

Exploring Trends in Children's Oral Health in Winnipeg, Canada

David Truong

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Supervisor: Dr. Robert J Schroth

Abstract:

Objective: The purpose of this study was to review the Winnipeg Regional Health Authority's (WRHA) SMILE plus program pediatric oral health surveillance data for the years 2006-2013 to determine whether caries prevalence and oral health needs have changed over time within the Winnipeg region.

Methods: Oral health surveillance data were captured in a cross-sectional manner from children attending identified high-needs schools in Winnipeg, Canada by trained dental staff. Screening data collected included the age of the child, sex, school, grade, caries prevalence in both deciduous and permanent teeth, and caries scores. Overall caries experience was then determined from these existing caries measures. Descriptive statistics were calculated to determine frequencies, means \pm standard deviations (SD). Bivariate analysis included Chi square analysis, t tests, and analysis of variance (ANOVA). A p valued ≤ 0.05 was statistically significant.

Results: A total of 30,121 children underwent a dental screening during the years 2006/07 to 2012/13. Overall, 27.2% of children were found to have experienced caries. The mean dt score for all children was 0.69 ± 1.82 (range 0-20) while the mean deft score was 2.20 ± 3.47 (range 0-20), indicating that 31.4% of children had untreated decay on their deciduous teeth. The mean DT for all children was 0.06 ± 0.38 (range 0-10) and the mean DMFT for all children was 0.30 ± 0.92 (range 0-12), revealing that 20.0% had untreated decay on their permanent teeth. To control for potential variations in yearly data, years were pooled into two groups (2006/07-2009/10 and 2010/11-2012/13) to determine changes in oral health status over time. For

children between ages 6-10, the overall caries experience increased in decade 2 compared to decade 1.

Conclusion: The study demonstrates that the number of children with caries is increasing, but the amount of decay per child is decreasing. Despite the amount of data analyzed during the study, as the amount of surveillance data increases, more information needs to be derived about the trends of caries in children in each community so that more effective planning, implementation and evaluation of dental public health practice can occur.

Introduction:

The overall vision of dental public health is for the protection and improvement of the oral health of a whole population.¹ A key component of dental public health is the science and art of preventing and controlling dental disease and promoting dental health through organized community efforts.¹ Many communities have benefited from decreasing caries rates because of the implementation of the fluoridation of the municipal water supplies and oral health promotion and awareness activities. However, in order to control dental disease information must be regularly collected and analyzed. One method to assess the oral health status at the population level is via an oral health surveillance system that identifies, investigates, and monitors oral health status, problems, needs and hazards as they are occurring over time. Regular dental surveillance of children can also assist in determining the impact of population-based health promotion initiatives and the adoption and implementation of oral health policies.

Data from the WHO suggest that the prevalence of caries all over the world has declined at the end of the previous and in the first decade of the present century.⁴ This includes an evident decline in dental caries in school-age and adolescent children in many countries, including the United States.² Studies in the United States show that caries rates in deciduous teeth for children 6 years and older have declined when comparing two time periods between 1988-1994 and 1999-2004, but have increased in children between 2-5 years old.³ In Canada, data for the years 1982 to 1994 indicate that caries prevalence and severity in the permanent dentition declined in the general populations of Canada, while caries experience in the primary dentition may have stabilized since 1986-87.¹ Additionally, some European countries have reported an increase in dental caries for school-aged children.⁶ As we know, caries

circumstances differ around the world, e.g., low-income countries experience more caries with higher sugar consumption, while between high-income countries experience a reversed correlation. In high-income countries, fluoride is widely used and preventive programs in dental offices are in place.⁴

School-based pediatric oral health surveillance has been a regular and ongoing activity in Winnipeg, Canada. The former City of Winnipeg's Dental Department conducted yearly dental screenings of elementary school children across the city. Oral health surveillance continued following the transfer of health services to the Winnipeg Regional Health Authority (WRHA) in 1999. The WRHA continues to undertake oral health surveillance activities in school-aged children. The WRHA is responsible for providing health services to residents of the City of Winnipeg, East St. Paul, West St. Paul, and the town of Churchill. It is one of the largest and most diverse health regions in Canada. One unique program that the WRHA operates is SMILE plus. The SMILE plus program's main goal is to achieve an optimal level of oral health and well-being for children in the Winnipeg region. Through the SMILE plus program, the WRHA is able to conduct dental screenings to collect and review children's oral health surveillance data each year so that this information can be applied to help serve the community's needs and oral health concerns.

