Evaluation of BC Early Childhood Dental Programs

FINAL REPORT
This document was prepared for the Early Childhood Dental Evaluation Subcommittee by the Human Early Learning Partnership’s Early Childhood Screening Research and Evaluation Unit at the University of British Columbia.

July, 2011

**Principal Investigator**
Brenda Poon

**Co-Principal Investigator**
Clyde Hertzman

**Research and Evaluation Manager**
Paul Holley

**Research and Evaluation Coordinator**
Amber Louie

**Research Assistants**
Deborah Heard, Declan Hsu, Allyson Rayner
Celina Vergel de Dios

**Data Analyst**
Anna Krasnova

**Spatial Data Analyst and Cartographer**
Anthony Smith
Contents

i ABOUT THE EVALUATION TEAM

ii ABOUT THE HUMAN EARLY LEARNING PARTNERSHIP

iii BACKGROUND AND OVERVIEW

1 EARLY CHILDHOOD CARIES AND BC EARLY CHILDHOOD DENTAL PROGRAMS

5 BC EARLY CHILDHOOD DENTAL PROGRAMS LOGIC MODEL

7 EVALUATION MEASURES AND METHODS
   7 Defining and Measuring Early Childhood Caries
   8 The Kindergarten Dental Survey in British Columbia: A Brief Overview
   9 Environmental Scan
   10 Focus Groups with Public Health Dental Staff
   11 Provincial and Regional Mapping

12 EVALUATION FINDINGS

13 EARLY CHILDHOOD DENTAL HEALTH SURVEILLANCE
   13 1. Is the oral health of young children improving? By community? By vulnerability?
      14 Early Childhood Caries in British Columbia’s Health Authorities and Health Regions
      17 Early Childhood Caries by School District and HELP Neighbourhoods
      22 Socioeconomic Influences of Early Childhood Oral Health in British Columbia
      29 On- and Off-Diagonals
      31 Visible Dental Decay Rates and Early Child Development Indicators
      33 Summary

34 RISK ASSESSMENT
   34 2. Are the current dental health risk assessment/screen guidelines implemented as intended?
   34 2i. What standardized dental health risk assessment tool/questions should be used with children aged 0-5 (including kindergarten entry) in BC?
   35 2ii. At what age(s) should these be administered?
   35 2iii. Who should administer the dental health risk assessment?
   36 2iv. What guidelines and follow-up procedures should be used?
   37 2v. To what extent does the dental health risk assessment/screening reach young children?
   38 2vi. To what extent does the program identify a broad spectrum of children at risk for caries?
   38 2vii. For those eligible children who dental public health is not reaching, what are the barriers?
   41 Summary
42 HEALTH PROMOTION AND PREVENTIVE STRATEGIES

42. Are health promotion interventions effective in supporting family dental health practices toward reducing early childhood caries?

43 BUILDING PARTNERSHIPS

43. What strategies are used in the health authorities to prevent early childhood dental disease? What is the most effective combination of strategies being provided in the health authorities to prevent early childhood dental disease?

46. What are the most effective combinations of strategies being used to reduce early childhood caries?

47 Summary

48 GENERAL THEMES

52 STRENGTHS AND LIMITATIONS OF THE EVALUATION PROCESS

52. Strengths
54. Limitations

55 RECOMMENDATIONS

58 REFERENCES

63 APPENDIX A: Evaluation Matrix

65 APPENDIX B: List of Evaluation Reports, Documents & Maps

67 APPENDIX C: Summary of Selected Studies Utilizing the Basic Screening Survey

68 APPENDIX D: Methodological Notes

72 APPENDIX E: HELP SES Scales and Subscales

74 APPENDIX F: Key Messages in Oral Health-related Public Health Handouts

List of figures

3. Figure 1. BC Early Childhood Dental Health Programs
6. Figure 2. 2007 BC Early Childhood Dental Program Logic Model
10. Figure 3. BC Kindergarten Dental Survey Coverage by Health Authority
16. Figure 4. Kindergarten Dental Health Outcomes by Health Authority
19. Figure 5.1. Map of British Columbia Depicting the Percentage of Kindergarten Students Identified as Having Visible Dental Decay in 2009/10 by School District
21. Figure 5.2. Tsawwassen North (VCHA)
21. Figure 5.3 Sun Valley (FHA)
21. Figure 5.4 Rockland (VIHA)
21. Figure 5.5 Dawson Creek (NHA)
23. Figure 6. SES and Demographic Measures for Province and Health Authorities
25. Figure 7. Visible Dental Decay Rates by HELP SES Percentile
Contents continued ...

List of tables

9 Table 1. BC Kindergarten Dental Survey Coverage for Health Regions by Survey Year
15 Table 2.1. Kindergarten Dental Health Outcomes by Survey Year for Health Regions
16 Table 2.2. Kindergarten Dental Health Outcomes and Number of Kindergarten Students Surveyed in 2006/07
17 Table 2.3. Kindergarten Dental Health Outcomes and Number of Kindergarten Students Surveyed in 2009/10 by Health Region
18 Table 2.4. Change in Kindergarten Dental Health Outcomes and Number of Kindergarten Students Affected by Health Region
20 Table 3.1. Neighbourhoods With a 25% or Greater Change in % Visible Dental Decay Between Survey Years
20 Table 3.2. School Districts with Consistent Visible Dental Decay Rates Across Survey Years
22 Table 4. Socioeconomic Status (SES) and Demographic Information for Province and HAs
24 Table 5. Visible Dental Decay (Code 02 + 03) Rates by Neighbourhood Socioeconomic Status (based on overall HELP SES Index)
24 Table 6.1. Correlations between Subcommittee SES/Demographic Measures and % Visible Dental Decay (Code 02 + 03)
25 Table 6.2. Correlations between HELP SES Index and Subcomponents and % Visible Dental Decay (Code 02 + 03)
26 Table 7.1. Regression Analysis for SES (Subcommittee) and % Visible Dental Decay (Code 02 + 03)
27 Table 7.2. Regression Analysis for SES (HELP) and % Visible Dental Decay (Code 02 + 03)
28 Table 8.1. Subcommittee SES/Demographic Importance Scores in Predicting the % Visible Dental Decay (Code 02 + 03)
29 Table 8.2. HELP SES Index and Component Importance Scores in Predicting the % Visible Dental Decay (Code 02 + 03)
30 Table 9. Summary of Neighbourhood On/Off-Diagonals (SES→Dental)
30 Table 10. Neighbourhood Off-Diagonals (SES→Dental)
31 Table 11. EDI (Wave 3) Vulnerability Rates (%) for Province and HAs
32 Table 12. Correlations between EDI Vulnerability Rates (Wave 3) and % Visible Dental Decay (Code 02 + 03)
32 Table 13. Regression Analysis for % Visible Dental Decay (Code 02 + 03) and EDI Vulnerability Rates (Wave 3)
ABOUT THE EVALUATION TEAM

Brenda Poon, Principal Investigator, is an Assistant Professor at the Human Early Learning Partnership (HELP), College for Interdisciplinary Studies at UBC, and an Associate faculty member in the School of Population and Public Health at UBC.

Clyde Hertzman, Co-Principal Investigator, is Director of HELP, College for Interdisciplinary Studies at UBC; 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 and adolescent drug and violence 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 four Research Assistants, one data analyst and a data analyst/cartographer. The four research assistants are Declan Hsu (BA), Celina Vergel de Dios (MA), Deborah Heard (BA&Sc), and Allyson Rayner (MA), 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 British Columbia 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, British Columbia’s Ministry of Health (MoH) established a province-wide goal in relation to early childhood dental health: 60% of British Columbia’s kindergarten population will have “no visible decay experience.” In other words, three out of five kindergarten children in BC whose dental health was checked through a standardized public health visual dental survey tool will be “caries-free.”

To determine progress toward this provincial goal, the MoH approached the Human Early Learning Partnership (HELP) at the University of British Columbia (UBC) in 2006 to conduct a systematic four-year evaluation of the BC Early Childhood Dental Programs. The stated purpose of the evaluation is to assess the effectiveness of existing BC Early Childhood Dental Programs to improve the dental health of children in BC. As a leader in population-based early child development research in British Columbia, HELP was well positioned to investigate BC’s early childhood dental programs in relation to the development of children over time, along with factors that can promote or undermine healthy child development. HELP also enhanced the project with the ability to draw linkages between dental outcomes and neighbourhood level data in regards to school readiness as measured by the Early Development Instrument (EDI).

In April 2007, a Dental Evaluation Subcommittee was formed to provide recommendations for the development and implementation of the evaluation plan for BC’s early childhood dental programs. The Subcommittee is comprised of representatives from each of the province’s five regional health authorities, the Ministry of Health, BC Initiatives and the National Collaborating Centre for Aboriginal Health, and the HELP evaluation team from UBC. Other individuals and organizations were also consulted on an ad hoc basis to enhance the diversity of experience and expertise in the group. 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 Health Authorities and across various stakeholders.

The Subcommittee met regularly to develop an evaluation framework to guide the four-year project1. Four overarching evaluation questions were established:

1. Is the oral health of young children improving? By community? By vulnerability?
2. Are the current dental health risk assessment/screen guidelines implemented as intended (i.e., appropriate referrals by public health nurses)? What standardized dental health risk assessment tool/questions should be used with children aged 0-5 (including kindergarten entry) in BC? At what age(s) should these be administered? Who should administer the dental health risk assessment? What guidelines and follow-up should be used? To what extent does the dental health risk assessment/screening reach young children? To what extent does the program identify a broad spectrum of children at risk for caries? For those eligible children who dental public health is not reaching, what are the barriers?

---

3. How effective are health promotion interventions (e.g., key messages) in supporting family dental health practices toward reducing early childhood?

4. What strategies are used in the health authorities to prevent early childhood dental disease? What is the most effective combination of strategies being provided in the health authorities to prevent early childhood dental disease?

To guide data collection and analyses and to ensure that the evaluation process remained focused on the four evaluation questions above, an evaluation matrix was developed at the outset of the project (see Appendix A). The matrix defined and linked the dental issues pertinent to the evaluation with the following: 1) evaluation questions, 2) key outcome measures and data sources, and 3) a timeline. The matrix was completed in collaboration with the Ministry of Health and regional health authorities, and was a key tool in understanding each partner’s roles and responsibilities.

The report presented herein responds to each of the four evaluation questions through a synthesis of qualitative and quantitative findings that were generated over the course of the four-year evaluation project (see Appendix B for a list of evaluation reports and documents).

The report begins with a brief overview of selected research related to early childhood caries as well as the BC Early Childhood Dental Programs. A summary of the data and methodologies used in the evaluation process is followed by a presentation of the evaluation findings. The evaluation findings have been organized in this report according to the four overarching evaluation questions and, more broadly, into the following four main categories: surveillance, risk assessment, health promotion and prevention strategies, and building partnerships.

The focus of the surveillance section is a presentation of selected findings from the analysis of the 2006/07 and 2009/10 Kindergarten Dental Surveys. Results are presented for the province, health authorities, and health service delivery areas in relation to socioeconomic status, demographics factors and early child development. Following this discussion of dental health surveillance, is a review of the results drawn from the province-wide focus groups. These qualitative findings are first presented in relation to risk assessments and their guidelines, respective tools, recommended tools, follow-up procedures and program reach. Results are presented in terms of current procedures and recommended procedures. A brief discussion is then presented on health promotion strategies and dental health, followed by an exploration of partnership building as an effective strategy for preventing dental decay. The report concludes with an overview of the key themes that have emerged from the data and four broad recommendations for consideration with respect to the BC Early Childhood Dental Programs.
EARLY CHILDHOOD CARIES AND BC EARLY CHILDHOOD DENTAL PROGRAMS

Dental health is essential to the health of the population as it has far-reaching implications for children and adults. In adulthood, for instance, poor oral health can negatively impact potential job opportunities, public speaking, and other social interactions. Among children, Early Childhood Caries (ECC), a term used to describe tooth decay found in children 71 months and younger, is the most common chronic disease – five times more prevalent than asthma and twenty times more prevalent than diabetes. Early childhood caries is an infectious disease involving a combination of factors, including social, behavioral, microbiologic, environmental, and clinical factors. The disease occurs worldwide, afflicting predominantly disadvantaged children. Four cohort studies have shown that children with previous caries experience are at elevated risk for future caries.

In studies of children under the age of 6, dental decay or early childhood caries has been linked to embarrassment, increased irritability, and fewer social interactions. Dental decay is also related to a child’s subsequent health and emotional development. Among children aged 4 to 15, caries has been significantly associated with adverse affects on smiling, self-confidence and emotional well-being.

Research has also found that dental decay affects the quality of life for children, including children from affluent families, with lower overall happiness for children experiencing dental decay.

While there are many potential causes of early childhood caries, one of the most important factors is socioeconomic status (SES), which is used to describe the social and economic wellbeing of a child’s family, neighbourhood and school.

The relationship between SES and ECC appears to be consistent across multiple measures of SES, including Townsend” and Jarman’s SES scores, which relate to neighbourhood-level characteristics such as unemployment, homeownership, households with children under 5 years, single parent families, and first generation citizens. The relationship between SES and dental health also holds strong across individual-level measures such as educational attainment, ethnicity and household income (based on the US National Health and Nutrition Examination Survey).

In BC, a large number of children experience dental decay before kindergarten and require immediate treatment. Due to challenges in providing dental treatment for young children (e.g., levels of child fear and cooperation during dental visits), such treatment often involves the use of general anesthetic services in hospital settings. In 2002, results from the public health visual dental survey indicated that 41 percent of children surveyed in BC had experienced some form of dental caries by the time they reached kindergarten. This is consistent with findings related to early child development outcomes in BC indicating that a high proportion (one-quarter) of young children in the province was developmentally at-risk or vulnerable in 2001-2004.

While childhood tooth decay is common, it is also preventable; the disease is multifactorial in nature but the extent or number of teeth affected can be influenced by preventive measures. Early intervention programs are an important element of dental public health service delivery as they seek to increase the potential for children to remain disease free. Due to its impact on health and the inequities in access to regular preventive and restorative dental care, the prevention of dental diseases is a core function of public health in BC, and dental health is recognized as one of the core programs for public health services across the province. The Model Core Program Paper for Dental Public Health (2006) provides direction for public health prevention services in BC, identifying three core functions for the delivery of dental public health programs:

1. Dental health promotion.
2. Prevention of dental disease, with a focus on prevention of childhood dental diseases.

In order to improve the dental health status of young children, the BC Early Childhood Dental Programs aim to: (a) provide universal access to early assessment for children under age six and (b) identify children needing dental treatment (see Figure 1).

### Dental Health Risk Assessment

Assessments are completed to determine risk for early childhood dental decay. Questions typically relate to dentist visits, sibling/parent dental decay, tooth brushing, use of fluoride toothpaste, feeding practices, and barriers to access.

Assessment may include:

- 1-to-1 education to parents emphasizing key messages related to: dentist visits, signs of decay, tooth brushing, use of fluoride toothpaste, feeding practices, and low-cost treatment options.
- Dental and nutrition handouts and toothbrushes (as available).
- Referral for additional assessment and dentist as appropriate.
- Referral to Fluoride Varnish Program (see below) for children at high risk of dental decay.

### Fluoride Varnish Program

Dental staff provide fluoride varnish to children aged five and under that have been assessed at high risk for dental decay. The varnish takes just a few minutes to put on the teeth, and can help prevent tooth decay from starting and slow the progression of existing decay. Applications are typically done in one to four short appointments, but there may be up to six applications depending on the child’s needs. Fluoride varnish applications are provided along with a risk assessment and one-to-one education with the parent(s) and/or guardian(s).

### Kindergarten Dental Survey

Dental staff use a small light and tongue depressor to perform the survey on Kindergarten students, in order to:

- Identify dental health problems in children;
- Collect data to identify provincial trends in dental health;
- Determine the prevalence of dental decay in BC; and
- Identify cases for referral and, in some regions, facilitate access to treatment (when required).

---

26 Information in the above figure is representative of BC early childhood dental programs as of 2008 (adapted from Figure 1 in the report ‘Dental Health of BC Children in Relation to Social Determinants and Early Child Development: Analysis and Mapping of the 2006/07 British Columbia Kindergarten Dental Survey.’)
Figure 1 above provides information about the various programs and services that comprise BC's Early Childhood Dental Programs. At the regional level, dental public health programs can be delivered in various ways to meet unique needs within each health authority.

The Dental Health Risk Assessment Programs involve assessment of young children as well as children in vulnerable populations. The assessment, often referred to as a Caries Risk Assessment (CRA), provides dental program staff with opportunities to provide preventive education to families. The risk assessment typically involves parents and families completing an assessment related to early identification of caries, appropriate oral health practices, and access to services. If deemed appropriate, program staff refer families to the fluoride varnish program or to the dentist for diagnosis and treatment.

The BC Kindergarten Dental Survey (formerly known as the BC School Dental Screening Program) was introduced in 1990. Under the Public Health Dental Program, registered Dental Hygienists and Certified Dental Assistants perform a visual check for dental decay in kindergarten children between the ages of 4 and 6. It is important to note that this check does not replace a regular dental exam. The purpose of the survey is to determine the prevalence of obvious or visible dental decay, to identify trends in dental health, and where possible, to obtain a measure of the effectiveness of early childhood prevention activities on this multifactorial disease. The survey has also been used in some regions to identify cases for referral and facilitate access to treatment when required.
BC EARLY CHILDHOOD DENTAL PROGRAMS LOGIC MODEL

A logic model approach 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 2 (see below) provides a systematic way of examining relationships among the resources dedicated to BC’s Dental Programs, the activities that are undertaken, and the changes or results that are achieved (or anticipated). The 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 four overarching evaluation questions.

The logic model was used to develop a multi-phase evaluation plan, including elements of clarification, interactive, monitoring, and impact evaluation. 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.

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). The primary focus of data collection was the BC School Dental Screening Program introduced in 1990, as well as the dental health risk assessment projects initiated in 1996. Our analysis centered on two primary datasets: the statistics gathered from the 2006/07 and 2009/10 BC Kindergarten Dental Surveys and the qualitative data gathered from focus groups with public health dental staff.

---

29 In this evaluation project, dental health risk assessment refers to caries risk assessment as well as the dental health assessment portion of early childhood health assessment. Caries risk assessment (CRA) refers to the determination of the likelihood of the incidence of caries. In BC health authorities, dental staff play a central role in caries risk assessment, while Public Health Nurses provide early childhood health assessments and make appropriate referrals to dental staff.
Figure 2. 2007 BC Early Childhood Dental Programs Logic Model

<table>
<thead>
<tr>
<th>RESOURCES (needs/ influencing factors)</th>
<th>ACTIVITIES (to address the problem)</th>
<th>OUTPUTS (direct results)</th>
<th>SHORT &amp; LONG TERM OUTCOMES (1-6 years)</th>
<th>IMPACT (7-10 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of budget allocated (e.g., for computers).</td>
<td>BC School Screening Dental Program (Kindergarten survey):</td>
<td># of families with infants 18 months old, or younger, who have received dental education/counseling. ( \dagger ) (Core Public Health Function)</td>
<td>Reduced prevalence of ECC in young children.</td>
<td>Knowledge of trends in the health of the community.</td>
</tr>
<tr>
<td>Staffing levels for Public Health Dental Programs and evaluation (FTE); Adequate administrative assistance to provide data needed for monitoring dental health status and evaluating programs.</td>
<td>- Monitoring trends in dental health status of children (population surveillance, e.g., IPIHS); - Referral to treatment. ( \ast )</td>
<td># of children receiving fluoride varnish. ( \dagger ) (Core Public Health Function)</td>
<td>Increased prevalence of preventive dental practices.</td>
<td>Knowledge of prevalence of decay in the population.</td>
</tr>
<tr>
<td># public health unit dental clinics and Community Health Clinics (non-profit, inter-disciplinary) offering dental services.</td>
<td>Dental Disease Prevention and Support Programs:</td>
<td># of K children surveyed per year.</td>
<td>Increased parent use of preventive dental practices.</td>
<td>Improved program planning and effectiveness.</td>
</tr>
<tr>
<td>Collaboration with Allied Health Professionals (e.g., training, referrals).</td>
<td>- Enhance community dental public health capacity; - Increase public awareness of preventive dental practices; - Increase community dental treatment capacity; - Enhance diagnostic and treatment services; Supporting families in accessing treatment services. ( \ast )</td>
<td>% of children who are caries-free (no obvious/visible dental decay at K survey (Code 01, HA Performance Measure 2006/07, Core Public Health Function)</td>
<td>Increased prevalence of children who are caries-free.</td>
<td>Improved general oral health status among pregnant women, families with low income, and Aboriginal families.</td>
</tr>
<tr>
<td>Socio-cultural and economic forces: Poverty: Language barriers; Remote areas; Isolation; Transportation; Aboriginal health inequities; Bond policies and funding; Transiency.</td>
<td></td>
<td>% of children in gr. 1 cohort showing evidence of visible decay by gr.1 (Code 03, HA Performance Measure up to 2005/06).</td>
<td>Identified patterns of inequities in ECC.</td>
<td>Reduced # of children requiring dental surgery with general anesthesia indicator: Surgical Daycare Utilization Rates (age 0-4, age 5-9). ( \dagger )</td>
</tr>
<tr>
<td>Some dentists may not take children.</td>
<td></td>
<td>% of children who are caries-free (no obvious/visible dental decay at K survey (Code 01, HA Performance Measure 2006/07, Core Public Health Function)</td>
<td>Increased eligible families using dental benefits (e.g., Healthy Kids, First Nations Dental Coverage).</td>
<td>Increased access to treatment by families with low income.</td>
</tr>
<tr>
<td>Difficulty in accessing children under 3 years old.</td>
<td></td>
<td>% children requiring dental surgery before age 14 (age 0-4, age 5-9).</td>
<td>Identified needs in research.</td>
<td>Improved population health promotion model.</td>
</tr>
<tr>
<td>BC Healthy Kids Program (MSP/MHR/ MCFD)</td>
<td></td>
<td>Number of children, up to 14 years old, who have had general anesthesia for dental treatment, in the past year (Core Public Health Function). ( \dagger ) (age 0-4, age 5-9)</td>
<td>Measured effectiveness of programming.</td>
<td>Increased integration and coordination across different disciplines.</td>
</tr>
<tr>
<td># private dental clinics accepting the benefit</td>
<td></td>
<td>5% eligible families using dental benefits (e.g., Healthy Kids, First Nations Dental Coverage).</td>
<td>Improved surveillance and analysis of early childhood dental health and dental programs. ( \dagger )</td>
<td></td>
</tr>
<tr>
<td># private dental clinics charging fees up-front</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal First Nations Dental Coverage (Non-Insured Health Benefits) and Children's Oral Health Initiative.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community water systems (&lt;4% of population accesses fluoridated water systems)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


\( \dagger \) Data available from BC hospitalization records; ...need to document current levels as a baseline for comparing differences over time. This is a broad measure that should be examined closely for relevant information. \( \ast \)
EVALUATION MEASURES AND METHODS

Defining and Measuring Early Childhood Caries

Researchers have noted that caution should be exercised when comparing the prevalence of early childhood caries found in different studies because different diagnostic criteria are used. The overall reported prevalence of ECC varies dramatically depending on case definition, population studied, and research methods employed. The American Academy of Pediatric Dentistry (AAPD) defines ECC as the occurrence of at least one primary tooth affected by decay in a child under 6 years of age. Although the AAPD clearly defines the meaning of ECC, the mechanisms for determining the presence of ECC still vary. For instance, the World Health Organization’s (WHO’s) standard for surveying early childhood caries is the DMFT/DMFS (Decayed, Missing, or Filled Teeth or Surfaces); however, this type of data collection typically involves a clinical setting and is thus not always conducive to large population surveys, such as the one in BC, which surveys more than 35,000 children each year. Instead, a Basic Screening Survey (BSS) is used in BC to assess the oral health status of its population of young children. The BSS has also been utilized in the US as a check for decay experience.

