.e., lenses) on a regular basis except for play activities.
- Only 1 three-year-old child and 2 kindergarten students were recommended for eye surgery in 2008/09. In the previous year, 6 kindergarten students were recommended for eye surgery.
- Of the referred kindergarten children, 5.0% (238 out of 4,784) were given eye patches by doctors over the two years.

Figure 5. Eye Examination Outcomes and Treatment Recommendations



Understanding Vision Screening Referral and Follow-up Outcomes in Context

In addition to the descriptive analysis presented above, we conducted a series of analyses to provide additional information related to questions #1 and #4 of the evaluation framework: *Is screening (and referral) reaching the target populations (i.e., by community, by vulnerability)? Are children referred from screening seeing an eye doctor?* Specifically, we aimed to better understand the extent that contextual factors may influence rates of vision screening referral and also uptake of visits to an eye doctor following referral.

The analyses we conducted, termed multiple regression analyses, used socioeconomic, demographic and regional variables to predict kindergarten vision screening outcomes. The socio-demographic data utilized, which were available from the BC Stats database, included the proportions of lone parents, low income persons, adults with no high school completion,[102] annual population growth, Aboriginal peoples,[103] and visible minorities in Local Health Areas (LHAs). ANOVA was also conducted to compare differences between HA outcomes. Vision screening outcomes of interest included *kindergarten vision referrals (%)* as well as *seen by eye doctor within 6 months prior to Vision Screening (%)*, *4 months after vision screening (%)*, and *12 months after vision screening (%)*. Please note that the analysis involved an overlay of vision screening referral outcome data with neighbourhood socioeconomic data. These data provide a characterization of socioeconomic status of neighbourhoods, on average; however, the neighbourhood-level socioeconomic data do not reflect the socioeconomic backgrounds of all individuals residing in that neighbourhood. General patterns can be acquired through these types of analyses, but more precise measurement of children's socioeconomic and vision screening outcome trajectories over time would require periodic and ongoing collection and analysis of aggregated individual-level socioeconomic information combined with individual-level vision screening referral outcome results

The various measures of socioeconomic status and demographics may have differing impacts on kindergarten vision referral rates and other screening and follow-up outcomes. For instance, we might generally predict that communities (i.e., LHAs) with higher socioeconomic status (e.g., lower percentages of lone parenthood, low-income, and no high school completion) would also have higher rates of eye doctor visitation in the six months prior to vision screening or in the year following screening. We might also predict that annual population growth would be associated with lower rates, because the influx of population may reduce available resources to a community and new residents may not be as familiar with local resources or able to access them. According to the literature,[104] residents of Aboriginal communities may experience a number of barriers in accessing health services; therefore, we might expect that as the percent Aboriginal increases in a community, eye doctor visitation rates would decline. Similarly, we expected that the percent

---

[102] In BC Stats, this variable refers to % of people aged 25 to 54 years old who have not graduated from high school.

[103] Refers to those persons who reported identifying with at least one Aboriginal group, that is, North American Indian, Métis or Inuit, and/or those who reported being a Treaty Indian or a Registered Indian, as defined by the *Indian Act* of Canada, and/or those who reported they were members of an Indian band or First Nation (Statistics Canada, "Aboriginal Identity", August 20, 2007, http://www12.statcan.ca/census-recensement/2006/ref/dict/pop001-eng.cfm).

[104] Muzychka, *Environmental Scan of Vision Health and Vision Loss in the Provinces and Territories of Canada.*

Visible Minority would be associated with lower rates of eye doctor visitation, since racialized and minoritized populations may experience multiple barriers in accessing vision care services and higher rates of undiagnosed vision problems than non-minoritized populations.[105]

To help us assess the robustness of these findings, a set of criteria were used in which only those LHAs with n=10 or more children referred were included in the analyses. Depending on the survey year and outcome variable, this procedure resulted in as few as n=49 and as many as n=57 Local Health Areas (LHAs) included in the analyses.

The following summaries (organized by type of outcome) correspond to the results of the analyses. In each summary below, the general patterns of the relationships between variables are presented by vision screening year and for all years combined. The detailed results of the statistical analyses are available upon request.

Kindergarten Vision Referral Rate (%)

- As the % of persons with low income (after tax) increases, the rate of kindergarten vision referrals decreases.
- LHAs with increasing population sizes from 2005-10 (i.e., growing communities) tend to have lower kindergarten vision referral rates.
- The Interior's rate of kindergarten vision referral is significantly higher than the provincial average. The other HA's rates of referral are similar to the BC average.

Seen By an Eye Doctor within 6 months prior to Vision Screening (%)

- LHAs with higher rates of lone parenthood tend to have a higher proportion of children seen by an eye doctor before screening.
- Communities with low levels of educational attainment (i.e., % adults age 25-54 with no high school completion) consistently have low rates of eye doctor visitation in the six months preceding vision screening.
- As the percent of the total population that self-identifies as Aboriginal increases, the rate of eye doctor visitation prior to screening decreases.
- The % Visible Minorities is not significantly related to the % of children who saw an eye doctor in the 6 months prior to vision screening.
- Interior HA had a significantly higher proportion of children who saw an eye doctor within 6 months prior to vision screening across all screening years. Northern HA had a significantly lower proportion. In 2009/10, Vancouver Coastal HA had a higher rate of eye doctor visits in the previous 6 months. The remaining HAs had similar rates to the provincial average.

[105] Buhrmann et al., "Appendix 17: Vision Health: Evidence Review for Newly Arriving Immigrants and Refugees."

Seen By an Eye Doctor within 4 months after Vision Screening (%)

- Higher rates of lone parenthood are generally associated with lower rates of eye doctor visits in the 4 months following kindergarten vision screening.
- Higher proportions of low income persons is associated with higher proportions of children who visit an eye doctor within 4 months after vision screening, but this finding only pertains to the 2008/09 survey year and the 2007-10 combined analysis.
- % Aboriginal Persons (self-identified) is generally associated with lower rates of eye doctor visits in the 4 months after vision screening.
- % Visible Minorities is associated with higher rates of eye doctor visits.
- In all screening years, kindergarten children from Fraser HA are more likely to be seen by an eye doctor in the 4 months after vision screening compared to the province as a whole.
- In 2007/08, the Interior had significantly lower rates of eye doctor visits in the 4 months following vision screening relative to the province, but the rates are similar to the province in other years.
- Vancouver Coastal HA had higher-than-provincial rates of eye doctor visits in the 4 months following vision screening in 2008/09 and overall from 2007-10.

Seen By an Eye Doctor within 12 months after Vision Screening (%)

- Communities with higher rates of lone parenthood tend to have lower rates of eye doctor visits in the 12 months after vision screening (in 2009/10 and in the overall 2007-10 analysis).
- Areas with higher proportion of low income persons tend to have higher rates of children who visit an eye doctor within 12 months after vision screening, with the exception of the 2007/08 screening year.
- As the rate of high school completion increases, the rate of eye doctor visits after 12 months also increases.
- Communities with higher percentages of self-identified Aboriginal Persons typically have lower percentages of children who saw an eye doctor in the year following vision screening (according to the 2008/09 and 2007/10 analyses).
- % Visible Minorities in the community increases the percent of children who saw an eye doctor in the 12 months following kindergarten vision screening.
- Fraser HA's rate of eye doctor visits in the year following kindergarten vision screening was similar to the rest of the province with the exception of the 2009/10 screening year, when their rates were higher than BC.
- Vancouver Coastal HA's rate of eye doctor visits was significantly higher than the rest of the province across all screening years.
- Northern HA's rate of eye doctor visits was significantly lower than the provincial average in all years but 2007/08.
- The Interior and Vancouver Island HAs' rate of eye doctor visits was similar to the rest of the province across years.

Overall, across all screening years (2007-10), the results of the analyses indicated that in LHAs where there were:

- Higher proportions of low income persons, there tended to be lower kindergarten vision referral rates, but higher rates of eye doctor visits at 4 and 12 months post-vision screening.
- More lone parent families, there were higher proportions of children who saw an eye doctor 6 months before screening, but a lower proportion who visited an eye doctor at 4 and 12 months after vision screening.
- Higher growth rates in the population, there tended to be lower kindergarten vision referral rates.
- Higher proportions of adults who have completed high school, there were higher proportions of children who saw an eye doctor 6 months before screening and 12 months after vision screening.
- Higher proportions of individuals who self-reported as Aboriginal, there were lower proportions of children who saw an eye doctor within 6 months prior to vision screening. There were also lower proportions of children who were seen by an eye doctor within 4 and 12 months of vision screening.
- Higher proportions of visible minorities, there were also higher proportions of children who were seen by an eye doctor within 4 and 12 months of vision screening.

In terms of regional differences,

- Interior HA had significantly higher rates of kindergarten vision referral as well as eye doctor visits in the 6 months prior to vision screening than the provincial average.
- Fraser HA had significantly higher rates of 4-month eye doctor visits after vision screening than the provincial average.
- Vancouver Coastal HA had significantly higher rates of eye doctor visits at 4 and 12 months after vision screening than the rest of the province.
- Vancouver Island HA had similar outcomes to the province as a whole.
- Northern HA had significantly lower rates of eye doctor visits at 6 months prior to vision screening as well as 4 and 12 months after vision screening relative to the province as a whole.

A summary of all socioeconomic, demographic, and regional variables' influence on the kindergarten vision referral rate and various follow-up outcomes can be found in Appendix K. For the most part, the observed relationships were as expected. Communities that were more socioeconomically disadvantaged and that characteristically experience barriers to accessing supports and services tended to have lower rates of eye doctor visits following screening referral.

There were, however, some exceptions. For instance, communities with high percentages of low-income persons were expected to have low rates of eye doctor visitation at 4- and 12-months post-screening, however, the opposite was found: areas with higher proportions of low-income

residents appeared to be associated with increased eye doctor visitation. It is possible that the individual components of 'socioeconomic status,' such as lone parenthood, low income, and high school completion rates, operate in a somewhat unique manner in relation to eye doctor visitation rates, with family structure and educational attainment perhaps playing more influential roles in follow-up care with an eye doctor than income level. This is consistent with other literature[106] indicating that not all indicators of socioeconomic status exert themselves similarly in all contexts or with all types of outcomes. Also, the percent Visible Minority was associated with increased rates of eye doctor visitation. A possible explanation for this may be that a large proportion of Visible Minority populations may tend to live in urban settings in BC, thus facilitating access to services.

Overall, the results of the analysis indicated that a higher proportion of children residing in more socioeconomically disadvantaged communities, in terms of lone parenthood and no high school completion, tended not to visit an eye doctor following screening referral. Similarly, communities with higher proportions of persons who self-identify as Aboriginal tended to be associated with lower rates of visits to an eye doctor, both prior to and following screening. These inequalities in uptake to follow-up care and treatment following vision screening referral are suggestive of the need to provide enhanced or intensified supports in communities where residents experience a higher proportion of barriers to accessing and utilizing services in comparison to the population more generally.

[106] Melby, J. N., Conger, R. D., Fang, S.-A., Wickrama, K. A. S., & Conger, K. J. (2008). Adolescent Family Experiences and Educational Attainment during Early Adulthood. *Developmental psychology*, *44*(6), 1519–1536. doi:10.1037/a0013352

3.3) What are reasons that children may not be seeing an eye doctor?

Key findings: HA staff reported a number of barriers to accessing vision care, including:

- financial concerns,
- difficulty finding an eye doctor,
- time constraints and long wait times for appointments,
- rural/remote barriers and transportation issues,
- language barriers, and
- public awareness.

In the Vision Screening Staff Experience Questionnaires, HA staff indicated that families across both rural and urban areas expressed challenges accessing an eye doctor. Staff indicated a number of barriers to accessing an eye doctor, including financial concerns, lack of information about public insurance programs (i.e., Healthy Kids), difficulty finding an eye doctor, time constraints, long waits for appointments, language barriers, and rural/remote barriers to access (e.g., transportation).

Although these findings are not based on data collected directly from parents, staff feedback was consistent with the research literature on barriers to accessing vision care. The barriers that were confirmed by vision screening staff also mirror those barriers to accessing health and early child development resources that HELP identified in conjunction with community service providers: cost, lack of information, transportation, language, social distance (e.g., lack of trust, embarrassment), time poverty, program or service not available, fragmentation, and parental consciousness (e.g., awareness of the benefits of programs/services).[107] For Aboriginal families, gaps between Provincial and First Nations and Inuit Health services as well as administrative complexities associated with these health benefits present additional barriers to access.[108]

Financial concerns. Multiple studies emphasize the importance of financial barriers to follow-up examinations after school vision screenings have occurred.[109,110,111,112] In BC, staff questionnaire results suggest that many families were unaware of the Healthy Kids Benefit Program. Those

[107] J. Schroeder et al., *Creating Communities for Young Children: A Toolkit for Change* (Vancouver, BC: Human Early Learning Partnership, 2009).
[108] Personal communication, Lauren Brown, February 2012.
[109] M.W. Preslan and A. Novak, "Baltimore Vision Screening Project: Phase 2," *Ophthalmology* 105, no. 1 (1998): 150–153.
[110] Alex R. Kemper, Rebecca L. Uren, and Sarah J. Clark, "Barriers to Follow-up Eye Care After Preschool Vision Screening in the Primary Care Setting: Findings from a Pilot Study," *Journal of American Association for Pediatric Ophthalmology and Strabismus* 10, no. 5 (2006): 476–478.
[111] Alex R. Kemper, Lisa M. Cohn, and Kevin J. Dombkowski, "Patterns of Vision Care Among Medicaid-enrolled Children," *Pediatrics* 113, no. 3 Pt 1 (2004): e190–196.
[112] Hayley Mark and Tami Mark, "Parental Reasons for Non-response Following a Referral in School Vision Screening," *Journal of School Health* 69, no. 1 (1999): 35–38.

families that were familiar with the program may have had concerns about additional charges.[113] Monetary concerns may also coincide with not owning a car or having consistent access to telephone services. This can act as a barrier to both appointment scheduling and attendance.[114] Obtaining a follow-up exam may also have low priority status for families who are struggling with immediate daily needs, such as securing food, shelter and safety.

Difficulty finding an eye doctor. HA staff reported that families experienced difficulty locating a local eye doctor. Families relying on the Healthy Kids Program and those facing language barriers may encounter additional difficulties, given that not all optical providers participate in the Healthy Kids Program and multilingual providers and translation services are limited. The Healthy Kids Program does not keep a list of participating optical providers, and it is therefore the responsibility of the parent to find an optical supplier who accepts children covered by the BC Healthy Kids Program.[115]

Time constraints and long wait times for appointments. Vision screening staff also indicated that long wait times for appointments and time constraints were barriers for families. In a North Carolina survey, one-half of parents/guardians cited lack of time or financial issues as reasons for non-response after a vision screening referral.[116] Time constraints may be particularly challenging for lone-parent and working poor families. Families may also have difficulty scheduling far into the future, making long waits for appointments a barrier to obtaining an eye exam.[117]

Rural/remote barriers and transportation issues. HA staff indicated that families across both rural and urban areas expressed challenges accessing an eye doctor. In rural areas, these barriers may relate to both transportation availability and time required for transportation over long distances. A lack of accessible transportation can act as a substantial barrier to obtaining an eye exam following a referral from screening.[118,119] Many rural and urban families may not have access to transportation, or public transportation may be too stressful, expensive or cumbersome. See Appendix J for a map of eye doctor practice locations across BC.

Language barriers. Staff questionnaire results also suggested that language barriers may impact various stages of the referral process, including difficulties interpreting the referral form. As a result, some families may be unaware that their child has been referred to see an eye doctor following screening. For parents/guardians aware that their child has been referred, the difficulty

---

[113] The Healthy Kids Program website (www.eia.gov.bc.ca/publicat/bcea/HealthyKids.htm) advises parents to check with their optical provider to see if the charges will be in excess of what is covered by the Healthy Kids Program.
[114] L. S. Kimel, "Lack of Follow-up Exams After Failed School Vision Screenings: An Investigation of Contributing Factors," *The Journal of School Nursing* 22, no. 3 (2006): 156.
[115] Government of British Columbia, "Healthy Kids Program", 2010, http://www.eia.gov.bc.ca/publicat/bcea/HealthyKids.htm.
[116] Mark and Mark, "Parental Reasons for Non-response Following a Referral in School Vision Screening."
[117] Kimel, "Lack of Follow-up Exams After Failed School Vision Screenings."
[118] L.K. Smith et al., "Factors Affecting Treatment Compliance in Amblyopia," *J.Pediatr.Ophthalmol.Strabismus* 32, no. 2 (1995): 98–101.
[119] Kimel, "Lack of Follow-up Exams After Failed School Vision Screenings."

and stress of finding a multilingual eye doctor and/or communicating with an English-speaking eye doctor who might use specialized jargon may be particularly inhibitory. Barriers faced by immigrant populations identified by the National Coalition for Vision Health include a lack of services and resources in multiple languages, cost, transportation/distance to services, and the lack of sensitivity of health providers to race, ethnicity and cultural issues.[120] For some families, perceived racial and financial discrimination may be an additional barrier to accessing vision care after receiving a referral.[121]

Public awareness. According to the literature, parents/guardians may not understand vision screening results or be aware that they are responsible for booking a follow-up eye exam.[122,123,124,125] Some parents may believe that their child is too young or lively to be reliably tested, whereas others may not be aware of the importance of early identification of vision problems.

These findings highlight specific barriers that prevent families from obtaining an eye exam following a referral from screening. Many of these barriers disproportionately affect families with low socioeconomic status, which has been linked to low screening participation as well as low referral compliance.[126,127] Being aware of and responsive to these barriers is crucial to effectively facilitate follow-up and vision care after screening.

---

[120] Muzychka, *Environmental Scan of Vision Health and Vision Loss in the Provinces and Territories of Canada.*

[121] M. Majeed et al., "Are There Inequities in the Utilisation of Childhood Eye-care Services in Relation to Socio-economic Status? Evidence from the ALSPAC Cohort," *British Journal of Ophthalmology* 92, no. 7 (2008): 965 –969.

[122] Human Early Learning Partnership, Early Childhood Screening Research and Evaluation Unit, *Staff Experience Questionnaire for Vision Screening Programs, 2008/2009 Results.*

[123] Alex R. Kemper, Kathryn E. Fant, and J. Thomas Badgett, "Preschool Vision Screening in Primary Care After a Legislative Mandate for Diagnostic Eye Examinations.," *Southern Medical Journal* 96, no. 9 (2003): 859–862.

[124] Kemper, Uren, and Clark, "Barriers to Follow-up Eye Care After Preschool Vision Screening in the Primary Care Setting."

[125] Kimel, "Lack of Follow-up Exams After Failed School Vision Screenings."

[126] T.H. Williamson et al., "Assessment of an Inner City Visual Screening Programme for Preschool Children," *Br.J.Ophthalmol.* 79, no. 12 (1995): 1068–1073.

[127] D. Ethan and C.E. Basch, "Promoting Healthy Vision in Students: Progress and Challenges in Policy, Programs, and Research," *Journal of School Health* 78, no. 8 (2008): 411-416.

3.4) What are the lessons learned from the program that could be applied in the future?

Key findings: HA staff suggested a number of ways to improve the vision screening program, including the development of a more user-friendly referral letter, offering families support in accessing eye care, telephoning families for follow-up, allocating adequate resources for follow-up, and sharing screening results with schools.

HA staff offered several suggestions for program improvement, often with the aim of facilitating follow-up and vision care after screening. Staff suggestions are well-supported by the research literature on overcoming barriers to vision care after early childhood screening.