The purpose of this study was to review the WRHA's SMILE plus program surveillance data for the years 2006-2013 to determine whether caries prevalence and oral health needs have changed over time within the Winnipeg region.

Methods:

The SMILE plus program's pediatric oral health surveillance data were captured in a cross-sectional manner on a yearly basis from students in key grades attending identified high-needs schools in Winnipeg, Canada. The population under investigation was children attending elementary school in the Winnipeg region between the academic years 2006/07 and 2012/13 (seven Years). The SMILE plus program surveyed six different school divisions in the 2006/07 and 2007/08 academic years. The six school divisions whose school children were screened include Louis Riel, Pembina Trails, River East/Transcona, Seven Oaks, St. James-Assiniboia, and the Winnipeg School Division.

Dental screenings were consistently performed by a team of trained SMILE plus dental staff. Children were clinically screened for caries in the classroom by trained WRHA dental hygienists and dental assistants using a flashlight and tongue depressor. Caries was diagnosed when visible cavitations into enamel or dentin existed. Radiographs were not used. Collected data included the age of the child, sex, school, grade, caries prevalence in both deciduous and permanent teeth, and caries scores based on the dmft/DMFT dental indices (total count of the number of decayed, missing due to caries, and filled teeth for deciduous and permanent teeth). Overall caries experience was then determined from these existing caries measures. The dmft/DMFT indices were useful to measure children's caries experiences and helped to determine the proportion of children with unmet dental needs (i.e. untreated caries).

This study was approved by the Health Research Ethics Board in 2014 (reference H2014:195, HS17700). Data were entered into an electronic Excel (Microsoft Office) database and analyzed using Number Cruncher Statistical Software (Version 9) (Kaysville, Utah).

Descriptive statistics were calculated (e.g. frequencies, means \pm standard deviations (SD)).

Bivariate analysis included Chi square analysis, t tests, and analysis of variance (ANOVA). Trends in caries outcomes were assessed for years under study. To control for potential variations in yearly data, years were pooled into two groups to determine changes in oral health status over time. The first of the two groups contained children screened between the years 2006/07-2009/10 and the second group were children screened between 2010/11-2012/13. A p value \leq 0.05 was statistically significant.

Results:

A total of 30,121 children underwent a dental screening during the years 2006/07 to 2012/13. The overall distribution of children by the specific academic year appears in Table 1. The SMILE plus program surveyed six different school divisions in 2006/07 to 2007/08 and after the academic year 2007/08, dental screenings were limited to the Winnipeg School Division (WSD), which comprised of 92.2% (27783/30122) of the total sample size of the study. There appeared to be an even distribution of males (52%) and females (48%) (Table 2). Ages of the children ranged from three to 15 years (mean age 7.6 ± 2.3). Analysis of variance revealed that the mean age of children did significantly differ by the various years.

Table 3 presents oral health outcomes for children who were screened. Overall, 27.2% of children were found to have experienced caries and 72.8% were caries-free. The mean dt score for all the children was 0.69 ± 1.82 (range 0-20) and the mean deft score was 2.20 ± 3.47 (range 0-20), indicating that 31.4% ($0.69/2.20$) of children had untreated decay on their deciduous teeth. The mean DT for all children was 0.06 ± 0.38 (range 0-10) and the mean

DMFT for all children was 0.30 ± 0.92 (range 0-12), revealing that 20.0% (0.06/0.30) had untreated decay on their permanent teeth. Table 3 also reports data limited to the WSD only and report that the mean dt for the children in the WSD was 0.79 ± 1.97 (range 0-20) and the mean deft was 2.40 ± 3.63 (range 0-20) indicating that a higher percentage (32.9%) of the caries were untreated caries as compared to all the children in the complete sample (31.4%). The mean number of caries in primary anterior teeth was higher in WSD (0.17 ± 0.77) as compared to all children (0.06 ± 0.76). Caries was higher in the posterior teeth when compared to the anterior teeth for both deciduous and permanent teeth for all children and the WSD. Overall, 6.5% and 19.0% of the children had anterior caries and posterior caries respectively in their deciduous teeth in the WSD.