“For its studies of decay experience in young children, the U.S. federal government...counts children as having decay experience only if they have one or more visible cavities (without radiographs), have one or more visible fillings, or have one or more teeth missing because of decay. White spots, even if readily evident, are not counted...” (p. 31).

The BSS provides a framework for obtaining oral health data that is inexpensive, easy to implement and consistent. The information gathered is at a level consistent with monitoring national health objectives found in the US Public Health Service’s Healthy People document. Although there is little research on the validity and reliability of the BSS measure, a 1994 study of 632 elementary school children in Georgia, US found high validity for caries and treatment needs (>90% sensitivity, specificity, and predictive values in a sample having 30% to 40% prevalence). The BSS has been noted to be a quicker and more cost-efficient method of collecting data on early childhood caries in lieu of more formal epidemiological surveys using the DMFT/DMFS.

Appendix C provides a brief summary of selected studies of ECC prevalence based on the BSS in various populations. All US jurisdictions used indicators and criteria from the BSS manual developed by the Association of State and Territorial Dental Directors (including additional coding options). In BC, the British Columbia

31 Berg and Slayton, Early childhood oral health.
34 Berg and Slayton, Early childhood oral health.
35 ibid.
37 Association of State and Territorial Dental Directors, Basic screening surveys: An approach to monitoring community oral health (Sparks, NV: Association of State and Territorial Dental Directors, 1999).
39 Association of State and Territorial Dental Directors, Basic screening surveys: An approach to monitoring community oral health.
public health dental programs staff follow a screening manual, which was developed in 1990 and later adapted by the BC Dental Public Health Committee (BCDPhC). This manual covers indicators and criteria which are consistent with the BSS manual, as well as additional training materials and topics relevant to the BC context (e.g., self-study sheets, documentation and privacy standards, regulation of dental personnel, low-cost dental clinics).

**The Kindergarten Dental Survey in British Columbia: A Brief Overview**

The Kindergarten Dental Survey is administered by public health dental staff (registered Dental Hygienists and Certified Dental Assistants) who perform a visual inspection of each kindergarten child’s mouth with a small light and tongue depressor to determine the presence of obvious or visible tooth decay. Dental program staff follow a calibration process to ensure consistent technique. They inspect kindergarten children’s mouths for broken enamel, existing restorations, and urgent treatment needs. After the inspection, children are classified as belonging to one of the following three oral health outcomes:

- **Code 1: No Visible Decay Experience**: Children with No Visible Decay or restorations.
- **Code 2: No Visible Decay; Has Treatment**: Children that have No Visible Decay but do have existing restorations (e.g., fillings or crowns).
- **Code 3: Visible Decay**: Children that have obvious decay as evidenced by broken enamel. Shadowing without broken enamel is not considered visible decay.

In addition, a fourth code exists, which can apply to any of the dental codes above:

- **Code 4: Urgent Treatment Needs**: Children in need of immediate dental care (e.g., a child who is in obvious pain at the time of the survey or has obvious visible infection as evidenced by an abscess, gross swelling, or the presence of pus).

In other words, a student can have ‘urgent treatment needs’ (Code 04) despite having no visible decay (Code 01). Students who have had previous treatment (Code 02) or who have visible decay (Code 03) can also have urgent treatment needs (Code 04). Numerically, the sum of Codes 01 to 03 should be equal to the number of kindergarten students surveyed.

BC’s Health Authorities conducted the first full-scale implementation of the Kindergarten Dental Survey during the 2006/07 school year with an estimated 35,602 kindergarten students. The Kindergarten Dental Survey was re-administered in 2009/10 with approximately 35,215 kindergarten students from public, independent and First Nations schools on Reserve.

In both survey years, BC’s Kindergarten Dental Survey reached approximately 9 out of 10 enrolled students. Table 1 displays the number of students surveyed and enrolled by health authority (HA) and health service delivery area (HSDA) for British Columbia in 2006/07 and 2009/10.

---

41 Note that due to the nature of the survey tool used it is becoming increasingly difficult to identify all restored teeth (e.g. white coloured fillings) Wyman, T. (Personal Communication, 2011).
• Northern Health Authority showed the largest percent increase among the health authorities in terms of survey coverage, with 91.0% of kindergarten students surveyed in 2006/07 and 95.3% (+4.3 percentage points) in 2009/10.

• The Northern Interior showed the largest percent increase in survey coverage among all health service delivery areas (HSDAs). In 2006/07, 86.5% of kindergarten students were surveyed; 94.4% were surveyed in 2009/10 (+7.8 percentage points).

Table 1. BC Kindergarten Dental Survey Coverage for Health Regions by Survey Year

<table>
<thead>
<tr>
<th>HA and Health Region</th>
<th>Surveyed 06-07</th>
<th>Enrolled* 06-07</th>
<th>% Surveyed 06-07</th>
<th>Surveyed 09-10</th>
<th>Enrolled* 09-10</th>
<th>% Surveyed 09-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraser</td>
<td>14,256</td>
<td>13,660</td>
<td>92.0</td>
<td>15,502</td>
<td>15,060</td>
<td>90.7</td>
</tr>
<tr>
<td>East</td>
<td>2,788</td>
<td>2,649</td>
<td>98.9</td>
<td>2,820</td>
<td>2,867</td>
<td>92.4</td>
</tr>
<tr>
<td>North</td>
<td>4,775</td>
<td>4,716</td>
<td>91.0</td>
<td>5,247</td>
<td>5,189</td>
<td>90.9</td>
</tr>
<tr>
<td>South</td>
<td>6,693</td>
<td>6,295</td>
<td>90.0</td>
<td>7,435</td>
<td>7,004</td>
<td>89.9</td>
</tr>
<tr>
<td>Interior</td>
<td>5,465</td>
<td>5,574</td>
<td>90.8</td>
<td>6,016</td>
<td>6,146</td>
<td>90.7</td>
</tr>
<tr>
<td>The Kootenays</td>
<td>1,224</td>
<td>1,296</td>
<td>89.3</td>
<td>1,370</td>
<td>1,434</td>
<td>90.4</td>
</tr>
<tr>
<td>Okanagan</td>
<td>2,543</td>
<td>2,542</td>
<td>91.2</td>
<td>2,787</td>
<td>2,769</td>
<td>91.8</td>
</tr>
<tr>
<td>TCS</td>
<td>1,698</td>
<td>1,736</td>
<td>91.3</td>
<td>1,859</td>
<td>1,943</td>
<td>89.3</td>
</tr>
<tr>
<td>Northern</td>
<td>2,769</td>
<td>2,980</td>
<td>91.0</td>
<td>3,044</td>
<td>3,126</td>
<td>95.3</td>
</tr>
<tr>
<td>Northeast</td>
<td>810</td>
<td>769</td>
<td>95.0</td>
<td>853</td>
<td>804</td>
<td>95.6</td>
</tr>
<tr>
<td>Northern Interior</td>
<td>1,306</td>
<td>1,313</td>
<td>86.5</td>
<td>1,509</td>
<td>1,391</td>
<td>94.4</td>
</tr>
<tr>
<td>Northwest</td>
<td>653</td>
<td>898</td>
<td>93.1</td>
<td>682</td>
<td>931</td>
<td>95.7</td>
</tr>
<tr>
<td>Vancouver Coastal</td>
<td>7,799</td>
<td>7,681</td>
<td>92.1</td>
<td>8,468</td>
<td>8,423</td>
<td>91.2</td>
</tr>
<tr>
<td>Vancouver</td>
<td>4,072</td>
<td>3,918</td>
<td>91.6</td>
<td>4,444</td>
<td>4,400</td>
<td>89.0</td>
</tr>
<tr>
<td>Richmond</td>
<td>1,473</td>
<td>1,520</td>
<td>92.1</td>
<td>1,600</td>
<td>1,626</td>
<td>93.5</td>
</tr>
<tr>
<td>Coastal</td>
<td>2,254</td>
<td>2,243</td>
<td>93.0</td>
<td>2,424</td>
<td>2,397</td>
<td>93.6</td>
</tr>
<tr>
<td>Vancouver Island</td>
<td>5,313</td>
<td>5,320</td>
<td>90.7</td>
<td>5,861</td>
<td>5,922</td>
<td>89.8</td>
</tr>
<tr>
<td>South</td>
<td>2,498</td>
<td>2,556</td>
<td>91.0</td>
<td>2,746</td>
<td>2,856</td>
<td>89.5</td>
</tr>
<tr>
<td>Central</td>
<td>1,825</td>
<td>1,765</td>
<td>97.9</td>
<td>2,030</td>
<td>1,979</td>
<td>89.2</td>
</tr>
<tr>
<td>North</td>
<td>990</td>
<td>999</td>
<td>91.2</td>
<td>1,085</td>
<td>1,087</td>
<td>91.9</td>
</tr>
<tr>
<td>BC (Total)</td>
<td>35,602</td>
<td>35,215</td>
<td>91.5</td>
<td>38,891</td>
<td>38,677</td>
<td>91.0</td>
</tr>
</tbody>
</table>

* Source of enrollment figures: BC Health Authorities.

Environmental Scan

In 2008, as part of an ongoing environmental scan of BC early childhood dental programs, HELP reviewed the dental health risk assessment tools, guidelines used in each Health Authority, as well as over 100 Health Authority handouts related to oral health and nutrition for children under age 6. Five main topics emerged from review of the content of these materials: dental visits, previous/family tooth decay, tooth brushing and fluoride, feeding practices, and socioeconomic status. Consultations with dental staff were also conducted to identify the range of dental health risk assessment strategies used across Health Authorities. The information gathered was used to address evaluation questions related to program activities, as well as to inform the design of focus groups with public health dental staff (for further details, see Dental Health Risk Assessment Focus Groups Provincial Analysis).
Focus groups were conducted in the summer of 2009 with public health dental staff across the province in order to: identify the range of dental health risk assessment strategies used in Health Authorities; understand key barriers to program reach; and reflect upon key success factors and how the programs could be improved. The focus group process was developed in collaboration with Health Authority representatives and the BC Early Childhood Dental Programs Evaluation Subcommittee. Questions developed for the focus groups participants explored issues such as implementation of assessment guidelines, barriers to public health dental program reach, lessons learned, and regionally-developed questions of interest.

Eight focus groups were conducted with a total of 61 public health dental staff, representing 72% of public health dental staff across the province. From across the five Health Authorities, participants included 33 Dental Hygienists, 24 Certified Dental Assistants, one Dentist, and three program partner staff (e.g., First Nations Health Staff). All participants were knowledgeable informers due to the perspectives gained from their personal experience and observations living and working in BC and taking part in implementation of a Health Authority early childhood dental program. Most participants had worked in dental public health for many years while a few had only recently become engaged in public health, and many reported that they also had experience working in private dental practices. On average, participants had 15 years of dental public health experience (ranging from 0 to 38 years).
Based on prior consultation with dental staff, focus group facilitators from HELP developed program implementation process diagrams for each Health Authority, which were reviewed and revised during the focus groups. Each focus group was transcribed verbatim. Transcripts were analyzed using constant comparative techniques to categorize the data into key themes.\textsuperscript{42} For further details, see: Dental Health Risk Assessment Focus Groups Provincial Analysis.

**Provincial and Regional Mapping**

The Kindergarten Dental Survey data was also used in conjunction with data from the 2004 Taxfiler dataset, the 2006 Census and Wave 3 of the Early Development Instrument (2007-2009) dataset in order to create a series of provincial and regional maps to visually represent dental health outcomes. The produced maps typically used pie charts to show the distribution of kindergarten children from each school district in each of the four dental outcome categories. As well, the maps were typically colour-coded according to ‘quintiles’ of vulnerability in the province. 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. The mapping feature of the evaluation process allowed HELP to visually depict regional, school district, and neighbourhood variation in dental decay for the health authorities. Additionally, HELP was also able to create several maps visually representing the correlations between early childhood caries and several socioeconomic status variables.

---

\textsuperscript{42} A qualitative method (grounded theory) was used to analyze the data. The goal of this type of analysis is not to conduct counts or quantify; rather, the aim is to provide a descriptive account of participant experiences and perspectives as voiced through the focus groups.
EVALUATION FINDINGS

The findings from the evaluation project are organized according to the four overarching evaluation questions and in turn the following four key themes:

1. Early Childhood Dental Health Surveillance
2. Risk Assessment
3. Health Promotion and Prevention Strategies; and
EARLY CHILDHOOD DENTAL HEALTH SURVEILLANCE

The first key theme of surveillance is related to the initial evaluation framework question:

1. Is the oral health of young children improving? By community? By vulnerability?

To determine if the oral health of young children (age 4-6) in BC is improving, we present findings from the 2006/07 and 2009/10 Kindergarten Dental Surveys for the province, health authorities, health regions (health service delivery areas) and HELP neighbourhoods (see Appendix D for more information on “HELP neighbourhoods”) with respect to the following:

a. Early Childhood Caries (ECC) rates, defined as the percent of kindergarten children surveyed with current or previous decay, and changes in these rates over time.43

b. Socioeconomic influences on early childhood oral health, including On- and Off-Diagonal relationships (i.e., neighbourhoods with high ECC despite having high socioeconomic standing or low-socioeconomic neighbourhoods with low rates of ECC).

c. The relationship between ECC and developmental vulnerability as measured by the EDI (Early Development Instrument).

According to analysis of the results from the 2006/07 and 2009/10 Kindergarten Dental Surveys, the oral health of young children in BC appears to have improved overall, and regional differences were identified in terms of dental health.

- In 2006/07, 61.1% of kindergarten students surveyed in BC had no visible decay (Code 01); in 2009/10, the percentage increased to 63.3%, which is 3.3% above the provincial target of 60%.

- 942 fewer kindergarten children were identified as having visible dental decay in 2009/10 than in 2006/07 in BC. 387 fewer children were surveyed in 2009/10 than in 2006/07.

- The greatest improvements were observed in the Interior, where the % Visible Dental Decay (Code 02+03) decreased from 40.2% in 2006/07 to 36.1% in 2009/10, and in Vancouver Coastal health authority, which experienced a 5.8% decrease (40.9% in 2006/07 to 35.1% in 2009/10).

43 Please note that in the context of this project, we are referring to Codes 02 + 03 as indicators of decay experience. These codes reflect the dental decay that is visible through a visual check rather than the dental decay (observable and non-observable) that would be detectable through more sensitive clinical assessment tools.
Early Childhood Caries in British Columbia’s Health Authorities and Health Regions

Overall, the oral health of kindergarten children showed slight improvements between survey years. In 2006/07, 61.1% of students surveyed had no visible decay (Code 01); in 2009/10, the percentage increased to 63.3%, which is 3.3% above the provincial target of 60%.

- The greatest improvements were observed in the Interior, where the percent Code 01 increased from 59.8% in 2006/07 to 63.9% in 2009/10, and in Vancouver Coastal HA, which experienced 5.8% increase (59.1% in 2006/07 to 64.9% in 2009/10).
- Among HSDAs, the percent Code 01 in the Northwest was 49.3% in 2006/07 and 53.7% in 2009/10; in the Coastal Region of VCHA, 72.4% of children had no visible decay in 2006/07 and 78.8% were caries-free in 2009/10.
- The highest rates in terms of fillings or other restorations (Code 02) were found in Fraser East in 2006/07 (26.6%) and the Northwest in 2009/10 (24.8%); and the lowest rates for Code 02 across survey years were found in Vancouver Coastal HSDA (17.7% in 2006/07 and 14.1% in 2009/10).
- Vancouver Coastal HSDA had the lowest rates for Code 03 whereas Thompson Cariboo Shuswap, Richmond and Northwest HSDAs showed relatively high rates of current decay (>25%) in 2006/07 and retained the highest rates of current decay relative to other HSDAs in 2009/10; rates of current visible decay for all three areas dropped slightly in 2009/10 to approximately 22%. Table 2.1 presents the percent of students surveyed by Code for HAs and HSDAs in 2006/07 and 2009/10. An additional column is presented in the table called “% Visible Dental Decay,” which is the sum of Codes 02 and 03 (including Code 04s) or the inverse of Code 01. This
variable defines our main dental outcome measure in the statistical analysis presented to follow. Figure 4 presents Health Authority rates for each of the dental codes as well.

- Table 2.2 presents kindergarten dental health outcome data by code for the 2006/07 survey year, and Table 2.3 presents this information for 2009/10.
- In addition, the tables present the number of students with no dental decay (Code 01), which are estimates based on the number of students surveyed in the health region. Table 2.4 presents the percentage change between survey years along with the number of kindergarten children (K) affected by this change.

- Overall, the provincial rate of kindergarten visible dental decay (Code 02+03) dropped between survey years by 2.2 percentage points, from 38.9% in 2006/07 (see Table 2.1 or 2.2) to 36.7% in 2009/10 (see Table 2.1 or 2.3).

- In terms of the number of kindergarten children affected by this percentage change, 942 fewer kindergarten children were identified as having visible dental decay in 2009/10 than in 2006/07 in the province of BC.

Table 2.1. Kindergarten Dental Health Outcomes by Survey Year for Health Regions

<table>
<thead>
<tr>
<th>HA and Health Region</th>
<th>% Code 01 06-07</th>
<th>% Code 01 09-10</th>
<th>% Code 02 06-07</th>
<th>% Code 02 09-10</th>
<th>% Code 03 06-07</th>
<th>% Code 03 09-10</th>
<th>% Code 04 06-07</th>
<th>% Code 04 09-10</th>
<th>% Visible Dental Decay (Code 02 + 03) 06-07</th>
<th>% Visible Dental Decay (Code 02 + 03) 09-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraser</td>
<td>61.6</td>
<td>62.3</td>
<td>22.5</td>
<td>20.3</td>
<td>16.0</td>
<td>17.4</td>
<td>1.6</td>
<td>2.2</td>
<td>38.4</td>
<td>37.7</td>
</tr>
<tr>
<td>Fraser East</td>
<td>62.4</td>
<td>63.3</td>
<td>26.4</td>
<td>23.2</td>
<td>11.2</td>
<td>13.5</td>
<td>0.6</td>
<td>0.6</td>
<td>37.6</td>
<td>36.7</td>
</tr>
<tr>
<td>Fraser North</td>
<td>65.8</td>
<td>65.0</td>
<td>23.2</td>
<td>21.1</td>
<td>11.0</td>
<td>13.9</td>
<td>1.5</td>
<td>1.9</td>
<td>34.2</td>
<td>35.0</td>
</tr>
<tr>
<td>Fraser South</td>
<td>58.1</td>
<td>59.8</td>
<td>20.3</td>
<td>18.6</td>
<td>21.5</td>
<td>21.6</td>
<td>2.2</td>
<td>3.1</td>
<td>41.9</td>
<td>40.2</td>
</tr>
<tr>
<td>Interior</td>
<td>59.8</td>
<td>63.9</td>
<td>20.7</td>
<td>18.2</td>
<td>19.5</td>
<td>17.9</td>
<td>3.5</td>
<td>3.1</td>
<td>40.2</td>
<td>36.1</td>
</tr>
<tr>
<td>The Kootenays</td>
<td>60.6</td>
<td>67.7</td>
<td>19.9</td>
<td>16.1</td>
<td>19.5</td>
<td>16.1</td>
<td>4.2</td>
<td>2.8</td>
<td>39.4</td>
<td>32.3</td>
</tr>
<tr>
<td>Okanagan</td>
<td>64.1</td>
<td>66.8</td>
<td>20.1</td>
<td>16.9</td>
<td>15.8</td>
<td>16.3</td>
<td>2.6</td>
<td>3.1</td>
<td>35.9</td>
<td>33.2</td>
</tr>
<tr>
<td>TCS</td>
<td>52.7</td>
<td>56.8</td>
<td>22.3</td>
<td>21.8</td>
<td>25.0</td>
<td>21.4</td>
<td>4.4</td>
<td>3.2</td>
<td>47.3</td>
<td>43.2</td>
</tr>
<tr>
<td>Northern</td>
<td>58.8</td>
<td>58.8</td>
<td>18.5</td>
<td>21.4</td>
<td>22.7</td>
<td>19.7</td>
<td>3.5</td>
<td>3.2</td>
<td>41.2</td>
<td>41.1</td>
</tr>
<tr>
<td>Northeast</td>
<td>58.9</td>
<td>58.0</td>
<td>19.3</td>
<td>21.5</td>
<td>21.9</td>
<td>20.4</td>
<td>2.8</td>
<td>2.3</td>
<td>41.1</td>
<td>41.9</td>
</tr>
<tr>
<td>Northern Interior</td>
<td>63.6</td>
<td>62.8</td>
<td>18.2</td>
<td>19.0</td>
<td>18.2</td>
<td>18.1</td>
<td>2.6</td>
<td>3.7</td>
<td>36.4</td>
<td>37.2</td>
</tr>
<tr>
<td>Northwest</td>
<td>49.3</td>
<td>53.7</td>
<td>17.9</td>
<td>24.8</td>
<td>32.8</td>
<td>21.5</td>
<td>6.0</td>
<td>3.0</td>
<td>50.7</td>
<td>46.3</td>
</tr>
<tr>
<td>Vancouver Coastal</td>
<td>59.1</td>
<td>64.9</td>
<td>20.5</td>
<td>18.3</td>
<td>20.4</td>
<td>16.8</td>
<td>1.8</td>
<td>1.3</td>
<td>40.9</td>
<td>35.1</td>
</tr>
<tr>
<td>Vancouver</td>
<td>54.7</td>
<td>59.9</td>
<td>22.4</td>
<td>19.8</td>
<td>22.9</td>
<td>20.3</td>
<td>2.0</td>
<td>1.5</td>
<td>45.3</td>
<td>40.1</td>
</tr>
<tr>
<td>Richmond</td>
<td>51</td>
<td>57.1</td>
<td>19.5</td>
<td>20.7</td>
<td>29.5</td>
<td>22.2</td>
<td>3.7</td>
<td>2.0</td>
<td>49.0</td>
<td>42.9</td>
</tr>
<tr>
<td>Coastal</td>
<td>72.4</td>
<td>78.8</td>
<td>17.7</td>
<td>14.1</td>
<td>9.9</td>
<td>7.1</td>
<td>0.3</td>
<td>0.4</td>
<td>27.6</td>
<td>21.2</td>
</tr>
<tr>
<td>Vancouver Island</td>
<td>65.1</td>
<td>65.5</td>
<td>23.6</td>
<td>20.7</td>
<td>11.3</td>
<td>13.8</td>
<td>1.2</td>
<td>1.1</td>
<td>34.9</td>
<td>34.5</td>
</tr>
<tr>
<td>South Vancouver Island</td>
<td>69.1</td>
<td>69.1</td>
<td>21.5</td>
<td>18.2</td>
<td>9.4</td>
<td>12.7</td>
<td>1.8</td>
<td>1.0</td>
<td>30.9</td>
<td>30.9</td>
</tr>
<tr>
<td>Central Vancouver Island</td>
<td>60.9</td>
<td>62.0</td>
<td>26.6</td>
<td>23.0</td>
<td>12.5</td>
<td>14.9</td>
<td>0.5</td>
<td>1.4</td>
<td>39.1</td>
<td>37.9</td>
</tr>
<tr>
<td>North Vancouver Island</td>
<td>62.4</td>
<td>62.3</td>
<td>23.6</td>
<td>22.8</td>
<td>13.9</td>
<td>14.7</td>
<td>0.9</td>
<td>0.8</td>
<td>37.6</td>
<td>37.5</td>
</tr>
<tr>
<td>BC (Total)</td>
<td>61.1</td>
<td>63.3</td>
<td>21.6</td>
<td>19.7</td>
<td>17.3</td>
<td>17.0</td>
<td>2.0</td>
<td>2.1</td>
<td>38.9</td>
<td>36.7</td>
</tr>
</tbody>
</table>

