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ORIGINAL ARTICLE

Predictors Of Dental Disease Among Youth Incarcerated At A Toronto-Area Youth Centre

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ABSTRACT

Canadian correctional institutions provide dental services to a vulnerable cohort ofyoung people: incarcerated youth.Published data on the oral health of thiscohortis not available.

Objective: To determine the oral health status of youth in a closed-custody facility in a large Canadian centre

Methods: A cross-sectional study of youth incarcerated ata Toronto-area facility was conducted from September 2010 till July 2011. Participants completed a survey on social, correctional and oral health histories, and underwent oral examination.

Results: Of 101adolescent participants, 81.2% had permanent teeth affected by tooth decay. In this group, an average of 4.39 teeth were affected and. the proportion of decayed teeth was 0.51. Race, custody history and case status were predictors of poor oral health.

CONCLUSIONS: By quantifying the need for oral health services and by identifying variables associated with greater dental disease, these findings may assist health care providers in youth correctional facilities with their program planning for their high-needs wards.

KEYWORDS: Youth, Prisons, Detention, Dental, Health

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INTRODUCTION

Oral health services are an integral component of comprehensive health services for those in custody (1). The World Health Organization urges corrections administrators to be aware of and responsive to the oral health needs of different populations in custody, and to strive to improve oralservice offerings (2). Improved oral health for these individuals has the potential to improve their quality of life once released from prison due to the association of oral health with speech, social mobility, employability, self-image, and esteem (3).

Little is known of the medical and dental status of incarcerated groups, except that their health is generally poor and laden with mental disorders and drug addictions (4)."These adolescents are an unusually high-risk cohort with numerous unmet medical and psychiatric needs" (5).

The literature search conducted by the authors of this paper did not retrieve any studies, published or unpublished, that determined the oral health status of any Canadian populations in youth and adult correctional facilities. This research project aims to advance international oral health knowledge on incarcerated youth.

OBJECTIVE

The primary objective of this research was to determine the oral health status of youth housed in a closed-custody youth facility in the Greater Toronto Area.Debris and calculus scores were

outcomes of interest, as were the proportions of participants having the highest two scores for debris and calculus. Other outcomes of interest were the overall mean and 95% confidence intervals for decayed teeth (DT), missing teeth (MT), filled teeth (FT), the sum of these numbers (DMFT), and the proportion of decayed teeth when the sum of decayed, missing, and filled teeth was greater than zero (DT÷DMFT when DMFT > 0). Also examined were the prevalence of decay (DT > 0) and caries history (DMFT > 0).

METHODS

This research project was a cross-sectional descriptive quantitative study. Participants were drawn from the population of youth in custody housed at the Roy McMurtry Youth Centre in Brampton, Ontario, from September 2010 till July 2011. Data collection was conducted by the Principal Investigator, a licensed dentist contracted to assess the dental status of newly admitted youth at an intake or initial visit, and to offer dental services to those requesting care.

This research project was approved by the University of Toronto Office for Research Ethics and by the Correctional Services/Youth Justice Research Committee of the Youth Justice Services Division at the Ministry of Children and Youth Services.

Every adolescent seen for their firstdental intake visit during the study time frame was asked to participate in the study, effectively recruiting each newly admitted adolescent to the facility. A consent form approved by the Ethics and Research committees described above was signed by each participant which also explained that there were no consequences for non-participation or withdrawal from the study. It was decided a priori that the study would exclude youth who themselves or whose parents had declined the facility's oral health care services, youth who were unable to understand the research methods and informed consent, and youth who posed security risks.

Each participant was asked to complete a structured questionnaire andundergo anintra-oral examination. The questionnaire had fourteen items with items pertaining to participants' oral healthhistoryand conditions, and to participants' non-dental characteristics which included age, sex, race, country of birth, social and correctional history.For the oral health examination, the following data were recorded: visual debris index and calculus index scores (6), teeth present and absent, existing fillings and appliances, and areas of tooth decay and fractures. Scores and indices did not include findings on third molars. These indices were chosen so that findings would be comparable to literature on similar populations.

The program SPSS version 19.0 (SPSS®, Chicago, IL, USA) was used for data management and statistical analysis. Non-parametric statistical tests were conducted to investigate these relationships further since the distribution of scores of the outcome data did not approximate the normal distribution. Statistical significance was noted only when p-values less than 0.05 were found.

RESULTS

This article describes only the results of the analysis of the non-dental variables: age, sex, race, country of birth, social and correctional history, as potential predictors of dental disease. The results of the analysis of the dental variables: time since last visit, site of last visit, and oral health conditions, will be discussed in a subsequent article.

All of the youth who were asked to participate in the study, agreed to participate (N = 101, n = 101). However, few youth responded to all questions in the survey, as evidenced by the high proportion of missing data (Table 1).