Figure 1 reports mean dt and mean DT scores for children by the various surveillance years. Mean dt scores ranged from 0.62 to 0.94 while mean DT scores ranged from 0.026 to 0.85. Children in the WSD had either higher or equal mean caries scores compared to that of all children. Figure 1 also shows that the mean dt was consistently higher than the mean DT. Overall, the mean dt and DT scores remained fairly constant throughout the recorded years.

Data were then separated into two groupings based on two different time periods, 2006-2010 and 2010-2013 (Table 4 and Figure 2). Figure 2 reveals the overall caries experience for children between the two time periods by age. For children between ages 6-10, the overall caries experience increased in decade 2 compared to decade 1. Figure 2 also shows that the age with the highest overall caries experience is 13 years old at 55.6% in period 1.

The overall caries experience was significantly higher in period 2 than in period 1 ($p < 0.0001$); 34.1% vs. 28.9%. However, the dt and DT scores were significantly lower for period

2 compared to period 1. Significantly fewer children were found to have localized dental pain in the second time period compared with the first time period (decreased from 1.5% in period one to 0.8% in period two), $p < 0.0001$). The proportion of children with urgent dental needs did not increase significantly over the two time periods (20.0% vs. 20.2%) $p = 0.70$.

Discussion:

The purpose of this study was to review seven years of pediatric oral health surveillance data from the WRHA's SMILE plus program to assess caries prevalence and oral health needs and to determine if the dental disease burden remained consistent over time or had changed within the Winnipeg region. One of the goals of systematic collection of oral health surveillance data is to analyze and review data for program planning, implementation and evaluation of public health practice.

An important oral health outcome examined was the proportion of children experiencing localized dental pain. Our data suggest that the prevalence of localized dental pain has decreased from 1.51% to 0.81% between the two time periods under study. 2009-11 Canadian Health Measures Survey (CHMS) report indicates that 5.4% of children 6-11 years of age experienced persistent or ongoing pain anywhere in their mouth. We are unsure why our rates are lower than this national data, but it may be due to different scales of measurement, differences in population characteristics, and different population sampling techniques.

The data from this study reveal that the overall caries experience in the Winnipeg school children has increased from 2006/10 (28.9%) to 2010/13 (34.1%). The 2009-11 CHMS reported that the overall caries experience of the children was 47.8%, which is higher than the overall prevalence of caries experienced by children in this study (27.2%).

A retrospective cohort study of kindergarten children in British Columbia showed that the average provincial rate of decay dropped between 2006/07 (38.9%) and the follow-up survey in 2009/10 (36.7%) by 2.2 percentage points.⁵ Our data shows that overall caries experience in period 1 to period 2 increased 5.2 percentage points from 28.9% to 34.1% respectively. According to Poon, urgent treatment needs (2.0%–2.1%) in the kindergarten children remained stable across years and the same results are seen in this study from period 1 and period 2 (20.0%-20.2%)

This study is not without limitations. The limitations of the study include cross-sectional data collection. There is no kappa agreement between examiners and the examiners were not calibrated for the screening process. Also, during some years, certain grades were not examined. The data was also limited due to the process by which the information and screenings have been conducted. The use of a tongue depressor and flashlight without a mirror and explorer during the screening process was one limit and secondly no radiographs were used. Also, screening forms lacked consistency with some years having more information than other years. For example, in some years, the surveillance forms did not collect information on the number of extracted and filled teeth, while some years collected information on filled and extracted teeth in the same field, but did not differentiate. This restricted our ability to calculate deft and DEFT scores for those years. This restricted our sample when we undertook comparisons of caries scores between years. Suggestions for the WHRA are included in Table 5. One of the recommendations arising from this evaluation exercise would be for the WRHA to develop and follow a detailed protocol such as the one developed by the Ontario Public Health Standards⁵ which would be of great use to gain

consistency for future studies. The Ontario Public Health Standards protocol also includes a reporting section which involves an annual report of the surveillance findings, trend analysis, program planning, implementation and evaluation.⁵ Another recommendation for enhancing ongoing screenings would be to have regular calibration and orientation sessions for dental examiners to ensure consistency.