Note: Cell values are colour coded to correspond to the ranges of values as presented in the attached mapping package. See legend for more details.
Figure 4. Kindergarten Dental Health Outcomes by Health Authority

Table 2.2. Kindergarten Dental Health Outcomes and Number of Kindergarten Students Surveyed in 2006/07 by Health Region

<table>
<thead>
<tr>
<th>Health Authority &amp; Health Service Delivery Area</th>
<th>Code 01</th>
<th>Code 02</th>
<th>Code 03</th>
<th>Code 04</th>
<th>% Visible Dental Decay (Code 02 + 03)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraser</td>
<td>61.6</td>
<td>8775</td>
<td>22.5</td>
<td>3204</td>
<td>16.0 2277 1.6 234 38.4 5481</td>
</tr>
<tr>
<td>Fraser East</td>
<td>62.4</td>
<td>1740</td>
<td>26.4</td>
<td>737</td>
<td>11.2 311 0.6 16 37.6 1048</td>
</tr>
<tr>
<td>Fraser North</td>
<td>65.8</td>
<td>3144</td>
<td>23.2</td>
<td>1106</td>
<td>11.0 525 1.5 71 34.2 1631</td>
</tr>
<tr>
<td>Fraser South</td>
<td>58.1</td>
<td>3891</td>
<td>20.3</td>
<td>1361</td>
<td>21.5 1441 2.2 147 41.9 2802</td>
</tr>
<tr>
<td>Interior</td>
<td>59.8</td>
<td>3267</td>
<td>20.7</td>
<td>1132</td>
<td>19.5 1066 3.5 192 40.2 2198</td>
</tr>
<tr>
<td>The Kootenays</td>
<td>60.6</td>
<td>742</td>
<td>19.9</td>
<td>243</td>
<td>19.5 239 4.2 52 39.4 482</td>
</tr>
<tr>
<td>Okanagan</td>
<td>64.1</td>
<td>1631</td>
<td>20.1</td>
<td>510</td>
<td>15.8 402 2.6 66 35.9 912</td>
</tr>
<tr>
<td>TCS</td>
<td>52.7</td>
<td>894</td>
<td>22.3</td>
<td>379</td>
<td>25.0 425 4.4 74 47.3 804</td>
</tr>
<tr>
<td>Northern</td>
<td>58.8</td>
<td>1629</td>
<td>18.5</td>
<td>511</td>
<td>22.7 629 3.5 96 41.2 1140</td>
</tr>
<tr>
<td>Northeast</td>
<td>58.9</td>
<td>477</td>
<td>19.3</td>
<td>156</td>
<td>21.9 177 2.8 23 41.1 333</td>
</tr>
<tr>
<td>Northern Interior</td>
<td>63.6</td>
<td>830</td>
<td>18.2</td>
<td>238</td>
<td>18.2 238 2.6 34 36.4 476</td>
</tr>
<tr>
<td>Northwest</td>
<td>49.3</td>
<td>322</td>
<td>17.9</td>
<td>117</td>
<td>32.8 214 6.0 39 50.7 331</td>
</tr>
<tr>
<td>Vancouver Coastal</td>
<td>59.1</td>
<td>4610</td>
<td>20.5</td>
<td>1599</td>
<td>20.4 1590 1.8 143 40.9 3189</td>
</tr>
<tr>
<td>Vancouver</td>
<td>54.7</td>
<td>2228</td>
<td>22.4</td>
<td>912</td>
<td>22.9 932 2.0 81 45.3 1844</td>
</tr>
<tr>
<td>Richmond</td>
<td>51.0</td>
<td>751</td>
<td>19.5</td>
<td>287</td>
<td>29.5 435 3.7 55 49.0 722</td>
</tr>
<tr>
<td>Coastal</td>
<td>72.4</td>
<td>1631</td>
<td>17.7</td>
<td>400</td>
<td>9.9 223 0.3 7 27.6 623</td>
</tr>
<tr>
<td>Vancouver Island</td>
<td>65.1</td>
<td>3457</td>
<td>23.6</td>
<td>1255</td>
<td>11.3 601 1.2 62 34.9 1856</td>
</tr>
<tr>
<td>South Vancouver Island</td>
<td>69.1</td>
<td>1727</td>
<td>21.5</td>
<td>536</td>
<td>9.4 235 1.8 44 30.9 771</td>
</tr>
<tr>
<td>Central Vancouver Island</td>
<td>60.9</td>
<td>1112</td>
<td>26.6</td>
<td>485</td>
<td>12.5 228 0.5 9 39.1 713</td>
</tr>
<tr>
<td>North Vancouver Island</td>
<td>62.4</td>
<td>618</td>
<td>23.6</td>
<td>234</td>
<td>13.9 138 0.9 9 37.6 372</td>
</tr>
<tr>
<td>BC (Total)</td>
<td>61.1</td>
<td>21738</td>
<td>21.6</td>
<td>7701</td>
<td>17.3 6163 2.0 727 38.9 13864</td>
</tr>
</tbody>
</table>
HELP previously worked closely with representatives from several BC communities to inform the creation of HELP neighbourhoods with geographic boundaries demarcated by natural boundaries as perceived by the neighbourhood’s residents. Several factors were considered when defining neighbourhood boundaries including:

- natural social and economic divisions in communities.
- natural or other physical boundaries such as ravines, waterways, major highways.
- local municipal boundaries (e.g., municipalities, regional districts).
- school catchment areas.
- neighbourhood association boundaries.

As a result of this process, HELP identified 478 neighbourhoods in BC, which are anticipated to account for the long-term anticipated growth and decline in the population patterns of communities (see Appendix D for further discussion about the creation of HELP neighbourhoods).

Using school districts and HELP neighbourhoods as boundaries, a Mapping Package was created to present kindergarten dental survey outcomes over time (i.e., in

### Table 2.3. Kindergarten Dental Health Outcomes and Number of Kindergarten Students Surveyed in 2009/10 by Health Region

<table>
<thead>
<tr>
<th>Health Authority &amp; Health Service Delivery Area</th>
<th>Code 01</th>
<th>Code 02</th>
<th>Code 03</th>
<th>Code 04</th>
<th>% Visible Dental Decay (Code 02 + 03)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code 01</td>
<td>Code 02</td>
<td>Code 03</td>
<td>Code 04</td>
<td>% K</td>
<td>% K</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Fraser</td>
<td>62.3</td>
<td>8508</td>
<td>20.3</td>
<td>2777</td>
<td>17.4</td>
</tr>
<tr>
<td>Fraser East</td>
<td>63.3</td>
<td>1677</td>
<td>23.2</td>
<td>614</td>
<td>13.5</td>
</tr>
<tr>
<td>Fraser North</td>
<td>65.0</td>
<td>3066</td>
<td>21.1</td>
<td>993</td>
<td>13.9</td>
</tr>
<tr>
<td>Fraser South</td>
<td>59.8</td>
<td>3765</td>
<td>18.6</td>
<td>1170</td>
<td>21.6</td>
</tr>
<tr>
<td>Interior</td>
<td>63.9</td>
<td>3562</td>
<td>18.2</td>
<td>1017</td>
<td>17.9</td>
</tr>
<tr>
<td>The Kootenays</td>
<td>67.7</td>
<td>878</td>
<td>16.1</td>
<td>209</td>
<td>16.1</td>
</tr>
<tr>
<td>Okanagan</td>
<td>66.8</td>
<td>1698</td>
<td>16.9</td>
<td>430</td>
<td>16.3</td>
</tr>
<tr>
<td>TCS</td>
<td>56.8</td>
<td>986</td>
<td>21.8</td>
<td>378</td>
<td>21.4</td>
</tr>
<tr>
<td>Northern</td>
<td>58.8</td>
<td>1753</td>
<td>21.4</td>
<td>638</td>
<td>19.7</td>
</tr>
<tr>
<td>Northeast</td>
<td>58.0</td>
<td>446</td>
<td>21.5</td>
<td>165</td>
<td>20.4</td>
</tr>
<tr>
<td>Northern Interior</td>
<td>62.8</td>
<td>825</td>
<td>19.0</td>
<td>250</td>
<td>18.1</td>
</tr>
<tr>
<td>Northwest</td>
<td>53.7</td>
<td>482</td>
<td>24.8</td>
<td>223</td>
<td>21.5</td>
</tr>
<tr>
<td>Vancouver Coastal</td>
<td>64.9</td>
<td>4983</td>
<td>18.3</td>
<td>1408</td>
<td>16.8</td>
</tr>
<tr>
<td>Vancouver</td>
<td>59.9</td>
<td>2347</td>
<td>19.8</td>
<td>777</td>
<td>20.3</td>
</tr>
<tr>
<td>Richmond</td>
<td>57.1</td>
<td>868</td>
<td>20.7</td>
<td>315</td>
<td>22.2</td>
</tr>
<tr>
<td>Coastal</td>
<td>78.8</td>
<td>1768</td>
<td>14.1</td>
<td>316</td>
<td>7.1</td>
</tr>
<tr>
<td>Vancouver Island</td>
<td>65.5</td>
<td>3483</td>
<td>20.7</td>
<td>1099</td>
<td>13.8</td>
</tr>
<tr>
<td>South Vancouver Island</td>
<td>69.1</td>
<td>1766</td>
<td>18.2</td>
<td>465</td>
<td>12.7</td>
</tr>
<tr>
<td>Central Vancouver Island</td>
<td>62.0</td>
<td>1095</td>
<td>23.0</td>
<td>406</td>
<td>14.9</td>
</tr>
<tr>
<td>North Vancouver Island</td>
<td>62.3</td>
<td>622</td>
<td>22.8</td>
<td>228</td>
<td>14.7</td>
</tr>
<tr>
<td>BC (Total)</td>
<td>63.3</td>
<td>22289</td>
<td>19.7</td>
<td>6939</td>
<td>17.0</td>
</tr>
</tbody>
</table>
Table 2.4. Change in Kindergarten Dental Health Outcomes and Number of Kindergarten Students Affected by Health Region

<table>
<thead>
<tr>
<th>Health Authority &amp; Health Service Delivery Area</th>
<th>Code 01</th>
<th>Code 02</th>
<th>Code 03</th>
<th>Code 04</th>
<th>% Visible Dental Decay (Code 02 + 03)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% K</td>
<td>% K</td>
<td>% K</td>
<td>% K</td>
<td></td>
</tr>
<tr>
<td>Fraser</td>
<td>+0.7</td>
<td>-267</td>
<td>-2.2</td>
<td>-427</td>
<td>+1.4 +98 +0.6 +67 -0.7 -329</td>
</tr>
<tr>
<td>Fraser East</td>
<td>+0.9</td>
<td>-63</td>
<td>-3.2</td>
<td>-123</td>
<td>+2.3 +47 0 +1 -0.9 -76</td>
</tr>
<tr>
<td>Fraser North</td>
<td>-0.8</td>
<td>-78</td>
<td>-2.1</td>
<td>-113</td>
<td>+2.9 +132 +0.4 +20 +0.8 +19</td>
</tr>
<tr>
<td>Fraser South</td>
<td>+1.7</td>
<td>-126</td>
<td>-1.7</td>
<td>-191</td>
<td>+0.1 -81 +0.9 +46 -1.7 -272</td>
</tr>
<tr>
<td>Interior</td>
<td>+4.1</td>
<td>+295</td>
<td>-2.5</td>
<td>-115</td>
<td>-1.6 -71 -0.4 -21 -4.1 -186</td>
</tr>
<tr>
<td>The Kootenays</td>
<td>+7.1</td>
<td>+136</td>
<td>-3.8</td>
<td>-34</td>
<td>-3.4 -30 -1.4 -16 -7.1 -64</td>
</tr>
<tr>
<td>Okanagan</td>
<td>+2.7</td>
<td>+67</td>
<td>-3.2</td>
<td>-80</td>
<td>+0.5 +12 +0.5 +14 -2.7 -68</td>
</tr>
<tr>
<td>TCS</td>
<td>+4.1</td>
<td>+92</td>
<td>-0.5</td>
<td>-1</td>
<td>-3.6 -53 -1.2 -19 -4.1 -54</td>
</tr>
<tr>
<td>Northern</td>
<td>0</td>
<td>+124</td>
<td>+2.9</td>
<td>+127</td>
<td>-3.0 -41 -0.3 -2 -0.1 +86</td>
</tr>
<tr>
<td>Northeast</td>
<td>-0.9</td>
<td>-31</td>
<td>+2.2</td>
<td>+9</td>
<td>-1.5 -20 -0.5 -5 +0.8 -11</td>
</tr>
<tr>
<td>Northern Interior</td>
<td>-0.8</td>
<td>-5</td>
<td>+0.8</td>
<td>+12</td>
<td>-0.1 0 +1.1 +15 +0.8 +12</td>
</tr>
<tr>
<td>Northwest</td>
<td>+4.4</td>
<td>+160</td>
<td>+6.9</td>
<td>106</td>
<td>-11.3 -21 -3.0 -12 -4.4 +85</td>
</tr>
<tr>
<td>Vancouver Coastal</td>
<td>+5.8</td>
<td>+373</td>
<td>-2.2</td>
<td>-191</td>
<td>-3.6 -300 -0.5 -44 -5.8 -491</td>
</tr>
<tr>
<td>Vancouver</td>
<td>+5.2</td>
<td>+119</td>
<td>-2.6</td>
<td>-135</td>
<td>-2.6 -138 -0.5 -23 -5.2 -273</td>
</tr>
<tr>
<td>Richmond</td>
<td>+6.1</td>
<td>+117</td>
<td>+1.2</td>
<td>+28</td>
<td>-7.3 -98 -1.7 -24 -6.1 -70</td>
</tr>
<tr>
<td>Coastal</td>
<td>+6.4</td>
<td>+137</td>
<td>-3.6</td>
<td>-84</td>
<td>-2.8 -64 +0.1 +3 -6.4 -148</td>
</tr>
<tr>
<td>Vancouver Island</td>
<td>+0.4</td>
<td>+26</td>
<td>-2.9</td>
<td>-156</td>
<td>+2.5 +134 -0.1 -4 -0.4 -22</td>
</tr>
<tr>
<td>South Vancouver Island</td>
<td>0</td>
<td>+39</td>
<td>-3.3</td>
<td>-71</td>
<td>+3.3 +90 -0.8 +19 0 +19</td>
</tr>
<tr>
<td>Central Vancouver Island</td>
<td>+1.1</td>
<td>-17</td>
<td>-3.6</td>
<td>-79</td>
<td>+2.4 +35 +0.9 +15 -1.2 -44</td>
</tr>
<tr>
<td>North Vancouver Island</td>
<td>-0.1</td>
<td>-4</td>
<td>-0.8</td>
<td>-6</td>
<td>+0.8 +9 -0.1 -1 -0.1 +3</td>
</tr>
<tr>
<td>BC (Total)</td>
<td>2.2</td>
<td>551</td>
<td>-1.9</td>
<td>-762</td>
<td>-0.3 -180 0.1 -4 -2.2 -942</td>
</tr>
</tbody>
</table>

2006/07 and 2009/10) and in relation to socioeconomic status for 59 school districts and 437 HELP neighbourhoods. Figure 5.1 below presents one of the provincial maps created to depict dental decay for kindergarten students (by school district) in 2009/10.

The Mapping Package (see Attached) presents neighbourhood-level dental health outcomes along with demographic and socioeconomic variables. Three types of maps are presented in the package: interactive maps, provincial maps, and health authority maps:

1. The interactive maps allow the user to generate a map tailored to her or his needs using optional layers such as health authority boundaries, city names, neighbourhood names, roads, socioeconomic status and demographics, and early child development data; these maps enable users to zoom into the neighbourhood level, or zoom out to the provincial level;

2. The provincial maps show dental decay by school district at each of the four code levels, as well as the change between the 2006/07 to 2009/10 data; and Health authority specific maps show dental decay by neighbourhood, with each of the four code levels, as well as the change between the 2006/07 to 2009/10 data.
The provincial and neighbourhood-level maps are accompanied by comprehensive data tables that present school district- and neighbourhood-level dental health outcomes, indicators of socioeconomic status and early child development as measured by the EDI during the 2007/08 and 2008/09 school years (Wave 3). The tables included in the package include a variable called “% Visible Dental Decay Change,” which measures the percent increase or decrease in the rate of visible dental decay from 2006/07 to 2009/10. This variable can be used as a general indicator of the oral health of young children in the community (i.e., neighbourhood). Table 3.1 presents neighbourhoods with 25% or greater change in visible dental decay rates across survey years. Table 3.2 presents school districts with consistent dental decay rates across survey years.
The interactive maps of the Mapping Package contain several interesting findings that might not otherwise be noticed in the data tables. For instance, some neighborhoods appear to be outliers in comparison with adjacent neighbourhoods in terms of dental health. Examples of these “outliers” include the following:

### Table 3.1. Neighbourhoods With a 25% or Greater Change in % Visible Dental Decay Between Survey Years

<table>
<thead>
<tr>
<th>HA</th>
<th>Neighbourhood Name</th>
<th>% Visible Dental Decay (06/07)</th>
<th>% Visible Dental Decay (09/10)</th>
<th>% Visible Dental Decay Change</th>
<th>SES Index (2006)</th>
<th>% Vulnerable on EDI (07/08 &amp; 08/09)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHA</td>
<td>Tsawwassen North</td>
<td>11.0</td>
<td>46.8</td>
<td>35.8</td>
<td>1.0</td>
<td>17.5</td>
</tr>
<tr>
<td>FHA</td>
<td>Abbotsford</td>
<td>67.7</td>
<td>41.9</td>
<td>-25.8</td>
<td>-1.3</td>
<td>38.1</td>
</tr>
<tr>
<td>IHA</td>
<td>Salmo</td>
<td>61.9</td>
<td>35.0</td>
<td>-26.9</td>
<td>0.2</td>
<td>32.7</td>
</tr>
<tr>
<td>IHA</td>
<td>Rossland/Warfield</td>
<td>47.2</td>
<td>20.0</td>
<td>-27.2</td>
<td>1.3</td>
<td>8.9</td>
</tr>
<tr>
<td>IHA</td>
<td>East Boundary</td>
<td>52.0</td>
<td>24.3</td>
<td>-27.7</td>
<td>0.7</td>
<td>27.9</td>
</tr>
<tr>
<td>IHA</td>
<td>Enderby</td>
<td>50.0</td>
<td>22.2</td>
<td>-27.8</td>
<td>-0.2</td>
<td>25.6</td>
</tr>
<tr>
<td>IHA</td>
<td>South West</td>
<td>67.7</td>
<td>32.3</td>
<td>-35.4</td>
<td>-0.4</td>
<td>28.0</td>
</tr>
<tr>
<td>NHA</td>
<td>North Peace Rural - East</td>
<td>28.6</td>
<td>55.6</td>
<td>27.0</td>
<td>1.2</td>
<td>41.5</td>
</tr>
<tr>
<td>VCHA</td>
<td>Norgate</td>
<td>45.5</td>
<td>20.0</td>
<td>-25.5</td>
<td>-0.7</td>
<td>30.6</td>
</tr>
<tr>
<td>VCHA</td>
<td>Hamilton</td>
<td>61.1</td>
<td>32.8</td>
<td>-28.3</td>
<td>0.4</td>
<td>22.6</td>
</tr>
<tr>
<td>VIHA</td>
<td>Gabriola</td>
<td>50.0</td>
<td>25.0</td>
<td>-25.0</td>
<td>0.0</td>
<td>NA</td>
</tr>
<tr>
<td>VIHA</td>
<td>Outer Gulf Islands</td>
<td>20.0</td>
<td>53.3</td>
<td>33.3</td>
<td>0.6</td>
<td>NA</td>
</tr>
<tr>
<td>VIHA</td>
<td>Comox West</td>
<td>46.7</td>
<td>19.2</td>
<td>-27.5</td>
<td>0.5</td>
<td>NA</td>
</tr>
<tr>
<td>VIHA</td>
<td>South Wellington - Cassidy</td>
<td>30.8</td>
<td>62.5</td>
<td>31.7</td>
<td>-0.8</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Table 3.2. School Districts with Consistent Visible Dental Decay Rates Across Survey Years