The majority of youth surveyed and examined were male (Table 1). The ages of the youth ranged from 14 to 20 years of age, with 17 as mean and mode.When asked to identify themselves as White, Aboriginal or Other, most selected "Other". In the blank space beside the "Other" choice, several participants wrote that they were of African descent and so these individuals were recoded as Black. Some responses were too vague, like "mixed", or occurred so infrequently that they were not re-categorized but left as "Other". Almost 22% did not provide any racial information. The vast majority of the youth who provided data were Canadian-born.

Over half of the youth in the sample specified that they were living with their parents or grandparents at the time of their arrests. A third of the sample responding to the question about Children's Aid Society recalled CAS involvement in the past. Twenty-four percent of respondents reported being removed from their family homes to be taken into the care of the Children's Aid Society.

Among respondents, 10.4% reported that their incarceration was the result of a first-time arrest, but 20.3% reported that this was their first time in custody. Nearly 30% of respondents were already sentenced, while the rest were held in custody on remand awaiting trial. The avoidance of answering questions pertaining to social and correctional history was high, ranging from 15.7 to 23.8%.

DEBRIS AND CALCULUS

Debris and calculus were scored according to how much of the labial or lingual surface was covered on indices teeth in the mouth. Scores of 0 and 1 meant an index tooth had no debris or calculus present, or debris or calculus on less than one-third of its surface. Scores of 2 and 3 meant that between one-third and two-thirds of the tooth, and more than two-thirds of the index tooth

Table 1: Sample characteristics by sex, age, race, country of birth, social, and correctional history

	N	%	Valid % (excluding missing data)
All	101	100	
Sex			
Male	87	86.1	86.1
Female	14	13.9	13.9
Age			
14	1	1.0	1.0
15	11	10.9	11.0
16	17	16.8	17.0
17	38	37.6	38.0
18	20	19.8	20.0
19	8	7.9	8.0
20	5	5.0	5.0
Missing	1	1.0	
Race*			
White	22	21.8	27.8
Aboriginal	5	5.0	6.3
Other	52	51.5	65.8
Missing	22	22.5	
Country of Birth			
Canada	79	78.2	88.8
Outside Canada	10	9.9	11.2
Missing	12	11.9	
Living arrangements prior to arrest			
With parents	51	50.5	63.0
With Other relatives	8	7.9	9.9
With partner/spouse	4	4.0	4.9
With friends	6	5.9	7.4
On own – in own place	6	5.9	7.4
On own – on street or in shelter	6	5.9	7.4
Missing	20	19.8	
Past involvement with CAS			
Yes	30	29.7	36.6
No	52	51.5	63.4
Missing	19	18.8	
Past care with CAS			
Yes	21	20.8	24.1
No	66	65.3	75.9
Missing	14	13.9	
History of arrest			
1 time	8	7.9	10.4
2-3 times	20	19.8	26.0
Greater than 3 times	49	48.5	63.6
Missing	24	23.8	
History of custody			
1 time	16	15.8	20.3
2-3 times	33	32.7	41.8
Greater than 3 times	30	29.7	38.0
Missing	22	21.8	
Case status			
On remand	61	60.4	71.8
Sentenced	24	23.8	28.2
Missing	16	15.7	

* When asked to identify themselves as White, Aboriginal or Other, most selected "Other" and many participants specified their race or ethnicity. Several participants wrote that they were Black, African-Canadian, or of African descent and so these individuals were recoded as Black in later analysis. Some responses were non-specific or occurred so infrequently that they were not re-categorized but left as "Other".

had debris or calculus. Only 5.9% of the participants examined had debris scores in the two highest categories and 2.4% had calculus scores in the two highest categories (Table 2). Sex and age had no discernable influence on high debris and plaque scores. Once age was dichotomized the prevalence of high debris and calculus scores in the younger group appeared to be higher, however this observation was not statistically significant. Participants born in Canada tended to have more high plaque and calculus scores than those born elsewhere, but again, this was not significant.

With respect to race, a statistically significant difference was observed between the percent of debris scores greater than 2 among Whites versus Aboriginals and Others ($p=0.027$) (Table 2). This significance did not hold once the "Other" responses for race category were examined and reclassified, although Whites still had the greater percentage. Participants who were living with parents, relatives, partner or spouse at the time of their arrest had greater percentages of debris scores in the two highest categories than those who were living with friends, and on their own. Participants with prior Children's Aid Services involvement and/or care had a somewhat higher prevalence of high debris and calculus scores than those with no Children's Aid Services history, but this was not statistically significant.