Developing a more user-friendly referral letter. Communicating screening results is an important logistical concern in children's vision screening, especially for families facing language barriers.[128] HA staff reported that some parents found the referral form confusing, did not understand the screening results, were unsure how to proceed or were under the impression that HA staff would book an eye exam for their child. Staff suggested that the referral form could be simplified and that parents be given a specific timeframe for obtaining an eye exam for their child. Some referral letters have been designed to have attractive logos, art work, and large font type.[129] Staff also suggested that communication to parents/caregivers regarding follow-up protocols could be made clear so that phone-calls do not come as a surprise. An Illinois study recommended that referral letters include a simple description of the screening process, written in plain, accessible language that does not exceed an eighth-grade reading level.[130] The authors suggested the following wording be included to explain the reason the child is being referred for a professional eye exam and to specify which part of the screening their child experienced difficulty. For example:

> "He/she had difficulty with:
>
> ___ seeing clearly with:
>
> ___right eye ___left eye ___both eyes
>
> ___eye muscles working together for:
>
> ___near vision ___far vision.
>
> ___far vision (looking at the board)."

[128] M. Mathers, M. Keyes, and M. Wright, "A Review of the Evidence on the Effectiveness of Children's Vision Screening," *Child: Care, Health and Development* 36, no. 6 (2010): 756–780.
[129] B.P. Yawn et al., "Barriers to Seeking Care Following School Vision Screening in Rochester, Minnesota," *J.Sch Health* 68, no. 8 (1998): 319–324.
[130] Kimel, "Lack of Follow-up Exams After Failed School Vision Screenings."

Offering families support in accessing eye care. HA staff also suggested that information on the Healthy Kids program accompany the referral form. Other suggestions included enclosure of a list of local eye doctors, detailing location, languages spoken, extra billing and whether or not they participate in Healthy Kids. Providing update-to-date information regarding service providers, hours of service, wait-time for an appointment and payment options can support families in accessing health services such as vision care.[131] The literature also highlights the importance of a reliable database system for tracking referrals to determine the number of children who successfully connect to the referred services after screening.[132] To better address the barriers to accessing follow-up eye exams, the authors of a school-based vision screening study[133] in Illinois recommended that a statement be included in the referral letter offering support in accessing eye care. In this particular program letter, a statement was included to:

"Call the school nurse if you would like help with:

- finding affordable eye care
- finding eye care for children with special needs
- making appointments
- financial assistance with eye care."

Telephoning families for follow-up. Vancouver Coastal HA staff found that telephone follow-up was best conducted by vision screeners. Vision screeners often remember the children from screening, which aids in building rapport and communicating clearly about screening results. HA staff suggested that follow-up contact should ideally happen soon after screening. An Illinois Department of Public Health vision screening study recommended that follow-up contacts should be done verbally when possible, as this is more effective and may save time in the long-run, particularly with marginalized populations.[134] The authors also recommended that during follow-up contacts, staff explore the following barriers to exams:

- Does parent/caregiver understand the vision concern?
- Does parent/caregiver need assistance locating affordable care?
- Does parent/caregiver need assistance scheduling an appointment?
- Does parent/caregiver need financial assistance?
- Does parent/caregiver need transportation assistance?

The *Follow-up Telephone Survey on Barriers to Access* could be used to facilitate dialogue about barriers with families and in doing so increase the likelihood that these barriers will be overcome (see the *Guide for Follow-up Telephone Survey: Barriers to Access*).

---

[131] S.E. Proctor, "Health Screenings and Referrals," *NASN School Nurse* 24, no. 1 (2009): 13–15.
[132] T. M. King et al., "Implementing Developmental Screening and Referrals: Lessons Learned from a National Project," *Pediatrics* 125, no. 2 (2010): 350–360.
[133] Kimel, "Lack of Follow-up Exams After Failed School Vision Screenings."
[134] Ibid.

Allocating adequate resources for follow-up. Following up with parents/guardians of children who have been referred for an eye exam following vision screening is labour-intensive. In the 2007/08 and 2008/09 staff questionnaires, it was noted that some staff did not have adequate time to implement follow-up guidelines due to competing job demands (beyond vision screening-related duties). Findings from multiple research studies emphasize allocating adequate resources to follow-up as necessary to ensure the success of vision screening programs.[135,136,137,138,139]

Sharing screening results with schools. A number of HA screening staff believed that sharing vision screening results with schools and three-year-old program sites such as day cares and preschools could strengthen follow-up efforts. The research literature also indicates that sharing screening results with teachers and child care providers can assist with follow-up and facilitate active support for children who are prescribed eyeglasses or eye patches.[140,141 ,142]

[135] Yawn et al., "Barriers to Seeking Care Following School Vision Screening in Rochester, Minnesota."
[136] Kimel, "Lack of Follow-up Exams After Failed School Vision Screenings."
[137] Williamson et al., "Assessment of an Inner City Visual Screening Programme for Preschool Children."
[138] Preslan and Novak, "Baltimore Vision Screening Project."
[139] M.S. Castanes, "Major Review: The Underutilization of Vision Screening (for Amblyopia, Optical Anomalies and Strabismus) Among Preschool Age Children," *Binocul.Vis.Strabismus* Q. 18, no. 4 (2003): 217–232.
[140] Ibid.
[141] Ethan and Basch, "Promoting Healthy Vision in Students."
[142] Yawn et al., "Barriers to Seeking Care Following School Vision Screening in Rochester, Minnesota."

Three-Year-Old Vision Screening

4.1) What lessons have been learned from three-year-old pilots that could be helpful to screening and case-finding initiatives in the future?

Key findings: HA staff suggested that involving public health nurses, integrating screening with other public health initiatives, as well as partnering and community organizations and services could increase the effectiveness of the existing initiatives. Staff responses also highlighted the need for more program resources, multilingual services, ongoing staff training, increased public awareness, and ongoing program documentation and cross-health authority communication.

HA staff indicated several lessons learned and suggestions for program improvement that could facilitate vision screening for three-year-old children. The suggestions described below are based largely upon responses to open-ended questions in the 2007/08 and 2008/09 staff questionnaires and the 2008 pilot planning template worksheets. In particular, staff were asked for input regarding marketing strategies, program planning and organization, and implementation and roll out of services.

Involving Public Health Nurses. According to HA staff, involving Public Health Nurses (PHNs) was very beneficial in reaching the three-year-old age group. PHNs have developed connections with community partners and gained knowledge and experience in working with populations of concern.[143] Three-year-old vision screening initiatives may benefit from liaising with PHNs and building on their existing work in communities. PHNs may also book vision screening appointments for families when seeing them at a Child Health Clinic, baby visit, or follow-up meeting.

Integrating with other public health initiatives. HA staff reported both benefits and challenges to integrating vision screening with existing public health initiatives. A suggested benefit to program integration was in potentially expanding program coverage. Similarly, the Centers for Disease Control and Prevention report, *Improving the Nation's Vision Health: A Coordinated Public Health Approach,* suggests that integrating public health vision screening with other public health services – such as dental, speech, audiology, or nutrition – may not only broaden the reach of vision screening, but compliment the development of coordinated frameworks for improved vision health outcomes and program efficiency.[144] The Oxford County Screening Program in Ontario is one example of successful integrated public health screening, where vision screening tests were conducted as part of the Preschool Health Fair Program.[145] This initiative targeted children

---

[143] R. Kang, "Building Community Capacity for Health Promotion: A Challenge for Public Health Nurses," *Public Health Nursing (Boston, Mass.)* 12, no. 5 (1995): 312–318.
[144] Centers for Disease Control and Prevention, *Improving the Nation's Vision Health: A Coordinated Public Health Approach.*
[145] B. Robinson et al., "Measurement of the Validity of a Preschool Vision Screening Program," *American Journal of Public Health* 89, no. 2 (February 1999): 193–198.

registered for kindergarten in the spring preceding their entry, and was able to reach 85% of new kindergarten registrants.[146] A key challenge to integration reported by staff was coordinating staff schedules among various public health disciplines.

Partnering with community organizations and services. HA staff suggested that three-year-old vision screening programs could increase program reach by partnering with community organizations and community services. Community-based organizations have community access and can help raise public awareness about vision health in local communities.[147] Collaboration has also been emphasized as a strategy for improving public health more generally.[148] Specific partnering suggestions from HA staff include: Words on Wheels (WOW) bus program, childcare centres, Early Child Development centres, social workers, optometrists, places of worship (churches, temples, mosques), Aboriginal Head Starts, school districts, Child Care Resource & Referral, Strong Starts, Mother Goose, and health fairs. Health fairs were specifically highlighted by staff as a fruitful way to initiate relationships with key organizations and agencies and to conduct vision screening.[149] These suggestions were echoed in focus groups with BC public health dental staff who emphasized that community partners helped to expand early childhood dental program coverage by providing venues for service provision, providing access to clients, and supporting healthy practices/policies, particularly with vulnerable and difficult-to-reach population groups. In other jurisdictions, public information campaigns were created alongside initiatives by local and national organizations (e.g., Lions Club, Salvation Army) to provide low or no cost frames for families.

Meeting program resource needs. In moving toward the goal of universal program coverage, vision screening staff listed a number of resources needed for program activities. These included mileage compensation for travel to remote areas, postage for mail outs, clerical support for scheduling screenings and answering questions, and interpretive/translation services. Equipment needs included access to a desk, telephone, photocopier, and vehicle, as well has having screening equipment readily available in every public health centre. Staff also suggested that it would be beneficial to have hand-outs, stickers, information on general child development and other programs such as nutrition and dental, and prizes for children such as sunglasses.

Providing multilingual services. Employing multilingual staff was also reported by HA staff to be beneficial in the three-year-old pilot projects. This included not only vision screeners, but also clerical staff who interact with families to explain screening results and schedule screenings. One staff member from Vancouver recounted, "We were fortunate to have vision screening staff with a second language, as the majority of families attending spoke Cantonese. Otherwise we would have needed to dedicate a large part of the budget to interpreter services." Language barriers

---

[146] Ibid.

[147] Centers for Disease Control and Prevention, *Improving the Nation's Vision Health: A Coordinated Public Health Approach.*

[148] S.T. Roussos and S.B. Fawcett, "A Review of Collaborative Partnerships as a Strategy for Improving Community Health," *Annual Review of Public Health* 21, no. 1 (2000): 369–402.

[149] B. Robinson et al., "Measurement of the Validity of a Preschool Vision Screening Program," *Am.J.Public Health* 89, no. 2 (February 1999): 193–198.

are identified as a systemic obstacle to accessing health care for Canadians[150] and may negatively impact children with special health care needs, including those with vision conditions.[151] Offering vision screening information and services in more than one language could help to improve program accessibility, utilization, and follow-up.[152]

Providing ongoing training. Vision screening procedures and protocols require staff preparation, memory and focus, particularly when screening three-year-old children. Based on staff questionnaire findings related to staff challenges in using the equipment, further training for screeners of three-year-olds may be beneficial in relation to the SureSight, and in particular the Randot Stereotest. This could include training related to procedural adaptations for the three-year-old population.

Increasing public awareness through social marketing. In the expanded three-year-old vision screening pilot, provincial promotional materials were developed and translated into six languages.[153] HA staff suggested that public awareness of the three-year-old program can increase through concentrated advertisement and media, particularly in areas and publications where parents of young children frequent (e.g., local and foreign language newspapers, television). For example, press releases and information on websites are common outreach strategies for newborn screenings in the United States.[154]

Ongoing program documentation and cross-health authority communication. Vision screening staff suggested that as the pilot projects are implemented, new knowledge could be documented and shared among HAs. By continuously exploring and refining a knowledge base in this way, programs may optimize program development by building upon effective strategies and lessons learned. This is an area to consider given staff suggestions for community partnerships, as sufficient time is usually needed to assess the extent to which partnership has made a meaningful impact on community health initiatives.[155]

---

[150] Sarah Bowen, *Language Barriers in Access to Health Care* (Ottawa: Health Canada, 2001).
[151] S.M. Yu et al., "Parent's Language of Interview and Access to Care for Children With Special Health Care Needs," *Ambulatory Pediatrics* 4, no. 2 (2004): 181-187.
[152] E.A. Jacobs et al., "Overcoming Language Barriers in Health Care: Costs and Benefits of Interpreter Services," *Am J Public Health* 94, no. 5 (2004): 866–869.
[153] Ministry of Health Living and Sport, *Vision Screening Pilots for Three-Year-Olds 2008 and 2009 Provincial Summary Report.*
[154] Alex R. Kemper, Kathryn E. Fant, and Sarah J. Clark, "Informing Parents About Newborn Screening," *Public Health Nursing* 22, no. 4 (2005): 332–338.
[155] S.M. Shortell et al., "Evaluating Partnerships for Community Health Improvement: Tracking the Footprints," *Journal of Health Politics Policy and Law* 27, no. 1 (2002): 49–92.

4.2) What factors or conditions have facilitated or served as barriers to pilot screening activities?

Key findings: HA staff made a number of suggestions to improve the three-year-old vision screening program, including:

- procedural adaptations to create age-appropriate screening activities,
- scheduling vision screenings at optimal times,
- improving parental consent procedures,
- sharing screening program information with site staff,
- improving lighting conditions at screening sites, and
- providing ongoing training for screeners to improve screening activities.

Within the staff experience questionnaires, participants identified a number of conditions and factors that may facilitate or hinder vision screening with the three-year-old population.

Developing age-appropriate screening procedures. Vision screeners reported that additional time was needed to make vision screening procedures age-appropriate and accessible to three-year-old children as compared with kindergarten children. In the staff questionnaires, participants across all five HAs most often reported challenges in using the screening equipment with three-year-olds as compared to kindergarteners, mainly related to child attention-span, liveliness, ability to follow instructions, and ability to recognize shapes. Similarly, in a national survey of US pediatricians who performed preschool vision screening, "cooperation from children" was reported as the major practical challenge.[156] HA staff in BC shared a number of procedural adaptations they found helpful in creating age-appropriate opportunities for three-year-old participation in vision screening:

- Planning for more time to screen three-year-olds than for kindergartners,
- Scheduling vision screening in the mornings, when children tend to be more well-rested,
- Using private screening rooms to reduce distractions,
- Working with another staff member to assist with screening activities,
- Involving the parents/caregivers,
- Asking the child to sit in a chair or on a parent's/caregiver's lap,
- Engaging the child by using age-appropriate language and explanations,
- Inviting the child to watch other children being screened,
- Making screening more fun,
- Offering the child a prize such as free sunglasses.

[156] Alex R. Kemper and Sarah J. Clark, "Preschool Vision Screening in Pediatric Practices," *Clinical Pediatrics* 45, no. 3 (2006): 263–266.

Staff suggestions for adapting screening procedures may be useful in future staff training, as well as any additions to the vision screening manual.

Scheduling screenings at optimal times. HA staff suggested that some ideal times to offer screenings for three-year-olds would be early evenings, weekends, and during preschool hours. Both drop-in sessions and pre-booked sessions were reported to work well. One participant suggested that pre-booked sessions should take place in the mornings and drop-in sessions in the afternoon. Another participant noted that drop-in sessions may be challenging as staff may be unable to accurately gauge how much time and how many resources to allocate to any one session, whereas using a parent sign-up sheet to estimate the number of attending children could help determine how many staff are needed for a specific session.

Developing procedures for obtaining consent. Challenges in obtaining parental consent were reported by staff to be a barrier for implementing vision screening with three-year-olds. Vision staff suggested that, where possible, preschool staff could assist in facilitating participation by obtaining written or verbal consent from parents/caregivers when they drop their children off, thereby permitting screening staff to administer vision screenings to all children present. In school-based research, attaching consent forms to documents requiring parent's signatures has been found to be more effective than mailing the consent forms directly to parents.[157]

Sharing information with three-year-old program site staff. Given the labour-intensive demands of follow-up in both kindergarten and three-year-old vision screening programs, staff suggested that referrals be shared with staff at preschools and other three-year-old program sites so that they could support follow-up with parents/caregivers regarding appointment booking.

Improving lighting conditions at screening sites. Given that 70% of vision screeners experienced difficulties with lighting conditions, it may be helpful to coordinate with schools to book rooms with optimal lighting conditions for screening. For example, letters to schools and screening sites could specify the room lighting conditions conducive to screening.

Providing ongoing training. Questionnaire results also indicated that best practices for screening should be supported, including time to ensure optimal lighting in school and community screening environments, as well as maintenance of equipment. First and second year screeners also expressed a need for further clarification regarding their implementation of the decision tree in the training manual.

---

[157] L. Wolfenden et al., "Obtaining Active Parental Consent for School-based Research: a Guide for Researchers," *Australian and New Zealand Journal of Public Health* 33, no. 3 (2009): 270–275.

GENERAL THEMES

Screening coverage and referral

In 2007/08, 2008/09, and 2009/10, the proportion of kindergarten children screened of those enrolled was 92.6%, 94.0%, and 91.5%, respectively. The number of three-year-olds screened as part of the new three-year-old vision screening program increased since its first year of pilot program implementation in 2007/08, with 796 children screened in 2007/08, 5,274 in 2008/09, and 5,453 in 2009/10. The program's referral criteria resulted in approximately 19% of kindergarten children being referred to an eye doctor following screening across all screening years. For three-year-olds, there were 31.9% referred in 2007/08 and 20.0% in 2008/09. This is comparable to findings from the Oxford County Screening Program in Ontario, where 25.5% to 34.7% of preschool children who received screening were referred to an eye doctor over a three year period.[158] Other Canadian preschool screening programs reported rates of 13% in Newfoundland and Labrador[159] and 13.6% in BC,[160] although these programs were significantly smaller in scale. While HAs were able to screen 94% of kindergarten children in 2008-2009,[161,162] findings from this evaluation illustrated the ongoing challenges in reaching the three-year-old population – particularly the most vulnerable populations of concern.

Screening processes

The evaluation findings indicated that information regarding adequate time to ensure optimal lighting in school and community screening environments; maintenance of equipment; clarification of the manual decision tree; and procedural adaptations for the three-year-old population (as detailed in the findings section) could be topics for ongoing training and updates to the training manual. Also, the findings indicated support for ongoing community outreach with confirmed populations of concern, such as through working with community partners to promote both vision screening and diagnostic eye examinations and sharing screening results with schools to strengthen follow-up efforts. Strong partnerships with communities would facilitate tailored and contextualized responses to the particular needs of specific groups.

Eye examinations following screening

A large proportion of children – at least half of three-year-old and kindergarten children in the iPHIS-PARIS linked database – saw an eye doctor within 4 months following screening referral. Even though public health staff across HAs attempted to contact a large proportion of children through follow-up phone calls or letters, one-third of the eye doctor visits from kindergarten children were occurring without public health follow-up phone calls or letters. Generally, the

---

[158] Robinson et al., "Measurement of the Validity of a Preschool Vision Screening Program."
[159] James R. Drover et al., "Prevalence of Amblyopia and Other Vision Disorders in Young Newfoundland and Labrador Children," *Canadian Journal of Ophthalmology* 43, no. 1 (2008): 89–94.
[160] Bradley and Riederer, "The Vision First Check Program in British Columbia: a Preschool Vision Screening Program for Children Age Two and Age Three."
[161] Ministry of Health Living and Sport, *Vision Screening Pilots for Three-Year-Olds 2008 and 2009 Provincial Summary Report.*
[162] Ibid.

increase in children referred attending an eye examination was quite small between the 4-month and 12-month mark, an increase of approximately 13% for kindergarten children and 12% for three-year-olds. According to the iPHIS/PARIS-MSP linked database, a large proportion of children referred were yet to have a follow-up eye examination within 12 months of screening: for referred kindergarten children, rates were 44.5% in 2007/08, 47.3% in 2008/09, and 45.5% in 2009/10; for referred three-year-olds, rates were 42.6% in 2008/09 and 34.6% in 2009/10.