According to the Canadian Pediatric Society, the public dental care information systems remain poorly developed due to insufficient disease surveillance and program evaluation.⁶ It is important to not only collect surveillance data, but the data must be sufficient, meaningful and useful to the population. The purpose of public health surveillance according to the WHO has many functions but two important functions are to document the impact of an intervention and to track progress towards specified goals; and monitor and clarify the epidemiology of health problems to allow priorities to be set and to inform public health policy and strategies.⁷ Conducting surveillance without proper and ongoing review of the findings may be considered unethical. If the goal is for disease monitoring, then regular and comprehensive review of surveillance of SMILE plus data should be undertaken. This analysis of the surveillance data for the school children of Winnipeg will be useful because the last data recorded by the City of Winnipeg Health Department was in 1963. The strengths of this surveillance study included a very large sample size of 30, 121 Winnipeg school children. The large database contains valuable information that can be used to connect the children of Winnipeg to their oral health professionals which is the purpose of analyzing surveillance data. The CHMS does not represent province-level results with great accuracy so it is beneficial to have more localized surveillance data on a specific community. Future studies should be completed using and/or

combining surveillance data to see if interventions such as oral health education, daily fluoride products or other treatments can improve the oral health. Having evidence to support particular interventions and treatments is important for improvement of oral health in specific communities and collecting data without using it is pointless.

Conclusion:

For most children in the city of Winnipeg, the caries rates seemed to remain steady with a mean deft/DEFT score between 0 and 1 each year for all children screened and the trend remains the same in the children that belong in the Winnipeg School Division. The study demonstrates that the number of children with caries is increasing but the amount of decay per child is decreasing. Despite the amount of data analyzed during the study, as the amount of surveillance data increases, more information needs to be derived about the trends of caries in children in each community so that more effective planning, implementation and evaluation of dental public health practice can occur.

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Table 1. The number of students screened in each school division per year

Year	School Division						Total Number of Children Screened N (%)
	Louis Riel N (%)	Pembina Trails N (%)	River East/ Transcona N (%)	Seven Oaks N (%)	St. James-Assiniboia N (%)	Winnipeg N (%)	
2006/2007	180	109	116	709	319	2587	4020 (13.3%)
2007/2008	116	29	33	464	263	1678	2583 (8.6%)
2008/2009	0	0	0	0	0	5428	5428 (18.0%)
2009/2010	0	0	0	0	0	2706	2706 (9.0%)
2010/2011	0	0	0	0	0	5979	5979 (19.9%)
2011/2012	0	0	0	0	0	4622	4622 (15.3%)
2012/2013	0	0	0	0	0	4783	4783 (15.9)
Total	296 (1%)	138 (0.5%)	149 (0.5%)	1173 (3.9%)	582 (1.9%)	27783 (92.2%)	30,121 (100%)

Table 2. Comparison of gender for all of the school children screened each year and the Winnipeg School Division (WSD)

Year	Female N (%)	Male N (%)	Total
2006/2007			
All Children	1869 (47.0%)	2111 (53.0%)	3980
WSD	1229 (48.1%)	1325 (51.9%)	2554
2007/2008			
All Children	1235 (48.1%)	1333 (51.9%)	2568
WSD	814 (49.0%)	849 (51.0%)	1663
2008/2009			
All Children	1349 (48.8%)	1414 (51.18%)	2763
WSD	1349 (48.8%)	1414 (51.18%)	2763
2009/2010			
All Children	638 (45.3%)	769 (54.7%)	1407
WSD	638 (45.3%)	769 (54.7%)	1407
2010/2011			
All Children	2401 (48.6%)	2537 (51.4%)	4938
WSD	638 (45.3%)	2457 (51.2%)	4799
2011/2012			
All Children	2224 (49.0%)	2313 (51.0%)	4537
WSD	2224 (49.0%)	2313 (51.0%)	4537
2012/2013			
All Children	2339 (48.9%)	2444 (51.1%)	4783
WSD	2339 (48.9%)	2444 (51.1%)	4783
Total			
All Children	12055 (48.3%)	12921 (51.7%)	24976
WSD	10935 (48.6%)	11571 (51.4%)	22506