<table>
<thead>
<tr>
<th>HA</th>
<th>SD</th>
<th>Neighbourhood Name</th>
<th>% Visible Dental Decay (06/07)</th>
<th>% Code 01 (06/07)</th>
<th>% Visible Dental Decay (09/10)</th>
<th>% Code 01 (09/10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IHA</td>
<td>19</td>
<td>Revelstoke - Central</td>
<td>47.1</td>
<td>52.9</td>
<td>42.3</td>
<td>57.1</td>
</tr>
<tr>
<td>IHA</td>
<td>19</td>
<td>Revelstoke - Northwest</td>
<td>61.5</td>
<td>38.5</td>
<td>42.9</td>
<td>57.1</td>
</tr>
<tr>
<td>IHA</td>
<td>19</td>
<td>Revelstoke - South</td>
<td>53.3</td>
<td>46.7</td>
<td>66.7</td>
<td>33.3</td>
</tr>
<tr>
<td>IHA</td>
<td>58</td>
<td>Merritt</td>
<td>54.2</td>
<td>45.8</td>
<td>48.0</td>
<td>52.0</td>
</tr>
<tr>
<td>IHA</td>
<td>58</td>
<td>Princeton</td>
<td>63.3</td>
<td>36.7</td>
<td>45.8</td>
<td>54.2</td>
</tr>
<tr>
<td>IHA</td>
<td>74</td>
<td>Gold Trail West</td>
<td>64.3</td>
<td>35.7</td>
<td>62.0</td>
<td>38.0</td>
</tr>
<tr>
<td>IHA</td>
<td>74</td>
<td>Gold Trail East</td>
<td>NA</td>
<td>NA</td>
<td>64.0</td>
<td>36.0</td>
</tr>
<tr>
<td>NHA</td>
<td>52</td>
<td>Prince Rupert - Centre</td>
<td>52.5</td>
<td>47.5</td>
<td>60.6</td>
<td>39.4</td>
</tr>
<tr>
<td>NHA</td>
<td>52</td>
<td>Prince Rupert - Cow Bay</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>NHA</td>
<td>52</td>
<td>Prince Rupert - South/Ferry</td>
<td>52.7</td>
<td>47.3</td>
<td>43.5</td>
<td>56.5</td>
</tr>
<tr>
<td>NHA</td>
<td>52</td>
<td>Prince Rupert - Seal Cove</td>
<td>68.4</td>
<td>31.6</td>
<td>53.9</td>
<td>46.2</td>
</tr>
<tr>
<td>NHA</td>
<td>52</td>
<td>North Coastal Communities</td>
<td>50.0</td>
<td>50.0</td>
<td>71.4</td>
<td>28.6</td>
</tr>
<tr>
<td>VCHA</td>
<td>45</td>
<td>Horseshoe Bay - Bow. Island</td>
<td>23.8</td>
<td>76.2</td>
<td>14.4</td>
<td>85.6</td>
</tr>
<tr>
<td>VCHA</td>
<td>45</td>
<td>Dundarave</td>
<td>24.3</td>
<td>75.7</td>
<td>15.8</td>
<td>84.2</td>
</tr>
<tr>
<td>VCHA</td>
<td>45</td>
<td>Ambleside - Brit Properties</td>
<td>23.9</td>
<td>76.1</td>
<td>16.3</td>
<td>83.7</td>
</tr>
</tbody>
</table>
• Tsawwassen North with 46.8% visible dental decay, but adjacent to Tsawwassen South with 23.3% visible dental decay and Delta Rural with 23.7% visible dental decay (see Figure 5.2).

Figure 5.2. Tsawwassen North (VCHA)

• Sun Valley with 62.1% visible dental decay, but surrounded by communities such as Pitt Meadows with 25.9% visible dental decay, Lincoln Park with 31.3%, Imperial Park with 37.5%, Central/Mary Hill with 30.8%, Citadel heights with 22.8%, Castle Park with 24.1% and Imperial Park with 37.5% (see Figure 5.3).

Figure 5.3. Sun Valley (FHA)

• Rockland with 51.6% visible dental decay, but adjacent to Quinsam-Strathcona with 31.0% visible dental decay, Campbell River South with 24.8% and Shelter Point with 28.1% (see Figure 5.4).

Figure 5.4. Rockland (VIHA)

• Dawson Creek Centre with 28.6% visible dental decay, but adjacent to communities Dawson Creek South with 52.4% visible dental decay, South Peace Rural with 51.6% and Dawson Creek North with 42.2% (see Figure 5.5).

Figure 5.5. Dawson Creek Centre (NHA)
Socioeconomic Influences of Early Childhood Oral Health in BC

The BC Dental Programs Evaluation Subcommittee provided input on the selection of variables for the analysis of socioeconomic status (SES) and dental health outcomes. Based on the Subcommittee’s feedback, the following socioeconomic and demographic variables from the 2001/2006 Census and 2004 Tax Filer datasets were selected for analysis:

1. Union or Professional Membership: Percent of population paying union or professional dues, with children under age 6.
2. Not Fluent in English/French: Percent of population that does not speak either English or French fluently.
3. No High School Education: Percent of population between the age of 25 and 64 that does not have a high school degree.
4. Low-Income: Percent of individuals living in households below the low-income cutoff (LICO). This variable does not include the working poor or individuals with lower incomes living above the social assistance line.
5. Lone-Parent Families: Percent of census families headed by a single parent.
6. Residential Mobility: Percent of population that moved residences in the past year.
7. Aboriginal Population: Percent of population that is Aboriginal (self-identified).

Table 4 presents descriptive statistics (sample size, means, standard deviations) for the province and health authorities on the seven variables selected for analysis by the Dental Evaluation Subcommittee. Some key findings from the table are as follows:

- Union and professional membership is similar across HAs, with the exception being in VCHA where 32.6% of tax filers pay dues compared to the provincial average of 35.1%.
- VCHA also has the highest rates of non-fluency in English or French (4.3%) and persons below the low-income cutoff (16.5% vs. 12.1% for the province).
- More than one in five adults (age 25-64) residing in NHA have not completed high school (22.0%) and 17.3% of households are led by a single parent.

### Table 4. Socioeconomic Status (SES) and Demographic Information for Province and HAs

<table>
<thead>
<tr>
<th>Subcommittee SES Variables</th>
<th>Fraser Interior</th>
<th>Northern Coastal</th>
<th>Vancouver Coastal</th>
<th>Vancouver Island</th>
<th>BC (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Union or Professional Membership</td>
<td>35.5</td>
<td>7.8</td>
<td>34.6</td>
<td>8.8</td>
<td>36.4</td>
</tr>
<tr>
<td>Not Fluent in English or French</td>
<td>3.7</td>
<td>3.7</td>
<td>0.4</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>No High School</td>
<td>13.1</td>
<td>6.1</td>
<td>15.6</td>
<td>5.6</td>
<td>22</td>
</tr>
<tr>
<td>Low-Income</td>
<td>14.1</td>
<td>6.8</td>
<td>9.3</td>
<td>3.8</td>
<td>9.7</td>
</tr>
<tr>
<td>Lone Parenthood</td>
<td>14.8</td>
<td>4.2</td>
<td>14</td>
<td>4.5</td>
<td>17.3</td>
</tr>
<tr>
<td>Mobility</td>
<td>15.9</td>
<td>4.7</td>
<td>16.7</td>
<td>3.9</td>
<td>17.2</td>
</tr>
<tr>
<td>Aboriginal Identity</td>
<td>2.9</td>
<td>2.8</td>
<td>6.5</td>
<td>6.8</td>
<td>20.4</td>
</tr>
</tbody>
</table>

Figure 6 below presents provincial and regional variations related to the seven Subcommittee-chosen variables. It should be made clear that of the seven variables presented in Figure 6, only union and/or professional membership is considered a ‘protective’ factor in terms of SES; all other measures are related to ‘risk’ factors (i.e., indicators of low SES).
HELP also created a SES index along with several subcomponents (e.g., Wealth, Education, Unemployment, etc.) in relation to early child development. Data for the HELP SES Index was derived from the 2006 Census and 2004 Tax Filer datasets. The names of these components, and the individual variables included in each of them, can be found in Appendix E. The appendix also presents information on how the HELP SES index was created.

Table 5 displays visible dental decay rates for five SES levels, the number of students surveyed within HELP SES categories and the number of students with dental decay by each socioeconomic classification. Using HELP’s SES index, we found that dental decay rates remained relatively stable across survey years for all levels of SES; however, dental decay rates varied greatly depending on the SES of the neighbourhood:

- Approximately 5 in 10 children from low SES neighbourhoods experience dental decay
- At least one-third of children from moderate-level SES neighbourhoods (which reflects the majority of BC neighbourhoods) experience dental decay.
- Approximately 3 in 10 children from high SES neighbourhoods experience dental decay.

HELP examined individual correlations between each of the seven SES variables chosen by the Dental Evaluation Subcommittee and early childhood dental health outcomes. Table 6.1 presents the results of the correlation analysis, which are summarized as follows:
In both 2006/07 and 2009/10, the % No High School forms the strongest relationship with % Visible Dental Decay.

Union and professional membership is the only “protective” factor among the group of SES variables.

With respect to the HELP SES Index the strongest relationships with the % Visible Dental Decay were wealth and unemployment.

Correlations were also computed between the % Visible Dental Decay and the HELP SES Index, including each of its eleven subcomponents (see Appendix E). The results of the analysis, which are summarized below, can be found in Table 6.2.

• The overall SES Index was a better predictor of dental health than any individual SES component (e.g., Wealth, Unemployment, etc.).

• The Wealth subcomponent of the SES Index had the strongest correlation with the % Visible Dental Decay in 2006/07 and 2009/10. This leads us to speculate that as a community’s wealth increases, their rate of dental decay will decline.

• Unemployment was another strong correlate of dental decay, but in this case as a risk factor. As the unemployment rate of communities rise, so does their rate of dental decay.

Table 5. Visible Dental Decay (Code 02 + 03) Rates by Neighbourhood Socioeconomic Status (based on overall HELP SES Index)

<table>
<thead>
<tr>
<th>HELP SES Index Categories</th>
<th>% Visible Dental Decay in 2006/07</th>
<th>% Visible Dental Decay in 2009/10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Low SES</td>
<td>49.6</td>
<td>11.1</td>
</tr>
<tr>
<td>Moderately Low SES</td>
<td>41.7</td>
<td>10.3</td>
</tr>
<tr>
<td>Moderate SES</td>
<td>37.8</td>
<td>10.5</td>
</tr>
<tr>
<td>Moderately High SES</td>
<td>33.9</td>
<td>8.4</td>
</tr>
<tr>
<td>High SES</td>
<td>30.9</td>
<td>8.8</td>
</tr>
<tr>
<td>TOTAL</td>
<td>38.8</td>
<td>11.8</td>
</tr>
</tbody>
</table>

Notes: Low SES = bottom 20th percentile of neighbourhoods in BC (in terms of SES) … High SES = top 20th percentile of neighbourhoods in BC. M = Mean (Average); SD = Standard Deviation; Neighborhoods = number of HELP neighborhoods assigned to SES category. *The number of kindergarten students surveyed and with decay is an underestimate due to suppression.

Table 6.1. Correlations between Subcommittee SES/Demographic Measures and % Visible Dental Decay (Code 02 + 03)

<table>
<thead>
<tr>
<th>Correlations (r)</th>
<th>Visible Dental Decay 06/07 (n = 438)</th>
<th>Visible Dental Decay 09/10 (n = 464)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Visible Dental Decay 06/07 (n = 438)</td>
<td>Visible Dental Decay 09/10 (n = 464)</td>
</tr>
<tr>
<td>Union/Prof. Membership</td>
<td>-.397</td>
<td>-.448</td>
</tr>
<tr>
<td>Not Fluent in English/French</td>
<td>.330</td>
<td>.304</td>
</tr>
<tr>
<td>No High School</td>
<td>.546</td>
<td>.577</td>
</tr>
<tr>
<td>Low-Income</td>
<td>.437</td>
<td>.356</td>
</tr>
<tr>
<td>Lone Parent Families</td>
<td>.363</td>
<td>.364</td>
</tr>
<tr>
<td>Residential Mobility</td>
<td>.228</td>
<td>.166</td>
</tr>
<tr>
<td>Aboriginal Identity</td>
<td>.337</td>
<td>.432</td>
</tr>
</tbody>
</table>

Note: All correlation coefficients in the table are significant at p<.01.
To further illustrate the relationship between SES and dental decay across survey years, Figure 7 presents a scatterplot showing the general pattern of the relationship between HELP’s SES Index (2006) and percent dental decay by kindergarten dental survey year.

• In both survey years, as the socioeconomic status of communities increases (moving from left to right on the X-axis), the percent dental decay steadily declines.

• The strength of the relationship between SES and visible dental decay is similar across both survey years; 70 – 75%

Table 6.2. Correlations between HELP SES Index and Subcomponents and % Visible Dental Decay (Code 02 + 03)

<table>
<thead>
<tr>
<th>Correlations (r)</th>
<th>Visible Dental Decay 06/07 (n = 438)</th>
<th>Visible Dental Decay 09/10 (n = 464)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELP SES Index (2006)</td>
<td>-.565</td>
<td>-.538</td>
</tr>
<tr>
<td>Wealth</td>
<td>-.541</td>
<td>-.551</td>
</tr>
<tr>
<td>Unemployment</td>
<td>.500</td>
<td>.512</td>
</tr>
<tr>
<td>Residential Stability</td>
<td>-.272</td>
<td>-.210</td>
</tr>
<tr>
<td>Poverty</td>
<td>.290</td>
<td>.278</td>
</tr>
<tr>
<td>Lone Parents</td>
<td>.433</td>
<td>.455</td>
</tr>
<tr>
<td>Housing Density</td>
<td>.152</td>
<td>.103</td>
</tr>
<tr>
<td>Language and Immigration</td>
<td>.234</td>
<td>.185</td>
</tr>
<tr>
<td>Women in Manufacturing</td>
<td>-.413</td>
<td>-.360</td>
</tr>
<tr>
<td>Education</td>
<td>-.383</td>
<td>-.429</td>
</tr>
<tr>
<td>Social Assistance</td>
<td>-.446</td>
<td>-.394</td>
</tr>
<tr>
<td>Median Gov’t Transfers</td>
<td>-.474</td>
<td>-.471</td>
</tr>
</tbody>
</table>

Note: All correlation coefficients in the table are significant at p<.01.

Figure 7. Visible Dental Decay Rates by HELP SES Percentile
of the variance in predicting visible dental decay rates across survey years is unexplained by SES. This means that there are other community-level factors that influence visible dental decay rates, which are not included in our analysis. HELP extended the correlational analysis by conducting a series of Multiple Regression Analyses, which provide the added benefit of examining the relationship between visible dental decay and several indicators of SES simultaneously. This allows for a fuller picture to be gleaned about the relationship between SES and dental decay because seven different indicators of SES, as chosen by the Dental Evaluation Subcommittee, were included in the same analysis.

The results of the analyses using the seven Subcommittee-chosen SES variables are presented in Table 7.1. Appendix D presents information on how to interpret the results of the Regression Analysis; some of the key findings are presented below:

- According to the analyses, the percent of adults (age 25-64) in the community with “No High School” (i.e., the % adults who did not complete high school) is the risk factor that best predicts young children’s oral health, explaining half of the variance in visible dental decay rates in 2006/07 and two-fifths of the variance in 2009/10.

- Low-income is the second strongest risk factor in terms of the % Visible Dental Decay in 2006/07, but this relationship is somewhat weakened in 2009/10.

- Union or professional membership and Non-Fluency in English or French are not strong predictors of early childhood dental decay in 2006/07, but they are in 2009/10.

- Lone parenthood and residential mobility are also not strong predictors of oral health outcomes of young children.

<table>
<thead>
<tr>
<th>Table 7.1. Regression Analysis for SES (Subcommittee) and % Visible Dental Decay (Code 02 + 03)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variables</strong></td>
</tr>
<tr>
<td><strong>Subcommittee SES/Demographic Variables</strong></td>
</tr>
<tr>
<td>Visible Dental Decay 06/07</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>Union/Prof. Membership</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Not Fluent in English/French</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>No High School</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Low-Income</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Lone Parent Families</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Residential Mobility</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Aboriginal Identity</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>N (neighbourhoods)</td>
</tr>
<tr>
<td>F</td>
</tr>
<tr>
<td>R²</td>
</tr>
<tr>
<td>Std. Error of the Estimate</td>
</tr>
</tbody>
</table>

**p < .01; *p < .05; Dp < .10. Values in bold are Importance Scores.
• Communities with larger numbers of Aboriginal peoples tend to have higher rates of early childhood caries.

Table 7.2. Regression Analysis for SES (HELP) and % Visible Dental Decay (Code 02 + 03)

<table>
<thead>
<tr>
<th>HELP SES Index and Scales</th>
<th>Visible Dental Decay 06/07</th>
<th>Visible Dental Decay 09/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELP SES Index (2006)</td>
<td>( b = -6.685** )</td>
<td>( b = -6.665** )</td>
</tr>
<tr>
<td></td>
<td>( \frac{s.e.}{100,000} = .467 )</td>
<td>( \frac{s.e.}{100,000} = .486 )</td>
</tr>
<tr>
<td>Wealth (Main Model)</td>
<td>( b = -4.621** )</td>
<td>( b = -4.711** )</td>
</tr>
<tr>
<td></td>
<td>( \frac{s.e.}{48,330} = .667 )</td>
<td>( \frac{s.e.}{47,500} = .682 )</td>
</tr>
<tr>
<td>Education (exclude Wealth)</td>
<td>( b = -4.968** )</td>
<td>( b = -5.875** )</td>
</tr>
<tr>
<td></td>
<td>( \frac{s.e.}{37,504} = .717 )</td>
<td>( \frac{s.e.}{44,961} = .714 )</td>
</tr>
<tr>
<td>Social Assistance</td>
<td>( b = -3.779** )</td>
<td>( b = -2.268** )</td>
</tr>
<tr>
<td>(exclude Wealth)</td>
<td>( \frac{s.e.}{34,171} = .785 )</td>
<td>( \frac{s.e.}{18,690} = .768 )</td>
</tr>
<tr>
<td>Median Gov’t Transfers</td>
<td>( b = -4.486** )</td>
<td>( b = -4.038** )</td>
</tr>
<tr>
<td>(exclude Wealth)</td>
<td>( \frac{s.e.}{41,088} = .767 )</td>
<td>( \frac{s.e.}{36,432} = .749 )</td>
</tr>
<tr>
<td>Unemployment</td>
<td>( b = 3.110** )</td>
<td>( b = 3.088** )</td>
</tr>
<tr>
<td></td>
<td>( \frac{s.e.}{26,330} = .655 )</td>
<td>( \frac{s.e.}{27,714} = .624 )</td>
</tr>
<tr>
<td>Residential Stability</td>
<td>( b = -0.581 )</td>
<td>( b = 1.780** )</td>
</tr>
<tr>
<td></td>
<td>( \frac{s.e.}{2,956} = .559 )</td>
<td>( \frac{s.e.}{6,663} = .571 )</td>
</tr>
<tr>
<td>Poverty</td>
<td>( b = 0.116 )</td>
<td>( b = 0.164 )</td>
</tr>
<tr>
<td></td>
<td>( \frac{s.e.}{0.671} = .507 )</td>
<td>( \frac{s.e.}{0.516} = .516 )</td>
</tr>
<tr>
<td>Lone Parents</td>
<td>( b = 0.821 )</td>
<td>( b = 1.928** )</td>
</tr>
<tr>
<td></td>
<td>( \frac{s.e.}{6.554} = .692 )</td>
<td>( \frac{s.e.}{16.175} = .687 )</td>
</tr>
<tr>
<td>Language and Immigration</td>
<td>( b = 3.181** )</td>
<td>( b = 3.776** )</td>
</tr>
<tr>
<td></td>
<td>( \frac{s.e.}{14.180} = .634 )</td>
<td>( \frac{s.e.}{12.450} = .652 )</td>
</tr>
<tr>
<td>Women in Manufacturing</td>
<td>( b = -0.797 )</td>
<td>( b = -0.526 )</td>
</tr>
<tr>
<td></td>
<td>( \frac{s.e.}{6.724} = .538 )</td>
<td>( \frac{s.e.}{3.643} = .544 )</td>
</tr>
<tr>
<td>(Constant)</td>
<td>( b = 39.694** )</td>
<td>( b = 39.932** )</td>
</tr>
<tr>
<td></td>
<td>( \frac{s.e.}{6.724} = .470 )</td>
<td>( \frac{s.e.}{3.643} = .488 )</td>
</tr>
<tr>
<td>N (neighbourhoods)</td>
<td>439</td>
<td>439</td>
</tr>
<tr>
<td></td>
<td>465</td>
<td>465</td>
</tr>
<tr>
<td>F</td>
<td>204.657**</td>
<td>47.130**</td>
</tr>
<tr>
<td></td>
<td>188.175**</td>
<td>50.520**</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>.319</td>
<td>.344</td>
</tr>
<tr>
<td></td>
<td>.289</td>
<td>.436</td>
</tr>
<tr>
<td>Std. Error of the estimate</td>
<td>9.764</td>
<td>8.967</td>
</tr>
<tr>
<td></td>
<td>10.439</td>
<td>9.356</td>
</tr>
</tbody>
</table>

**\( \text{p} < .01; \text{p} < .05; \text{Dp} < .10 \). Numbers in bold are Importance Scores.
With regard to the HELP SES index and subcomponents, several regression analyses were run to predict the % Visible Dental Decay in 2006/07 and in 2009/10. Table 7.2 presents the results of these analyses (see Appendix D for information on interpreting regression analyses). The key findings are as follows:

- As was found in the correlational analysis, “Wealth” was the socioeconomic protective factor that most strongly predicted the oral health outcomes of young children, explaining nearly half of the variance in visible dental decay rates across both survey years.
- Education and Median Government Transfers were also strong protective factors in predicting the % Visible Dental Decay, but these subcomponents of the HELP SES Index were highly related to Wealth (see Appendix D for explanation). In other words, these 3 factors have an overlapping influence on the oral health of communities.
- Unemployment was the sole socioeconomic risk factor that consistently predicted dental decay rates in both 2006/07 and 2009/10.