The prevalence of high debris and calculus scores was also greater amongst youth who had been incarcerated and arrested previous to this incarceration, and seemed to increase with repeated bouts with the law. Of statistical significance was the finding that 20.8% of the youth incarcerated for the purposes of serving a sentence had debris scores in the two highest categories in contrast to virtually no high debris scores amongst the youth held on remand ($p=0.001$). A smaller and not statistically significant difference was noted

Table 2: Statistically significant associations between variables and percent of participants with highest scores for debris and calculus (p <0.05)

	Percent with (%) score >2 (%)	Percent with calculus debris score >2 (%)
All	5.9	2.4
SEX		
Male	5.7	2.8
Female	7.1	0.0
Age		
15*	0.0	0.0
16	5.9	7.7
17	7.9	0.0
18	5.0	0.0
19	12.5	12.5
20	0.0	0.0
AGE DICHOTOMIZED		
<16	6.8	2.7
≥16	0.0	0.0
RACE		
White	**18.2**	0.0
Aboriginalπ	**0.0**	0.0
Other	**1.9**	4.5
Race expanded		
White	16.7	0.0
Aboriginalπ	0.0	0.0
Other	6.7	8.3
Black	0.0	3.2
COUNTRY OF BIRTH		
Canada	7.5	3.2
Outside of Canada	0.0	0.0
Living with prior to arrest		
Parents	5.9	4.8
Other relatives	12.5	0.0
Partner/spouse	25.0	0.0
Friends	0.0	0.0
No one - own place	0.0	0.0
No one – street/shelter	0.0	0.0
LIVING WITH PRIOR TO ARREST		
Parents/Other relative	6.8	4.1
Partner/spouse/friends/no one	4.5	0.0
Past involvement with CAS		
Yes	6.7	4.0
No	5.8	2.3
Past care with CAS		
Yes	9.5	5.6
No	4.5	1.9
HISTORY OF ARREST		
1 time	0.0	0.0
2-3 times	0.0	0.0
Greater than 3 times	8.2	2.4
History of arrest		
1 time	0.0	0.0
2 or more times	5.8	1.8
HISTORY OF CUSTODY		
1 time	0.0	0.0
2-3 times	3.0	3.3
Greater than 3 times	13.3	4.3
HISTORY OF CUSTODY		
1 time	0.0	0.0
2 or more times	7.9	3.8
Case status		
Sentenced	**20.8**	4.5
On remand	**0.0**	2.0

* group includes sole 14 year old subject; β 1 or more cells have expected count less than 5, interpret with caution; π less than 5 participants, interpret with caution; **BOLD** results were statistically significant p<0.05 using either Pearson Chi-Square or Fisher's Exact test.

for high calculus scores.

PREVALENCE AND SEVERITY OF CARIES

The 101 youth examined and surveyed had a mean DMFT of 4.39 with 18.8% of participants presenting as caries-free- or conversely, 81.2% had experienced dental caries. Among those participants with caries experience, the mean DTrose to 5.40 and DT accounted for 51% of the index scores (Table 3).

When the data were stratified by sex, the only caries indicators that differed with statistical significance between the two groups were the FT and the DT/DMFT when DMFT > 0. Females had more filled teeth with a mean of 3.36 ($p = 0.015$)while males had an increased proportion of decayed to caries-affected teethwith a mean of 0.55 ($p = 0.050$). In both cases however, there was some overlap between 95% confidence intervals.

As described in the Methods section, participants classified themselves as either White, Aboriginal or Other. Using these predictor groups, the Kruskal-Wallis test for comparing different sets of non-parametric data revealed that those who self-identified as Other had lower DMFT scores($p = 0.001$ and $p = 0.002$) and fewer decayed teeth($p = 0.029$) than at least one of the other two groups (Table 4). The 95% confidence intervals suggest that the statistically significant difference lies between the White and Other groups. The questionnaire responses for Other were examined and then re-classified by the principal researcher to the four groups: White, Aboriginal, Other, and Black (Table 4). Those who were re-classified as Black had lower DMFT scores ($p = 0.001$ and $p = 0.003$), fewer decayed teeth ($p = 0.033$), fewer filled teeth ($p = 0.013$), and a higher proportion of decayed teeth to affected teeth ($p = 0.046$) than at least one of the other three groups. Again, the 95% confidence intervals for the means of these outcomes suggest that the statistically

Table 3: Prevalence and severity of caries of the sample by sex, age and age dichotomized relative to age 16 yrs