Our analyses indicated that there were patterns of relationships between the social contexts in which families reside and their rates of visiting an eye doctor, both prior to screening and following screening referral. For example, no high school completion was a strong predictor of eye doctor visits in the 6 months before vision screening and the 12 months following screening. As the education level of adults in the community increased, so did the rate of eye doctor visits. The proportion of the total population that was Aboriginal was associated with lower percentages of children who saw an eye doctor in the 6 months prior to vision screening and lower rates of eye doctor visits in the 4 months and 12 months following screening. Higher rates of lone parenthood were associated with higher rates of eye doctor visits in the 6 months prior to vision screening. Conversely, higher rates of lone parenthood were generally associated with lower rates of follow-up visits to an eye doctor 4 months and 12 months post-screening. The proportion of the total population that were visible minorities was consistently associated with higher percentages of children who saw an eye doctor in the 4 months and 12 months after kindergarten vision screening.

Diagnosed vision problems

Using data from a non-randomized sample of 5,568 cases available in the screening referral form database, rates of vision condition detection and prevalence were calculated. Of the kindergarten children referred who visited an eye doctor, the program identified cases of referral that were subsequently associated with provision of treatment in 28.6% of cases in 2007/08 and 32.6% in 2008/09. These rates were slightly lower for three-year-olds across screening years: 26.6% of cases in 2007/08 and 24.9% in 2008/09. Of the kindergarten children screened, approximately 13.0% in 2007/08 and 11.8% in 2008/09 received a screening refer result, but did not require follow-up treatment from an eye doctor. This rate was slightly higher (15.0%) for the three-year-old group screened in 2008/09. Also, approximately 5.0% of three-year-olds screened in 2008/09 received a refer result that was also associated with subsequent follow-up treatment with an eye doctor. Data from the three-year-old groups screened in 2008/09, provided estimates of specificity (i.e., likelihood that the test indicates absence of a disease/condition when it is actually absent) of approximately 85.0% and sensitivity (i.e., likelihood that the test indicates presence of a disease/condition when it is actually present) of 42.2%. The specificity rate approaches the 90% rate reported in previous Vision in Preschoolers studies that utilized the Welch Allyn SureSight tool; the sensitivity falls within the

range of results (29% to 68%) obtained from Vision in Preschoolers groups that screened for comparable target conditions.[163]

The data from the iPHIS/PARIS-MSP linked database provided a prevalence estimate for the target vision conditions of approximately 11.8% (n=5,274 screened) in 2007/08 and 10.8% (n=11,523 screened) across screening years in 2007-10. This falls within the range reported by other Canadian preschool screening programs, from 10.5% to 14%,[164,165] although these figures include all diagnosed vision disorders. Prevalence of strabismus ranged between 2.0% to 4.5%[166,167] and amblyopia between 0.83% to 1.4%[168,169] in the Canadian literature.

With respect to treatment outcomes of the eye examinations, 70.0% (n=3,660) of the vision screening and referral forms indicated that no treatment was needed, with an additional 2.2% (n=115) of cases where current corrective lenses were adequate. In the remaining cases, 1,066 children (20.3%) were recommended to receive corrective lenses, 238 children (4.5%) eye patching, 67 children (1.3%) eye exercises. A very small number of children (n=19) were recommended to receive other types of services, such as referral to the vision impairment program, surgery, and low vision aids. It should be noted, however, that the data obtained from the screening referral form database reflected the immediate treatment plans for children, and, therefore, underestimate other types of interventions, such as surgery, that may be initiated later, following the initial prescription of treatment.[170]

Detection of vision problems following screening

The purpose of a health screening program is to have strategies to distinguish between those people who will have the disease or condition and those who will not[171] and, in the context of this project, those who will have a vision problem and those who will not. In order to meet this primary purpose, the information about the diagnostic outcome is critical. In fact, common calculations associated with screening, such as determination of the disease detection rate or sensitivity of a screening tool depend on having data available about whether or not the individuals did indeed have the disease or condition of interest to the program.

In the vision screening program, there were various data sources for obtaining child eye examination outcome information. However, the rate of return of the referral and follow-up forms

---

[163] Schmidt et al., "Comparison of Preschool Vision Screening Tests as Administered by Licensed Eye Care Professionals in the Vision In Preschoolers Study."

[164] Robinson et al., "Measurement of the Validity of a Preschool Vision Screening Program."

[165] Drover et al., "Prevalence of Amblyopia and Other Vision Disorders in Young Newfoundland and Labrador Children."

[166] Robinson et al., "Measurement of the Validity of a Preschool Vision Screening Program."

[167] L.D. Kornder et al., "Detection of Manifest Strabismus in Young Children. 2. A Retrospective Study," *Am.J.Ophthalmol. 77*, no. 2 (February 1974): 211–214.

[168] Robinson et al., "Measurement of the Validity of a Preschool Vision Screening Program."

[169] E. Ross, AL Murray, and S. Stead, "Prevalence of Ambylopia in Grade 1 Schoolchildren in Saskatoon.," *Canadian Journal of Public Health. Revue Canadienne De Santé Publique* 68, no. 6 (1977): 491.

[170] Personal Communication, Dr. Ross Kennedy, November, 2011.

[171] K. Strong et al., "Current Concepts in Screening for Noncommunicable Disease: World Health Organization Consultation Group Report on Methodology of Noncommunicable Disease Screening," *Journal of Medical Screening* 12, no. 1 (March 1, 2005): 12 –19.

from eye doctors occurred only 44% of the time, which was an increase from previous years, but, overall, still meant that public health staff did not receive the eye doctor outcome information in the majority of cases. Through the iPHIS/PARIS-MSP linked dataset, it was possible to extract information regarding children's visits to an eye doctor within 4 months and 12 months of screening. Without this information, it would not have been possible to conduct a meaningful level of analysis about the extent that the screening program resulted in follow-up care with an eye doctor. Although the ability to use the MSP diagnostic outcome information in this project was limited owing to variation in MSP database recording practices, the linked iPHIS/PARIS-MSP database has the potential to provide useful population-level information regarding uptake of eye doctor visits following referral and also more precise vision condition identification rates, if a simple modified coding procedure could be consistently used.

STRENGTHS & LIMITATIONS OF THE EVALUATION PROCESS

Strengths

The evaluation process emphasized a participatory methodology, and each milestone of the project was finalized in collaboration with representatives from HAs and the MoH. By conducting the evaluation in such a manner, HELP was able to ensure the continued relevance of the evaluation outcomes with regards to the changing needs of HAs and MoH. Additionally, by drawing upon multiple data sources, HELP was able to provide robust findings. The staff questionnaires and pilot planning templates were able to integrate the initial experiences of public health staff in implementing vision screening programs with new equipment, including pilot projects with the three-year-old population. The Kindergarten Universal Vision Screening Program had extensive coverage, providing population-level data, and used an objective screening device found to be age-appropriate for three- to five-year-old children.[172,173]

Several ancillary and regional projects were developed in addition to the provincial evaluation process, strengthening the evaluation outcomes:

- Three-Year-Old Pilot Planning Template
- Guide for Follow-up Telephone Survey: Barriers to Access
- Kindergarten Vision Screening Program Information Sheet and Checklist for Teachers

Pilot Planning Template for Three-Year-Old Vision Screening

During the development of the Evaluation Framework, HA representatives found it difficult to establish evaluation questions related to the three-year-old pilot projects which were still under development at that time. To support both program planning and evaluation documentation, HELP developed pre- and post-implementation pilot planning worksheets to be filled out by public health vision screening leads. The worksheets covered topics such as: target populations, program partners, communication strategies, tailored services, success factors, and challenges (see the *Pilot Planning Template for Three-Year-Old Vision Screening*).

Follow-up Telephone Survey on Barriers to Access

In 2007, the BC Vision Screening Evaluation Subcommittee suggested that a parent/guardian telephone survey may be useful to identify and resolve issues of access to vision care services. HELP developed a telephone survey to be conducted with parents/caregivers by HA staff during the follow-up phone call (see the *2007-2008 Guide for Follow-up Telephone Survey: Barriers to Access*).

---

[172] C. Green Health Info, *A Review of the Science Underlying Preschool Vision Screening with Implications for BC*.
[173] L. Dunfield and T. Keating, *Preschool Vision Screening*, Technology Report (Ottawa, ON: Canadian Agency for Drugs and Technologies in Health, 2007).

Kindergarten Vision Screening Program Information Sheet and Checklist for Teachers

Given that kindergarten teachers play a key role in the vision screening program, HELP developed an information sheet and checklist to support this important contribution. The one-page document included information about the program and ways that teachers could help to support public health staff as they screen kindergarten children in BC (for further details, see: *Kindergarten Vision Screening Program Information Sheet and Checklist for Teachers*).

Limitations

With the available data, we were unable to determine the following:

- The estimated percentage of children who did not have the target vision problems of concern but who were likely to receive a pass result from screening; and
- The estimated percentage of children with a pass result who were likely to have the target vision conditions.

There were also limitations in the available datasets that influenced our estimates of true and false positive rates. There was a small subset of completed screening referral and follow-up forms available for analysis. Also, variation in MSP recording practices limited our ability to utilize the full range of data available in the linked iPHIS/PARIS-MSP database.

Two additional data sources that were originally intended to be included in the evaluation were unavailable: 1) individual-level electronic child health records from iPHIS (the Public Health Information System) and 2) questionnaires with caregivers (parents/guardians) and community partners.

Individual-level electronic child health records. The development of the Evaluation Framework included confirmation of a set of minimum iPHIS data elements to provide information on vision screening services received (including referral and follow-up) and diagnostic outcomes (through linkage with MSP data). The individual-level electronic dataset from iPHIS was unavailable for analysis due to unforeseen delays in establishing an Information Sharing Agreement.

Questionnaires with caregivers and community partners. The second key data source that was not feasible to obtain within the allotted timeframe was questionnaire data from caregivers and community partners. These questionnaires were originally designed to address evaluation question 6, regarding the types of services and strategies that might facilitate screening three-year-old children, and evaluation question 8, regarding public awareness of the program and satisfaction of community partners. The following section outlines possible future directions for eliciting input from parents or caregivers.

TWO RESOURCES FOR OBTAINING INPUT FROM PARENTS

In the original evaluation framework, the Vision Screening Evaluation Subcommittee indicated the importance of obtaining input from caregivers (parents and guardians) in order to increase family participation and to reach the three-year-old population. Two questionnaires were developed in order to obtain input from caregivers: (1) the *Parent/Guardian Preference Questionnaire*, to elicit feedback about how best to offer screening services to the three-year-old age group, and (2) the *Parent/Guardian Experience Questionnaire*, to elicit feedback about satisfaction with vision screening services provided. Both questionnaires include socio-demographic background questions to provide context for interpretation of the responses and to identify program support needs, such as those related to language translation, cultural safety, or special needs.

Parent/Guardian Preference Questionnaire

The *Parent/Guardian Preference Questionnaire* was designed to gather information about the types of services and strategies that might facilitate screening three-year-old children *universally* in BC. In collaboration with evaluation subcommittee members, questionnaire items were developed to determine caregiver preferences for specific aspects of the Three-Year-Old Vision Screening Program (e.g., timing and location of services) (see: *Parent Preference Questionnaire: How Can Public Health Provide Vision Screening For Your Three-Year-Old Child?*). The HELP evaluation team developed questionnaire packages, information postcards, and promotional posters, including instructions for distribution to clients and community partners by public health staff. Each questionnaire package contains (1) the cover letter to parents/guardians (2) the anonymous questionnaire, (3) a self-addressed stamped envelope, and (4) a complimentary children's book as a free gift to promote parent/guardian participation, either *Alphabetter* or *Our Healthy Journey*.[174] Province-wide data collection was originally planned for 2009, and then postponed due to the provincial election period as well as delays in establishing an Information Sharing Agreement. Since that time, Northern HA opted to participate in data collection. Findings will be reported in a forthcoming document.

Parent/Guardian Experience Questionnaire

The *Parent/Guardian Experience Questionnaire* was designed to gather information on how satisfied participating caregivers were with the way in which three-year-old vision screening services were delivered. In collaboration with evaluation subcommittee members, questionnaire items were developed to assess caregiver experiences with the information provided, the referral process, and the accessibility and convenience of screening locations (see: *Parent/Guardian Experience Questionnaire for Three-Year-Old Vision Screening)*. In mid-April 2008, a pilot study was conducted in which 190 mail-back questionnaires were distributed to parents/guardians of three-year-old children who received vision screening in North Vancouver. Thirty-two questionnaires were returned (17% response rate) and the questionnaire was revised based on open-ended parent feedback.

---

[174] *Alphabetter* donated by Ministry of Education and *Our Healthy Journey* donated by National Aboriginal Health Organization.

RECOMMENDATIONS

Based on the findings described in this report, we put forth the following broad recommendations for consideration. The recommendations relate to maintaining kindergarten vision screening, further assessing the three-year-old vision screening program, improving follow-up with families and their access to diagnostic examinations post-screening referral, improving screening detection of key vision conditions, and refining surveillance.

1) Kindergarten Vision Screening

1.1 Recommendation to the Ministry of Health:

Maintain current services for universal kindergarten vision screening.

- Between 2007 and 2010, the screening program consistently provided excellent coverage of the kindergarten population and consistent referral rates across Health Authorities.
- The value of universal screening also stems from the program's ability to promote a continuum of prevention and care for vision health from the early years onward. For example, the evaluation data set indicated that 2,838 children in 2007/08 and 2008/09 attended their first eye exam as a direct consequence of referral from the program. The program acts as a key entry point for many families to begin treatment and monitoring of vision health over time, particularly for families who may not have initiated a vision check with an eye doctor without a screening referral.

2) Three-Year-Old Screening

2.1 Recommendation to the Ministry of Health:

Assess the cost-effectiveness of three-year-old vision screening in BC.

With the limited data set available, there were indications that there is value and benefit to pursuing a three-year-old screening program.

- More children visited an eye doctor in a 4-month period following screening referral than in the 6 months prior to it, thus indicating the role of the program in promoting early prevention and treatment services with an eye doctor.
- The majority of children referred, who had treatment outcome information available in 2007/08 and 2008/09, received their first eye exam as a direct consequence of screening referral (323 of 456 children).
- In 2008/09, at least 94 three-year-olds were prescribed treatment as a result of the program, including 63 children for corrective lenses; 17 for eye patching; 4 for eye exercises; and 1 for surgery.

However, the benefits and costs of implementing a universal program are yet to be determined. Criteria for health screening programs, including those put forward by the WHO Consultation Group for screening, consistently include cost-effectiveness as a

requirement.[175] Such an analysis was beyond the scope of this project. Future decision-making regarding the continuation and expansion of a universal three-year-old screening program could be based on a cost-effectiveness analysis that involves:

- Assessing the net benefits gained from screening children at an earlier age (e.g., the additional number children who would be identified with a vision problem) for the level of resources expended[176] (e.g., financial costs, staff effort, time required of families).
- Weighing the costs and benefits of screening with respect to alternative strategies.

2.2 Recommendation to the Ministry of Health and Health Authorities:

If further expansion of the three-year-old program occurs, then create and build upon multidisciplinary partnerships to increase access for marginalized population groups.

Findings from this evaluation illustrate the ongoing challenges in reaching the three-year-old population, particularly the most marginalized groups. Consider:

- Developing provincial and regional strategies to coordinate vision screening with community partners that interact with young children and their families, service providers, and other public health initiatives. Collaborators could include family doctors, eye doctors, early child care and learning centre providers, and other public health services.
- Integrating vision health and three-year-old screening as an integral component of overall public health services. This may compliment the development of coordinated frameworks for improved vision health outcomes and early child development outcomes more generally.
- Supporting community partnerships to increase access for families who may not typically access public health services, particularly Aboriginal, racialized and immigrant communities, rural and remote communities, and communities where immunizations occur primarily outside public health.

[175] Strong et al., "Current Concepts in Screening for Noncommunicable Disease."
[176] Russell Harris et al., "Reconsidering the Criteria for Evaluating Proposed Screening Programs: Reflections From 4 Current and Former Members of the U.S. Preventive Services Task Force," *Epidemiologic Reviews* 33, no. 1 (July 1, 2011): 20 –35.

3) Follow-up after Screening Referral

3.1 Recommendation to the Ministry of Health:

Promote and support access to eye examinations following screening referral.

The evaluation findings indicated that there were two main challenges associated with the follow-up period post-screening referral:

- *Public health follow-up activities.* Approximately half of referred children who had not visited an eye doctor in the 4-month period did not receive public health follow-up contact.
- *Visits to an eye doctor following screening referral.* In both the three-year-old and kindergarten age groups, a large proportion of children (45.8% of referred kindergarten children and 39.6% of referred three-year-old children) did not visit an eye doctor within the year following screening referral, particularly among communities that are socioeconomically disadvantaged and/or experience systemic barriers to accessing services.

For these reasons, consider:

- Assessing with Health Authorities the level of staffing resources needed for the number of children referred each year; in particular, the resources required for public health staff to make multiple follow-up contacts with families after screening referral.
- Allocating resources to address systemic barriers in access to vision health services, with intensified attention and supports in communities that include population subgroups known to have lower rates of eye doctor visits following screening referral. This could involve strategies to:
    - Promote the availability of diagnostic eye exams covered by MSP. This could include a multi-media campaign (similar to KidSmiles.ca for early childhood dental visits) and providing information in the HealthLink BC Files (under "Young Children and their Eyes" and other Files on services covered under MSP).
    - Develop more accessible resources for parents/caregivers on children's vision health needs, such as a simplified referral letter and translated materials.[177]

[177] For recommended languages and approaches for the BC context, see K. Malli. *Familiar sounds: providing cultural context for health information and dissemination across language communities* (BC: BC Early Hearing Program, April 2006).

3.2 Recommendation to Health Authorities:

Promote and support access to eye examinations following screening referral.

- Match program staffing to levels commensurate with screening referral rates in order to facilitate public health follow-up contacts with families and, in turn, families' utilization of vision care services following screening referral.
- Enhance ongoing contact and support for families in utilizing vision care services by maintaining telephone follow-up with families, improving its coverage of referred children, and providing information of sufficient detail to facilitate their access to eye care (e.g., a list of local eye doctors, eligibility for basic eye care coverage through the Healthy Kids program).

4) Screening Detection of Vision Problems

4.1 Recommendation to the Ministry of Health:

Continue to monitor the ability of the screening program to identify children with key vision conditions by determining the sensitivity and specificity of vision screening (see also Recommendation 5).

- Given the limitations of the current data sets that we have outlined in this report, ongoing monitoring, enhancements of the annual vision screening data sets, and analyses with associated databases (e.g., MSP) is necessary to ensure that screening is consistently, and as accurately as possible, identifying children in need of vision care.
- Further precise measurement of the sensitivity and specificity of screening for both the three-year-old and kindergarten populations is needed. For example, a one-time, focused, small-scale investigation of screening detection rates using a gold-standard eye exam would be a useful source of information for obtaining precise estimates (e.g., false positive and false negative rates). Note that this type of 'check' is not meant to determine if screening is equivalent to a gold standard eye exam. Rather, it is a useful and efficient way of determining whether or not screening tools are reasonably accurate, over-referrals/false-positives are minimized, and screening is leading to the identification of children in need of treatment/care.

4.2 Recommendation to the Ministry of Health:

Develop provincially-coordinated strategies to decrease the number and proportion of children referred who are not subsequently diagnosed with a vision condition (i.e., false-positives).

- The best available data indicated that the proportion of children referred who subsequently did not require treatment ranged from 61.7 to 75.1%. This could be minimized to reduce the impact of follow-up on HAs (see section 2.2 for further information regarding false positive estimates).