Table 3. Caries status of screened children

	All Children N	All Children	Winnipeg School Division N	Winnipeg School Division Only
Overall caries experience	30121	8190 (27.2%) 21931 (72.8%)	22931	7273 (31.7%) 15658 (68.3%)
Yes				
No				
Primary Dentition				
Mean Number of Primary Anterior Teeth with Caries	25249	0.06 ± 0.76 (Range 0-12)	22772	0.17 ± 0.77 (Range 0-12)
Mean Number of Primary Posterior Teeth with Caries	25404	0.50 ± 1.30 (Range 0-8)	22927	0.51 ± 1.32 (Range 0-8)
Primary Anterior Teeth with Caries Count (%)	25249	1628 (6.5%)	22772	1502 (6.6%)
Primary Posterior Teeth with Caries Count (%)	25404	4838 (19.0%)	22927	4445 (19.4%)
Mean dt	4271	0.69 ± 1.82 (Range 0-20)	2839	0.79 ± 1.97 (Range 0-20)
Mean et	4268	0.35 ± 1.18 (Range 0-20)	2836	0.37 ± 1.24 (Range 0-20)
Mean ft	4270	1.14 ± 2.39 (Range 0-14)	2838	1.17 ± 2.41 (Range 0-13)
Mean deft	4269	2.20 ± 3.47 (Range 0-20)	2682	2.40 ± 3.63 (Range 0-20)
Permanent Dentition				
Mean Number of Permanent Anterior Teeth with Caries	25182	0.005 ± 0.09 (Range 0-5)	22706	0.006 ± 0.99 (Range 0-5)
Mean Number	25231	0.06 ± 0.35	22755	0.07 ± 0.36

of Permanent Posterior Teeth with Caries		(Range 0 -7)		(Range 0-7)
Permanent Anterior Teeth with Caries (%)	25182	90 (0.36%)	22706	89 (0.39%)
Permanent Posterior Teeth with Caries (%)	25231	1009 (4.00%)	22755	968 (4.25%)
Mean DT	4230	0.06 ± 0.38 (Range 0-10)	2798	0.08 ± 0.43 (Range 0-10)
Mean MT	4228	0.01 ± 0.18 0.02 (Range 0-7)	2796	0.01 ± 0.17 0.02 (Range 0-5)
Mean FT	4226	0.21 ± 0.78 (Range 0-8)	2794	0.25 ± 0.86 (Range 0-8)
Mean DMFT	4090	0.30 ± 0.92 (Range 0-11)	2714	0.35 ± 1.00 (Range 0-11)