DMFT	% with >0	n	DT		MT		FT		DMFT	DMFT	n with DMFT>0 >0	DMFT when when DMFT		Proportⁿ of DT >0	
			Mean	95%CI	Mean	95%CI	Mean	95%CI	Mean	95%CI		Mean	95%CI	Mean	95%CI
	81.2	101	2.42	1.76-3.07	0.15	0.06-0.24	1.82	1.37-2.27	4.39	3.62-5.15	82	5.40	4.61-6.19	0.51	0.43-0.60
SEX															
Male	79.5	87	2.37	1.71- 3.02	0.15	0.05-0.25	1.57	1.13-2.02	4.09	3.31-4.88	69	5.16	4.35-5.97	0.55	0.46-0.64
Female	92.9	14	2.71	-0.02- 5.45	0.14	-0.07-0.35	3.36	1.68-5.03	6.21	3.53-8.90	13	6.69	4.00-9.39	0.31	0.10-0.52
Fisher's exact test p-value	0.458														
M-W U-test p-value			**0.745**		**0.793**		**0.015**		**0.081**			**0.230**		**0.050**	
AGE															
15*	84.6	12	2.00	0.08-3.92	0.25	-0.14-0.64	1.08	0.21-1.96	3.33	1.19-5.47	10	4.00	1.64-6.36	0.52	0.20-0.84
16	88.2	17	3.00	0.73- 5.27	0.12	-0.05-0.29	2.00	0.86-3.14	5.12	2.97-7.27	15	5.80	3.60-8.00	0.52	0.28-0.77
17	78.9	38	2.55	1.59-3.52	0.16	-0.02-0.34	1.79	0.92-2.65	4.50	3.23-5.77	30	5.70	4.40-7.00	0.58	0.44-0.72
18	70.0	20	2.20	0.35-4.05	0.15	-0.02-0.32	1.70	0.65-2.75	4.05	1.95-6.15	14	5.79	3.30-8.27	0.41	0.20-0.63
19	100.0	8	3.00	0.90- 0.51	†		3.00	1.00-5.00	6.00	3.32-8.68	8	6.00	3.32-8.68	0.54	0.22-0.87
20	80.0	5	0.40	-0.71-1.50	†		1.80	-0.74-4.34	2.20	-0.02-4.42	4	2.75	0.36-5.14	0.25	-0.55-1.05
Pearson Chi-Sqp-value	0.524β														
K-W test‡ p-value			**0.328**		**0.801**		**0.562**		**0.296**			**0.245**		**0.571**	
AGE DICHOTOMIZED															
<16	84.6	12	2.00	0.08-3.92	0.25	-0.14-0.64	1.08	0.21-1.96	3.33	1.19-5.47	10	4.00	1.64-6.36	0.52	0.20-0.84
≥16	80.7	88	2.48	1.76-3.20	0.13	0.04-0.21	1.92	1.41-2.43	4.52	3.69-5.36	71	5.61	4.75-6.47	0.51	0.42-0.61
Fisher's Exact Test p-value	1.000														
M-W U-test p-value			**0.636**		**0.469**		**0.339**		**0.347**			**0.081**		**0.907**	

DT = sum of number of decayed teeth; MT = sum of number of missing teeth; FT = sum of number of filled teeth; DMFT = sum of number of decayed, missing, and filled teeth; K-W = Kruskal-Wallis; M-W = Mann-Whitney; *group includes sole 14 year old subject; †number of missing teeth is constant for ages 19 & 20 and so is omitted from calculations; ‡not corrected for ties; α number of missing teeth is constant for Other, and so is omitted from calculations; β 1 or more cells have expected count less than minimum required for statistical calculation, interpret with caution;

Table 4: Prevalence and severity of caries of the sample by race, race with "Other" responses re-classified, and country of birth

	% with DMFT >0	n	DT		MT		FT		DMFT		n with DMFT >0	DMFT when DMFT>0		Proportn of DT when DMFT >0	
			Mean	95%CI	Mean	95%CI	Mean	95%CI	Mean	95%CI		Mean	95%CI	Mean	95%CI
	81.2	101	2.42	1.76-3.07	0.15	0.06-0.24	1.82	1.37-2.27	4.39	3.62-5.15		5.40	.61-6.19	0.51	0.43-0.60
RACE															
White	90.9	22	4.27	2.28-6.26	0.18	0.01-0.36	2.64	1.29- 3.98	7.09	5.00-9.18	20	7.80	5.78-9.82	0.50	0.33-0.68
Aboriginalπ 1.06	80.0	5	4.00	-0.97-8.97	.20	-0.36-0.76	2.40	0.72-5.52	6.50	1.14- 12.05	4	8.25	3.87-12.63	0.56	0.06-
Other	73.1	52	1.77	1.00-2.54	0.12	-0.02-0.25	1.37	0.85- 1.88	3.25	2.36-4.14	38	4.45	3.48-5.42	0.54	0.41-0.67
Pearson Chi-square p-value	0.232β														
K-W test p-value			**0.029**		**0.384**		**0.104**		**0.001**			**0.002**		**0.843**	
RACE RE-CLASSIFIED															
White	87.5	24	4.00	2.14-5.86	0.17	0.01-0.33	2.63	1.33-3.92	6.79	4.80-8.79	21	7.76	5.84-9.68	0.49	0.33-0.66
Aboriginalπ	100	4	5.00	-1.09-11.09	0.25	-0.55-1.05	3.00	-0.90-6.90	8.25	3.87-12.63	4	8.25	3.87-12.63	0.56	0.06-1.06
Other	73.3	15	1.73	-0.54-4.00	A		2.07	0.93-3.20	3.80	1.53-6.07	11	5.18	2.53-7.83	0.30	0.06-0.54
Black	71.4	35	1.80	1.08-2.52	0.17	-0.02-0.37	0.89	0.40-1.37	2.86	1.90-3.81	25	4.00	2.98-5.03	0.66	0.51-0.82
Pearson Chi-square p-value	0.323β														
K-W TEST P-VALUE			**0.033**		**0.368**		**0.013**		**0.001**			**0.003**		**0.046**	
Country of birth															
Canada	80	79	2.62	1.82-3.42	0.14	0.04-0.24	1.81	1.30-2.32	4.57	3.66-5.48	63	5.73	4.77-6.67	0.52	0.42-0.61
Outside of Canada	80	10	2.10	0.37-3.83	0.20	-0.10-0.50	0.90	-0.02-1.82	3.20	0.97-5.43	8	4.00	1.51-6.59	0.65	0.29-1.00
Fisher's Exact Test p-value	1.00														
M-W U-test p-value			**0.898**		**0.452**		**0.239**		**0.377**			**0.210**		**0.351**	