Tables 8.1 and 8.2 present Importance Scores along with the pattern of the relationship for each SES variable (Subcommittee-chosen and HELP SES Index with subcomponents) and the rate of visible dental decay.

- Higher Importance Scores (positive values) represent stronger relationships with the % Visible Dental Decay relative to other SES variables.
- Importance scores for the SES index in these models = 100%, because it is the sole variable predicting dental decay in the models (see first of two columns under each analysis of the % Visible Dental Decay in 2006/07 and 2009/10).
- In both survey years, a one-unit increase in the HELP SES Index corresponds to nearly a 7-percent reduction in the rate of visible dental decay. A one-unit increase in the SES Index roughly corresponds to a percentile increase from 50th (provincial average) to the 79th percentile.

Table 8.1. Subcommittee SES/Demographic Importance Scores in Predicting the % Visible Dental Decay (Code 02 + 03)

<table>
<thead>
<tr>
<th>Subcommittees SES variables</th>
<th>% Visible Dental Decay in 2006/07 Importance Score</th>
<th>Pattern of Relationship</th>
<th>% Visible Dental Decay in 2009/10 Importance Score</th>
<th>Pattern of Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Union/Prof. Membership</td>
<td>1.9</td>
<td>↓ Decay</td>
<td>12.5*</td>
<td>↓ Decay</td>
</tr>
<tr>
<td>Not Fluent in English/French</td>
<td>5.3</td>
<td>↑ Decay</td>
<td>12.9**</td>
<td>↑ Decay</td>
</tr>
<tr>
<td>No High School</td>
<td>50.4**</td>
<td>↑ Decay</td>
<td>40.1**</td>
<td>↑ Decay</td>
</tr>
<tr>
<td>Low-Income</td>
<td>32.7**</td>
<td>↑ Decay</td>
<td>10.3*</td>
<td>↑ Decay</td>
</tr>
<tr>
<td>Lone Parent Families</td>
<td>-1.7</td>
<td>↓ Decay*</td>
<td>2.5</td>
<td>↑ Decay</td>
</tr>
<tr>
<td>Residential Mobility</td>
<td>1.5</td>
<td>↑ Decay</td>
<td>-1.0</td>
<td>↓ Decay+</td>
</tr>
<tr>
<td>Aboriginal Identity</td>
<td>9.9*</td>
<td>↑ Decay</td>
<td>22.8**</td>
<td>↑ Decay</td>
</tr>
</tbody>
</table>

Note: Importance Scores may not add up to 100 due to rounding error. *p < .05; **p < .01.
+ Counterintuitive finding: the relationship with % Visible Dental Decay formed the opposite relationship from what was expected (hence the negative importance score).
An exploratory analysis was conducted to identify ‘on’ and ‘off’ diagonal neighbourhoods. On-diagonal neighbourhoods are neighbourhoods that have expected outcomes in terms of SES and dental health.

More formally, on-diagonals can be defined as:

- High SES neighbourhoods with low rates of visible dental decay in both 2006/07 and 2009/10; or
- Low SES neighbourhoods with high rates of visible dental decay in both survey years.

Off-diagonals are neighbourhoods that have either worse than expected or better than expected dental outcomes with regard to their socioeconomic status. Off-diagonals can be defined as:

- High SES neighbourhoods with high rates of visible dental decay in both 2006/07 and 2009/10; or
- Low SES neighbourhoods with low rates of visible dental decay in both survey years.

Table 9 presents the number and percent of on and off-diagonal neighbourhoods identified across survey years. Some key findings are as follows:

- 277 neighbourhoods (out of 444 neighbourhoods) were identified as on-diagonals in 2006/07 and again in 2009/10. These neighbourhoods had rates of visible dental decay that were as expected based on their socioeconomic status (i.e., higher visible dental decay rates were associated with lower socioeconomic standings). For information on how on-diagonal

### Table 8.2. HELP SES Index and Component Importance Scores in Predicting the % Visible Dental Decay (Code 02 + 03)

<table>
<thead>
<tr>
<th></th>
<th>% Visible Dental Decay in 2006/07</th>
<th>% Visible Dental Decay in 2009/10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Importance Score</td>
<td>Pattern of Relationship</td>
</tr>
<tr>
<td>HELP SES Index</td>
<td>100.0**</td>
<td>▼ Decay</td>
</tr>
<tr>
<td>Wealth (Main Model)</td>
<td>48.3**</td>
<td>▼ Decay</td>
</tr>
<tr>
<td>Unemployment</td>
<td>26.3**</td>
<td>▼ Decay</td>
</tr>
<tr>
<td>Residential Stability</td>
<td>-3.0</td>
<td>▼ Decay+</td>
</tr>
<tr>
<td>Poverty</td>
<td>0.7</td>
<td>▼ Decay</td>
</tr>
<tr>
<td>Lone Parents</td>
<td>6.6</td>
<td>▼ Decay</td>
</tr>
<tr>
<td>Language and Immigration</td>
<td>14.2**</td>
<td>▼ Decay</td>
</tr>
<tr>
<td>Women in Manufacturing</td>
<td>6.7</td>
<td>▼ Decay</td>
</tr>
</tbody>
</table>

Note: Importance Scores may not add up to 100 due to rounding error. Importance Scores for Education, Social Assistance and Median Government Transfers are not included in the main model due to collinearity. (i.e., the analysis including Education excludes Wealth, Social Assistance, and Median Government Transfers from the model). *p < .05; **p < .01.  
▼ Counterintuitive finding: the relationship with % Visible Dental Decay formed the opposite relationship from what was expected (hence the negative importance score).
scores are calculated, please see Forer (2007).

- In total, 100 off-diagonals were identified either in 2006/07 and in 2009/10, 50 better than expected and 50 worse than expected. A list of these neighbourhoods by survey year is provided in the excel spreadsheet attachment. For information on how off-diagonal scores are calculated, please see Forer (2007).

- In order to be considered a consistent off-diagonal, the neighbourhood must be an off-diagonal in both Kindergarten Dental Survey years. In total, 30 neighbourhoods were identified as consistent off-diagonals: 14 better than expected (e.g., Fairview in Vancouver) and 16 worse than expected (e.g., Rosedale/Chilliwack East in Fraser East).

<table>
<thead>
<tr>
<th>Table 9. Summary of Neighbourhood On/Off-Diagonals (SES → Dental)</th>
</tr>
</thead>
<tbody>
<tr>
<td># Neighbourhoods</td>
</tr>
<tr>
<td>Persistent On-Diagonal</td>
</tr>
<tr>
<td>Off-Diagonal in 06/07 only</td>
</tr>
<tr>
<td>Off-Diagonal in 09/10 only</td>
</tr>
<tr>
<td>Off-Diagonal in 06/07 &amp; 09/10</td>
</tr>
<tr>
<td>Persistent Off-Diagonals in 06/07 &amp; 09/10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 10. Neighbourhood Off-Diagonals (SES → Dental)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveyed Dental Decay CHANGE SES Health Region Neighbourhood 06-07 09-10 06-07 09-10 06/07-09/10 Percentile</td>
</tr>
<tr>
<td>Better Than Expected</td>
</tr>
<tr>
<td>Fraser N.</td>
</tr>
<tr>
<td>Okanagan</td>
</tr>
<tr>
<td>Okanagan</td>
</tr>
<tr>
<td>Okanagan</td>
</tr>
<tr>
<td>North Shore</td>
</tr>
<tr>
<td>North Shore</td>
</tr>
<tr>
<td>North Shore</td>
</tr>
<tr>
<td>North Shore</td>
</tr>
<tr>
<td>North Shore</td>
</tr>
<tr>
<td>Vancouver</td>
</tr>
<tr>
<td>Vancouver</td>
</tr>
<tr>
<td>N. Van. Island</td>
</tr>
<tr>
<td>S. Van. Island</td>
</tr>
<tr>
<td>S. Van. Island</td>
</tr>
<tr>
<td>Worse Than Expected</td>
</tr>
<tr>
<td>Fraser E.</td>
</tr>
<tr>
<td>Fraser N.</td>
</tr>
<tr>
<td>Fraser S.</td>
</tr>
<tr>
<td>TCS</td>
</tr>
<tr>
<td>TCS</td>
</tr>
<tr>
<td>TCS</td>
</tr>
<tr>
<td>TCS</td>
</tr>
<tr>
<td>TCS</td>
</tr>
<tr>
<td>E. Kootenay</td>
</tr>
<tr>
<td>Kootenay B.</td>
</tr>
<tr>
<td>Northeast</td>
</tr>
<tr>
<td>Northeast</td>
</tr>
<tr>
<td>Northwest</td>
</tr>
<tr>
<td>C. Van. Island</td>
</tr>
<tr>
<td>C. Van. Island</td>
</tr>
<tr>
<td>N. Van. Island</td>
</tr>
</tbody>
</table>
Table 10 presents data on the 30 identified off-diagonal neighbourhoods. The corresponding neighbourhood-level maps for health authorities also identify these neighbourhoods. Off-diagonals serve as a good starting point to identify unique cases where dental programs are working and, alternatively, where more resources may be needed throughout the province.

Visible Dental Decay Rates and Early Child Development Indicators

In this section, we present the analysis of kindergarten visible dental decay rates and early child development outcomes in BC, as measured by the Early Development Instrument (EDI). The approach to analyze early childhood dental health data with respect to early child development outcomes is reflective of a holistic view that oral health is not mutually exclusive from a child’s overall health and development more generally. For example, it is anticipated that populations considered at high risk in terms of their general health and well-being may disproportionately experience not only higher rates of visible dental decay but also higher rates of developmental vulnerability. Analysis of population-level early child development data with kindergarten visible dental decay data could yield new information about the extent that there are common risk factors, such as the socioeconomic status and demographics of a neighbourhood, that may differentially influence young children’s oral health and overall development over time and across geographic areas.

The EDI is used in BC to understand the vulnerability of the population of young children. Measuring children’s development at school entry is important because it reflects the quality of children’s early experiences. The EDI is a holistic measure of children’s development and provides measurement on these five distinct scales:

1. Physical health and well-being
2. Social competence
3. Emotional maturity
4. Language and cognitive development
5. Communication skills and general knowledge

Kindergarten teachers complete an EDI checklist for each child in their class after they have known their students for several months. All teachers undergo standardized training in the administration of the instrument. For more discussion of the EDI, please see Appendix D.

Table 11. EDI (Wave 3) Vulnerability Rates (%) for Province and HAs

<table>
<thead>
<tr>
<th>EDI Wave 3 (2007-09)</th>
<th>Fraser</th>
<th>Interior</th>
<th>Northern</th>
<th>Vancouver Coastal</th>
<th>Vancouver Island</th>
<th>BC (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Vulnerable by Scale</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Physical Health &amp; Well-being</td>
<td>11.0</td>
<td>6.7</td>
<td>10.2</td>
<td>6.8</td>
<td>15.9</td>
<td>9.0</td>
</tr>
<tr>
<td>Social Competence</td>
<td>12.4</td>
<td>6.9</td>
<td>9.9</td>
<td>6.0</td>
<td>14.7</td>
<td>9.9</td>
</tr>
<tr>
<td>Emotional Maturity</td>
<td>11.3</td>
<td>6.3</td>
<td>11.5</td>
<td>7.3</td>
<td>12.8</td>
<td>6.0</td>
</tr>
<tr>
<td>Language &amp; Cognitive Development</td>
<td>9.9</td>
<td>6.2</td>
<td>8.6</td>
<td>6.0</td>
<td>15.0</td>
<td>8.7</td>
</tr>
<tr>
<td>Communication Skills &amp; General Knowledge</td>
<td>13.3</td>
<td>7.0</td>
<td>10.0</td>
<td>6.5</td>
<td>14.0</td>
<td>9.4</td>
</tr>
<tr>
<td>One or More Scales</td>
<td>27.8</td>
<td>11.1</td>
<td>24.6</td>
<td>10.9</td>
<td>33.3</td>
<td>13.1</td>
</tr>
</tbody>
</table>

Note: M = mean; SD = standard deviation.
Table 11 presents descriptive statistics (sample size, means, standard deviations) for the province and five health authorities for each of the five EDI subscales, including the overall measure of vulnerability (vulnerable on one or more scales). The data are from Wave 3 of the EDI, which was administered in the 2007/08 and 2008/09 school years.

As an initial test of the relationship between EDI and the oral health of young children, correlations were computed between the % Visible Dental Decay in 2006/07 and six indicators of early child development (as measured by Wave 3 of the EDI). The results of the correlation analysis are presented in Table 12.

Multiple Regression Analyses were also conducted in which the % Visible Dental Decay and the HELP SES Index were jointly used to predict each measure of EDI in Wave 3 (e.g., % children vulnerable in terms of physical health and well-being). The results of these analyses are presented in Table 13 and summarized below:

- The oral health of young children, as measured by the % of kindergarten children with visible dental decay, is a significant predictor of early child

| Table 12. Correlations between EDI Vulnerability Rates (Wave 3) and % Visible Dental Decay (Code 02 + 03) |
|-----------------------------------------------|-----------------------------------------------|
| **Correlations (Pearson’s r)** | **Visible dental Decay** |
| EDI Vulnerability (Wave 3): | .398 |
| Physical Health & Well-being | .335 |
| Social Competence | .280 |
| Emotional Maturity | .222 |
| Language & Cognitive Development | .366 |
| Communication Skills & General Knowledge | .376 |

Note: All correlation coefficients in the table are significant at p < .01.
development in terms of (1) physical health and well-being, (2) language and cognitive development, and (3) overall developmental vulnerability (i.e., vulnerability on one or more scales of the EDI).

- These relationships were found after controlling for the effects of SES. Relative to the socioeconomic status of the child’s community, however, the oral health of young children is a relatively weak predictor of early child development.

**Summary**

Overall, these findings suggest:

- Dental outcomes of children differ by geographic location and socioeconomic status of the neighbourhood.
- Although the percentage change in visible dental decay rates at a provincial level between 2006/07 and 2009/10 was small, rates of change differed greatly depending upon the neighbourhood.
- Children from socioeconomically disadvantaged neighbourhoods tend to have higher rates of visible dental decay than those in more advantaged neighbourhoods. The proportion of children affected is highest in the lowest socioeconomic status neighbourhoods (i.e., 1 for every 2 children has visible dental decay); however, in terms of numbers of children with visible dental decay, the majority of children with visible dental decay reside in neighbourhoods with mid-level categories of socioeconomic status.
- There is a moderate level of consistency between rates of vulnerability, as measured by the EDI, and rates of visible dental decay, at least for the 2006/07 dental survey dataset.
- Visible dental decay does not appear to make a strong, unique contribution over and above socioeconomic factors in predicting rates of early childhood vulnerability.
RISK ASSESSMENT

2. Are the current dental health risk assessment/screen guidelines implemented as intended?

A variety of tools, guidelines, and follow up techniques are currently being used across health authorities.

Additionally, dental staff consistently reported that risk assessments/screening guidelines were being implemented as intended, and were simple to use.

Within focus group discussions, dental staff consistently reported that they were familiar with region-specific protocols and guidelines for dental health risk assessments. In general, staff in each Health Authority stated that dental health risk assessment guidelines were being implemented as intended and that the tools were simple to use as part of the established, routine procedures. There were some variations among dental health risk assessment implementation protocols and guidelines, such as which assessment tools are used, as well as the procedures for asking parents questions, identifying and classifying risk levels, and following-up with families.

2i. What standardized dental health risk assessment tool/questions should be used with children aged 0-5 (including kindergarten entry) in BC?

In 2007/2008 HELP undertook a Caries Risk Assessment Tool Development project, which included a review of the literature and best-practices within and outside BC, consultations with public health dental staff, and recommendations from the BC Early Childhood Dental Programs Evaluation Subcommittee. As a result of this process, HELP was able to distill five key themes that cut across the literature as well as the different tools and guidelines used in health authorities: dentist visits, signs of decay, tooth brushing and fluoride, feeding practices, barriers to access (see Appendix F for more details). These themes were drawn upon to propose several risk assessment questions that could be considered with any future development of the tool (For further information about these questions, please see the Provincial Caries Risk Assessment (CRA) Tool Development and Validation Template).

In considering any revisions to the assessment tool, it may be useful to note that in a Scottish study of 1500 one-year-olds, the two most significant risk indicators for the child having at least three carious teeth at the age of four were (1) living in social housing, and (2) the health visitor’s subjective opinion on “Is this child at high risk

44 In this evaluation project, dental health risk assessment refers to caries risk assessment as well as the dental health assessment portion of an early childhood health assessment. Caries risk assessment (CRA) refers to the determination of the likelihood of the incidence of caries. In BC health authorities, dental staff play a central role in caries risk assessment, while Public Health Nurses provide early childhood health assessments and referrals to dental staff.
of or from caries” (yes/no) (sensitivity = 65%, specificity = 69%). In the Scottish National Clinic Guideline for the Prevention and Management of Tooth Decay in the Preschool Child, it is stated that caries risk assessment would be appropriate for use by both dental and non-dental personal, and would be appropriate in a primary care setting. Extrapolating from the available evidence, the guideline recommends that “specialist community public health nurses and child healthcare professionals could consider carrying out a caries risk assessment of children in their first year as a part of the child’s overall health assessment.”

2ii. At what age(s) should these be administered?

At the time of evaluation, health authorities were screening children at diverse ages. In some health authorities a questionnaire was administered at 12-month-old Child Health Clinics (CHCs). Others health authorities offer the risk assessment in community settings and at the health unit for children 0-4 years old. Fraser Health Authority also offered integrated screening programs for 18-month-old children in care as well as 3-year-old children at selected community sites. Vancouver Island Health Authority integrated dental health-related questions into the health assessment by Public Health Nurses (PHNs) at each CHC, from the 2-month through the 24-month visit.

In the focus groups, opinions on the ideal age at which risk assessments should be administered ranged from 6 months-old to 18 months-old. Generally, it was believed that assessment at an earlier age provides more timely preventive interventions. It provides opportunities for public health staff to work with the caregivers or parents and also enables the child to become familiar with oral health examinations. The literature recommends that caries risk assessments be administered no later than 12 months-old, with the caveat that the field of caries risk assessment is relatively new and that there are multiple population factors to consider in program planning (including socioeconomic status, language diversity, etc).

2iii. Who should administer the dental health risk assessment?

A variety of health authority staff administered dental health risk assessments at the time of evaluation. In some health authorities, health unit volunteers, clerks or PHNs handed out a paper-based questionnaire to parents. In other health authorities, health units with dental staff in-house (and usually serving smaller populations), a face-to-face dialogue with parents may have taken place.

As part of the 2007/08 CRA Tool Development process, members of the Dental Evaluation Subcommittee recommended that if written simply, the standardized CRA could be used by public health dental personnel, including Certified Dental

---

50 Association of State and Territorial Dental Directors, Research Brief: Fluoride Varnish: an Evidence-Based Approach (Sparks, NV: Association of State and Territorial Dental Directors, 2007).
Assistants, Dental Hygienists, and non-dental public health staff. It was suggested that where feasible, dental staff would administer risk assessments since they could immediately provide follow-up. If no dental staff were available, non-dental public health staff (e.g., clerical staff or volunteers) could administer the questionnaire and submit the completed forms to dental staff for follow-up.

2iv. What guidelines and follow-up procedures should be used?

A variety of guidelines were being used across BC at the time of the evaluation: a classification grid, counseling notes, health authority-specific protocols, PHN practice guidelines. A variety of follow up practices were also used, including on-site fluoride varnish, distribution of pamphlets, mailing toothpaste, and phoning families to offer fluoride varnish. In VIHA, families were referred to dental staff for caries risk assessment if dental risk factors or concerns were identified during the Health Check or PHN screening. Although not brushing twice daily is considered “high risk” in some areas and “medium risk” in others, this risk factor consistently determined referral to the fluoride varnish program across all five health authorities. Ultimately, all guidelines and follow up procedures included contact by mail or phone with an offer of fluoride varnish for children assessed as high risk (and/or recommendation to see a dentist for treatment as needed).

With regards to the format of guidelines and procedures to be used, HELP recommends that the Ministry of Health consider developing standardized guidelines and follow up procedures (see Recommendations section for further details). As part of the 2007/08 CRA Tool Development process, HELP developed a questionnaire to gather health authority staff perspectives on what guidelines and follow-up procedures should be used (e.g., content and types of guidelines, documentation, preventive strategies by risk level, mandatory versus suggested follow-up). The administration of the questionnaire was discontinued in order to focus the evaluation on the implementation of the existing dental health risk assessment programs.

Content areas for consideration that stem from focus group discussions and the literature include:

1. Fluoride Varnish
   - Any protocol on the application of fluoride varnish should be based on risk assessment.  
   - For predominately high-risk populations (e.g., people with low socio-economic status, new immigrants and refugees, all First Nations and Inuit children), fluoride varnish should be applied twice a year, unless the individual has no risk of caries, as indicated by past and current caries history.  
   - Given that there is good evidence of the complementary effectiveness of sealants and varnish, as well as toothbrushing and nutritional counseling, oral health care programs should include as many complementary preventive strategies as feasible. (see also: Crall, 2007)  
   - Population factors to consider in fluoride varnish program planning include

---

52 Ibid.
54 Azarpazhooh and Main, “Fluoride varnish in the prevention of dental caries in children and adolescents.”
availability of dental care and proportion of the population who 1) are low SES, 2) are an ethnic minority, 3) speak English as a second language, 4) are homeless, 5) have limited education, 6) have special health care needs, 7) have high caries incidence and prevalence rates or advanced disease, and 8) lack access to fluoridated water.55

2. Supporting families in accessing treatment services56
   • Recommend visits to dentists.
   • Maintain lists of dentists and accessibility information (e.g., accepting new patients, wheelchair accessible, accepts First Nations Non-Insured Health Benefits, accepts Healthy Kids Benefits).
   • Inform families that dental offices may require payment at time of service and suggest that they ask in advance of dentist visits whether or not payment is required, thereby helping the family to be aware of any challenges they may encounter at the dental office.