Figure 1. Comparison of mean d and mean D in all children and WSD each year

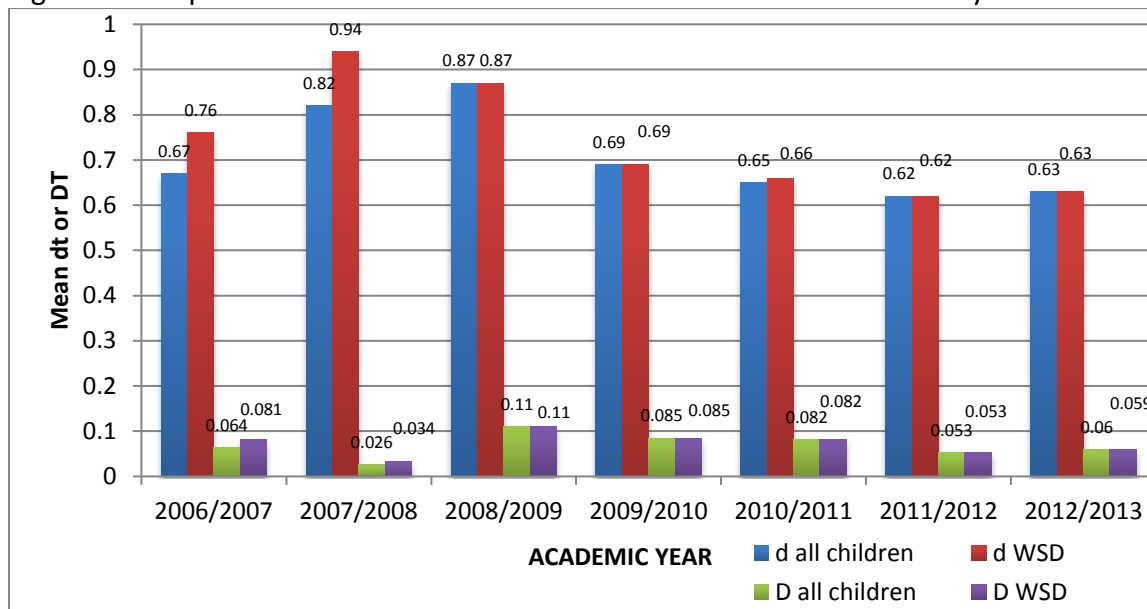


Figure 2. Overall caries experience by age by time period in all children

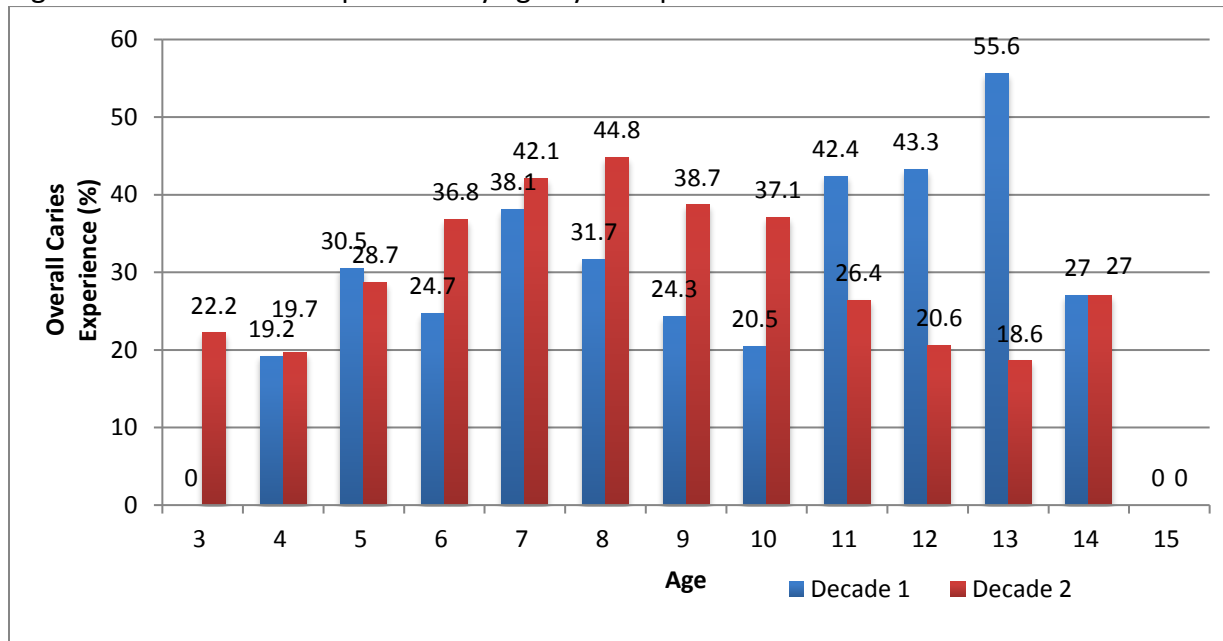


Table 4. Comparison of dental outcomes of children from WSD between two time periods

Variable	Period 1 (2006-2010)	Period 2 (2010-2013)	p value
Sex [†]			
Female	4030 (48.1%)	6905 (48.9%)	0.21
Male	4357 (51.9%)	7214 (51.1%)	
Mean age*	7.5 ± 2.1	7.8 ± 2.5	<0.0001
Urgent Dental Needs [†]			
No	6822 (80.0%)	11313 (79.8%)	0.70
Yes	1703 (20.0%)	2862 (20.2%)	
Localized Pain [†]			
No	8398 (98.5%)	14070 (99.2%)	<0.0001
Yes	130 (1.5%)	110 (0.8%)	
Overall Caries experience [†]			
No	6312 (72.1%)	9346 (65.9%)	<0.0001
Yes	2439 (28.9%)	4834 (34.1%)	
Mean dt*	0.82 ± 1.96 (Range 0-20)	0.64 ± 1.83 (Range 0-20)	<0.0001
Mean DT*	0.08 ± 0.40 (Range 0-10)	0.06 ± 0.37 (Range 0-12)	0.002

* t-test

[†] chi square

Table 5. Suggested recommendations to the WRHA for Oral Health Surveillance

- Annual calibration of dental staff conducting dental surveillance
- Review and enhancements to the dental surveillance screening forms
- Adopt a detailed surveillance screening protocol such as the one developed by the Ontario Public Health Standards⁵ that includes a reporting section which involves an annual report to the WRHA of the surveillance findings, trend analysis, program planning, implementation and evaluation
- Adoption of electronic recording of dental surveillance
- Annual review of dental surveillance data by the WRHA for planning and evaluation purposes
- Disseminating outcomes and findings of yearly dental surveillance activities