- In order to reduce the number of families referred (and requiring follow-up) and the rate of false positives, more stringent referral criteria could be considered. Utilizing a more restricted range in referral criteria, however, would also likely increase the rate of false negatives from screening, and result in a higher proportion of children who passed the screening, but who did in actuality have a vision problem of concern to the program.[178]
- Continue to monitor the performance of the screening technology (in BC and other Canadian and international contexts) and make adjustments/enhancements as needed. Optimize consistency and accuracy in utilizing screening technology through continued coordination of provincial training updates on a periodic or as needed basis.

4.3 Recommendation to Health Authorities:

Promote accuracy and consistency in use of screening technology and protocols to minimize number and proportion of children referred who are not subsequently diagnosed with a vision condition.

- Ongoing, periodic training updates and random audits would help to support and optimize appropriate and consistent use of the screening instrumentation and recording of results.

5) Surveillance

The availability of complete and valid data is vital to ongoing surveillance and program evaluation. The limitations of the three datasets available to this evaluation constrained our ability to estimate screening detection rates.

5.1 Recommendation to the Ministry of Health:

Continue linkage and analysis of public health vision screening data with eye doctors' MSP data.

- The iPHIS/PARIS-MSP data linkage currently provides a useful source of data for obtaining information about families' uptake of eye doctor visits following screening referral. This is particularly relevant for monitoring as it enables rigorous assessment of differential access to and utilization of follow-up care post-screening.

[178] This is speculated, but could only be assessed through a focused examination of false negatives using a gold standard diagnostic eye examination.

5.2 Recommendation to Ministry of Health:

Refine the MSP claims system to promote greater accuracy of vision screening referral outcome data.

- Data from the MSP claims system currently has inconsistencies that limit the ability to assess diagnostic outcomes following vision screening. Consider the introduction of a new MSP billing code to ensure that billing practices record each eye doctor examination that results from screening referral and any associated diagnosis of a target vision condition. Such a revision could also involve further collaboration with the associations representing both BC Ophthalmologists and Optometrists in order to promote widespread adoption of an alternate or additional code.

As indicated in this evaluation, there were significant strengths of both the kindergarten vision screening program and three-year-old pilot initiatives. We have put forward several broad-based strategies to build upon promising directions in current practice and also facilitate enhancements to the program in future years. With the data sets available for this evaluation, it is premature to recommend expansion (or dissolution) of the three-year-old program; further assessment and cost-effectiveness analysis is recommended. Recommended areas for refinement with both the three-year-old and kindergarten programs focus primarily upon promoting families' visits to an eye doctor following screening referral, developing strategies to optimize screening detection of vision problems and minimize over-referrals, and improving practices to precisely assess the extent that screening is leading to identification of key vision problems in young children.

APPENDIX A: BC EARLY CHILDHOOD VISION PROGRAMS LOGIC MODEL

A logic model approach to evaluation enhances the clarity and usefulness of the evaluation by focusing on issues (and outcomes) of value to the various parties involved with or potentially influenced by the program being examined. The logic model presented in Figure 6 (see below) provides a systematic way of examining relationships among the resources dedicated to BC's Vision Programs, the activities that are undertaken, and the changes or results that are achieved (or anticipated). The logic model illustrates the following:

- Resources needed to accomplish program activities and influential factors,
- Activities to be accomplished by the program,
- Outputs or immediate results the activities will produce,
- Short and long-term outcomes expected, and
- Longer-term impacts of the accomplished activities.

Each of these five components illustrates the connection between the efforts and work that go into program operations and the intended results. This logic model provided a common starting point for discussion of the priorities for the evaluation project and in turn the development of the overarching evaluation questions.

The logic model (see Figure 6) was used to develop a multi-phase evaluation plan, including elements of clarification, interactive, monitoring, and impact evaluation.[179] Clarification evaluation aims to make explicit the essential features of the program, while interactive evaluation assists program planners to make decisions about ways to improve the program. Monitoring allows for evaluation of the current state of a program, while impact evaluation assesses the effects of program activities on target populations over time. Throughout the process, a utilization-focused approach was also employed to give careful consideration for how intended users would apply evaluation findings.[180]

While the original logic model and evaluation questions encompassed context, activities, and outcomes, the data collection ultimately centered on program activities and implementation (clarification, interactive, and monitoring evaluation), rather than effectiveness and outcomes (impact evaluation). As outlined in the following section, our data collection and analysis centered on three primary datasets: (1) the Vision Screening, Referral and Follow-Up Data, (2) Staff Experience Questionnaires, and (3) Three-Year-Old Pilot Planning Template.

[179] John Owen, *Program Evaluation: Forms and Approaches*, 3rd ed. (New York: Guilford Press, 2007).
[180] Michael Patton, *Utilization-focused Evaluation*, 4th ed. (Thousand Oaks, CA: Sage Publications, 2008).

Figure 6. BC Early Childhood Vision Programs Logic Model

Logic Model: BC Early Childhood Vision Screening Services

RESOURCES (influencing factors)	ACTIVITIES	OUTPUTS	SHORT & LONG TERM OUTCOMES (1–3 years)	MID TERM OUTCOMES (4–6 years)	LONG TERM OUTCOMES (7–10 years)
Difficulty in accessing 3-yr olds. Availability and accessibility of ophthalmic and/or optometric services to take care of children that test positively for the target conditions. Socio-cultural and economic forces: Poverty; Language barriers; Remote areas; Isolation; Transportation; Aboriginal health inequities, Band policies and funding; Transience. Family follow-through with treatment. Conditions targeted for screening and how they are defined. Ease of use of screening equipment. Ability of the screener to use the equipment as per training instruction/ manual. Testability of children screened.	**3-year Old and Kindergarten Universal Vision Screening Program:** *Pilot public health vision screening for 3 year olds to provide early identification and management of amblyopia and strabismus and reach a maximum number of children, and in particular, those at highest risk of having vision problems; Provide vision screening to children in kindergarten until the majority [target tbd] of three year olds are screened.* Early Childhood Vision Case-Finding: Enhance community vision public health capacity; enhance vision education and case-finding capacity (using public health practitioners, physicians and other early childhood practitioners in established programs and services).	*Completed pre-school screenings as a part of pilot programs. Identification of children screened and unable to screen.* *Evaluation of strategies, barriers and facilitators for screening pre-school age children in selected populations of concern.* Completed annual kindergarten screenings in public, independent and band schools. Identification of children screened, missed/ absent, and unable to screen. Completed referrals through 3-year old and kindergarten screening and case-finding for diagnostic assessment and/or follow-up by vision specialists (optometrists, and ophthalmologists) and/or family physicians. Completed follow-up with parents (up to three contacts) to determine outcome (e.g., unable to visit eye care professional, no answer, moved). Completed visits to eye care professionals and parent reported satisfaction with services received in terms of timeliness, manner of service delivery, accessibility of services. Identification of referral source (case-finding, kindergarten screening, 3-year old screening, etc) and diagnosis. Information provided about vision and eye health to parents, guardians and care providers e.g. at newborn visits, Well Child Health Clinics or Parent/Toddler programs, preschools and childcare settings, Child Development Centres or locations frequented by young children and their famlies.	Early identification and treatment of amblyopia, strabismus and refractive errors. *Improved understanding of various strategies for reaching pre-school age children in specific populations of concern through pilot vision screening programs. Improved ability to plan screening programs to reach broader populations of pre-school age children.* High proportion of children in target population who have been screened for the target vision conditions before or at kindergarten. Aboriginal children under age six will receive vision screening.† High levels of satisfaction from parents/families with services delivered and the way in which they were delivered. Use of valid and reliable screening tools. Screening has a high sensitivity and specificity. Screening has a low rate of false positives and false negatives; Screening program has acceptable positive and negative predictive values. High access & utilization of diagnostic and treatment services by children and their parents.	Awareness of eye health and vision development. *Universal Screening in place for 3 year olds.* Increased utilization of vision care benefits (Healthy Kids & First Nations Health Benefit).	Improved vision health outcomes of children in BC. Improved program planning and effectiveness. Reduced prevalence of amblyopia, strabismus and of VA deficit in children in BC. An improved model of ocular and visual surveillance with increased participation rates from children and parents.

Note: *Italicized text* indicates relevance to 3-year old pilot vision screening only.
See: BC Ministry of Health Planning. *Population Health and Wellness Service Plan* 2005/2006; Population Health and Wellness. *Program Charter: Preschool and Kindergarten Universal Vision Screening Program*, April 16, 2007; Population Health and Wellness. (2005). *Provincial Vision Screening Manual*; BC Ministry of Health. (2006). *2006/07 – 2008/09 Service Plan*; † *The Transformative Change Accord: First Nations Health Plan.*

APPENDIX B: EVALUATION MATRIX

P/K [181]	#	Evaluation Questions / Data Needed	Data Sources	Data Collection by	Data Collected	Indicators
PK	1.	**Is screening reaching the target populations (by age, by community, by vulnerability)?** ****priority question**	- Class list/appointment list (client identifiers removed) - Electronic health record, - (iPHIS – vision tab) PARIS (future). - Vision Screening Referral and Follow-up Form. - 3-year Old Pilot Planning Template Worksheets	**HA** staff at time of screening	# screened, # absent, # could not be tested (CNT) By - HSDA, - School District (including public and private and independent schools) - School or by Site. Electronic health record data. # of children eligible for pilot program	- % of children eligible who were screened - # schools per SD participating in screening - # and type of screening sites per HSDA and per cohort - Referral patterns, follow-through to diagnostics, and outcomes by neighbourhood/area. - % of children screened and referred by vulnerability and neighbourhood. - % of children diagnosed with a vision problem by vulnerability. Each of the above indicators would be collected by age.
PK	2.	Is screening identifying children with the key vision conditions (i.e., amblyopia, strabismus, refractive errors)?	- Vision Screening Referral and Follow up Forms (client identifiers removed) - Electronic health record - iPHIS – vision tab - PARIS (future)	**HA** staff via parents/guardians via eye doctors. **HA** staff record results for children referred and outcome of referral on child health record.	Information as per Vision Screening Referral and Follow up Form. Pass/Fail/CNT for each test for children who fail screening or could not be tested Parent-reported follow-up data. Diagnostic outcome results for children referred.	- % of false positives by tool - % of true positives by tool - # of children referred with First Eye exam. (New diagnosis) Outcome management by eye doctor: - % referred receiving corrective lenses, needing no treatment, with adequate lenses, and requiring treatment. - Results of screening for children referred by age of child for each screening tool. - # of children referred who do not have diagnostic outcome information. - # referred per screening test by age of child. - # could not be tested per screening test by age of child. - % of true positives by age by tool. - % of false positives by age by tool. - % of false negatives by age by tool (child referred by different tool result than final condition diagnosed by eye doctor) - # declined screening – currently under care of eye doctor

[181] P indicates this question applies to 3-year old population. K indicates this question applies to kindergarten population.

P/K [181]	#	Evaluation Questions / Data Needed	Data Sources	Data Collection by	Data Collected	Indicators
PK		Are screening referral criteria appropriate?	Class list/appointment list (client identifiers removed)	**HA** staff at time of screening	Stereopsis (pass/fail) For each eye: - Sphere - Cylinder - Reliability Difference Or VA fraction for each eye.	- # referred per screening tool - # could not be tested per screening tool - # passed per screening tool - Range of screening results per tool
PK	3.	What follow-up activities by public health following a vision screening referral are followed by the child having a diagnostic exam by an eye doctor? (e.g., attempted follow-up contacts)	HA staff. Parents. Information recorded on Electronic health record (iPHIS vision tab or PARIS [future]). Vision Screening Referral and Follow up Forms (client identifiers removed).	**HA** staff record contact follow up and outcome of follow up.	Date(s) of follow-up contacts. Type of follow-up contact (e.g., mail, phone). Outcome of follow-up.	- # of contacts by contact method and comparison to timeliness of diagnostic outcome. - % of eye examinations associated with initial referral follow-up by strategy (as reported by HA staff; not available in iPHIS) – mail, take home, telephone. - Average # of follow up attempts associated with progression to diagnostic service. - # of children with follow-up outcome information but diagnostic information not provided by eye doctor.
PK	4.	What proportion of children referred from screening saw an eye doctor? For how many was this the first visit to an eye doctor? What are the reasons that children do not see an an eye doctor following a referral from screening?	HA staff. Information recorded on Electronic health record (iPHIS vision tab or PARIS [future]). Vision Screening Referral and Follow up Forms (client identifiers removed). HA staff/designates. Parents/guardians Key reports, interview transcript(s), questionnaire(s), cluster meeting summaries.	**HA** staff: track and record screening and outcome data as per vision screening program protocol; **HA** participation through interview, questionnaire, or cluster meeting. **HELP** parent/guardian interview or questionnaire. **HAs** distribute questionnaire to parents/guardians.	Date of screening. Eye Examination Date. Interview, questionnaire, or cluster meeting data.	- % of children referred who seek eye examination within 1 month, 2 month, 3 months, 4 months - Time interval between screening and diagnostic outcome result (Vision Screening Referral and Follow-up Form). - # of children referred with completed Vision Screening Referral and Follow-up Form. - Service providers (e.g., screeners, eye doctors), program planners, parents/guardians report types of barriers. - % of parents/guardians who reported barriers to accessing eye care (e.g., geographic distance, wait times)

P/K [181]	#	Evaluation Questions / Data Needed	Data Sources	Data Collection by	Data Collected	Indicators
PK		What are the lessons learned from the program that could be applied in the future?	HA staff participate in Staff Experience Questionnaire. Service providers, community partners, program planners, & parents/guardians participate in cluster meetings/interviews/ focus groups.	**HA staff** complete online questionnaire. **HELP**: Develops questionnaire; Report/Document Review; cluster meeting facilitation. **HA**: Participation in interviews, cluster meetings.	Staff Experience Questionnaire data. Cluster meeting summaries, interview/focus group transcripts.	Evidence of: - what worked - what didn't work - how could program be improved
PK	5.	What case-finding activities/strategies have been developed and adopted to support regional and provincial objectives?[182] What factors or conditions have facilitated or served as barriers to case-finding activities?	HA staff/designates Key reports, cluster meeting summaries, Evaluation Sub-committee minutes, Vision Screening Manual, Electronic Health Record.	**HELP**: Report/Document Review, **HA**: Participation in cluster meetings.	Cluster meeting summaries. Available documents.	- Descriptions of services delivered as part of case-finding activities. - Descriptions of any facilitators or barriers to case-finding activities.

[182] Descriptive documentation of activities for the first year could serve as a baseline (as described in existing documentation, Vision Steering Committee meetings, or Cluster Meetings). Descriptive documentation of activities in future years could consist of updates on any changes to activities. This information could be reported upon to help explain differences in outcomes over time and across regions and serve as a resource for future activity planning. This questions was rated Medium priority.

P/K [181]	#	Evaluation Questions / Data Needed	Data Sources	Data Collection by	Data Collected	Indicators
P	6.	**What types of services and strategies might facilitate screening 3-year old children?** **(e.g., marketing strategy, program planning and organization, implementation and role out of services)** What factors or conditions have facilitated or served as barriers to pilot screening activities? 183 **Priority question for 2007/2008	Parents/Guardians participate in questionnaire. HA staff/designates, cluster meeting and/or interview summaries. 3-year Old Pilot Planning Template Worksheets.	**HAs** distribute questionnaire to parents/guardians. **HELP**: develops questionnaire. **HELP** from cluster meeting and/or interview participants.	Parent/Guardian Preference Questionnaire and/or Experience Questionnaire data. Cluster meeting and/or interview summaries. 3-year Old Pilot Planning Template Worksheet data.	- Parent/guardian descriptions of preferences for service delivery. - Parent/guardian descriptions of experiences with vision screening services. - HA descriptions of facilitators and challenges to screening activities.
P	7.	How satisfied were parents/guardians whose children were screened through the 3-year old screening program with the way in which services were delivered?	Parent/guardian questionnaire data and/or interviews/focus group transcripts.	**HAs** distribute questionnaire to parents/guardians. **HELP**: develops questionnaire and/or facilitates interview/focus groups.	Questionnaire data and/or interviews/focus group transcripts.	- % of parents/guardians who reported feeling satisfied with the way in which screening services were delivered.

[183] Barriers/facilitators to *Activities* focus on organisational-level factors within the program realm of jurisdiction (e.g., managerial- or staff-level). In contrast, contextual factors (under *Context*) are macro-level (e.g., societal) influencing factors largely beyond the role of the program.

P/K [181]	#	Evaluation Questions / Data Needed	Data Sources	Data Collection by	Data Collected	Indicators
P	8.	To what extent are parents/guardians, allied health professionals and the larger community aware of the 3-year old vision screening program? ** Priority question (future years) How satisfied are service providers (e.g., screeners and eye doctors) and their community partners with the delivery of the 3-year old screening program? What could be improved?	General public questionnaire data; service provider and partner questionnaire and/or interviews/focus group transcripts.	**HELP**: develops questionnaire and/or facilitate interview/focus groups.	Questionnaire data and/or interviews/focus group transcripts.	- Evidence of public awareness of vision screening activities. - % of service providers and community partners feeling satisfied with delivery of the screening program (e.g., process is user-friendly)
P	9.	What lessons have been learned from 3-year old pilots that could be helpful to screening and case-finding initiatives in the future? What worked? What didn't work? What are some critical success factors? How could the program be improved? ** Priority question for 2007/2008	HA staff participate in Staff Experience Questionnaire. Service providers, community partners, program planners, and parents participate in cluster meetings/interviews/ focus groups. 3-year Old Pilot Planning Template Worksheets	**HA staff** complete online questionnaire. **HELP**: develops questionnaire. **HELP**: Report/Document Review, **HA:** Participation in interviews, cluster meetings.	Staff Experience Questionnaire data. Cluster meeting summaries, interview/focus group transcripts. 3-year Old Pilot Planning Template Worksheet data.	Evidence of: - what worked - what didn't work - how could program be improved

APPENDIX C: GLOSSARY OF TARGET EYE CONDITIONS[184]

Amblyopia (Lazy eye):
A condition where the vision in one eye is weaker than the other. The child's brain ignores the weak eye and uses the stronger eye in an attempt to see. If left untreated, the child's brain develops a clear picture in the good eye and a blurry picture in the weak eye. Lazy eye is often associated with crossed-eyes or a large difference in the degree of nearsightedness or farsightedness between the two eyes. It usually develops before the age of 6.

Strabismus (Crossed eyes):
Occurs when one or both eyes turns in, out, up or down, and is usually caused by poor eye muscle control. This misalignment often first appears before age 21 months but may develop as late as age 6. A child will not outgrow strabismus. In fact, the condition may get worse without treatment.

Refractive errors (Hyperopia, Myopia and Astigmatism):
The normal eye has various transparent parts through which the light must travel to reach the retina. Light is refracted by the transparent media so that the eye, while at rest can form a clear image on the retina. When light rays cannot be brought to a single focus on the retina of a resting eye, a refractive error is present.

Hyperopia (Farsightedness):
A condition whereby the eye, while at rest, insufficiently refracts light from a distant object so that the image theoretically is focused BEHIND the retina. This may be due to a short eye or too flat a curvature of the cornea. Sight may be normal or very poor depending upon the state of accommodation and the amount of hyperopia. The person sees distant objects clearly but close objects appear blurry.

Myopia (Nearsightedness):
A condition whereby the eye, while at rest, over refracts the light from a distant object so that the image of the distant object is focused in FRONT of the retina. The person perceives a blurred image that cannot be improved by accommodation. The condition is usually a structural, congenital, and/or developmental anomaly. The person sees near objects clearly but distant objects appear blurry.