3. Modes of follow-up contact
   • Consider more personalized follow-up procedures. Focus group findings suggest that that follow-up phone calls may be more effective than letters in expanding fluoride varnish coverage (although phoning all families may be more costly in urban centres than rural areas). Follow-up phone calls provided a point of contact in rural areas where dental staff could not attend CHCs and had limited interaction with parents. Participants across the province mentioned that phone calls worked well with some vulnerable populations.
   • Research indicates that telephone contact, although costly, is more effective than letters to increase vaccination rates.57 Research also indicates that recall and reminder systems can have “spillover effects” in increasing preventive care and primary care visits.58
   • Where appropriate and convenient for families, dental staff could use text messaging to reduce the cost of communication for families, particularly younger families with lower incomes.

2v. To what extent does the dental health risk assessment/screening reach young children?

Electronic child health records were not available for analysis, and so the actual number of children receiving the dental health risk assessment is unknown. In the four health authorities that provide dental health risk assessment at 12-month immunization clinics, dental staff reported that they were not reaching families that do not access 12-month immunizations through public health. About 35% of immunizations in BC are provided by physicians (and 90% in Vancouver and Richmond).59 Also, BC immunization coverage rates do not include First Nations and Inuit children living on reserve where immunization is delivered by Band Nurses or by First Nations and Inuit Health.

55 Association of State and Territorial Dental Directors, Research Brief: Fluoride Varnish: an Evidence-Based Approach.
56 This component is included in the Population Health and Wellness Service Plan 2007/2008.
57 V.J. Jacobson and P. Szilagyi, “Patient reminder and patient recall systems to improve immunization rates,” Cochrane Database of Systematic Reviews (Online), no. 3 (2005): CD003941.
In regions that provided risk assessment in community sites, dental staff expressed concern that the program was not reaching the populations that could most benefit. One speculation made was that those families with at-home childcare (e.g., provided by extended family members such as grandparents or aunts), would be disproportionately excluded from the program’s reach:

“I think we missed a lot of young families at home, that are at home, and aren’t attending groups. That’s where something like an intensive home visiting program [could be useful] … where the Public Health Nurse is really connected to the family, and brings in the dental component as needed.”

2vi. To what extent does the program identify a broad spectrum of children at risk for caries?

Dental staff described a range of demographic groups who often do not access public health services, and therefore do not receive information about dental health programs or key oral health messaging. As such, focus group participants felt that these groups were at higher risk for developing caries and might not be accessing the preventive services offered by dental public health. When discussing the specific demographic groups who were particularly hard-to-reach, dental staff primarily referred to: families with low income, lone-parent families, families residing in rural or remote locations, recent immigrant families, families of Aboriginal descent, and families with special needs. Results from the 2009/10 Kindergarten Dental Survey corroborate the dental staff’s identification of the above mentioned demographic groups, with particularly high importance scores, at the neighbourhood-level, for areas with higher proportions of individuals with no high school graduation (accounting for 40.1% of variability in kindergarten dental decay, of Aboriginal identity (22.8%), not fluent in English (12.9%), and with low income (10.3%). Results for Aboriginal children show that 28.5% of Aboriginal kindergarten-aged children had untreated visible decay, compared to 16.2% of non-Aboriginal children (and 34.5% of First Nations children attending First Nations schools on reserve).60 Taken together, these findings underscore the need for early childhood preventive services to be tailored for populations of concern.

2vii. For those eligible children who dental public health is not reaching, what are the barriers?

The most commonly referenced barriers to accessing preventative dental care were families’ overriding daily stressors, lack of transportation, lack/expense of telephone, language barriers, distrust of public health professionals.

One of the barriers to program reach that was mentioned in relation to the Health Authority target numbers for assessment was staff workloads such that managers tended to focus on community sites known to provide easy access to children. As one participant stated:

In terms of barriers to health care access for families, focus group discussions were largely consistent with Canadian Oral Health Strategy recommendations for improving social/cultural access to oral health (i.e., access to oral health care in a comfortable setting where the client can feel at ease from a cultural, social, and linguistic point of view). Dental staff described multiple interconnected barriers that can create access issues to oral health care, including overriding daily stressors, lack of transportation, lack/expenditure of telephone, language barriers, a distrust of health professionals, and limits to the First Nations Health Benefit program. Barriers are discussed below in further detail.

**Overriding stressors:** families may often give preventive dental health concerns a low priority status when juxtaposed with more immediate daily needs, such as obtaining food, working irregular hours, coping with domestic violence, addressing language barriers, or perhaps attending more important appointments, such as those with social workers.

**Transportation:** many families may not have access to transportation, or public transportation may seem too cumbersome with a child in-tow, especially when considered in conjunction with the overriding stressors mentioned above.

**Language barriers:** the societal discrimination experienced by people with English as a second language may make them more cautious to enter potentially culturally incongruent environments, such as those posed by public health offices. Additionally, the difficulty and stress of communicating with an English speaking dental practitioner who might use specialized jargon may be particularly inhibitory for families who have English as a second language.

**Distrust of public health professionals:** many families may avoid public health services, regardless of need, due to a fear of child apprehension and/or being reported to child welfare agencies. As underscored by the BC Aboriginal Child Care Society:

“Because of the history of residential schools, the child protection system / “60’s scoop”, and other aspects of the relationship between First Nations and institutions of mainstream society, many First Nations families are wary of entrusting their young children to formal, non-familial care and education programs (p. 5).”

The above barriers that were confirmed by dental staff also mirror those barriers to accessing health and early child development resources that HELP identified in conjunction with community service providers: Transportation, Language, Social Distance (e.g., lack of trust, embarrassment), Time Poverty, and Parental Consciousness (e.g., awareness of the benefits of programs/services).65

Of note with respect to barriers to accessing preventive dental care, is that dental staff reported that the above mentioned barriers can disproportionately affect specific demographic groups: families with low income, lone-parent families, families residing in rural or remote locations, recent immigrant families, families of Aboriginal descent, and those families with special needs. Additionally, one should understand that barriers may not be easily addressed in isolation from each other, as families can experience multiple barriers. Consideration of these barriers could be useful in planning future service delivery.

Considering Aboriginal Communities

As stated above, Aboriginal identity accounted for 22.8% of the variability of dental decay in the 2009/10 Kindergarten survey, and as such, Aboriginal identity is a significant predictor of developing early childhood dental decay in British Columbia. First Nations people on reserve receive a mix of dental health prevention services funded through regional health authorities and Health Canada’s First Nations and Inuit Health program (including the Children’s Oral Health Initiative).66 Barriers preventing Aboriginal families from accessing oral health care which were discussed in the focus group included: lack of transportation, missed immunization appointments due to too many overriding stressors, a sense of mistrust towards public health services, band nurses not being aware of caries risk screening, and Aboriginal parents not feeling comfortable with entering health units.67

Understanding and appreciating these barriers to access can help public health dental staff to better reach Aboriginal families and communities on the topic of oral-health care. UNICEF Canada stated that “nowhere is the health disparity between Aboriginal and non-Aboriginal children more evident than in dental health.”68 In one Aboriginal community within Ontario, for example, 74% of the children between 3 and 5 years of age had previous experience with carious lesions. Focus group discussions pertaining to methods for dismantling barriers to care that many Aboriginal families experience centered on: cultural safety training for dental staff, community outreach initiatives, community partnerships, and trying to mitigate some of the extraneous stressors such as transportation.

67 UNICEFCanada, “Aboriginal children’s health: Leaving no child behind” (Canadian UNICEF Committee, 2009), 15.
68 UNICEFCanada, “Aboriginal children’s health: Leaving no child behind.”
Summary

Overall, the findings related to caries risk assessment and barriers to accessing public health services highlight two areas for future consideration. First, the variety of health authority risk assessment tools and guidelines that are currently being used across the province could be standardized into one coherent and comprehensive toolkit for use by all health authorities. This standardized toolkit could include a risk assessment tool, guidelines and follow-up techniques that are grounded in the key themes that emerged from the environmental scan. Second, the findings illuminated the specific types of barriers that prevent families from accessing public health services, and that disproportionately affect populations of concern.
HEALTH PROMOTION AND PREVENTIVE STRATEGIES

3. Are health promotion interventions effective in supporting family dental health practices toward reducing early childhood caries?

Public health dental focus group participants indicated that for participating families, the dental health risk assessment was effective in supporting healthy parent practices when used in conjunction with preventive counseling, education, or additional support. Strategies for supporting healthy parent practices highlighted by dental staff included tailored group health education sessions to populations of concern, building rapport and trust, motivational interviewing, role playing, and tooth fairy costumes. Dental staff in VCHA and VIHA attributed improvements in parent awareness and children's oral health to dental staff community health promotion efforts prioritizing preschool programs as juice-free environments. Dental staff across all health authorities reported difficulty reaching vulnerable populations as a barrier to program coverage and effectiveness in general.

A systematic review of the research concluded that strategies targeting high-risk groups within a whole population may help reduce inequalities in oral health.69 Mailing fluoride toothpaste to a specific “at-risk” population of children from 12 months onward also was associated with reduced caries prevalence in kindergarten children.70 In 2004, a Glasgow community development program in a low income area aimed to deliver consistent messages, improve diet, provide access to fluoride toothpaste, and support preschool tooth brushing programs.71 Over four years, this multi-strategy program was associated with significant improvements in preschool dental health. Similar to our findings, a recent US focus group study among caregivers with low incomes concluded that community-based oral health initiatives should emphasize developing trust of caregivers with service providers.72

---

BUILDING PARTNERSHIPS

4. What strategies are used in the health authorities to prevent early childhood dental disease? What is the most effective combination of strategies being provided in the health authorities to prevent early childhood dental disease?

Preventive strategies could include community outreach and partnership-building, integration with existing public health programs, and supporting families in accessing dental care.

In addition to the dental health risk assessment and fluoride varnish programs, dental staff described several preventive strategies used in health authorities, as outlined below.

**Community outreach:** Community outreach was frequently mentioned as the most effective strategy for reaching hard-to-reach populations that were typically missed by public health dental teams. This finding is echoed by the US Surgeon General recommendation that “partnerships be used to improved oral health.”73 By building partnerships with community organizations, public health dental programs can efficiently expand their program coverage to include the families that the community partners already work with. Types of community partners which were highlighted by dental staff included: drop-in programs, health fairs, community events, support groups, infant programs, parenting groups, early childhood development networks, preschools, school districts, and individual community champions. Specific organizations that were mentioned in reference to community outreach included StrongStart, Healthiest Babies Possible, and Aboriginal Friendship Centres. Similarly, the Surgeon General listed community programs such as Head Start and supplemental food programs as potential partners. Additionally, Andersen’s revised access to care model includes community programs as enabling factors that may be precursors for utilization of available oral health services.74 Community programs can improve the links between families and oral health care through referrals and networking,75 with community program staff being well-positioned to identify children vulnerable to caries at an early age.76

**Building rapport and trust with families:** A focus on building a rapport with families was repeatedly highlighted as being an effective strategy for reducing early childhood caries. Building trust, rapport, and respect with clients often encourages the clients, in due time, to follow health practitioner’s suggestions for health-promoting practices.77 According to participants, building rapport may

---

74 Ronald Andersen, Changing the US health care system: Key issues in health services, policy, and management, 2nd ed. (San Francisco Calif.: Jossey-Bass, 2001).
77 Karen Saunder Lundy and Sharyn Jones, Community health nursing: Caring for the public’s health (Sudbury, MA: Jones & Bartlett, 2009).
allow caregivers to feel more at ease to disclose more accurate information, from which dental staff can provide the most appropriate follow-up. Additionally, building rapport with families can help to build trust between caregivers and dental staff, a lack of which is stated to inhibit some populations from more frequently accessing public health services. Aboriginal populations for example, are perhaps the one population with the most entrenched distrust towards public health initiatives due to the decades of unqualified removal of Aboriginal children from Aboriginal families. Applying their framework for oral health disparities in a case study of Alaska, Patrick and colleagues maintain that “rapport, trust, and tribal cooperation/collaboration and endorsement are necessary to address community oral health issues.” A focus on earning the trust of Aboriginal families and communities, may therefore be, the most effective strategy for addressing dental health issues in Aboriginal communities.

Please note that an important precursor to earning the trust of Aboriginal families may be implementing cultural safety training for staff. Cultural safety differs from cultural sensitivity, in that it shifts the focus from individual interactions to societal/structural level inequities for minority groups. It helps participants to think critically about their own social position by being “mindful of their own sociocultural, economic, and historical location.” Societal level power imbalances become salient in cultural safety training, leading to more sensitive and effective services. An Aboriginal cultural safety training workshop delivered to General Practitioners in Australia, found that the most effective cultural safety training procedures were those that were developed in partnership with local Aboriginal communities; these workshops were reported to have a long term effect on changes to clinical practices and the GP’s ability/comfort to license with local Aboriginal communities.

**Building partnerships with other health practitioners:** Building partnerships with health practitioners, including other public health practitioners and primary care providers, similar to the community partnerships discussed above, can expand program coverage by reaching those families that other health practitioners are reaching. Within public health, partnerships with Public Health Nurses, health unit aides, and administrative staff, all of whom can play a key role in making referrals, could be quite valuable. Both improved health outcomes and significant behavior changes have been empirically linked to partnership building in public health. Coordinated care involving primary care providers can facilitate referrals, prevention of oral disease and health promotion, and early identification of dental disease.
Partnership building, as a strategy for providing oral health care is commensurate with an upstream approach to health care which considers the underlying social determinants of oral health.\textsuperscript{86,87} Collaboration and coordination should also be considered with federal programs that provide services on reserve, such as the Children’s Oral Health Initiative (COHI), Health Canada’s Maternal and Child Health program, and First Nations and Inuit Health.

**Advocacy efforts:** Many dental staff strived to act as advocates in facilitating access to oral health care for families in need. Advocacy efforts included: a) working with families and community champions to facilitate access to reduced-cost services and dental access funds, b) phoning dental receptionists to advocate for a client after a missed appointment, and c) maintaining lists of dentists and information regarding the accessibility of various dental services.

These efforts support Canadian Oral Health Strategy\textsuperscript{88} recommendations for health regions to:

- Maintain information on oral health professionals who provide services outside the traditional practice settings, and their experiences and challenges;
- Continue efforts to develop programs and services that recognize the different health care needs of the sectors that have reduced access to care;
- Arrange clinics for oral care using a collaborative team approach.

Some dental staff also facilitate role playing activities in parent groups, which focus on how to communicate with dental receptionists when they are having difficulty obtaining an appointment (e.g., after a previous missed appointment). Dental staff have described role playing activities as being able to help parents to learn how to self-advocate for their child’s oral health, to learn strategies for re-entry into the dentist clinic, and to understand how missing appointments impacts the dental office. Additionally, dental staff have worked to facilitate access to the Children’s Oral Health Initiative (COHI) by encouraging and supporting Aboriginal community applications to this federal program funded by First Nations and Inuit Health.

In advocating for individual children’ access to dental care, dental staff members are responding to a documented social gradient in access to dental care,\textsuperscript{86,90,91} whereby health inequalities and types and numbers of barriers to accessing services are strongly tied to levels of socioeconomic advantage. Additional recommendations for health regions to improve access to care from the Canadian Oral Health Strategy include:

- Provide continuing education on oral health service provision for special populations that exhibit low dental service utilization rates.
- Increase the delivery of oral health care out of community health centers.

\textsuperscript{88} Federal, Provincial and Territorial Dental Directors, A Canadian oral health strategy.
• Increase awareness and mobilize the public to advocate for universal access to dental care, which is well designed and adequately funded.

**Outreach to prenatal and postnatal groups:** Given that cariogenic bacteria can be transmitted from caregiver to child and maternal oral health is a strong indicator of children’s oral health, even after controlling for poverty status,92, 93 prevention efforts at the prenatal stage can reduce the risk of ECC.94, 95, 96, 97, 98 Prenatal groups were discussed in the focus groups as an ideal place to conduct preventive education before daily parenting becomes an overriding priority.

**Promoting healthy preschool environments:** Some dental staff have worked with their local preschools to promote juice-free environments, which not only reduces the children’s sugar intake, but also helps parents to build an awareness of good oral health practices. Dental staff reported observable reductions in the amount of early childhood caries found in the preschools with which they have partnered to create juice-free environments. One study found that preschool policies on availability of foods and snacks can lead to reduced sugar intake in the preschool and at home.99

**What are the most effective combinations of strategies being used to reduce early childhood caries?**

Program effectiveness was not quantifiable due to a lack of consistent electronic health records data linking delivery of preventive services to child health outcomes. In the focus groups, public health dental staff emphasized the integration of preventive dental services with existing public health and community partner initiatives as a way to improve dental health outcomes. There were frequent calls for specific preventive strategies including: integration with existing community initiatives, community development, partnership-building, promotion of healthy preschool environments, and involvement of interdisciplinary public health teams.

When asked to identify priority activities for allocation of staff time, IHA dental staff ranked community-level services as priority activities they could spend more time on to have a higher impact on oral health status. In particular:

• Developing a dental program based on identified dental needs, in conjunction with the health unit team and community.

• Providing delivery of dental health lessons/demonstrations for individuals, parents, children (e.g., Strong Start sites), and groups in community settings.

• Coordinating inter-agency programs in the community related to the dental program.

---

Research in the United States has uncovered similar findings to the extent that the U.S. Surgeon General has endorsed partnerships as a way to improve dental outcomes. Children involved with community initiatives, programs, or organizations have an increased likelihood of dentist visitation, as “community programs can serve as a vehicle to increase access to the oral health care system.”

A review of public health education interventions concluded that for school-aged children, health education interventions alone are insufficient to change parent health practices but can be effective when combined with environmental or legislative changes, such as changes to school meals. One-to-one dental education has not been found to be consistently effective in changing behaviour. Similarly, one-to-one dietary advice has not been conclusively shown to prevent caries. A study of low-income Brazilian children found that preschool policies on availability of foods and snacks can lead to reduced sugar intake in the preschool and at home. This is consistent with the focus group findings on promoting healthy preschool environments.

A school-based education program demonstrated a sustained improvement in plaque scores for children in more advantaged areas, whereas children from less advanced areas showed no benefit from the program. This suggests that in some cases universal programs may serve to increase social inequities in oral health, possibly owing to families from more advantaged areas facing fewer barriers to adopting oral health practices. While a targeted approach within the most socioeconomically disadvantaged areas may address the urgent unmet dental treatment needs of the most severely affected children (e.g., Codes 3.3, 3.4, and 04), this does not address oral health in middle-income areas, in which a large proportion of children having experience with treated decay and/or new decay reside (e.g., Codes 02, 3.1). The Marmot Review advocates for what they call proportionate universalism, stating that “to reduce the steepness of the social gradient in health, actions must be universal, but with a scale and intensity that is proportionate to the level of disadvantage.”

**Summary**

Overall the findings pertinent to evaluation question #4 suggest that building partnerships and relationships with community organizations, public health practitioners, and families, can be highly influential with respect to increasing program reach, effectiveness, and efficiency. It is not just that more services are needed, but that services need to be offered through certain types of partnerships, such as those with preschools, prenatal groups, public health nurses, and early childhood services. This finding is commensurate with recommendations from the Canadian Oral Health Strategy report which states that access needs to be considered along geographic, financial, social, cultural, and legislative terms.

100 Lee, “Chapter 10: Community programs and oral health.”
101 Ibid.
102 Scottish Executive, Nursing for health: a review of the contribution of nurses, midwives and health visitors to improving the public’s health in Scotland (Edinburgh: The Stationery Office, 2001).
104 Rodrigues and Sheiham, “The relationships between dietary guidelines, sugar intake and caries in primary teeth in low income Brazilian 3-year-olds.”
105 Sprood, Anderson, and Treasure, Effective oral health promotion.
GENERAL THEMES

Three broad themes characterize the findings: surveillance issues, standardization of assessment tools, and partnership building.

Surveillance: Is the oral health of young children improving?

Change over time and variability in dental decay rates across BC neighbourhoods

The results of the Kindergarten Dental Survey indicated that, at a provincial level, there were modest improvements in dental status at kindergarten across the two dental survey years. These changes were not uniform, however, as there were changes in visible dental decay rates (increases and decreases) that were more extensive in some geographic locations than others.

Similarly, visible dental decay rates in each survey year varied across neighbourhoods with some instances of adjacent neighbourhoods having disparate visible dental decay outcomes (e.g., Tsawwassen North, Dawson Creek Centre). These differences in dental health outcomes across geographic areas in BC indicate oral health disparities that parallel those found with other health outcomes, such as life expectancy and premature mortality rates.

Social influences on dental health outcomes

The findings from this project suggest that variation in visible dental decay rates across regions was not random. The rates of visible decay in the majority of neighbourhoods surveyed indicated that social factors, including the socioeconomic conditions and demographic characteristics that characterize where a child lives, were predictive of dental health outcomes at kindergarten. Children residing in more socioeconomically advantaged areas tended to have lower rates of visible dental decay than those children residing in socioeconomically disadvantaged areas. This finding is consistent with the large body of evidence indicating the influence that individual- and neighbourhood-level socioeconomic circumstances have on disparate health outcomes across geographic areas.

Analysis of the kindergarten dental survey data in both 2006/07 and 2009/10 indicated that there was visible dental decay for approximately half of the children.

children in the most socioeconomically disadvantaged neighbourhoods in BC. Rates of visible dental decay decreased or, in other words, improved, with increasing socioeconomic status of the neighbourhood. In 2009/10, the most socioeconomically disadvantaged neighbourhoods have a reported visible dental decay rate of 48%, whereas a visible dental decay rate of 30%, on average, was reported in areas with the highest socioeconomic advantage. Although the precise mechanism for this ‘social gradient’ in dental health outcomes has not been established, it is clear that differences in dental health outcomes exist.