DT = sum of number of decayed teeth; MT = sum of number of missing teeth; FT = sum of number of filled teeth; DMFT = sum of number of decayed, missing, and filled teeth; K-W = Kruskal-Wallis; M-W = Mann-Whitney; α number of missing teeth is constant for Other, and so is omitted from calculations; β 1 or more cells have expected count less than minimum required for statistical calculation, interpret with caution; π fewer than 5 participants, interpret with caution

significant difference lies between the White and Black groups.

Age, when considered as an integer of actual years or as a dichotomized variable, did not appear to affect any indicators of caries outcomes to a statistically significant extent(Table 3). Country of birth did not appear to influence caries prevalence or severity either(Table 4).The variable entitled "Living arrangement prior to participants' arrest"was unable to predict caries prevalence or severity (Table 5). When dichotomized, a statistically significant difference between the mean numbers of filled teeth emerged ($p = 0.047$)although confidence intervals overlapped. Having been involved with or in the care of the Children's Aid Society had no detectable influence on caries prevalence or severity (Table 5).

With respect to correctional history, the mean DT and DMFT scores were related to custodial history (Table 6). Those who were first-timers in the facility had fewer carious lesions ($p < 0.001$), less caries experience ($p = 0.007$), and a lower proportion of decayed to affected teeth ($p = 0.017$) compared to those who were repeat detainees. Participants who were awaiting trial had fewer decayed teeth ($p = 0.006$), fewer filled teeth ($p = 0.003$), and less caries experience ($p < 0.001$) as compared with participants who had been sentenced. Caries prevalence and severity appeared to increase with more arrests, but this trend was not statistically significant. Only the mean DT for participants who had been arrested more than three times was significantly greater than at least one of the two groups: those arrested once and those arrested two to three times ($p = 0.050$). Still, overlap between confidence intervals persisted. Among the sentenced youth, all participants had at some point experienced caries. Prevalence was 100%. Caries prevalence among participants held on remand, on the other hand, was 73.8% ($p = 0.004$).

Prevalenceriskratios were calculated from the questionnaire data, and decayed teeth and DMFT outcomes (Table7). The analysis revealed that participants with a prior history of arrest presented with decay 2.61 times more often than those without a prior history of arrest ($p = 0.050$), but the confidence interval for this risk ratio straddled to no-effect value of 1. The analysis also showed that participants with a prior history of custody presented with decay 2.86 times more often than those without ($p = 0.001$). The former also had DMFT scores greater than zero 1.37 times more often,but this result was not statistically significant from the Fisher`s exact test result ($p = 0.067$). Additionally, the confidence interval straddled the no-effect value of 1. Participants who were sentenced presented with DMFT scores greater than zero 1.36 times more frequently than those who were held on remand ($p = 0.004$).

Multivariate analysis and regression were not attempted for this research owing to the high proportion of missing data.

DISCUSSION

This exploratory research project is the first investigation of the oral health status of an incarcerated population in Canada. This section strives to account for the project's results and disentangle the relationships between the predictor variables and poor oral health outcomes investigated by this research project. Further, this study's limitations and implications for clinical practice are explored.

The results can be compared to the findings of the Canadian Health Measures Survey. The Canadian Health Measures Survey conducted from 2007 to 2009 collected data on the medical and dental health of over 5,000 Canadians at 15 sites spread across the country who represented 97% of the population aged 6 to 79 years (7). It did not assess debris and calculus in a similarly aged cohort to this study and so no comparison can be drawn made. However, comparisons can be made for disease prevalence and severity.

The average number DMFT for this study's participants was 4.39. In the Canadian adolescent population, the DMFT was only 2.49 (7). The prevalence of caries-free dentitions among the incarcerated youth was 18.8% compared to 41.2% in the general adolescent population. For incarcerated youth with prior caries experience, the proportion of decayed teeth to total affected teeth was more than 0.5. This proportion is only 0.15 in the general adolescent population. The differences in disease prevalence and severity demonstrate the dissimilar utilization and access to care: incarcerated youth had more caries experience and less evidence of treatment.

Age is a usual confounder in oral health studies. Interestingly, no statistically significant trend in the number of decayed teeth, missing teeth, filled teeth, or proportion of decayed teeth was found when the participants were grouped by age. This research study may not have had enough power to detect the influence of age.

This study points to a greater mean number of filled teeth and lower proportion of decayed teeth to DMFT amongst female participants. Although not statistically significant, the DMFT score for females was higher as well. This result may be linked to the well-documented increased probability of females accessing oral health services compared to males (8).