Astigmatism:
A vision condition that occurs when the front surface of the eye, the cornea, is slightly irregular in shape. This irregular shape prevents light from focusing properly on the retina. As a result, vision may be blurred at all distances.

---

[184] BC Ministry of Health, *Provincial Vision Screening Training Manual.*

APPENDIX D: STAFF EXPERIENCE QUESTIONNAIRE FOR VISION SCREENING PROGRAMS

Description: This questionnaire, created for Health Authority staff, helps you identify critical challenges and success factors related to Vision Screening. Answers provided are anonymous and no personal information is stored.

Consent: If you fill out and submit the online questionnaire, we assume that you give your consent for us to use the information, which will be combined with other respondents' answers. Your Invitation & Consent Letter serves as your consent form. We suggest you keep a copy for your records.

- *Section 1. Training & Information Letters.*
- *Section 2. Critical Challenges and Success Factors.*
- *Section 3. Families and Program Partners.*
- *Section 4. Lessons Learned.*
- *Section 5. Role and Service Area.*

Introduction

The Human Early Learning Partnership (HELP) is working with Health Authorities and the Ministry of Healthy Living and Sport to evaluate the Vision Screening Program. Information gathered from this staff questionnaire will be used to inform program decision-making about vision screening.

Please note that this questionnaire is completely anonymous. However, by obtaining your HSDA, we could try to determine where some of the challenges you are experiencing might be coming from.

Note: Although vision screening is often combined with other services (e.g., hearing screening), the focus of this questionnaire is **3-year Old and Kindergarten Vision Screening** for the **2008/09 school year only.**

Section 1. Training, Information Letters, and Referral and Follow-up Form.

1. Is this your first year providing vision screening using the SureSight?

O **Yes.**

If yes, how did you receive your training? Please check **all** that apply.

O Train-the-trainer.
O Group training.
O Individual training.
O Read the manual.
O Watched a video.
O Other (Please describe:)_____

O **No,** this is my second year providing vision screening using the SureSight.

If no, did you receive a training update/refresher?

O Yes O No

2. Please recall the **Vision Screening Training Manual,** and indicate your opinion about the following statements.

On a scale of **1 (strongly agree)** to **5 (strongly disagree):**

a) After reading the manual, I understand the eye conditions I am screening for.

O 1 O 2 O 3 O 4 O 5 O Not applicable.

b) I was able to follow the step-by-step procedures for the SureSight screener.

O 1 O 2 O 3 O 4 O 5 O Not applicable.

c) I was able to follow the step-by-step procedures for the Randot Stereotest

O 1 O 2 O 3 O 4 O 5 O Not applicable.

d) I understand the SureSight referral criteria.

O 1 O 2 O 3 O 4 O 5 O Not applicable.

e) I understand the Randot referral criteria.

O 1 O 2 O 3 O 4 O 5 O Not applicable.

f) I understand the Vision Screening and Referral Decision Tree.

O 1 O 2 O 3 O 4 O 5 O Not applicable.

g) I understand the manual guidelines for recording the screening results.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ Not applicable. h) I used the vision screening protocol self-test true or false questions. ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ Not applicable. i) I used the vision screening checklists to check my testing ability. ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ Not applicable.
Information letters were provided to parents/guardians and school personnel regarding public health vision screening. In some areas, letters were also sent to service providers for 3-year olds (e.g., preschools, daycares, Strong Start, Head Start, early childhood centres).
3. a) Did you get any feedback on the information letter to parents/guardians? ○ Yes ○ No ○ Not applicable. b) If yes, please describe:
4. a) Did you get any feedback on the letter to teachers? ○ Yes ○ No ○ Not applicable. b) If yes, please describe:
5. a) Did you get any feedback on the letter to principals? ○ Yes ○ No ○ Not applicable. b) If yes, please describe:
6. a) Did you get any feedback on the letter to service providers for 3-year olds in your community (e.g., preschools, daycares, Strong Start, Head Start, early childhood centres)? ○ Yes ○ No ○ Not applicable. b) If yes, please describe:
The **Vision Screening Referral and Follow-up Form** was provided to the parents/guardians to advise further follow-up by an eye doctor.
7. a) Did you receive any feedback about the Vision Screening Referral and Follow-up Form **from families**? ○ Yes ○ No ○ Not applicable. b) If yes, was the feedback negative?

○ Yes ○ No

c) If yes, please describe the feedback that you received:

8. a) Did you receive any feedback about the Vision Screening Referral and Follow-up form **from eye doctors**?

○ Yes ○ No ○ Not applicable.

b) If yes, was the feedback negative?

○ Yes ○ No

c) If yes, please describe the feedback that you received:

Section 2. Critical Challenges and Success Factors.

- Using the equipment.
- Recording the screening results for all children screened.
- Electronic data entry.
- Using the Referral & Follow-up Form.
- Providing follow-up as per the guidelines.

Questions in this section ask you to describe any key challenges or facilitators with respect to various components of the program. Please only describe those factors that you believe are critical to rolling out the program next fall.

9. **Using the screening equipment.**

○ This was part of my role. ○ Not applicable (skip this question).

a) On a scale of 1 (very challenging) to 5 (very easy), how easy was it to use the **SureSight screener:**

with 3-year olds? ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

with kindergarten students? ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

b) Please describe any critical challenges using the **SureSight screener…**

with 3-year olds:	with kindergarten students:

c) Did you overcome these challenges? ○ Yes ○ No

d) If yes, how? What worked best?

with 3-year olds:	with kindergarten students:

e) On a scale of 1 (very challenging) to 5 (very easy), how easy was it to use the **Randot Stereotest:**
with 3-year olds? ○ 1 ○ 2 ○ 3 ○ 4 ○ 5
with kindergarten students? ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

f) Please describe any critical challenges using the **Randot Stereotest…:**

with 3-year olds:	with kindergarten students:

g) Did you overcome these challenges? ○ Yes ○ No

h) If yes, how? What worked best?

with 3-year olds:	with kindergarten students:

i) On a scale of 1 (very challenging) to 5 (very easy), how easy was it to use the **HOTV eye chart** with kindergarten students?
○ 1 ○ 2 ○ 3 ○ 4 ○ 5
○ Not applicable (please skip to question 'm')

j) Please describe any critical challenges using the **HOTV eye chart** with kindergarten students:

k) Did you overcome these challenges? ○ Yes ○ No

l) If yes, how? What worked best?

m) What equipment and environmental difficulties did you face?

Please check **all** difficulties that apply:

○ Not applicable (I did not use the equipment).
○ Charging batteries.
○ Temperature during transport.
○ Equipment availability.
○ Equipment failure.
○ Lighting conditions.
○ None.
○ Other (please describe below):

10. **Recording the screening results for all children screened.** (Vision Screening Results Form, Documentation Spreadsheet, or appointment list where you record screening results for all children screened).

O This was part of my role. O Not applicable (skip this question).

a) On a scale of 1 (very challenging) to 5 (very easy), how easy was it to record the vision screening results for all children screened:

O 1 O 2 O 3 O 4 O 5 O Not applicable

b) Please describe any critical challenges:

c) What would you like to change on the form you used? Was anything missing?

11. **Using the Referral & Follow-up Form.**

O This was part of my role. O Not applicable (skip this question).

a) On a scale of 1 (very challenging) to 5 (very easy), how easy was it to record information on the Vision Screening Referral and Follow-up form?

O 1 O 2 O 3 O 4 O 5

b) Please describe any critical challenges:

c) Upon return of the Vision Screening Referral and Follow-up form from the eye doctors, did you have any problems interpreting the eye doctor's results?

O Yes O No

d) Please describe any problems interpreting the eye doctors' results:

12. **Electronic data entry.**

O This was part of my role. O Not applicable (skip this question).

a) On a scale of 1 (very challenging) to 5 (very easy), how easy was it to record results in iPHIS or PARIS:

for 3-year olds? O 1 O 2 O 3 O 4 O 5 O Not applicable

for kindergarten students? O 1 O 2 O 3 O 4 O 5 O Not applicable

b) Please describe any critical challenges:

with 3-year olds:	with kindergarten students:

c) What information did you record electronically for 3-year olds?

○ Passes only ○ Refers only ○ Both Passes and Refers
○ Did not record information electronically

13. **Providing follow-up as per the guidelines.**
○ This was part of my role. ○ Not applicable (skip this question).

a) Were you able to follow the guidelines for follow-up? ○ Yes ○ No ○ Not applicable

b) Did you phone parents/guardians? ○ Yes ○ No

c) Did you send a letter to parents/guardians? ○ Yes ○ No

d) Did you need language translation services? ○ Yes ○ No

e) If yes, were language translation services available? ○ Yes ○ No

f) Did parents/guardians indicate any challenges accessing an eye doctor? ○ Yes ○ No

g) If yes, please describe the challenges:

Section 3. Clients and Program Partners

- Healthy Kids Program
- Teachers and School Staff
- Eye Doctors
- First Nations Health Staff

14. a) On a scale of 1 (not aware) to 5 (very aware), how aware were families about the Healthy Kids program?
○ 1 ○ 2 ○ 3 ○ 4 ○ 5

b) Please describe any feedback you received from families about the Healthy Kids program:

15. a) Have you been asked to share any screening information with anyone

at the school (e.g., teachers, school/program staff)? ○ Yes ○ No ○ Not applicable
at the 3-year old program site? ○ Yes ○ No ○ Not applicable

b) If yes, was there any negative feedback because you were not allowed to share the information

with the school under privacy legislation? ○ Yes ○ No ○ Not applicable

with the 3-year old program site? ○ Yes ○ No ○ Not applicable

c) If yes, what was the feedback?

From the school?	From the 3-year old program site?

16. How did you communicate or work with eye doctors?

Please check **all** that apply:

- ○ Not applicable
- ○ Answering eye doctor's questions (e.g., about the Referral Form, honorarium invoice).
- ○ Sending eye doctors a blank Referral Form.
- ○ Discussing extra fees charged (e.g., for form completion).
- ○ Discussing Healthy Kids.
- ○ Discussing First Nations Health Benefit.
- ○ Discussing Health Authority funds for glasses.
- ○ Other (please describe below).

17. a) Did you provide any vision screening services in a First Nations school?
○ Yes ○ No

b) Did you provide any vision screening services with a First Nations 3-year old program?
○ Yes ○ No

c) Did you work together with First Nations health staff to coordinate vision screening?
○ Yes, for kindergarten students.
○ Yes, for 3-year old children.
○ No

d) If yes, were you able to coordinate any follow-up with First Nations health staff?
○ Yes, for kindergarten students.
○ Yes, for 3-year old children.
○ No

e) Do you have any comments?

Section 4. Lessons Learned

18. What are the lessons learned that could help to improve the program in the future?

19. Looking ahead, is there anything else that should be considered related to rolling out kindergarten screening next fall?

20. Looking ahead, is there anything else that should be considered to effectively reach the majority of 3-year olds in your area?

Section 5. Role & Service Area

21. *What is your role in the Vision Screening Program?
Please check all that apply:
- ○ Vision screener.
- ○ Family follow-up.
- ○ Data entry.
- ○ Staff trainer.
- ○ Vision screening coordinator.

22. *What Health Authority do you work in?

[Drop box options: FH, IH, NH, VCH, VIHA]

23. What Health Service Delivery Area (HSDA) do you work in for the majority of your time related to the vision screening program?
Please check **all** that apply: [options will be limited to HA selected in previous question]

Fraser Health Authority
- ○ Fraser East
- ○ Fraser North
- ○ Fraser South

Interior Health Authority
- ○ East Kootenay
- ○ Kootenay Boundary
- ○ Okanagan
- ○ Thompson Cariboo Shuswap

Northern Health Authority
- ○ Northeast
- ○ Northern Interior
- ○ Northwest

Vancouver Coastal Health Authority
- ○ North Shore/Coastal
- ○ Richmond
- ○ Vancouver

Vancouver Island Health Authority
- ○ Central Vancouver Island
- ○ North Vancouver Island
- ○ South Vancouver Island

24. What are the first three digits of the postal code of your primary health unit/centre (e.g., V6J)? ☐ ☐ ☐

Thank you for taking the time to fill out this questionnaire

APPENDIX E: METHODOLOGICAL NOTES

Population Denominators

In calculating the proportion of three-year-old/kindergarten children screened by the BC Early Childhood Vision Screening Programs, two pieces of information were needed: the number of children screened (numerator) and the number of children in the population (denominator). The available vision screening datasets (e.g., paper-based classroom/appointment lists, iPHIS-MSP linked dataset, etc.) contained information on the number of screened children by age group, but not the total number of three-year-olds and kindergarten age children in the population. The paper-based classroom/appointment lists dataset, for instance, provided detailed school-level information on the number of children screened and referred along with the number enrolled, but this information was not consistently recorded. As a result, the population denominators provided by the data were underestimates. When aggregating school-level information to that of the neighbourhood or health region and school enrollment data is missing for some schools, the population denominator used to calculate vision referral rates was naturally decreased, thereby inflating or overestimating the true rates of referral.

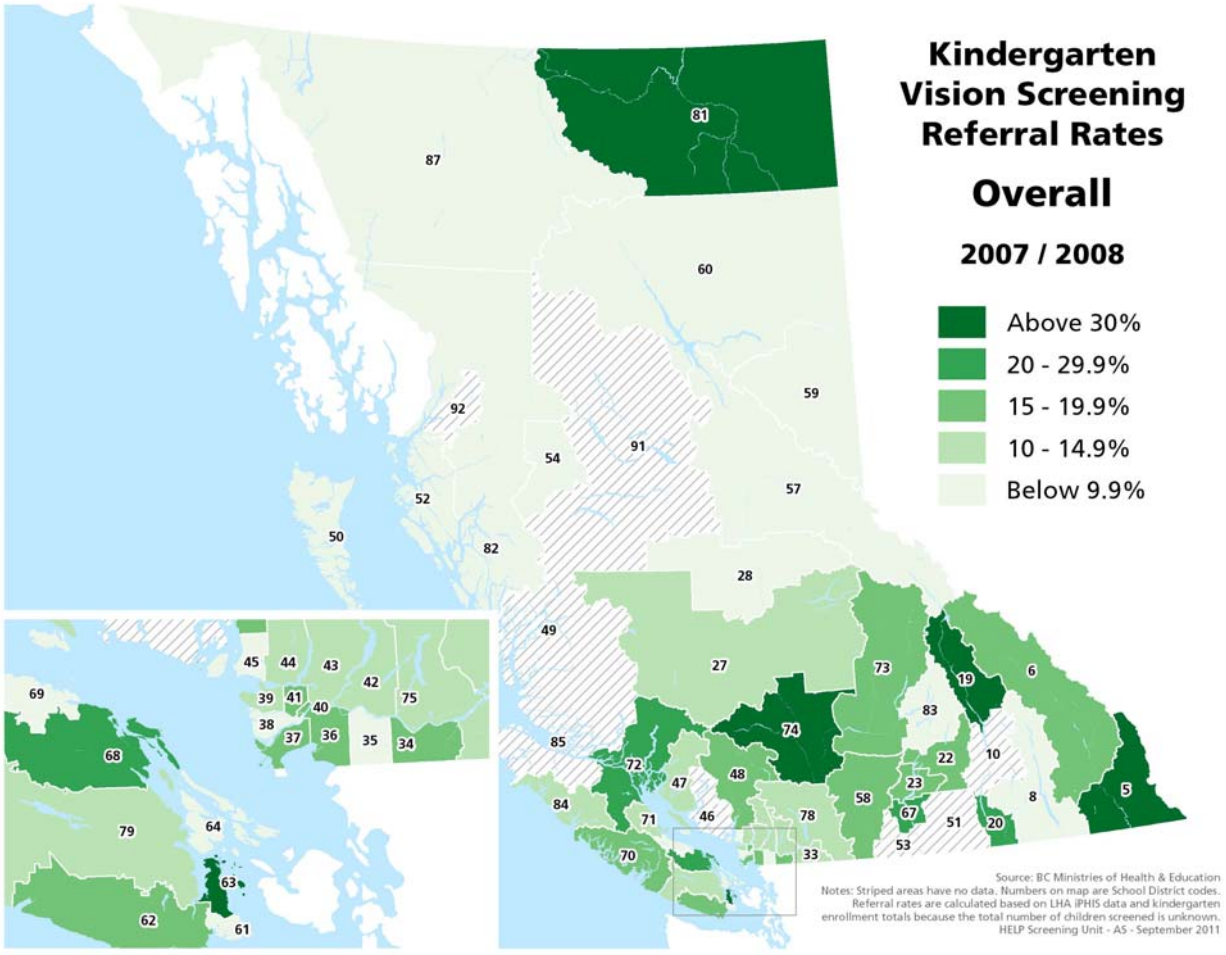
In order to more accurately determine the number of three-year-old/kindergarten children in the population and more closely approximate rates of vision referral, preference was given to specific data sources that were deemed more reliable. For instance, when reporting the HA and HSDA rates of vision screening and referral as estimated by the paper-based and iPHIS-MSP datasets, the population denominator used was generated separately and obtained by e-mail correspondence from HAs to the MoH. Using a common data source also has the added advantage of comparability across rates based on the different datasets.