The analysis of the kindergarten dental survey data indicated that in 2006/07 and 2009/10, the average rate of visible dental decay was highest in the most socioeconomically disadvantaged neighbourhoods; whereas in the moderate to moderately high socioeconomic status neighbourhoods, approximately 1 in 3 children experienced visible dental decay. That is, the data indicated that, on average, higher rates of visible dental decay are not occurring exclusively in the most socioeconomically disadvantaged neighbourhoods; they are distributed across varying levels of socioeconomic status.

There is a growing consensus that public health interventions need to combine both population-based and high-risk approaches.117, 118, 119 The Marmot Review recommends a policy of proportionate universalism in which “actions must be universal, but with a scale and intensity that is proportionate to the levels of disadvantage.”120 It is possible, for example, that a multi-pronged coordinated approach that involves a combination of individual- and community-level interventions may be well suited for the most socioeconomically disadvantaged areas (with high rates of dental decay), where it is expected that families encounter multiple, pervasive barriers to accessing services. However, interventions that solely target ‘at risk’ individuals or the most disadvantaged areas are not sufficient to address the social gradient in dental health, nor would they address the majority of new lesions.121, 122, 123

It is important to note that the socioeconomic data available for analyses of the kindergarten dental survey data reflect the socioeconomic status of the neighbourhood, on average, and would not necessarily reflect the socioeconomic background of each individual in that neighbourhood. Recent studies indicate that both individual- and neighbourhood-level socioeconomic factors may independently impact individual dental health.124, 125, 126

119 Watt, “From victim blaming to upstream action: tackling the social determinants of oral health inequalities.”
121 Batchelor and Sheiham, “The limitations of a ‘high-risk’ approach for the prevention of dental caries.”
123 Watt, “From victim blaming to upstream action: tackling the social determinants of oral health inequalities.”
125 Turrell et al., “The independent contribution of neighborhood disadvantage and individual-level socioeconomic position to self-reported oral health.”
126 Willems et al., “The independent impact of household- and neighborhood-based social determinants on early childhood caries.”
**Drawing from population-level datasets**

Population-based data collection through the Kindergarten Dental Survey allowed for similarities and differences in dental health outcomes and rates of change over time by neighbourhood to be examined. Surveillance that involved consistent measurement of visible dental decay across geographies and over time was critical in developing a better understanding of oral health trends within BC.

**Risk Assessment: Are the current dental health risk assessment/screen guidelines implemented as intended?**

At the time of publication, a diversity of risk assessment tools, guidelines and follow-up techniques were being used across the province. Creating a standardized tool kit using key messaging found in the literature and current assessment tools could ensure consistent and comprehensive messaging. Standardization of tools and consistency in data would allow health authorities to share data with one another and make comparisons across a variety of settings to investigate the effectiveness of intervention/prevention strategies. A rigid standardization is not recommended, but instead there could be standardized components of the risk assessment tools and data, preferably the components which would be identified as core functions of the risk assessments. Doing so will allow health authorities and HSDAs to: a) communicate with each other and compare data on the same elements without need for translation, and b) tailor their services to meet their communities’ unique needs, ensuring that their program is the most appropriate fit for the cultural or social environment.

Standardization also allows the Ministry of Health (MoH) to ensure that every HSDA is up-to-date with industry standards, as revision rollouts would be centralized and efficient. As such, this would increase regional health authorities’ and MoH’s capacity for service delivery and program evaluation. Training, as well, may also be easier with standardized components, as the MoH, partnered with regional health authorities, may be able to develop one core training module that could be augmented and tailored for individual health authorities or HSDAs and their respective communities.127

**Building partnerships: What strategies are used in the health authorities to prevent early childhood dental disease?**

Certain demographic groups and children residing in certain areas of the province have been shown to be more vulnerable for developing early childhood caries. An efficient and effective way to reach these families is to partner with organizations that have those families within their catchment. The value of community partnership and partnership building intersectorally or across disciplines (e.g., public health nurse, family physician, dental staff) is consistent with creation of a coordinated set of strategies that counteracts fragmentation and reflects the notion that oral health problems do not occur in isolation. A partnership rather than disease-specific approach is indicative that oral health problems share common risk factors (related to diet, hygiene, etc.) with other chronic diseases that are also disproportionately prevalent within more disadvantaged areas.

Building partnerships will allow public health dental staff to tailor their programs so that they can have maximum benefit for the families they are trying to reach. It will also allow dental staff to plan programs that are responsive to the culture and etiquette of the populations residing in their respective areas. Creating such responsive programming will enable families, who may feel alienated or distrustful of health care providers, to build/establish trust with the public health sector. Additionally, public health dental programs could become integrated into the community structure. Working with community organizations may facilitate dental programming that takes into consideration community input and priorities, thereby making dental programming maximally suited and relevant to community members.

Furthermore, the great consistency between the reported barriers to access to dental programs and those associated with families accessing early childhood programs, more generally, suggest that ongoing dialogue and collaboration with staff within early childhood education programs to discuss families’ common barriers to access could result in a coordinated set of strategies that potentially could help more families reach services. It is possible that families from all socioeconomic backgrounds may encounter barriers to accessing services; for example, time poverty may be a barrier to accessing services relevant for families across socioeconomic backgrounds. However, it is anticipated that families in the most socioeconomically disadvantaged neighbourhoods would likely experience a higher number of barriers relative to those who are more advantaged and that the number of barriers encountered would decrease with increasing advantage in socioeconomic status.
STRENGTHS AND 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 health authorities and the Ministry of Health. By conducting the evaluation is such a manner, HELP was able to ensure the continued relevance of the evaluation outcomes with regards to the changing needs of health authorities and Ministry of Health. Additionally, by drawing upon both qualitative and quantitative methods, HELP was able to provide robust findings. The focus groups and interviews were able to integrate in-depth knowledge possessed by public health dental staff that, on average, had 15 years (the range was 0 to 38 years) of experience in the field. The Kindergarten Dental Survey had extensive coverage, was at the population-level, and enabled analysis of change in kindergarten visible dental decay rates over time, owing to public health staff’s consistent coding and recording practices in both 2006/07 and 2009/10.

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

• Regional reports for the five health authorities,
• Provincial Caries Risk Assessment (CRA) tool development & validation template;
• Additional maps,
• IHA Time Use Questionnaire, and
• BCDA Member Survey.

Regional Evaluation Frameworks and Focus Group Reports

In addition to the provincial evaluation questions, each health authority developed two to three regionally-defined evaluation questions which targeted specific issues relevant to their health authority. These questions were incorporated into the focus group guides and qualitative analysis, and a brief report was developed for each region. A copy of each report was provided to the respective health authority. The topic-areas of regionally defined questions were complimentary to the provincially defined questions, and centered on such issues as program reach, outcome trends, comparisons across HSDAs, and suggestions for program improvement.

Provincial Caries Risk Assessment (CRA) Tool Development & Validation Template

In 2007, the Dental Evaluation Committee decided to develop a standardized provincial caries risk assessment tool. Leading up to March 2008, HELP developed a preliminary draft of a screening tool, called, “Baby Tooth Check-up.” The development of this 5-item provincial CRA tool was informed by a review of the literature, best-practices both within and outside BC, consultations with public health dental staff, and recommendations from the BC Early Childhood Dental Program Evaluation Subcommittee. The five questions cover topics such as access to oral health care, the establishment of a “dental home,” family history of dental decay, oral health care practices, and nutrition. A CRA validation meeting was planned to establish consensus around the indicators to be included in a provincial CRA tool, as well as the guidelines and follow-up procedures for use province-wide. This
validation process was discontinued in order to evaluate the existing risk assessment procedures. However, the materials developed remain available for future program planning. The CRA tool development and validation materials include: CRA Toolkit Development Questionnaire (to obtain input on content, procedures and guidelines), CRA Indicator Appraisal Questionnaire (to assess selected items in terms of feasibility, program value, evidence-base, and appropriateness for a diversity of staff and clients).

**Additional Maps**
HELPs mapping team produced three maps beyond the original evaluation plan, to better understand the context of early childhood oral health in BC:

- Driving Distance to a Dentist in BC
- Distributions of Dentists in BC
- Dentist Locations Map (Interactive map including distribution of dentists, and driving distance to a dentist in BC)
- Interactive Health Authority Maps, for each of the five health authorities

**IHA Time-Use Questionnaire and Literature Review**
A Time-Use Questionnaire was developed, distributed, collected, and analyzed for the Interior Health Authority, in reference to one of their regionally defined question on the weighting of one-on-one versus group-level services. The questionnaire was conducted in 2008/09, and was focused on assessing the relative amounts of staff-time devoted to individual-level versus group-level services. Thirteen (out of the eighteen) IHA dental staff participated in this questionnaire by answering questions about their time-use over the previous three month period. The results indicate that IHA dental staff spend 29% of their weekly hours on one-on-one service delivery (e.g., risk assessment), 19% on group-level service delivery (e.g., education sessions in community sites), 7% on surveillance, 24% on administration, 7% on travel, 14% on other activities, such as email correspondence.

**BCDA Member Survey**
In 2009, 369 general practice dentists participated in a BC Dental Association member survey, representing approximately 13% of the 2938 general practice dentists in BC. This survey indicated that 86% of the dentists in BC are aware of the recommendation that a child’s first dental visit should occur no more than six months after the eruption of the child’s first tooth, or approximately at the age of one year-old. Only 75% of BC dentists, however, report that they examine children under the age of 2 years-old. For those dentists who do not examine children under two, about half of them reported that this is due to “Patient Management Difficulties.” “Patient Management Difficulties” may include time management problems, and difficulties gaining the trust of the child and caregiver. Additionally, only 36 dentists (1%) specialize in pediatric dentistry, and less than 5% (158) are employed in rural-designated postal code areas. Questionnaire items were developed for inclusion in this survey in order to address a VCH-defined regional evaluation question regarding dental visits for children under 12 months-old.

---

128 Cheryl Landrigan, Personal communication, July 29, 2009.
129 BC College of Dental Surgeons.
Limitations

One limitation is that the ecological analyses conducted (i.e., the overlay of visible dental data with socioeconomic 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 dental health trajectories over time would require periodic and ongoing collection and analysis of aggregated individual-level socioeconomic information combined with individual-level visible dental decay results.

Also, there were two additional data sources that were originally intended to be included in the analysis: 1) electronic child health records from iPHIS (the Public Health Information System), and 2) focus groups with parents and community partners.

Electronic child health records of preventive services received

The development of the Evaluation Framework included confirmation of a set of minimum iPHIS data elements to provide information on preventive services received (caries risk assessment and fluoride varnish), identified risk-levels, and Kindergarten Dental Survey outcomes. The electronic dataset from iPHIS was not available for analysis due to unforeseen delays in establishing an Information Sharing Agreement. As such, HELP was not able to definitively respond to evaluation questions about the coverage or effectiveness of preventive services.

Focus groups with parents/caregivers and community partners

The second key data source which was not feasible to obtain within the allotted timeframe was that of focus group data from parents and community partners. These focus groups were originally designed to address evaluation question #3, regarding health promotion interventions for supporting healthy family dental practices.
RECOMMENDATIONS

Based on the findings described in this report, we put forth four broad recommendations for consideration. The recommendations relate to surveillance, caries risk assessment, program and service planning, and partnership building.

1. Surveillance

Kindergarten dental survey and risk assessments

Determine ongoing program data needs to support surveillance and program monitoring at a provincial and health authority level. For example, consider incorporating caries risk assessment into a coordinated and integrated model of longitudinal developmental surveillance that includes collecting and recording data at 12 months of age and at kindergarten.

Recommendation 1a: Continue to implement the Kindergarten Dental Survey, using consistent coding and recording practices, every three years (e.g., 2012/13, 2015/16, etc.) to continue to monitor the state of early childhood oral health in BC. Trends in visible dental decay would become more readily apparent after multiple data points have been collected.

Recommendation 1b: Utilize the data from the surveys to intensify prevention interventions in those neighbourhoods that are identified with a consistently high incidence of visible dental decay and those with visible decay rates consistently worse than expected (i.e., persistent off-diagonal neighbourhoods). Consistent documentation and recording of information about the interventions and populations served, as well as the outcomes of these interventions would strengthen the capacity, both provincially and regionally, to understand the types of factors that may influence differential rates of decay across BC neighbourhoods.

2. Standardized tool development

Caries Risk Assessment Guidelines

Consider developing Provincial Caries Risk Assessment Guidelines to:

- Standardize assessment and follow-up processes (e.g., risk factors assessed, timeframe for follow-up, number of contact attempts, personalized contact methods).
- Support consistent risk classification and data collection.
- Standardize messaging and resource development (e.g. oral health-related handouts) to focus on concise and consistent communication of key oral health messages to caregivers.
- Reinforce and expand best practices (e.g., community partnership, personalized services).

Note: The tools do not necessarily need to be exactly the same, but standardized risk classification and resources should be developed. Health Authorities are also encouraged to continue using/developing additional and supplementary tools that uniquely reflect their individual regions. See the findings section for Evaluation Question 2 for more detailed recommendations about standardized assessment and follow-up guidelines.
3. Program and service planning

Consider planning programs and services that are proportionate to reported rates of dental decay and level of socioeconomic disadvantage.

The results of the analysis of the 2006/07 and 2009/10 Kindergarten Dental Survey data sets indicate the need for population-based approaches that address the incidence of visible dental decay across BC neighbourhoods of varying socioeconomic status. It is recommended to supplement a population-based approach with actions that direct services in those neighbourhoods with moderate and moderately low socioeconomic status, as well as prioritize and intensify interventions in the most socioeconomically disadvantaged areas with consistently high rates of visible decay. The level, individual- or community-based, or ‘intensity’ of services could be tailored depending on the reported rates of visible dental decay and neighbourhood socioeconomic status.

4. Provincially coordinated strategies to support community-level partnerships

Community partnership initiatives for confirmed populations of concern

Consider developing provincially coordinated strategies to collaborate with new and existing community organizations and early learning centers to:

• Increase program reach to vulnerable populations and families who may not typically access public health services, especially in communities where immunizations occur primarily outside public health.

In policy documents and strategic plans, consider including statements to support ongoing community outreach with confirmed populations of concern for whom dental programs should be specifically tailored. This could include working with community partners to promote healthy early childhood settings (e.g., providing healthy snacks, education on healthy feeding practices). From this evaluation project, several population groups have been confirmed: families with low income, families residing in rural or remote locations, recent immigrant families, families of Aboriginal descent, lone-parent families, and those with special needs. These groups coincide with the populations of concern identified in the Core Functions for Public Health in BC (please see the companion Focus Groups Provincial Analysis report for specific suggestions about new community partnership initiatives).

Cultural safety training

Consider making cultural safety training available to all dental staff, particularly with respect to working with Immigrant and Aboriginal communities and families. By offering cultural safety training, target populations who may otherwise avoid public health facilities due to fear or mistrust, can begin to feel safe within public health services. This recommendation is commensurate with the Canadian Oral Health Strategy recommendations for improving social/cultural access which states that services should be provided where families “can feel at ease from a cultural, social and linguistic point of view.” Making cultural safety training available can help dental staff to begin earning the trust of alienated populations, thus potentially making any community outreach initiatives more effective. Cultural safety training ay also be necessitated at the management level so as to understand and dismantle discriminatory policies.
Public Health Partnership

Consider developing provincially coordinated strategies to collaborate with or integrate dental health into existing early childhood public health programs. Partnerships across public health programs and disciplines that share common priorities and objectives, such as dental health and nutrition, could be established or further developed.\(^{130}\) Also, Public Health Nurses could communicate key dental health messages to families at early points of contact, particularly at Child Health Clinics for 2, 4, 6, 12, and 18 months of age. Given that approximately two-thirds of BC’s children under age two years are up-to-date in their immunizations, it is recommended that dental public health continue to develop coordinated primordial and primary prevention strategies that coincide with children’s immunization appointments.

Primary Care Providers

Consider developing provincially coordinated strategies to collaborate with primary care providers who deliver immunizations to ensure dental health messaging is delivered as a part of the visit. All medical professionals caring for children need general knowledge about the risk factors for dental disease, maternal oral health, oral hygiene practices, and fluorides.\(^{131}\) Coordinated care can facilitate referrals, prevention of oral disease and health promotion, and early identification of dental disease. In particular, the confirmed populations of concern benefit from a team approach to health care.

Federal Program Service Providers

Consider developing provincially coordinated strategies to collaborate with federal program service providers such as the Children’s Oral Health Initiative (COHI), Health Canada’s Maternal and Child Health program, and First Nations and Inuit Health. This could include the planning of coordinated services and consistent prevention messages.


\(^{131}\) Mouradian and Maier, “The total health team: Working together to improve children’s health.”
REFERENCES


## APPENDIX A: Evaluation Matrix

### 1. Is the oral health of young children improving? a) By community b) By vulnerability?

<table>
<thead>
<tr>
<th>Data Sources</th>
<th>Data Collection by</th>
<th>Indicator/Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kindergarten Dental Survey Dental Data Set</td>
<td><strong>HA</strong> sends completed school-level spreadsheet and individual-level (2009-10) kindergarten dental survey outcome data.</td>
<td>% of kindergarten children by dental survey outcome code (Code 01, 02, 03, 04), by year, by community, by vulnerability (EDI, SES). Change in dental survey outcome code (Code 01, 02, 03, 04) over time, by community, by vulnerability.</td>
</tr>
</tbody>
</table>

| Electronic Child Health Record (e.g., iPHIS, PARIS). | **HA** enters and sends dental service data in Child Electronic Health Record (e.g., iPHIS). | % of children by dental health risk assessment category (regionally specific) by year, by community, by vulnerability (EDI, SES). Change in dental health risk assessment category over time, by community, by vulnerability. |

| Data regarding vulnerable populations: Early Development Instrument (EDI) Census 2001 Ministry of Education | **HELP** overlays school-level (2006-07) and individual-level (2009-10) dental survey outcomes with de-identified data from other sources regarding vulnerable populations (neighbourhood-level and individual-level). | % receiving public health dental service by Dental Service Type (e.g., CRA, FV1, FV2, FV3) |

### 2a. Are the current dental health risk assessment/screen guidelines implemented as intended?

| Program records (e.g., brochures, logic model), strategy documents or reports. Consultation meeting notes. Dental health risk assessment Environmental Scan. HA staff/designates (e.g. Dental Hygienists, Certified Dental Assistants) | **HA participation in focus group/interview/questionnaire.** | Description by HA of - The dental health risk assessment tool/questions are being used with children aged 0-5. - Age(s) these assessments are being administered. - The types of staff administering the dental health risk assessment. - The guidelines and follow-up being used. - The extent that program identifies a broad spectrum of children at risk for caries. - For those eligible children who dental public health is not reaching, identification of the barriers. Report of key themes and recommendations; Lessons learned. |

### 2b. To what extent does the dental health risk assessment/screen reach young children?

| Electronic Child Health Record (e.g., iPHIS, PARIS). | **HA** enters dental service data (to be defined) in Child Electronic Health Record (e.g., iPHIS, PARIS). | % children screened/assessed by ECHA/dental health risk assessment. % children per dental health risk category. |
### 3. Are health promotion interventions effective in supporting family dental health practices toward reducing early childhood caries?

<table>
<thead>
<tr>
<th><strong>HA staff/designates:</strong></th>
<th><strong>HA staff/designates participation through interview, questionnaire, or focus group and provision of relevant, key documents to the HELP evaluation team (tbd).</strong></th>
<th><strong>Among parents:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Key regional/provincial strategy documents or reports, interview transcript(s), questionnaire(s), or focus group summaries.</td>
<td></td>
<td>- Proportion of parents indicating a moderate or high knowledge about “health promoting” dental practices.</td>
</tr>
<tr>
<td><strong>Parents and community partners:</strong></td>
<td><strong>HELP Parent Questionnaire, Interview, or Focus Group (tbd)</strong></td>
<td>- Proportion of parents indicating changes in attitudes, behaviour/skills, and knowledge as a result of health promotion.</td>
</tr>
<tr>
<td>Interview transcript(s), questionnaire(s), or focus group summaries.</td>
<td><strong>HELP Community Partner Questionnaire, Interview, or Focus Group (tbd).</strong></td>
<td>- % of parents reporting each barrier/facilitator to health promotion and behaviour change.</td>
</tr>
<tr>
<td><strong>HAs may assist in recruitment (e.g., distribute questionnaires to parents, make brochures available).</strong></td>
<td></td>
<td>- Evidence that families have better access to preventive education.</td>
</tr>
</tbody>
</table>

### 4. What strategies are used in the health authorities to prevent early childhood dental disease? What is the most effective combination of strategies?