While the results of this research study do not show a relationship between being born in Canada and oral health status, they do suggest an association between race and oral health status. The literature suggests that racialized groups, because of income gaps, unemployment, poverty, and disproportionate contact with the criminal justice

Table 5 : Prevalence and severity of caries of the sample by social history

	% with DMFT >0	n	DT		MT		FT		DMFT		n with DMFT >0	DMFT when DMFT>0		Proportⁿ of DT when DMFT >0	
			Mean	95%CI	Mean	95%CI	Mean	95%CI	Mean	95%CI		Mean	95%CI	Mean	95%CI
	81.2	101	2.42	1.76-3.07	0.15	0.06-0.24	1.82	1.37-2.27	4.39	3.62-5.15	82	5.40	4.61-6.19	0.51	0.43-0.60
LIVING ARRANGEMENT PRIOR TO ARREST															
Parents	80.4	51	2.53	1.58-3.48	0.12	0.01-0.23	1.67	0.99-2.34	4.31	3.20-5.42	51	5.37	4.20-6.53	0.57	0.45-0.70
Other relatives	62.5	8	2.25	-0.60-5.10	0.25	-0.14-0.64	1.50	0.16-2.84	4.00	0.29-7.71	5	6.40	1.54-11.26	0.39	-0.08-0.85
Partner/spouse	75.0	4	3.50	-2.38-9.38	α		1.75	-0.25-3.75	5.25	-2.03-12.53	3	7.00	-1.96-15.96	0.59	0.00-1.17
Friends	100.0	6	5.17	-1.65-11.98	0.17	-0.26-0.60	2.33	-1.22-5.89	7.67	1.24-14.09	6	7.67	1.24-14.09	0.56	0.08-1.03
No one - own place	83.3	6	2.33	0.50-4.17	0.50	-0.79-1.79	2.17	0.02-4.31	5.00	1.82-8.18	5	6.00	3.52-8.48	0.55	0.11-0.98
No one – street/shelter	100.0	6	0.67	-0.19-1.52	α		3.50	2.05-4.95	4.17	2.24-6.09	6	4.17	2.24-6.09	0.14	-0.03-0.30
Pearson Chi-square p-value	0.440β														
K-W test p-value			0.525		0.669		0.217		0.702			0.679		0.208	
LIVING ARRANGEMENT PRIOR TO ARREST															
Parents/relatives	78.0	59	2.49	1.62-3.36	0.14	0.03-0.24	1.64	1.04-2.24	4.27	3.24-5.31	46	5.48	4.38-6.57	0.55	0.43-0.67
Partner/spouse/ friends/on own	90.9	22	2.86	1.09-4.63	0.18	-0.11-0.48	2.50	1.53-3.47	5.55	3.73-7.36	20	6.10	4.28-7.92	0.43	0.26-0.60
Fisher's Exact Test p-value	0.219														
M-W U-test p-value			0.659		0.770		0.047		0.158			0.500		0.218	
Past involvement with CAS															
Yes	86.7	30	2.93	1.29-4.57	0.20	-0.03-0.43	1.87	1.08-2.66	5.00	3.35-6.65	26	5.77	4.05-7.49	0.49	0.33-0.64
No	78.8	48	2.35	1.54-3.15	0.08	0.00-0.16	1.83	1.13-2.54	4.17	3.07-5.27	37	5.41	4.26-6.55	0.52	0.40-0.65
Fisher's Exact Test p-value	0.555														
M-W U-test p-value			0.796		0.594		0.849		0.590			0.943		0.705	
PAST CARE WITH CAS															
Yes	85.7	20	3.45	1.02-5.88	0.25	-0.09-0.59	2.25	1.18-3.32	5.95	3.69-8.21	18	6.61	4.30-8.92	0.41	0.22-0.60
No	77.3	58	2.19	1.47-2.91	0.09	0.01-0.16	1.71	1.10-2.31	3.98	3.03-4.94	45	5.13	4.13-6.13	0.54	0.43-0.66
Fisher's Exact Test p-value	0.543														
M-W U-test p-value			0.741		0.603		0.143		0.121			0.184		0.187	

DT = sum of number of decayed teeth; MT = sum of number of missing teeth; FT = sum of number of filled teeth; DMFT = sum of number of decayed, missing, and filled teeth; K-W = Kruskal-Wallis; M-W = Mann-Whitney; α number of missing teeth is constant for "with partner/spouse" and "on own - on street or in shelter", and so is omitted from calculations; β 1 or more cells have expected count less than 5, interpret with caution.