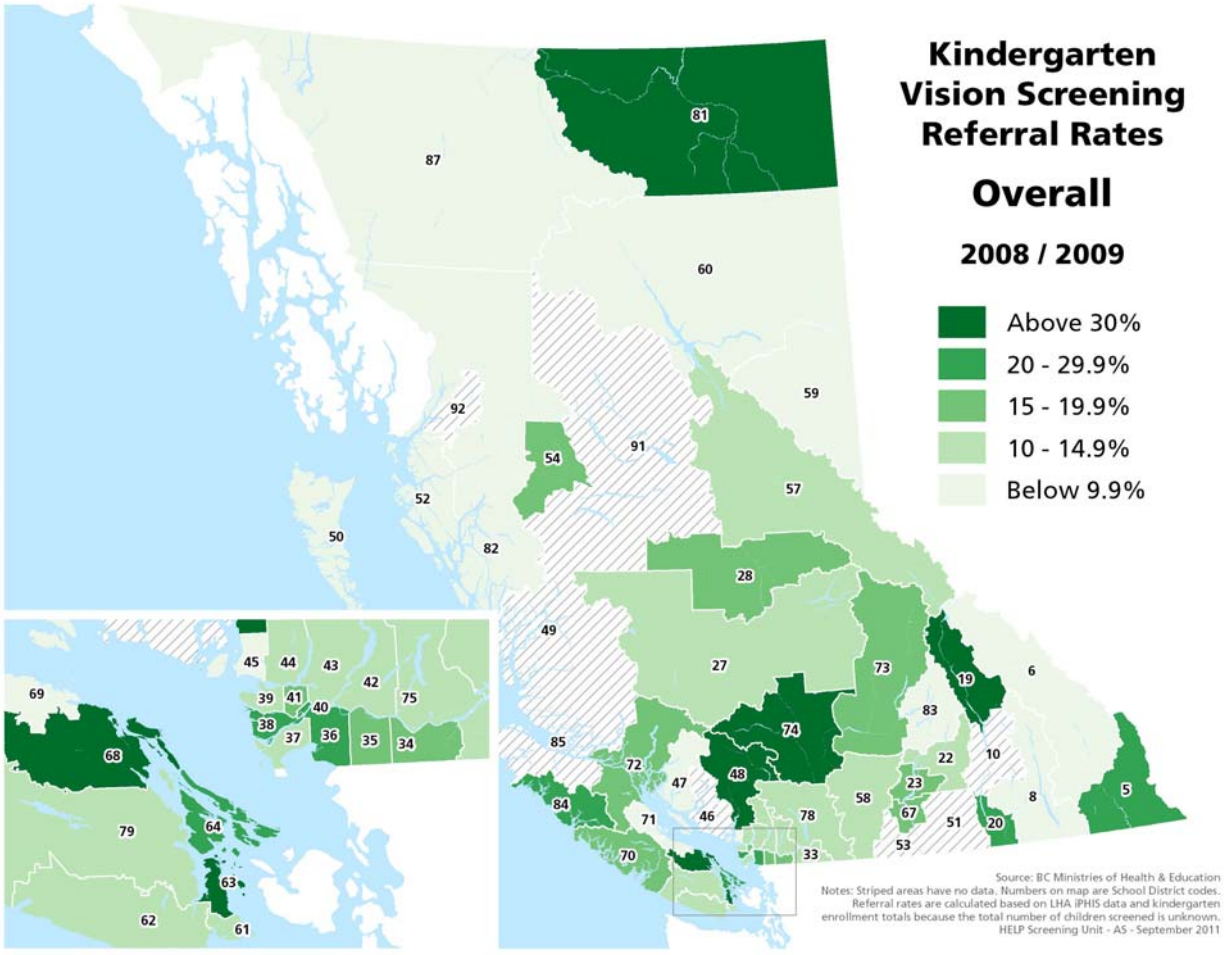
APPENDIX F: MAPS OF KINDERGARTEN VISION SCREENING REFERRAL RATES BY SCHOOL DISTRICT

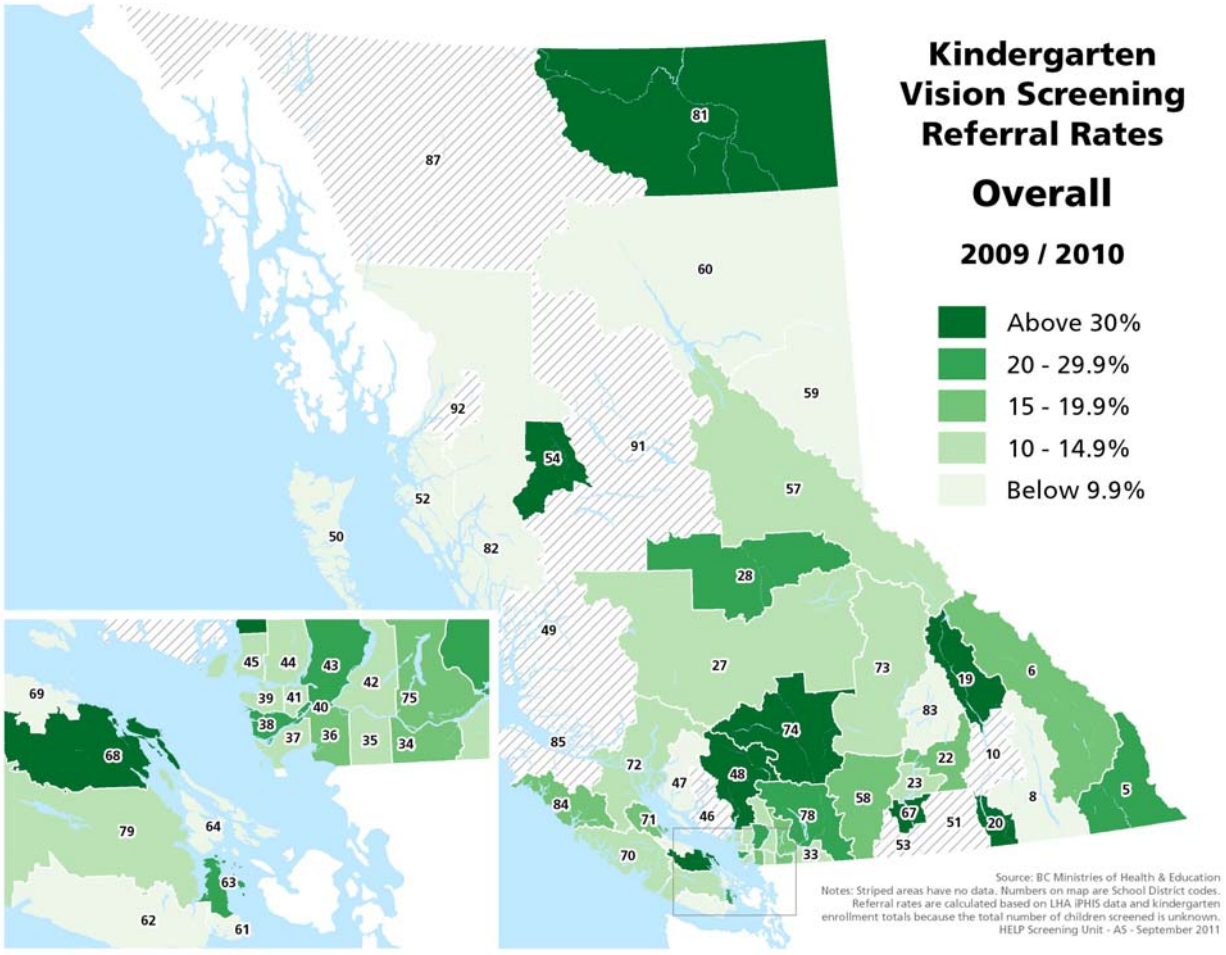
List of School Districts

School District Number	School District Name
School District 5	Southeast Kootenay
School District 6	Rocky Mountain
School District 8	Kootenay Lake
School District 10	Arrow Lakes
School District 19	Revelstoke
School District 20	Kootenay Columbia
School District 22	Vernon
School District 23	Central Okanagan
School District 27	Cariboo Chilcotin
School District 28	Quesnel
School District 33	Chilliwack
School District 34	Abbotsford
School District 35	Langley
School District 36	Surrey
School District 37	Delta
School District 38	Richmond
School District 39	Vancouver
School District 40	New Westminster
School District 41	Burnaby
School District 42	Maple Ridge/Pitt Meadows
School District 43	Coquitlam
School District 44	North Vancouver
School District 45	West Vancouver
School District 46	Sunshine Coast
School District 47	Powell River
School District 48	Sea to Sky
School District 49	Central Coast
School District 50	Haida Gwaii
School District 51	Boundary
School District 52	Prince Rupert

School District Number	School District Name
School District 53	Okanagan Similkameen
School District 54	Bulkley Valley
School District 57	Prince George
School District 58	Nicola-Similkameen
School District 59	Peace River South
School District 60	Peace River North
School District 61	Greater Victoria
School District 62	Sooke
School District 63	Saanich
School District 64	Gulf Islands
School District 67	Okanagan Skaha
School District 68	Nanaimo-Ladysmith
School District 69	Qualicum
School District 70	Alberni
School District 71	Comox Valley
School District 72	Campbell River
School District 73	Kamloops / Thompson
School District 74	Gold Trail
School District 75	Mission
School District 78	Fraser-Cascade
School District 79	Cowichan Valley
School District 81	Fort Nelson
School District 82	Coast Mountains
School District 83	North Okanagan Shuswap
School District 84	Vancouver Island West
School District 85	Vancouver Island North
School District 87	Stikine
School District 91	Nechako Lakes
School District 92	Nisga'a A


Kindergarten
Vision Screening
Referral Rates
Overall
2007 / 2008
Above 30%
20 - 29.9%
15 - 19.9%
10 - 14.9%
Below 9.9%
87
81
60
59
92
91
54
57
52
50
82
28
49
27
73
19
6
83
74
85
72
47
48
22
10
23
58
8
5
84
71
46
78
67
51
20
70
33
53
45
44
43
42
75
69
39
41
40
38
37
36
35
34
68
79
64
63
62
61
Source: BC Ministries of Health & Education
Notes: Striped areas have no data. Numbers on map are School District codes.
Referral rates are calculated based on LHA iPHIS data and kindergarten
enrollment totals because the total number of children screened is unknown.
HELP Screening Unit - AS - September 2011


Kindergarten
Vision Screening
Referral Rates
Overall
2008 / 2009
Above 30%
20 - 29.9%
15 - 19.9%
10 - 14.9%
Below 9.9%
87
81
60
59
92
91
54
57
52
50
82
28
49
27
73
19
6
83
74
85
72
48
22
10
47
23
58
8
84
71
46
78
67
51
5
20
70
33
53
79
64
63
62
61
69
68
45
44
43
42
75
39
41
40
38
37
36
35
34
Source: BC Ministries of Health & Education
Notes: Striped areas have no data. Numbers on map are School District codes.
Referral rates are calculated based on LHA iPHI5 data and kindergarten
enrollment totals because the total number of children screened is unknown.
HELP Screening Unit - AS - September 2011


Kindergarten
Vision Screening
Referral Rates
Overall
2009 / 2010
Above 30%
20 - 29.9%
15 - 19.9%
10 - 14.9%
Below 9.9%
87
81
60
59
92
91
54
57
52
50
82
28
49
27
73
19
6
69
45
44
43
42
39
41
40
75
83
74
68
38
37
36
35
34
85
72
22
10
48
47
23
5
58
8
84
78
67
51
79
64
71
46
20
70
33
53
63
62
61
Source: BC Ministries of Health & Education
Notes: Striped areas have no data. Numbers on map are School District codes.
Referral rates are calculated based on LHA iPHI5 data and kindergarten
enrollment totals because the total number of children screened is unknown.
HELP Screening Unit - AS - September 2011

APPENDIX G: WELCH ALLYN SURESIGHT REFERRAL CRITERIA

To review ways in which the rates of referral change with differing criteria, we also present an example of the rates that would be obtained with the SureSight criteria.

SureSight referral rates were drawn from the Welch Allyn SureSight Screening Manual[185] and were calculated based on the following criteria:

-1.0 <= Sphere >= +2.0

-1.0 <= Cylinder >= +1.0

-1.0 <= Difference >= +1.0

In both screening years, the referral rates using the comparative SureSight criteria were at least double the rates of those obtained from the BC referral criteria. For instance, the number of children referred in 2007/08 was 7480 using the BC referral criteria. If the alternate SureSight criteria had been used, the number of children referred would have been 17,096, which would have greatly impacted the need for follow-up and presumably also increased the number of false positives.

The following tables present kindergarten vision screening referral rates by HA in 2007/08 and 2008/09 based on the two sets of criteria.

[185] Welch Allyn, Inc., *Welch Allyn SureSight* (Skaneateles Falls, NY: Welch Allyn, Inc., n.d.), http://www.schoolhealth.com/text/pdf/52316_Users_Manual.pdf.

TABLE 14.1		As Entered				BC Referral Rates				SureSight Referral Rates			
Kinder-garten	Total Screened (2007/08)	# Missing	# Pass	# Refer	% Refer	# Missing	# Pass	# Refer	% Refer	# Missing	# Pass	# Refer	% Refer
Interior HA	6,318	541	4,470	1,307	22.6	574	4,452	1,292	22.5	574	3,141	2,603	45.3
Fraser HA	16,526	1,258	12,199	3,069	20.1	1,198	12,031	3,297	21.5	1,198	7,793	7,535	49.2
Vancouver Coastal HA	7,859	745	5,951	1,163	16.3	718	5,726	1,415	19.8	718	3,817	3,324	46.5
Vancouver Coastal HA	7,799	0	6,465	1,334	17.1	--	--	--	--	--	--	--	--
Vancouver Island HA	6,322	1,258	3,858	1,206	23.8	909	3,842	1,571	29.0	909	2,592	2,821	52.1
Northern HA	2,234	341	1,579	314	16.6	671	1,207	356	22.8	671	812	751	48.0
BC Total	**47,058**	**4,143**	**34,522**	**8,393**	**19.6**	**4,070**	**27,258**	**7,931**	**22.5**	**11,869**	**18,155**	**17,034**	**48.4**

Source: Paper-based classroom lists database

TABLE 14.2		As Entered				BC Referral Rates				SureSight Referral Rates			
Kinder-garten	Total Screened (2008/09)	# Missing	# Pass	# Refer	% Refer	# Missing	# Pass	# Refer	% Refer	# Missing	# Pass	# Refer	% Refer
Interior HA	5,826	488	4,187	1,151	21.6	512	4,180	1,134	21.3	509	3,001	2,316	43.6
Fraser HA	16,083	742	12,338	3,003	19.6	686	12,173	3,224	20.9	686	7,954	7,443	48.3
Vancouver Coastal HA	7,846	3	6,483	1,360	17.3	7,846	0	0	--	7,846	0	0	--
Vancouver Island HA	5,093	575	3,490	1,028	22.8	549	3,496	1,048	23.1	201	2,782	2,110	43.1
Northern HA	2,710	302	1,889	519	21.6	317	1,824	569	23.8	420	1,194	1,096	47.9
BC Total	**37,558**	**2,110**	**28,387**	**7,061**	**19.9**	**9,910**	**21,673**	**5,975**	**21.6**	**9,662**	**14,931**	**12,965**	**46.5**

Source: Paper-based classroom lists database

APPENDIX H: DIAGNOSTIC OUTCOMES OF INTEREST

The list of diagnostic outcomes of interest was drawn from MSP billing records. A list was developed by the BC Early Childhood Vision Screening Steering Committee, with the guidance of its eye doctor committee members. This list was subsequently updated (see table below) to reflect a subset of the original codes that were more descriptive and provided additional identifiers of a condition of interest.[186] The diagnostic codes highlighted in yellow were included in the analysis if they were billed within 30 days of the first vision screening date of the child.

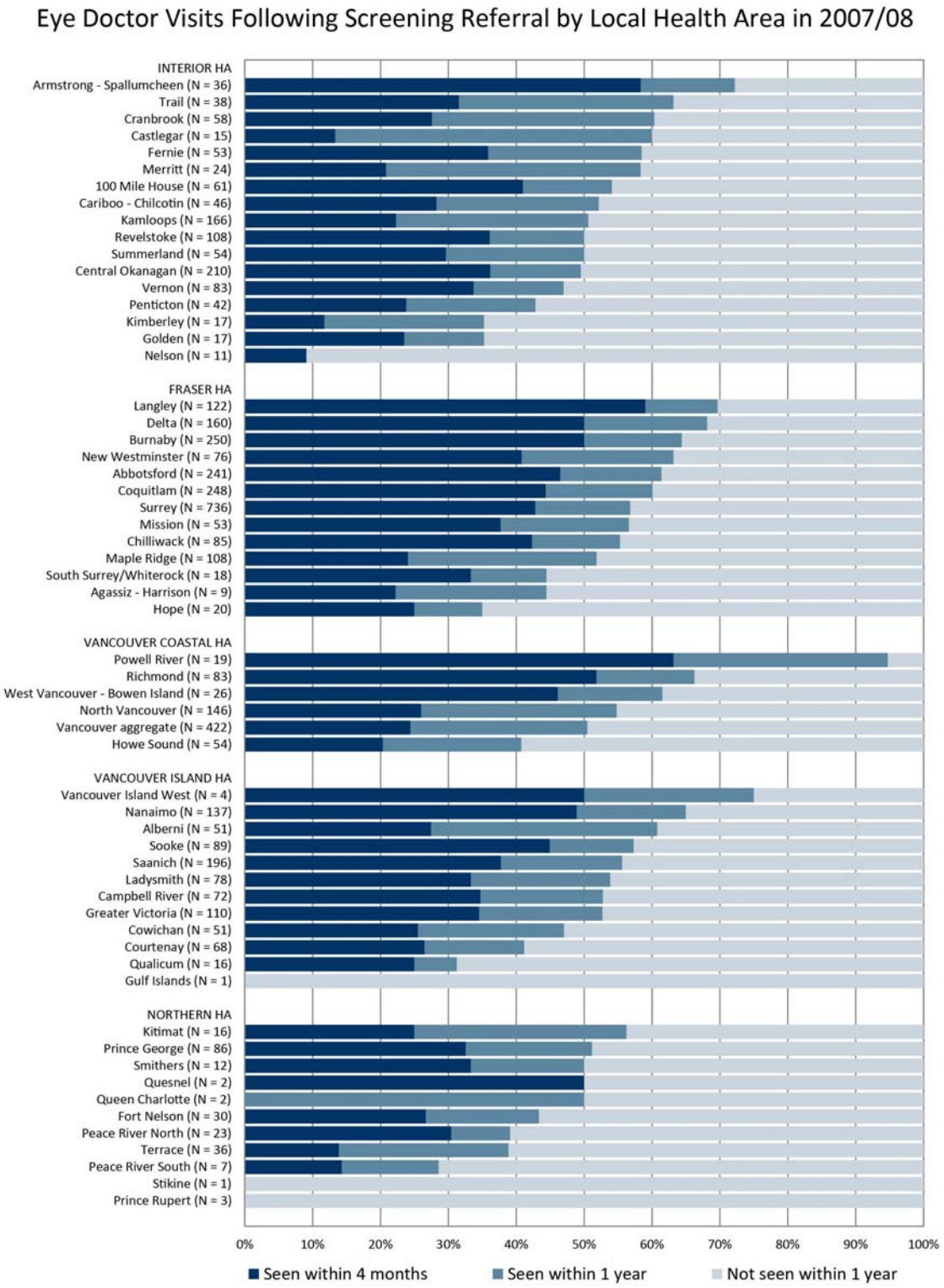
Diagnostic Code	Diagnostic Code Description
2246	Benign neoplasm of eye - choroid
360	Disorders of the globe
36100	Retinal detachments and defects - detachment/tear, unspecified
362	Other retinal disorders
36220	Other proliferative retinopathy
36221	Other retinal disorders - retrolental fibroplasia
364	Disorders of iris and ciliary body
36402	Disorders of iris and ciliary body - iridocylitis, recurrent
3648	Disorders of iris and ciliary body - other disorders of iris and cilia
365	Glaucoma
3650	Glaucoma - borderline glaucoma
36500	Glaucoma - preglaucoma, unspecified
3670	Disorders of refraction and accommodation
36700	Disorders of refraction and accommodation - hypermetropia
3671	Myopia
36710	Disorders of refraction and accommodation - myopia
3672	Astigmatism
36720	Disorders of refraction and accommodation - astigmatism
36721	Disorders of refraction and accommodation - astigmatism, regular
36722	Disorders of refraction and accommodation - astigmatism, irregular
3673	Disorders of refraction and accommodation - anisometropia and aniseiko
36731	Disorders of refraction and accommodation - anisometropia
36732	Disorders of refraction and accommodation - aniseikonia
3674	Disorders of refraction and accommodation - presbyopia
3675	Disorders of refraction and accommodation - disorders of accommodation
36751	Disorders of refraction and accommodation - accommodation, paresis of
36753	Disorders of refraction and accommodation - accommodation, spasm of

[186] For example, 'disorders of refraction and accommodation' (code 3670) was not included in the database unless the client had multiple visits to an eye doctor within a defined time period (e.g., within 4 months of screening referral). More descriptive codes, such as 36720 'disorders of refraction and accommodation – astigmatism' and 36801 'visual disturbances – amblyopia, strabismic' were included in the database prepared for the evaluation.