<table>
<thead>
<tr>
<th><strong>Program records (e.g., brochures, logic model), strategy documents or reports. Consultation meeting notes. Dental Health Risk assessment Environmental Scan.</strong></th>
<th><strong>HELP Document Review.</strong></th>
<th><strong>Documentation (descriptive) of activities for the first year as a baseline. Documentation (descriptive) of any changes to activities in future years.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HA staff/designates (e.g., Dental Hygienists, Certified Dental Assistants).</strong></td>
<td><strong>HA participation in focus group/interview/questionnaire.</strong></td>
<td>- Health authority staff and other program partners describe:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Staffing levels &amp; roles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Program partners &amp; roles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Similarities &amp; differences between prevention activities &amp; processes across locations/time.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Barriers/facilitators to program reach and implementation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Lessons learned.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Description of</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- What may be working in areas that have intended outcomes?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- What may not be working in areas that do not have intended outcomes?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- What were the critical success factors?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- How could the program be improved?</td>
</tr>
</tbody>
</table>
APPENDIX B: List of Evaluation Reports, Documents & Maps

The follow is a list of all the reports and documents that HELP has created during the four year evaluation of BC’s Early Childhood Dental programs

- Logic Model: British Columbia Ministry of Health Provincial Dental Health Programs, 2007
- Analysis & Mapping of the 2006/07 British Columbia Kindergarten Dental Survey, 2009
- Analysis & Mapping of the 2006/07 & 2009/10 British Columbia Kindergarten Dental Surveys, 2011
- Dental Health Risk Assessment Focus Groups: Provincial Analysis, 2009
- Development and Validation of a Provincial Caries Risk Assessment (CRA) Tool, 2008
- **Dental Health Risk Assessment Focus Groups: Regional Analyses, 2010**
  - Fraser Health: Dental Health Risk Assessment Focus Groups
  - Interior Health: Dental Health Risk Assessment Focus Groups
  - Northern Health: Dental Health Risk Assessment Focus Groups
  - Vancouver Coastal Health: Dental Health Risk Assessment Focus Groups
  - Vancouver Island Health: Dental Health Risk Assessment Focus Groups
- **Regional Logic Models, 2007**
  - Logic Model: Fraser Health Public Health Prevention Dental Program
  - Logic Model: Interior Health Public Health Dental Services
  - Logic Model: Northern Health Public Health Dental Services
  - Logic Model: Vancouver Coastal Dental Health Services
  - Logic Model: Vancouver Island Public Health Dental Services
- **Regional Dental Health Risk Assessment Evaluation Project Summaries, 2010**
  - Fraser Health: Regional Dental Health Risk Assessment Evaluation Project Summary
  - Interior Health: Regional Dental Health Risk Assessment Evaluation Project Summary
  - Northern Health: Regional Dental Health Risk Assessment Evaluation Project Summary
  - Vancouver Coastal Health: Regional Dental Health Risk Assessment Evaluation Project Summary
  - Vancouver Island Health: Regional Dental Health Risk Assessment Evaluation Project Summary
- **British Columbia Early Childhood Dental Programs Evaluation: Regional Summaries, 2010, 2011**
  - Fraser Health: Regional Summary
  - Interior Health: Regional Summary
  - Northern Health: Regional Summary
  - Vancouver Coastal Health: Regional Summary
  - Vancouver Island Health: Regional Summary
Dental Tables and Maps

Interactive Dentist Location Map (including driving distance to a dentist in BC), 2010

Map 1.5 Aboriginal Residents and Dental Status in BC Health Authorities (requested by First Nations Health Council), 2008

Provincial Dental Mapping Package, January 26, 2011
- Dental Decay 2006/07
- Dental Decay 2009/10
- Dental Decay Change 2006/07 - 2009/10
- Percent No Visible Decay Experience (Code 01), 2009/10
- Percent Fillings or Other Restorations (Code 02), 2009/10
- Percent Visible Decay (Code 03), 2009/10
- Percent Urgent Treatment Needs (Code 04), 2009/10
- BC School Districts

Provincial Dental Mapping with Socio-economic Status (SES) Overlays, March 22, 2011
- Kindergarten Children with Dental Decay in 2009/10, overlaid with:
  - SES Index by School district in 2006
  - No High School Graduation by School District in 2006
  - Incidence of Low Income by School District in 2005
- Kindergarten Children with Dental Decay in 2006/07, overlaid with:
  - SES Index by School District in 2006
  - No High School Graduation by School District in 2006
  - Incidence of Low Income by School District in 2005

Interactive Health Authority Maps (Regional Zoomable PDFs), March 22, 2011
- Fraser Health: Interactive Health Authority Map
- Interior Health: Interactive Health Authority Map
- Northern Health: Interactive Health Authority Map
- Vancouver Coastal Health: Interactive Health Authority Map
- Vancouver Island Health: Interactive Health Authority Map
- All Health Authorities Interactive Map, January 26, 2011

Neighbourhood Dental Mapping Packages, January 26, 2011
- Fraser Health: Dental Mapping Package
- Interior Health: Dental Mapping Package
- Northern Health: Dental Mapping Package
- Vancouver Coastal Health: Dental Mapping Package
- Vancouver Island Health: Dental Mapping Package
## APPENDIX C: Summary of Selected Studies Utilizing the Basic Screening Survey

### Basic Screening Surveys of Early Childhood Caries (ECC) Prevalence in Various Populations

<table>
<thead>
<tr>
<th>Investigator(s)</th>
<th>Region / Country</th>
<th>Sample size</th>
<th>Sample demographics</th>
<th>Measure</th>
<th>Prevalence %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cote et al. (2006) $^{132}$</td>
<td>U.S.</td>
<td>224</td>
<td>Refugees age 6 mos-18 yrs</td>
<td>Untreated caries Early care Urgent care</td>
<td>49/51/53/14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11,296</td>
<td>NHANES III comparison Age 2-17</td>
<td>Untreated caries Early care Urgent care Urgent care</td>
<td>23/49/19/3</td>
</tr>
<tr>
<td>Lukes et al. (2006) $^{133}$</td>
<td>Illinois, U.S.</td>
<td>490</td>
<td>Children of migrant and seasonal farm workers, Age 6-9</td>
<td>Untreated decay Early care Urgent care Treatment urgency</td>
<td>47/66/12</td>
</tr>
<tr>
<td>Dental Health Foundation (2006) $^{134}$</td>
<td>California, U.S.</td>
<td>10,949</td>
<td>Kindergarten students</td>
<td>Untreated decay Early care Urgent care</td>
<td>28/54/21/6</td>
</tr>
<tr>
<td>Connecticut Department of Public Health (2007) $^{135}$</td>
<td>Connecticut, U.S.</td>
<td>4,315</td>
<td>Kindergarten students</td>
<td>Untreated decay Early care Urgent care</td>
<td>16/27/12/0.6</td>
</tr>
<tr>
<td>Christensen (2007) $^{136}$</td>
<td>Colorado, U.S.</td>
<td>3,023</td>
<td>Age 5-10 yrs (mean age 6)</td>
<td>Untreated decay Early care Urgent care</td>
<td>23/45/18/5</td>
</tr>
<tr>
<td>Beltran et al. (1997) $^{137}$</td>
<td>Georgia, U.S.</td>
<td>632</td>
<td>Age 5-12 yrs</td>
<td>Untreated decay Restoration present Urgent care</td>
<td>40/59/40/13</td>
</tr>
</tbody>
</table>

Note: All measures listed above were based on consistent indicator definitions from the BSS manual, although some studies labeled “Untreated decay” as “Untreated caries” and “Decay experience” as “Caries experience.” “Early care” indicates treatment recommended within several weeks for caries without other oral health problems or symptoms. “Urgent care” indicates treatment required as soon as possible for patients experiencing pain, infection, or swelling.

---

137 Beltrán, Malvitz, and Ekblad, “Validity of two methods for assessing oral health status of populations.”
APPENDIX D: Methodological Notes

Data suppression
The kindergarten dental health data collected by the Ministry of Health was aggregated to prevent identification of an individual client. Data suppression is required for any data sample where there are less than 5. As such, Health Authorities were instructed by the BC Ministry of Health to suppress (i.e., remove) any sensitive information for schools where five (5) or fewer kindergarten students were surveyed, or in cases where five (5) or less students were assigned to a given dental health category (e.g., Code 01, Code 02). After this process was complete, HAs sent their school-level dental data to the manager of the Early Childhood Health and Screening Program within BC Ministry of Health, who in turn sent the data to the evaluation team at HELP. A similar process was enacted for the 2009/10; however, only schools with fewer than six (6) students surveyed were suppressed from the dataset.

HELP Neighbourhoods
Neighbourhood boundaries were originally created through the consensus of local Early Child Development Coalitions located throughout the province. HELP was instrumental in coordinating this boundary definition process, the result of which identified 478 socially and geographically relevant communities in BC. Visible dental decay percentages for HELP neighbourhoods were calculated by aggregating school-level information into neighbourhoods. 439 neighbourhoods were surveyed in 2006/07 and 465 neighbourhoods were surveyed in 2009/10. The analysis presented herein pertains to the linked database file, which includes common data elements for 437 neighbourhoods that were surveyed in both years of the Kindergarten Dental Survey. This number is less than the original 478 neighbourhoods because not all neighbourhoods were surveyed in each survey year and in some cases, neighbourhoods that were surveyed in one year were not surveyed in the other year.

Detailed results of the t-tests
A paired-sample t-test was used to determine if the oral health of children in BC was improving over time, using HELP neighbourhoods as the unit of analysis. Paired-sample t-tests compare neighbourhood rates of visible dental decay between survey years to determine if statistically significant changes have occurred over time. The average rate of early childhood visible dental decay (Code 02+03) for the provincial sample of 437 neighbourhoods was 38.8% in 2006/07 and 37.0% in 2009/10. These two rates are used for comparison by the paired samples t-test.

- The results of the paired-samples t-test (analysis not shown, but available upon request) provide initial statistical evidence that the overall oral health of BC's kindergarten children improved between survey years.
  - The t-value of -3.44 indicates that the rate of visible dental decay has declined between survey years (2006/07 and 2009/10).
  - The p-value = .001 demonstrates the statistical significance of this finding.
    In other words, we can be 99.9% certain that our finding of an overall improvement in oral health is accurate.
- In addition to the overall provincial analysis, a series of paired-samples
t-tests were run for each of the five (5) Health Authorities and sixteen (16) Health Service Delivery Areas (HSDAs). The analysis revealed the following findings:

- Two (2) out of five (5) HAs showed statistically significant improvements in oral health: the Interior (t = -3.38; p = .001) and Vancouver Coastal Health (t = -5.98; p < .001).
- Five (5) out of sixteen (16) HSDAs showed statistically significant improvements in oral health (see Table 2.1 and/or Figure 4 for reference): Kootenay Boundary (t = -2.73; p < .05); North Shore/Coast Garibaldi (t = -4.18; p < .001); Okanagan (t = -1.88; p < .10); Richmond (t = -2.73; p < .05); and Vancouver (t = -2.73; p < .001).

**Measuring effect size**

Beyond statistical tests of significance (e.g., t-test), tests of effect size (Cohen’s d) measure the magnitude or the size of the observed effect. One advantage of tests for effect size is that they are not influenced by the size of the sample. This is important because as sample size increases, so does the likelihood of obtaining statistical significance. According to Cohen (1988), an effect size of .2 is small, .5 is medium, and .8 is large.

The calculated effect size for the provincial sample of n = 437 is d = .15, which according to Cohen’s typology is relatively small. In other words, although the decrease in the rate of provincial rate of visible dental decay from 2006/07 to 2009/10 is statistically significant, the overall magnitude of change is relatively small.

Effect sizes for the two HAs that demonstrated significant improvements in oral health over time were more pronounced than for the province as a whole: d = .35 (Interior) and d = .49 (VCHA).

Effect sizes for the five HSDAs that were significant are as follows: Kootenay Boundary (d = .73); North Shore/Coast Garibaldi (d = .18); Okanagan (d = .88); Richmond (d = .73); and Vancouver (d = .73).

**Interpreting the findings of the regression analysis**

The diagram opposite demonstrates the predicted relationships between SES, kindergarten dental health and early child development.

As the diagram predicts, the socioeconomic status of communities may have direct influences on both early child development and early childhood caries. This model was used to guide the analysis of early childhood dental health and development.

Tables 7.1 and 7.2 present three pieces of information for the relationship between each SES measure (independent variables) and the % Visible Dental Decay (dependent variable):
1. The “b” coefficient represents the unstandardized value for beta, which is the amount of increase in the dependent variable (% Visible Dental Decay) for every 1% increase in the measure of SES. For example, the % Visible Dental Decay increases by .704% for every 1% increase in the % No High School, controlling for the effects of union or professional membership, non-fluency in English or French, low-income, lone-parent families, residential mobility and Aboriginal identity.

2. “s.e.” is the standard error, or the estimate of the amount that our predicted value for % Visible Dental Decay is “off” from the actual value in the population. **To arrive at a t-value, one could simply divide b / s.e. The t-value provides a test of statistical significance. Values ± 1.96 (for a two-tailed test) are typically needed to obtain significance level of p = .05, which is denoted by an asterisk (*); if p < .01, two asterisks (**) are used.

3. The third piece of information in the table is the Importance Scores, which represent the amount (%) of variance explained by the variable, relative to all other variables in the model. Higher importance scores (positive values) represent stronger relationships with the % Visible Dental Decay relative to the other variables in the model. Importance Scores are calculated as follows: [(Pearson's r) * (beta weight) * (100)] / R2 for each variable in the model. The sum of Importance Scores is 100 and negative scores indicate that the relationship between the SES-measure and % Visible Dental Decay switches its direction (from + to – or vice versa) from the correlation analysis to the regression analysis, which includes other variables in the analysis. This usually occurs when the correlation is initially small, and then it changes signs in the regression analysis because the effects of the other variables influence the relationship.

In the analysis of the eleven HELP SES subcomponents as predictors of the % Visible Dental Decay, a few methodological considerations were made to improve the analysis. Several of the SES subcomponents were highly correlated with one another, which can result in unpredictable results due to multicollinearity. More specifically, the SES subcomponents for Wealth, Education, Social Assistance and Median Government Transfers were all highly correlated with one another (i.e., above r = .70). In addition, Housing Density was highly correlated with Residential Stability (r = .74). Running regression analyses while including all of these subcomponents as predictors would reduce the overall efficiency of the model and could lead to a misinterpretation of results. Therefore, separate models were run to compensate for this multicollinearity:

Model 1. Wealth was included along with Unemployment, Residential Stability, Poverty, Lone Parents, Language and Immigration, and Women in Manufacturing, as predictors of the % Visible Dental Decay. This represents our “Main Model.”

Model 2. The Wealth subcomponent was dropped from the model and each of the highly correlated subcomponents (Education, Social Assistance, and Median Government Transfers) were entered as separate models in the regression analysis.

Note: Housing Density was dropped from the analyses altogether due to a high correlation with Residential Mobility and a relatively low correlation with dental decay (r < .20 in both 2006/07 and 2009/10).
This methodological technique, of entering key variables and removing others from the analysis, has the advantage of removing, at least partially, the negative effects of collinearity from the regression models. The final model coefficients (e.g., F, R², Std. Error of the Estimate) all correspond to the regression model with Wealth included.

**Interpreting the Early Development Instrument (EDI)**

In its development, the EDI has undergone psychometric testing across Canada to ensure its validity and reliability. Ongoing testing is carried out both in Canada and other countries that are using the EDI. (More information and a link to a copy of the instrument can be found at http://www.earlylearning.ubc.ca/research/initiatives/early-development-instrument/).

Vulnerability describes the portion of a population which, without additional support and care, may experience challenges and which may not function as well in school and society. The determination of vulnerability is based on EDI scores. Children who score below the vulnerability cut-off on an EDI scale are said to be vulnerable on that scale of development. Vulnerability cut-offs were set after the first EDI pilot in 1998. When the first pilot EDI data had been collected, analysis showed that, on each of the EDI scales, approximately 10% of the children fitted a profile of vulnerability. Using these data, the cutoff for each of the EDI scales was determined using the range of actual scores collected and setting vulnerability at the score that represented the lowest 10% of that range. The vulnerability cut-off scores have remained consistent since they were first calculated. HELP's research over the last 10 years, in B.C. and across Canada, has demonstrated that the cut-offs have tremendous predictive capability: they do explain children's school experience, and are highly correlated with adolescent and adult health and well-being measures as well.

Results from the EDI are interpreted only at the level of the group (school, neighbourhood, region, or school district). Results are never interpreted at the individual level. Communities benefit from this research in a number of ways. The research helps to show where there are large differences in children’s development; where groups of children are more or less developmentally ready for school across communities, regions, and the province; and how broad socio-economic factors may influence children’s early development. This information can help community members become more aware of ways to create environments to help children and families thrive. The EDI also provides information on children’s development in distinct populations. Trends in the development of children who are Aboriginal or speak English as a second language can be analyzed separately. For more information on the interpretation of results for these groups, please see: http://www.earlylearning.ubc.ca/research.

---

138 M. Janus et al., The Early Development Instrument: population-based measure for communities: a handbook on development, properties and use (Hamilton, Ont.: Offord Centre for Child Studies, 2007).
APPENDIX E: HELP SES Scales and Subscales

Data Sources: 2004 Tax Filer and 2006 Census data

Wealth: Families with Children

% families receiving investment income or capital gains, families with children under 18
% families declaring charitable donations, families with children under 18
% families receiving investment income or capital gains, families with children under 6
% families declaring charitable donations, families with children under 6
% families declaring charitable donations, lone female families with children under 18
% families declaring charitable donations, couple families with children under 18
% families receiving investment income or capital gains, couple families with children under 6
% of families declaring charitable donations, couple families with children under 6

Unemployment

Employment rate, children under 6
Female unemployment rate, females 15 and up
Female unemployment rate, females 25 and up
Male employment rate, children any age
Male employment rate, children under 6
Participation rate, 25 and up
Unemployment rate, children under 6
Unemployment rate, all 15 and up
Unemployment rate, all 25 and up

Residential Stability

% moved in last year
% of non-migrant movers IN LAST 5 YEARS
Home ownership rate
Poverty: Women Only Earners
% heterosexual families, female only employment income, families w/ no under 18
% heterosexual families, female only employment income, families w/ children under 18
% heterosexual families, female only employment income, families w/ children under 6

Lone Parents

% lone parent families
% lone female families
% lone male families
Share of all lone mother families with children under 18 in entire population
Share of all lone mother families with children under 6 in entire population

Housing Density

Percentage of single detached houses
Percentage of apartment that has 5 or more stories
Percentage of apartment that has fewer than 5 stories

Language and Immigration

% Buddhists
Number of non-Christian religions, 1% of pop or greater
% 3rd or more generation 15yrs and over
% first generation Canadians
% immigrants who arrived before 1961
% immigrants who arrived before 1991 and 1995
% immigrants who arrived before 1996 and 2001
% immigrants who arrived before 1961 and 1970
% of pop with Canadian Citizenship
% of total pop that immigrated between 1996-2001
% home language English
% of pop with English as mother tongue
% of pop with non-official language as mother tongue
% using foreign in home language
% visible minority
Women in Manufacturing
% women in manufacturing positions

Education
% of people aged 20 and older with a university degree
% of people aged 20 and older who have not graduated from high school

Social Assistance
% families with young children receiving social assistance
% families without young children receiving social assistance

Median Government Transfers
Median amount of government transfers, for families with young children
Median amount of government transfers, for families without young children

Creation of the HELP SES Index
For each of the variables within the HELP SES Index and Components, a standard score was calculated for each neighbourhood in BC. For some variables, where higher scores are associated with lower socio-economic status, these standard scores then had to be “reversed” (i.e., the sign was changed) to maintain consistency in the Index (i.e., all SES measures coded so as to be “protective” factors in relation to kindergarten visible dental decay). Unemployment and lone parenthood are two examples of variables where the scores were reversed. For each component, the mean of the standardized scores of the variables in that component was calculated for each neighbourhood. Since the mean for each variable overall is zero, the mean of these component scores is also zero. However, the standard deviation of these component scores is less than 1 because of the aggregation over several standardized individual variables. These mean component scores were then standardized to have a standard deviation of 1. The SES Index was then constructed by taking the mean of these standardized component scores. Again, the aggregation process results in an Index with an overall mean of 0, but a standard deviation of less than 1, and so as a final step, the HELP SES Index was standardized by setting the overall standard deviation to 1.
APPENDIX F: Key Messages In Oral Health-related Public Health Handouts

Five main themes emerged from a 2007/2008 review of BC public health handouts related to oral health and nutrition for children under 6:

1) Dentist visits. Within the dental visit theme, the primary message was that a child should have the first dentist visit 6 months after the appearance of the first tooth or around age one and then see a dentist every 6 to 12 months.

2) Signs of decay. There was some overlap between the dental visit and decay themes as a key message under the decay theme was to check a baby’s mouth once monthly for signs of decay, such as white or brown spots on the teeth particularly near the gum line, and to see a dentist if decay was suspected or visible. The second key message within the decay theme related to bacterial transference from caregiver to child. Handouts informed parents that bacteria, some of which cause tooth decay, begin to grow upon appearance of a child’s first tooth. Advice to reduce the risk of bacterial transmission included using separate toothbrushes and spoons as well as washing a soother in water rather than licking it to clean it. In addition, caregivers were advised to use a fluoride toothpaste themselves and to ensure that their own dental work was up to date. One health authority had handouts, which noted that when caregivers of young children chew gum-containing xylitol, fewer bacteria were transmitted to children, and those children had fewer cavities.

3) Tooth brushing and fluoride. Many handouts addressed tooth brushing and fluoride toothpaste use in detail. This theme also included instructions to clean a baby’s gums twice daily with a clean, damp face cloth prior to the appearance of teeth. Once the first tooth appeared, parents were to use a soft baby toothbrush with a smear of fluoride toothpaste to brush teeth twice daily, in the morning and before bedtime after the last breast feed, bottle or food. The amount of toothpaste used was to be increased to a pea-sized amount at age 3 to 6 years as molars appeared and anterior teeth finished coming in. Flossing was to commence when teeth were touching. Information in the handouts informed parents that children would not be able to clean their own teeth until around age 6 to 8 years, when they also gained the capability to write their own name. The purpose of the fluoride toothpaste was noted to be for the prevention of caries by helping teeth be more resistant to acids from foods and cavity causing bacteria. Fluoride varnish was recommended for: children who had white spot lesions, previous caries experience, or current oral care difficulties; children who slept with a bottle containing a liquid other than water; children who did not have their teeth cleaned twice daily with a fluoride toothpaste; or children whose primary caregiver had had decay in the past 12 months.

4) Feeding practices. Drinking and feeding habits related to dental outcomes was another popular theme covered in many handouts. A reoccurring message was that the length of time a sugar-containing beverage or food is in contact with teeth is a factor for tooth decay. For example, many handouts commented that a child who slept with a bottle containing a liquid other than water was at risk for tooth decay. Lists of sugar-containing beverages, such as cow’s milk, formula, fruit juice and sweetened drinks (e.g. iced tea, pop, lemonade) were reported in numerous
handouts. The use of a clean, wet cloth to wipe baby’s mouth after nursing was advised. Sticky foods, such as teething cookies and biscuits were not recommended because they remain on teeth for lengthy periods of time and provide an easily accessible substrate or food for cavity causing bacteria. Putting sugar, honey or corn syrup on a soother also was advised against. In addition, frequent sipping (liquids other than water) and eating during the daytime also was noted to be a risk for tooth decay. Because it does not cause tooth decay, water was suggested as a thirst quencher between meals with milk and juice reserved for meal and snack times. Finally, information from a number of handouts recommended switching from a bottle to a cup starting at 6 to 9 months of age with completion of the switch by 12 to 14 months of age.

5) **Barriers to access.** Barriers to access was a less commonly occurring theme among the handouts. For example, one health authority had a couple of handouts that described dental programs available to vulnerable populations, such as families on Premium Assistance through their medical plan, clients of the Ministry of Human Resources or Ministry of Children and Family Development, Aboriginal children with a status number, or children from low-income families, who were in need of urgent care due to pain, infection or severe decay.