Table 6 : Prevalence and severity of caries of the sample by correctional history

	% with DMFT >0	n	DT		MT		FT		DMFT		n with DMFT >0	DMFT when DMFT>0		Proportⁿ of DT when DMFT >0	
			Mean	95%CI	Mean	95%CI	Mean	95%CI	Mean	95%CI		Mean	95%CI	Mean	95%CI
	81.2	101	2.42	1.76-3.07	0.15	0.06-0.24	1.82	1.37-2.27	4.39	3.62-5.15	82	5.40	4.61-6.19	0.51	0.43-0.60
HISTORY OF ARREST															
1 time	62.5	8	1.25	-1.10-3.60	0.13	-0.17-0.42	2.00	-0.28-4.28	3.38	0.70-6.05	5	5.40	2.83-7.97	0.33	-0.25-0.92
2-3 times	75.0	20	1.50	0.50-2.50	0.15	-0.08-0.38	1.80	1.02-2.58	3.45	1.98-4.92	15	4.60	3.06-6.14	0.38	0.18-0.58
Greater than 3 times	85.7	49	3.06	1.93-4.19	0.16	0.02-0.31	1.98	1.25-2.71	5.20	3.96-6.56	42	6.07	4.80-7.34	0.55	0.43-0.68
Pearson C-Sqp-value	0.236β														
K-W test p-value			**0.050**		**0.974**		**0.966**		**0.241**			**0.514**		**0.196**	
HISTORY OF ARREST (DICHOTOMIZED)															
1 time	62.5	8	1.25	-1.10-3.60	0.13	-0.17-0.42	2.00	-0.28-4.28	3.38	0.70-6.05	5	5.40	2.83-7.97	0.33	-0.25-0.92
2 or more times	82.6	69	2.61	1.75-3.47	0.16	0.04-0.28	1.93	1.37-2.48	4.70	3.71-5.78	57	5.68	4.67-6.70	0.51	0.41-0.61
Fisher's Exact p-value	0.182														
M-W U-test			0.082		0.964		0.889		0.439			0.822*		0.336*	
HISTORY OF CUSTODY															
1 time	62.5	16	0.44	-0.04-0.91	0.06	-0.07	1.81	0.67-2.95	2.31	1.17-3.46	10	3.70	2.69-4.71	0.23	-0.02-0.49
2-3 times	87.9	31	3.13	1.75-4.50	0.26	0.01-0.51	1.77	0.85-2.70	5.16	3.54-6.78	27	5.93	4.26-7.59	0.60	0.45-0.75
Greater than 3 times	83.3	30	2.87	1.45-4.28	.10	-0.01-0.21	2.17	1.32-3.02	5.13	3.64-6.63	25	6.16	4.69-7.63	0.48	0.33-0.63
Pearson C-Sqp-value	0.096β														
K-W test p-value			**0.001**		**0.592**		**0.619**		**0.027**			**0.143**		**0.024**	
HISTORY OF CUSTODY (DICHOTOMIZED)															
1 time	62.5	16	0.44	-0.04-0.91	0.06	-0.07	1.81	0.67-2.95	2.31	1.17-3.46	10	3.70	2.69-4.71	0.23	-0.02-0.49
2 or more times	85.7	61	3.00	2.04-3.96	0.18	0.04-0.32	1.97	1.35-2.58	5.15	4.08-6.22	52	6.04	4.96-7.12	0.54	0.44-0.65
Fisher's Exact p-value	0.067														
M-W U-test			**0.000**		**0.458**		**0.869**		**0.007**			**0.058**		**0.017**	
CASE STATUS															
Sentenced	100.0	24	4.17	2.47-5.87	0.17	0.01-0.33	2.75	1.74-3.76	7.08	5.64-8.53	24	7.08	5.64-8.53	0.49	0.35-0.64
On remand	73.8	61	1.92	1.15-2.69	0.15	0.03-0.27	1.36	0.83-1.89	3.43	2.48-4.37	45	4.64	3.57-5.72	0.54	0.42-0.66
Fisher's Exact p-value	0.004														
M-W U-test p-value			**0.006**		**0.546**		**0.003**		**0.000**			**0.002**		**0.498**	

DT = sum of number of decayed teeth; MT = sum of number of FT = sum of number of filled teeth; DMFT = sum of number of decayed, missing, and filled teeth; K-W = Kruskal-Wallis; M-W = Mann-Whitney; * not corrected for ties; β 1 or more cells have expected count less than 5, interpret with caution

Table 7: Statistically significant Prevalence Risk Ratios for untreated decay DT>0 and caries experience DMFT>0