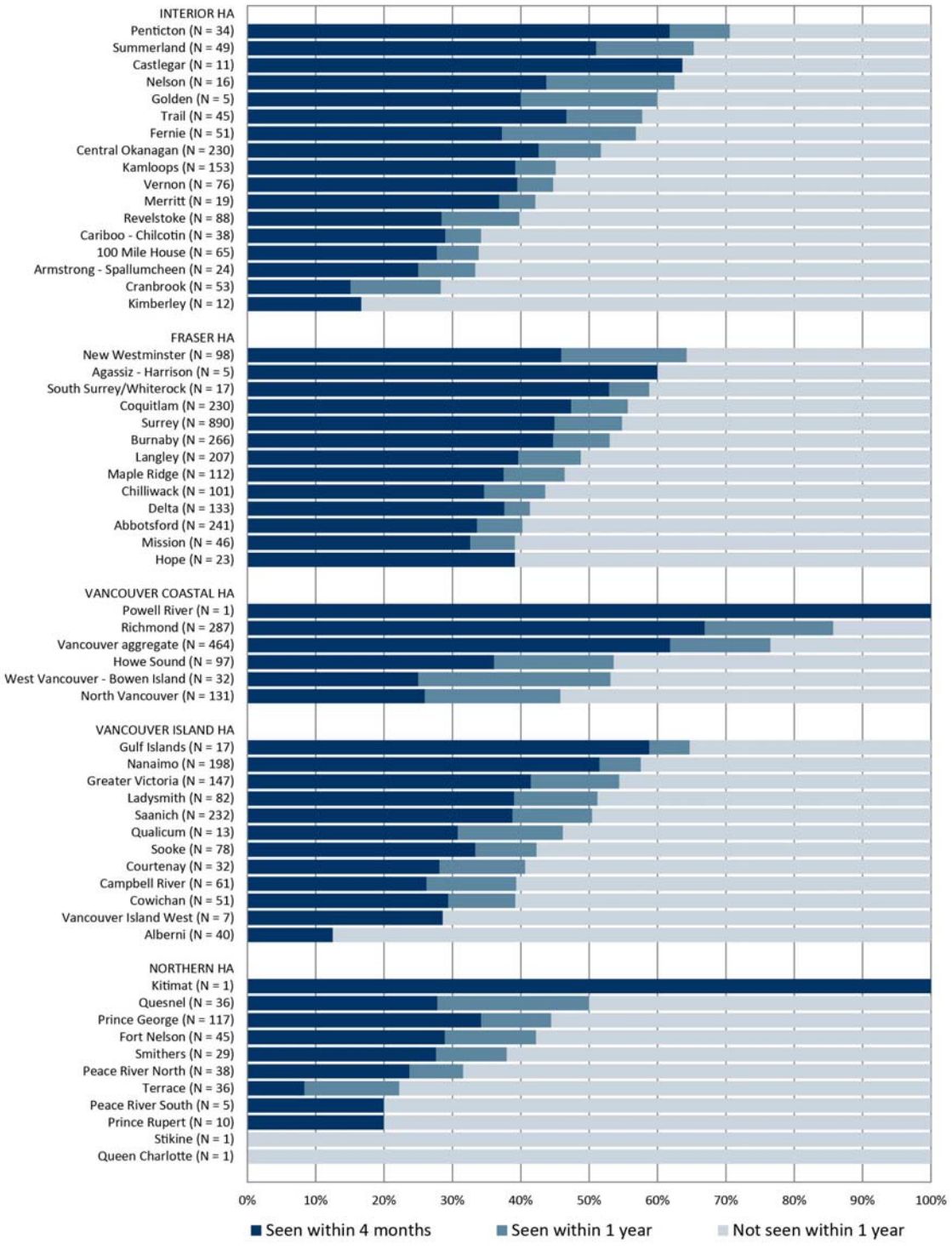
Diagnostic Code	Diagnostic Code Description
3678	Disorders of refraction and accommodation - other
3680	Visual disturbances - amblyopia ex anopsia
36800	Visual disturbances - amblyopia, unspecified
36801	Visual disturbances - amblyopia, strabismic
36802	Visual disturbances - amblyopia, deprivation
36803	Visual disturbances - amblyopia, refractive
3681	Visual disturbances - subjective visual disturbances
36810	Visual disturbances - subjective visual disturbances
36811	Visual disturbances - sudden vision loss
36813	Visual disturbances - asthenopia
3682	Visual disturbances - diplopia
3683	Visual disturbances - other disorders of binocular vision
36830	Visual disturbances - other disorders of binocular vision
36831	Visual disturbances - suppression of binocular vision
36840	Visual disturbances - visual field defect, unspecified
3685	Visual disturbances - colour vision deficiencies
36852	Visual disturbances - colour vision deficiency, deutan
36880	Visual disturbances - other visual disturbances
371	Corneal opacity and other disorders of cornea
3710	Corneal opacity and other disorders of cornea - corneal scars and opac
37200	Disorders of conjunctiva - acute conjunctivitis unspecified
37201	Disorders of conjunctiva - serous conjunctivitis
37202	Disorders of conjunctiva - acute conjunctivitis, follicular
37214	Other chronic allergic conjunctivitis
37250	Conjunctival degeneration, unspecified
37271	Disorders of conjunctiva - hyperemia of conjunctiva
377	Disorders of optic nerve and visual pathways
37716	Disorders of optic nerve and visual pathways - optic atrophy, heredita
3772	Disorders of optic nerve and visual pathways - other disorders of opti
37723	Disorders of optic nerve and visual pathways - coloboma of optic disk
3774	Disorders of optic nerve and visual pathways - other disorders of opti
3776	Disorders of optic nerve and visual pathways - disorders of other visu
378	Strabismus and other disorders of binocular eye movements
3780	Strabismus and other disorders of binocular eye movements - convergent
37800	Strabismus and other disorders of binocular eye movements - esotropia,
37801	Strabismus and other disorders of binocular eye movements - esotropia,
37805	Strabismus and other disorders of binocular eye movements - esotropia,
3781	Strabismus and other disorders of binocular eye movements - divergent
37810	Strabismus and other disorders of binocular eye movements - exotropia,
37811	Strabismus and other disorders of binocular eye movements - exotropia,
37815	Strabismus and other disorders of binocular eye movements - exotropia,

Diagnostic Code	Diagnostic Code Description
37821	Strabismus and other disorders of binocular eye movements - intermitta
37822	Strabismus and other disorders of binocular eye movements - intermitta
37823	Strabismus and other disorders of binocular eye movements - intermitta
37824	Strabismus and other disorders of binocular eye movements - intermitta
37831	Strabismus and other disorders of binocular eye movements - hypertropi
37835	Strabismus and other disorders of binocular eye movements - exotropia
37842	Exophoria
37843	Strabismus and other disorders of binocular eye movements - hyperphori
3785	Strabismus and other disorders of binocular eye movements - paralytic
3788	Strabismus and other disorders of binocular eye movements - other diso
37883	Strabismus and other disorders of binocular eye movements - convergenc
37884	Strabismus and other disorders of binocular eye movements - convergenc
3790	Other disorders of eye - scleritis and episcleritis
37900	Other disorders of eye - scleritis, unspecified
3795	Other disorders of eye - nystagmus and other irregular eye movements
37951	Other disorders of eye - nystagmus, congenital
37957	Other disorders of eye - saccadic eye movement deficiencies
37958	Other disorders of eye - smooth pursuit deficiencies
3798	Other disorders of eye - other disorders of eye and adnexa
37991	Other disorders of eye - eye pain
E02	Change of 0.5 dioptres or > to spherical or cylinder lens.
36372	Hemorrhagic choroidal detachment
372	Disorders of conjunctiva
37272	Disorders of conjunctiva - conjunctival hemmorhage
7840	Symptoms involving head and neck - headache
78400	Symptoms involving head and neck - headache
918	Superficial injury of eye and adnexa
9180	Superficial injury of eye and adnexa - eyelids and periocular area
9181	Superficial injury of eye and adnexa - cornea
91810	Superficial injury of eye and adnexa - cornea
92190	Unspecified contusion of eye
9502	Injury to optic nerve and pathways - injury to optic pathways
9503	Injury to optic nerve and pathways - injury to visual cortex

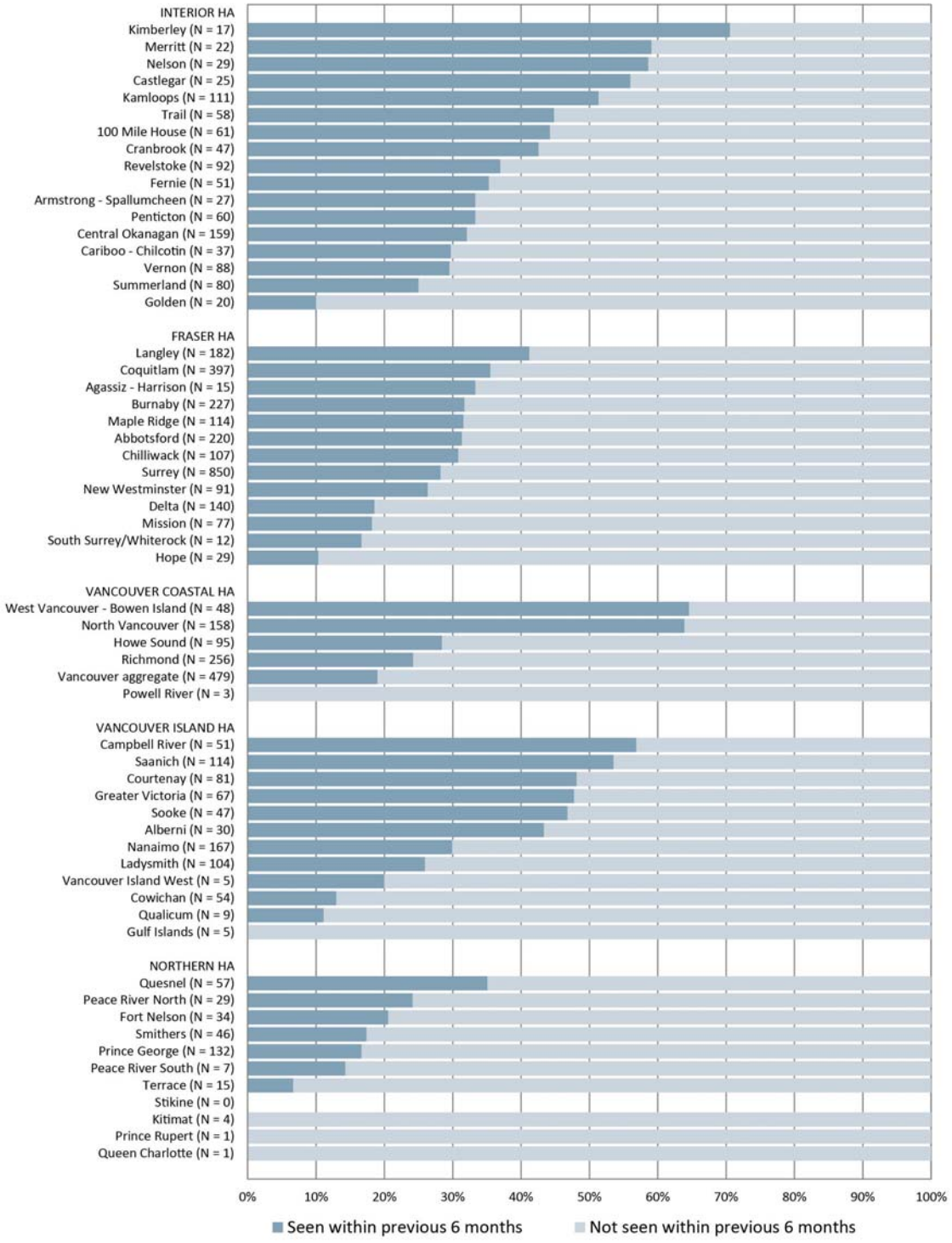
APPENDIX I: EYE DOCTOR VISITS FOLLOWING SCREENING REFERRAL



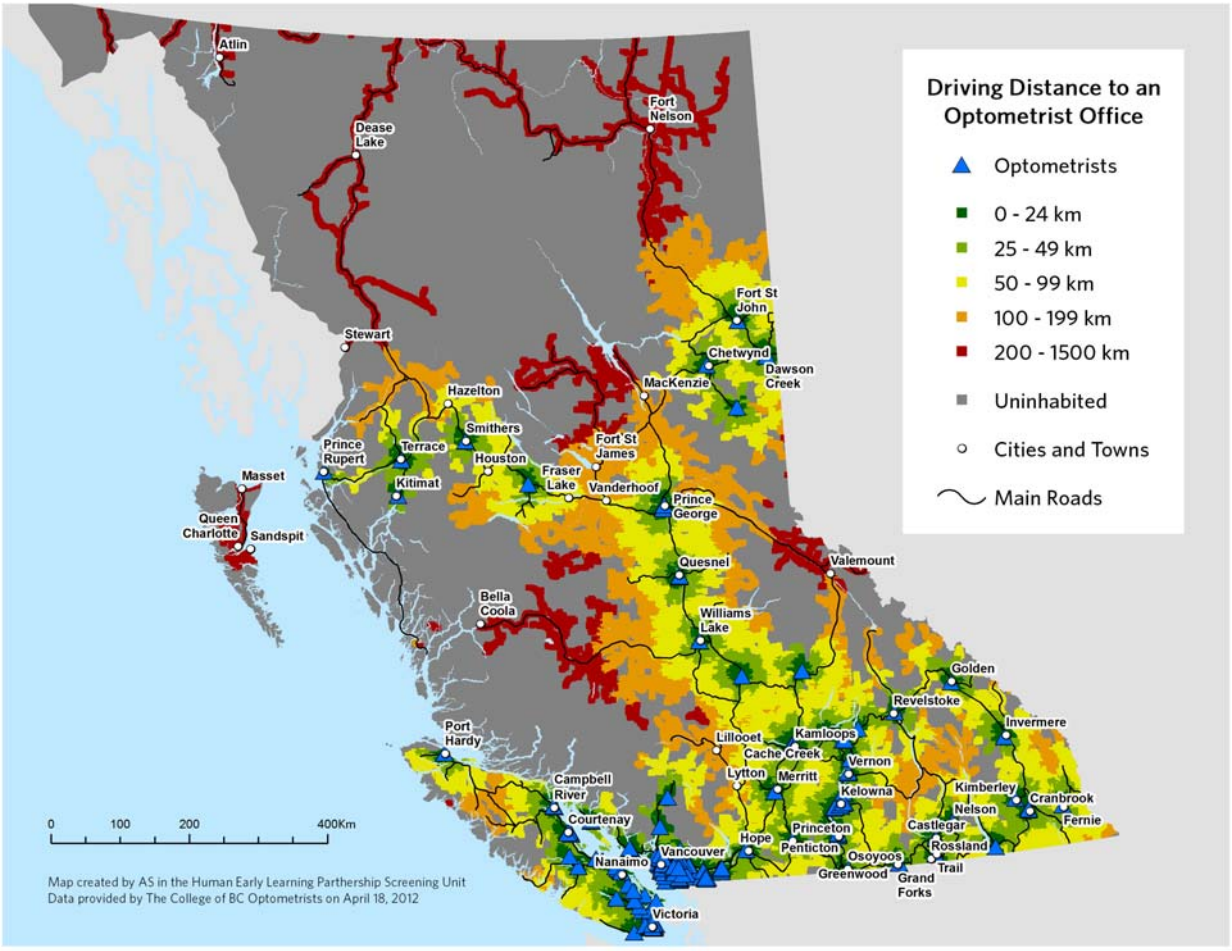
Eye Doctor Visits Following Screening Referral by Local Health Area in 2008/09



Eye Doctor Visits 6 Months Before Screening by Local Health Area in 2009/10



APPENDIX J: MAP OF DRIVING DISTANCES TO BC EYE DOCTORS' OFFICES



APPENDIX K: SUMMARY OF KEY FINDINGS FROM VISION-SOCIOECONOMIC STATUS STATISTICAL ANALYSIS

Observed relationship was not as expected. Observed relationship was as expected

Sociodemographic Variables	*Kindergarten Vision Referral Rate*	*Seen 6 Months Before Screeening*	*Seen 4 Months After Screeening*	*Seen 12 Months After Screeening*
Lone Parents, % Families w/ Children	Not significantly related.	As lone parents ↑, the % children who saw an eye doctor 6 mos. before screening ↑.	As lone parents ↑, the % children who saw an eye doctor 4 mos. after screening ↓.	As lone parents ↑, the % children who saw an eye doctor 12 mos. after screening ↓.
Low Income Persons, % After Tax	As low income ↑, kindergarten vision referral rates ↓.	Not significantly related.	As low income ↑, the % children who saw an eye doctor 4 mos. after screening ↑.	As low income ↑, the % children who saw an eye doctor 4 mos. after screening ↑.
No High School Completion, % Adults Age 25-54	Not significantly related.	As high school completion among adults ↑, the % children who saw an eye doctor 6 mos. before screening also ↑.	Not significantly related. Note: In 2009/10, high school completion slightly increased eye doctor visitation rates.	As high school completion among adults ↑, the % children who saw an eye doctor 12 mos. after screening also ↑.
Population Growth, Annual % (2005-10)	As population growth ↑, kindergarten vision referral rates ↓.	Not significantly related.	Not significantly related.	Not significantly related.
Aboriginal Peoples, % Total Pop.	Not significantly related.	As % Aboriginal ↑, the % children who saw an eye doctor 6 mos. before screening ↓.	As % Aboriginal ↑, the % children who saw an eye doctor 4 mos. after screening ↓.	As % Aboriginal ↑, the % children who saw an eye doctor 12 mos. after screening ↓.
Visible Minorities, % Total Pop.	Not significantly related.	Not significantly related.	As % Visible Minorities ↑, the % children who saw an eye doctor 4 mos. after screening also ↑.	As % Visible Minorities ↑, the % children who saw an eye doctor 12 mos. after screening also ↑.

Regional Variables	*Kindergarten Vision Referral Rate*	*Seen 6 Months Before Screeening*	*Seen 4 Months After Screeening*	*Seen 12 Months After Screeening*
Interior (31 LHAs)	IHA's kindergarten vision referral rate was significantly higher than the provincial avg,	A significantly higher % of children in the Interior saw an eye doctor 6 months before screening compared to the provincial avg.	Not significantly different from BC avg., with the exception of 2007/08 (lower eye doctor visitation rate than provincial avg.)	Not significantly different from BC avg.
Fraser (13 LHAs)	Not significantly different from BC avg.	Not significantly different from BC avg.	A significantly greater % of children from Fraser saw an eye doctor 4 months after screening compared to the provincial avg.	Not significantly different from BC avg., with the exception of 2009/10 (higher eye doctor visitation rate than provincial avg.)
Vancouver Coastal (15 LHAs)	Not significantly different from BC avg.	Not significantly different from BC avg.	A significantly greater % of children from VCHA saw an eye doctor 4 months after screening compared to the provincial avg.	A significantly greater % of children from VCHA saw an eye doctor 12 months after screening compared to the provincial avg.
Vancouver Island (14 LHAs)	Not significantly different from BC avg.	Not significantly different from BC avg.	Not significantly different from BC avg.	Not significantly different from BC avg.
Northern (17 LHAs)	Not significantly different from BC avg.	A significantly lower % of children from NHA saw an eye doctor 6 months before screening compared to the provincial avg.	A significantly lower % of children from NHA saw an eye doctor 4 months after screening compared to the provincial avg.	A significantly lower % of children from NHA saw an eye doctor 12 months after screening compared to the provincial avg.

REFERENCES

Access Economics Pty Limited. *The Cost of Vision Loss in Canada*. CNIB and the Canadian Ophthalmological Society, 2009.

Adams, G.G.W., and M. Karas. "Effect of Amblyopia on Employment Prospects." *The British Journal of Ophthalmology* 83, no. 3 (1999): 378–378.

Adhikari, S., and U. Shrestha. "Validation of Performance of Certified Medical Assistants in Preschool Vision Screening Examination." *Nepalese Journal of Ophthalmology: A Biannual Peer-Reviewed Academic Journal of the Nepal Ophthalmic Society: NEPJOPH* 3, no. 6 (July 2011): 128–133.

American Academy of Ophthalmology, Pediatric Ophthalmology/Strabismus Panel. *Preferred Practice Pattern Guidelines*. San Francisco, CA: American Academy of Ophthalmology, 2007. Available at: http://www.aao.org/ppp.

American Optometric Association Community Health Center Committee, Michelle Proser, and Peter Shin. "The Role of Community Health Centers in Responding to Disparities in Visual Health." *Optometry - Journal of the American Optometric Association* 79, no. 10 (2008): 564–575.

Atkinson, Donna L. *Preschool Vision Screening and Aboriginal Eye Health: An Environmental Scan and Literature Review*. Prince George, BC: National Collaborating Centre for Aboriginal Health, the University of Northern British Columbia, 2007.

Atkinson, Jeanette, Shirley Anker, Marko Nardini, Oliver Braddick, Clare Hughes, Sarah Rae, John Wattam-Bell, and Sue Atkinson. "Infant Vision Screening Predicts Failures on Motor and Cognitive Tests up to School Age." *Strabismus* 10, no. 3 (2002): 187–198.

Atkinson, Jeanette, Oliver Braddick, Marko Nardini, and Shirley Anker. "Infant Hyperopia: Detection, Distribution, Changes and Correlates-outcomes from the Cambridge Infant Screening Programs." *Optometry and Vision Science* 84, no. 2 (2007): 84–96.

Atkinson, Jeanette, Marko Nardini, Shirley Anker, Oliver Braddick, Clare Hughes, and Sarah Rae. "Refractive Errors in Infancy Predict Reduced Performance on the Movement Assessment Battery for Children at 3 1/2 and 5 1/2 Years." *Developmental Medicine & Child Neurology* 47, no. 4 (2005): 243–251.

Bassett, K., and I. Forbes. *Vision Screening for Strabismus and Amblyopia: a Critical Appraisal of the Evidence*. Vancouver, BC: BC Office of Health Technology Assessment, April 1995.

BC Ministry of Health. *Provincial Vision Screening Training Manual*. Victoria, BC: BC Ministry of Health, 2008.

Bowen, Sarah. *Language Barriers in Access to Health Care*. Ottawa: Health Canada, 2001.

Bradley, Lorie J., and Mary Lou Riederer. "The Vision First Check Program in British Columbia: a Preschool Vision Screening Program for Children Age Two and Age Three." *Can.J.Public Health* 91, no. 4 (July 2000): 252–255.

Buhrmann, Ralf, Andrew Toren, William Hodge, Alison Eyre, Michele Martin, Walter Delpero, Robert Laroche, Kevin Pottie, and Canadian Collaboration for Immigrant and Refugee Health. "Appendix 17: Vision Health: Evidence Review for Newly Arriving Immigrants and Refugees." *Cmaj* 6, no. 7 (2010): 1–10.

C. Green Health Info. *A Review of the Science Underlying Preschool Vision Screening with Implications for BC*. Victoria, BC: Healthy Children, Women, and Seniors, BC Ministry of Health Services, 2005.

Castanes, M.S. "Major Review: The Underutilization of Vision Screening (for Amblyopia, Optical Anomalies and Strabismus) Among Preschool Age Children." *Binocul.Vis.Strabismus* Q. 18, no. 4 (2003): 217–232.

Centers for Disease Control and Prevention. *Improving the Nation's Vision Health: A Coordinated Public Health Approach*. Atlanta, GA: CDC Centers for Disease Control and Prevention, 2007. http://www.visionandhealth.org/documents/ReportImprovingtheNationsVisionHealth.pdf.

Chou, R., T. Dana, and C. Bougatsos. "Screening for Visual Impairment in Children Ages 1-5 Years: Update for the USPSTF." *Pediatrics* (2011): peds–2010.

Chua, B., and P. Mitchell. "Consequences of Amblyopia on Education, Occupation, and Long Term Vision Loss." *British Journal of Ophthalmology* 88, no. 9 (2004): 1119 –1121.

Ciner, Elise B., Paulette Schmidt, Deborah Orel-Bixler, Velma Dobson, Maureen Maguire, Lynn Cyert, Bruce Moore, and Janet Schultz. "Vision Screening of Preschool Children: Evaluating the Past, Looking Toward the Future." *Optometry and Vision Science 75*, no. 8 (1998): 571–584.

Colburn, D.D., D.G. Morrison, R.L. Estes, C. Li, P.C. Lu, and S.P. Donahue. "Longitudinal Follow-up of Hypermetropic Children Identified During Preschool Vision Screening." *Journal of American Association for Pediatric Ophthalmology and Strabismus* 14, no. 3 (2010): 211–215.

Community Paediatrics Committee, Canadian Paediatric Society. "Vision Screening in Infants, Children and Youth." *Paediatrics & Child Health* 14, no. 4 (2009): 246–248.

Cools, G., A.C. Houtman, W. Spileers, E. Van Kerschaver, and I. Casteels. "Literature Review on Preschool Vision Screening." *Bulletin De La Société Belge d'Ophtalmologie* 313 (2009): 49–64.

Davidson, S., and G.E. Quinn. "The Impact of Pediatric Vision Disorders in Adulthood." *Pediatrics* (2011): peds.2010–1911.

Drover, James R., Patrick G. Kean, Mary L. Courage, and Russell J. Adams. "Prevalence of Amblyopia and Other Vision Disorders in Young Newfoundland and Labrador Children." *Canadian Journal of Ophthalmology* 43, no. 1 (2008): 89–94.

Dunfield, L., and T. Keating. *Preschool Vision Screening*. Technology Report. Ottawa, ON: Canadian Agency for Drugs and Technologies in Health, 2007.

Dunfield, Lesley, and Tamara Keating. *Preschool Vision Screening*. Ottawa: Canadian Agency for Drugs and Technologies in Health, 2007.

Ethan, D., and C.E. Basch. "Promoting Healthy Vision in Students: Progress and Challenges in Policy, Programs, and Research." *Journal of School Health* 78, no. 8 (2008): 411–416.

Goldstand, S., K.C. Koslowe, and S. Parush. "Vision, Visual-information Processing, and Academic Performance Among Seventh-grade Schoolchildren: A More Significant Relationship Than We Thought?" *The American Journal of Occupational Therapy* 59, no. 4 (2005): 377 –389.

Government of British Columbia. "Healthy Kids Program", 2010. http://www.eia.gov.bc.ca/publicat/bcea/HealthyKids.htm.

Harris, Russell, George F. Sawaya, Virginia A. Moyer, and Ned Calonge. "Reconsidering the Criteria for Evaluating Proposed Screening Programs: Reflections From 4 Current and Former Members of the U.S. Preventive Services Task Force." *Epidemiologic Reviews* 33, no. 1 (July 1, 2011): 20 –35.

Hartmann, E.E., V. Dobson, L. Hainline, W. Marsh-Tootle, G.E. Quinn, M.S. Ruttum, P.P. Schmidt, and K. Simons. "Preschool Vision Screening: Summary of a Task Force Report. Behalf of the Maternal and Child Health Bureau and the National Eye Institute Task Force on Vision Screening in the Preschool Child." *Pediatrics* 106, no. 5 (November 2000): 1105–1116.

Hertzman, Clyde. *Leave No Child Behind! Social Exclusion and Child Development*. Vancouver, BC: University of British Columbia, 2002. http://www.cccabc.bc.ca/res/pubs/pdf/hertzman.pdf.

Houwen, S., C. Visscher, K. Lemmink, and E. Hartman. "Motor Skill Performance of Children and Adolescents with Visual Impairments: A Review." *Exceptional Children* 75, no. 4 (2009): 464–492.

Human Early Learning Partnership, Early Childhood Screening Research and Evaluation Unit. *BC Early Childhood Vision Screening Program: Evaluation Framework Overview*. Vancouver, BC: University of British Columbia, 2009.

———. *Staff Experience Questionnaire for Vision Screening Programs, 2007/2008 Results*. Vancouver, BC: University of British Columbia, 2008.

———. *Staff Experience Questionnaire for Vision Screening Programs, 2008/2009 Results*. Vancouver, BC: University of British Columbia, 2009.

Ibironke, J.O., D.S. Friedman, M.X. Repka, J. Katz, L. Giordano, P. Hawse, and J.M. Tielsch. "Child Development and Refractive Errors in Preschool Children." *Optometry and Vision Science* 88, no. 2 (2011): 181–187.

Jacobs, E.A., D.S. Shepard, J.A. Suaya, and Esta-Lee Stone. "Overcoming Language Barriers in Health Care: Costs and Benefits of Interpreter Services." *Am J Public Health* 94, no. 5 (2004): 866–869.

Kang, R. "Building Community Capacity for Health Promotion: A Challenge for Public Health Nurses." *Public Health Nursing (Boston, Mass.)* 12, no. 5 (1995): 312–318.

Kemper, Alex R., and Sarah J. Clark. "Preschool Vision Screening by Family Physicians." *Journal of Pediatric Ophthalmology and Strabismus* 44, no. 1 (2007): 24.

———. "Preschool Vision Screening in Pediatric Practices." *Clinical Pediatrics* 45, no. 3 (2006): 263–266.

Kemper, Alex R., Lisa M. Cohn, and Kevin J. Dombkowski. "Patterns of Vision Care Among Medicaid-enrolled Children." *Pediatrics* 113, no. 3 Pt 1 (2004): e190–196.

Kemper, Alex R., Kathryn E. Fant, and J. Thomas Badgett. "Preschool Vision Screening in Primary Care After a Legislative Mandate for Diagnostic Eye Examinations." *Southern Medical Journal* 96, no. 9 (2003): 859–862.

Kemper, Alex R., Kathryn E. Fant, and Sarah J. Clark. "Informing Parents About Newborn Screening." *Public Health Nursing* 22, no. 4 (2005): 332–338.

Kemper, Alex R., Lisa M. Keating, Jorie L. Jackson, and Erika M. Levin. "Comparison of Monocular Autorefraction to Comprehensive Eye Examinations in Preschool-aged and Younger Children." *Archives of Pediatrics & Adolescent Medicine* 159, no. 5 (May 1, 2005): 435.

Kemper, Alex R., Rebecca L. Uren, and Sarah J. Clark. "Barriers to Follow-up Eye Care After Preschool Vision Screening in the Primary Care Setting: Findings from a Pilot Study." *Journal of American Association for Pediatric Ophthalmology and Strabismus* 10, no. 5 (2006): 476–478.

Kimel, L. S. "Lack of Follow-up Exams After Failed School Vision Screenings: An Investigation of Contributing Factors." *The Journal of School Nursing* 22, no. 3 (2006): 156.

King, T. M., S. D. Tandon, M. M. Macias, J. A. Healy, P. M. Duncan, N. L. Swigonski, S. M. Skipper, and P. H. Lipkin. "Implementing Developmental Screening and Referrals: Lessons Learned from a National Project." *Pediatrics* 125, no. 2 (2010): 350–360.

Kornder, L.D., J.N. Nursey, J.A. Pratt-Johnson, and A. Beattie. "Detection of Manifest Strabismus in Young Children. 2. A Retrospective Study." *Am.J.Ophthalmol.* 77, no. 2 (February 1974): 211–214.

Krumholtz, I. "Results from a Pediatric Vision Screening and Its Ability to Predict Academic Performance." *Optometry* 71, no. 7 (2000): 426–430.

Kulp, M.T., and P.P. Schmidt. "Visual Predictors of Reading Performance in Kindergarten and First Grade Children." *Optometry and Vision Science* 73, no. 4 (1996): 255–262.

van Leeuwen, R., M.J.C. Eijkemans, J.R. Vingerling, A. Hofman, P. de Jong, and H.J. Simonsz. "Risk of Bilateral Visual Impairment in Individuals with Amblyopia: The Rotterdam Study." *British Journal of Ophthalmology* 91, no. 11 (2007): 1450 –1451.

Majeed, M., C. Williams, K. Northstone, and Y. Ben-Shlomo. "Are There Inequities in the Utilisation of Childhood Eye-care Services in Relation to Socio-economic Status? Evidence from the ALSPAC Cohort." *British Journal of Ophthalmology* 92, no. 7 (2008): 965 –969.

Maples, W.C. "Visual Factors That Significantly Impact Academic Performance." *Optometry* 74, no. 1 (2003): 35–49.

Mark, Hayley, and Tami Mark. "Parental Reasons for Non-response Following a Referral in School Vision Screening." *Journal of School Health* 69, no. 1 (1999): 35–38.

Marshall, E.C., R.E. Meetz, and L.L. Harmon. "Through Our Children's eyes--The Public Health Impact of the Vision Screening Requirements for Indiana School Children." *Optometry - Journal of the American Optometric Association* 81, no. 2 (2010): 71–82.

Mathers, M., M. Keyes, and M. Wright. "A Review of the Evidence on the Effectiveness of Children's Vision Screening." *Child: Care, Health and Development* 36, no. 6 (2010): 756–780.

Ministry of Health Living and Sport, Women's Healthy Living Secretariat. *Vision Screening Pilots for Three-Year-Olds 2008 and 2009 Provincial Summary Report*. Victoria, BC: Ministry of Healthy Living and Sport, 2009.

Muzychka, Martha. *Environmental Scan of Vision Health and Vision Loss in the Provinces and Territories of Canada*. Toronto, ON: National Coalition for Vision Health, 2009.

Owen, John. *Program Evaluation: Forms and Approaches*. 3rd ed. New York: Guilford Press, 2007.

Patton, Michael. *Utilization-focused Evaluation*. 4th ed. Thousand Oaks, CA: Sage Publications, 2008.

Preslan, M.W., and A. Novak. "Baltimore Vision Screening Project: Phase 2." *Ophthalmology* 105, no. 1 (1998): 150–153.

Proctor, S.E. "Health Screenings and Referrals." *NASN School Nurse* 24, no. 1 (2009): 13–15.

Reed, Maureen J., and Stephen P. Kraft. "Vision Health Care Providers' Attitudes and Experiences with Preschool Vision Screening in Ontario." *Optometry & Vision Science* 81, no. 7 (2004): 548.

Robinson, B., W. R. Bobier, E. Martin, and L. Bryant. "Measurement of the Validity of a Preschool Vision Screening Program." *American Journal of Public Health* 89, no. 2 (February 1999): 193–198.

Robinson, B., W.R. Bobier, E. Martin, and L. Bryant. "Measurement of the Validity of a Preschool Vision Screening Program." *Am.J.Public Health* 89, no. 2 (February 1999): 193–198.

Roch-Levecq, A., B.L. Brody, R.G. Thomas, and S.I. Brown. "Ametropia, Preschoolers' Cognitive Abilities, and Effects of Spectacle Correction." *Arch Ophthalmol* 126, no. 2 (2008): 252–258.

Rogers, David L., Daniel E. Neely, Janice B. Chapman, David A. Plager, Derek T. Sprunger, Naval Sondhi, Gavin J. Roberts, and Susan Ofner. "Comparison of the MTI Photoscreener and the Welch-Allyn SureSight™ Autorefractor in a Tertiary Care Center." *Journal of American Association for Pediatric Ophthalmology and Strabismus* 12, no. 1 (February 2008): 77–82.

Ross, E., AL Murray, and S. Stead. "Prevalence of Ambylopia in Grade 1 Schoolchildren in Saskatoon." *Canadian Journal of Public Health. Revue Canadienne De Santé Publique* 68, no. 6 (1977): 491.

Roussos, S.T., and S.B. Fawcett. "A Review of Collaborative Partnerships as a Strategy for Improving Community Health." *Annual Review of Public Health* 21, no. 1 (2000): 369–402.

Schmidt, Paulette, Maureen Maguire, Velma Dobson, Graham Quinn, Elise Ciner, Lynn Cyert, Marjean Taylor Kulp, et al. "Comparison of Preschool Vision Screening Tests as Administered by Licensed Eye Care Professionals in the Vision In Preschoolers Study." *Ophthalmology* 111, no. 4 (April 2004): 637–650.

Schroeder, J., J. Harvey, N. Razaz-Rahmati, G. Corless, J. Negreiros, L. Ford, P. Kershaw, et al. *Creating Communities for Young Children: A Toolkit for Change*. Vancouver, BC: Human Early Learning Partnership, 2009.

Shin, H.S., S.C. Park, and C.M. Park. "Relationship Between Accommodative and Vergence Dysfunctions and Academic Achievement for Primary School Children." *Ophthalmic and Physiological Optics* 29, no. 6 (2009): 615–624.

Shortell, S.M., A.P. Zukoski, J.A. Alexander, G.J. Bazzoli, D.A. Conrad, R. Hasnain-Wynia, S. Sofaer, B.Y. Chan, E. Casey, and F.S. Margolin. "Evaluating Partnerships for Community Health Improvement: Tracking the Footprints." *Journal of Health Politics Policy and Law* 27, no. 1 (2002): 49–92.

Smith, L.K., J.R. Thompson, G. Woodruff, and F. Hiscox. "Factors Affecting Treatment Compliance in Amblyopia." *J.Pediatr.Ophthalmol.Strabismus* 32, no. 2 (1995): 98–101.

Statistics Canada. "Aboriginal Identity", August 20, 2007. http://www12.statcan.ca/census-recensement/2006/ref/dict/pop001-eng.cfm.

Stifter, E., G. Burggasser, E. Hirmann, A. Thaler, and W. Radner. "Monocular and Binocular Reading Performance in Children with Microstrabismic Amblyopia." *British Journal of Ophthalmology* 89, no. 10 (2005): 1324 –1329.

Strong, K., N Wald, A Miller, A Alwan, and On behalf of the WHO Consultation Group. "Current Concepts in Screening for Noncommunicable Disease: World Health Organization Consultation Group Report on Methodology of Noncommunicable Disease Screening." *Journal of Medical Screening* 12, no. 1 (March 1, 2005): 12 –19.

Teed, R.G., C.M. Bui, D.G. Morrison, R.L. Estes, and S.P. Donahue. "Amblyopia Therapy in Children Identified by Photoscreening." *Ophthalmology* 117, no. 1 (2010): 159–162.

Webber, A.L., J.M. Wood, G.A. Gole, and B. Brown. "The Effect of Amblyopia on Fine Motor Skills in Children." *Investigative Ophthalmology & Visual Science* 49, no. 2 (2008): 594 –603.

Welch Allyn, Inc. *Welch Allyn SureSight*. Skaneateles Falls, NY: Welch Allyn, Inc., n.d. http://www.schoolhealth.com/text/pdf/52316_Users_Manual.pdf.

Williams, W.R., A.H.A. Latif, L. Hannington, and D.R. Watkins. "Hyperopia and Educational Attainment in a Primary School Cohort." *Archives of Disease in Childhood* 90, no. 2 (2005): 150 –153.

Williamson, T.H., R. Andrews, G.N. Dutton, G. Murray, and N. Graham. "Assessment of an Inner City Visual Screening Programme for Preschool Children." *Br.J.Ophthalmol.* 79, no. 12 (1995): 1068–1073.

Wilson, J.M.G., and G. Jungner. *Principles and Practice of Screening for Disease. Public Health Paper No. 34*. Geneva: World Health Organization, 1968. http://whqlibdoc.who.int/php/WHO_PHP_34.pdf.

Wolfenden, L., K. Kypri, M. Freund, and R. Hodder. "Obtaining Active Parental Consent for School-based Research: a Guide for Researchers." *Australian and New Zealand Journal of Public Health* 33, no. 3 (2009): 270–275.

Yawn, B.P., M. Kurland, L. Butterfield, and B. Johnson. "Barriers to Seeking Care Following School Vision Screening in Rochester, Minnesota." *J.Sch Health* 68, no. 8 (1998): 319–324.

Yu, S.M., R.M. Nyman, M.D. Kogan, Z.J. Huang, and R.H. Schwalberg. "Parent's Language of Interview and Access to Care for Children with Special Health Care Needs." *Ambulatory Pediatrics* 4, no. 2 (2004): 181–187.