Variable	1st group: 2nd group	DT>0 1st group is ___ times more likely than 2nd group to have untreated decay			DMFT>0 1st group is ___ times more likely than 2nd group to have caries experience		
		Prevalence ratio	95%CI	Pearson Chi-Sq p-value	Prevalence ratio	95%CI	Pearson Chi-Sq p-value
Sex	Female : Male	0.93	0.58-2.15	0.764	1.17	0.98-1.14	0.229
Age	≥16yrs : <16yrs	0.98	0.62-1.55	0.928	0.97	0.74-1.27	0.826β; 1.000
Race	White : Black	1.06	0.73-1.55	0.764	1.23	0.95-1.59	0.143
Living with prior to arrest	Parents/Other relatives : Spouse/friends/no one	0.90	0.63-1.27	0.553	0.86	0.71-1.04	0.182β; 0.219
Past involvement with CAS	Yes : No	1.12	0.80-1.57	0.526	1.10	0.90-1.34	0.378
Past care with CAS	Yes : No	1.08	0.73-1.60	0.726	1.11	0.89-1.38	0.406β; 0.543
History of arrest	Yes : No	2.61	0.78-8.77	0.027β; 0.050	1.32	0.76-2.29	0.174β; 0.182
History of custody	Yes : No	2.86	1.21-6.78	0.001	1.37	0.93-2.03	0.034β; 0.067
Case status	Sentenced : Remand	1.33	0.97-1.80	0.105	1.36	1.17-1.57	0.005β; 0.004
Time since last dental visit	≤2yrs : >2yrs or never	0.82	0.60-1.11	0.236	0.97	0.79-1.20	0.784
Site of last dental visit	In community : In/escorted by facility	0.99	0.73-1.35	0.963	0.90	0.75-1.09	0.288
Toothache past 12mos	Yes : No	1.91	1.24-2.96	0.001	1.36	1.05-1.76	0.010
Pain hot cold food drink past 12mos	Yes : No	1.60	1.07-2.40	0.009	1.32	1.02-1.71	0.014
Persistent or ongoing pain anywhere in mouth in past 12mos	Yes : No	1.35	0.96-1.88	0.079	1.11	0.89-1.39	0.342

β 1 or more cells have expected count less than 5 using Pearson Chi-Sq and Fisher's Exact value follows

system, are at greatest risk for poor general and oral health 9. In contrast, this study has revealed lower dental disease prevalence amongBlack and visible minority incarcerated youth as compared to their white peers.

The explanation for this disparity may lie in a web-published report from the Research Branch of the Correctional Service of Canada (9). That report described non-Aboriginal visible minority offenders in the federal adult penitentiary system as "less 'entrenched' in a criminal lifestyle than Caucasian offenders" (10). They appeared to have higher levels of education, less unemployment, and were less often single. This observation implies improved social determinants of health and reduced risk of the onset of oral disease for visible minorities.

Interestingly, the mean ratio of decayed teeth to caries experience was higher for Blacks than Whites. This difference suggests reduced access to treatment and is quite consistent with theassertions of the report just described (9). When specialized needs arise racialized individuals at risk of offending appear to encounter more barriers to professional services including dental care. Valencia-Rojas, Lawrence, and Goodman (11) found that family involvement with Toronto Children's Aid Services had a protective effect on local younger children's oral health. At least two studies (12,13) reported high unmet dental needs amongst homeless Toronto-area youth. Surprisingly, in this research project, CAS involvement and homelessness displayed no influence on the prevalence and severity of oral disease.

A possible explanation for the lack of relationship between CAS involvement and oral health status is that the protective effect of childhood CAS experiences had waned with the influence of other environmental factors and risk behaviours. With respect to homelessness, there may have been too few homeless youth to detect differences and the questionnaire's response choices may also have been inappropriate for assessing homelessness.

This research study found that a history of previous arrest and custody was related to poor oral health outcomes. The instability in the lives of re-offenders would not be conducive to maintaining self-care regimens, attending health provider visits, or paying for oral care products and services. When in custody, variable dental facilities and staffing, waitlists for dental visits, cariogenic diet, and scant hygiene aids would facilitate dental disease progression. Similarly, sentenced youth would be disadvantaged by these features of incarceration for longer than those held in remand.

A major limitation of this research project was its inability to control for

known confounders of oral health status like socioeconomic status, maternal education, and high-risk behaviours. The researchers originally hypothesized that parental earnings, abuse history, criminal charges, and gang involvement would impact health outcomes. However, delving too deeply into these would have increased participants' feelings of vulnerability and reduced their willingness to participate. This research project still had low power. Only 101 youth participated in the study,and the avoidance of answering questions pertaining to social and correctional history was high.

It is unlikely that another study conducted at a single closed-custody facility over a similar time period would have a greater sample size. Since the enactment of the Youth Criminal Justice Act in 2002, the numbers of youth in these facilities have been dropping. Facilities are operating with fewer offenders than they were built to house. Additional centres might be recruited, but the increased sample size might not justify the additional time and expense of involving the typically smaller facilities in the province.

Nonetheless, youth at risk of offending and those already incarcerated are likely to haveunmet dental needs, and many barriers to accessing care both in and out of custody. Access to dental care in prisons and the breadth of services offered varies from facility to facility. The findings of this research study can be used to help decision-makers allocate adequate and appropriate funding for dental services, design and evaluate programs, and develop much-needed service baskets and triage tools for rationing care. Dissemination to those who could use these findings best could be challenging given competing interests, and lack of capacity and expertise in this area. It may be worthwhile to consider how correctional dental services are managed, delivered, or organized outside of Canada. Such insight into the characteristics of dental programs would be useful in developing legislative direction, practice guidelines, and improved coordination between key stakeholders.

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