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STARTING FROM SCRATCH: A MICRO-COSTING ANALYSIS FOR PUBLIC DENTAL CARE IN CANADA

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SUMMARY

With federal political parties increasingly interested in new options for dental services, it's worth exp oring two policy solutions to expand dental care into the public realm. Denticare w uld be a universal dental program for all Canadian residents. Dentica d would be a public dental insurance program for all Canadian children and uninsured adults. This paper estimates the costs of each option through micro-cost ng, which identifies the likely resources patients would use in each program nd sums each unit cost in a given year to generate the estimated annual cl nical cost.

With no dental record-level information available for academic research, these est mates rely on survey data on oral health collected from across Canada. In particular, this paper uses the Canadian Community Health Survey (CCHS) and the Canadian Health Measures Survey (CHMS), both released by Statistics Canada. When neither survey contains the necessary data to inform assumptions and costing, data from similar high-income jurisdictions are used.

Denticare's costs are estimated using four key variables: the expected number of Canadians using dental services in a given year, the expected number of visits per year, the probability of dental treatments used per visit and the expected price of dental treatments. The first variable is based on Statistics Canada's 2016 census data, multiplied by their 2019 overall provincial population estimates. The second relies mostly on the CCHS question "when was the last time you visited the dentist?" The third variable uses Australian data and the fourth integrates data from a variety of provincial dental fee guides. High, low and baseline cost scenarios are included, with each province and territory's clinical costs projected five years after implementation in all three scenarios. To project future changes

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in service costs, the rate of price increase is calculated from changes between the 2015 and 2019 suggested fee schedules.

Methods for micro-costing the denticaid program are similar to the denticare mode and the variables are mostly treated similarly. However, the population variable is manipulated to account only for individuals without private dental insurance.

There are limitations to this approach. The CCHS is only a telephone survey and does not collect dental data from across every province. The lack of pan-Canadian service-level use data meant that data from an Australian survey was used in its place This model could not account for the effects of income on the frequency with wh ch a y particular dental treatment category is accessed per visit. Australia also cover most dental treatments for children, so use of dental services could be higher than what could be expected in Canada. To obtain a more exact picture, provincia gove nments should try to collect service-level data on dental use and dental practice activity.

However, this paper does provide Canadian policy-makers interested in exploring some sort of public dental care program with a rigorous estimation of the reimbursement of clinical costs for the options of both denticare and de ticaid programs.

1. INTRODUCTION

There is a growing interest from several federal political parties, and the present Liberal minority government in Canada, to explore new public options for the provision of dental services. In the Canadian health-care system, any dental services not requir ng a hospital's resources are ineligible for coverage in any province or territory's public health insurance system. This leaves the vast majority of dental care to be paid either through private insurance plans or directly out of pocket. In 2017, 54 per cent of dental expenses were paid through private insurance, 40 per cent were thr ugh d rect out-of-pocket payments, and only six per cent were through public-sector funding (Canadian Institute for Health Information 2019). Current public dental programs n Canada tend to employ tight restrictions around the types of dental treatments covered For example, Alberta Health Services offers a subsidy program on check-ups and fillings, while advanced procedures that may follow some basic procedures, such as a crown after root canal therapy, are not covered (Alberta Health Services n.d.) The dental professionals have also voiced discontent over these programs for being underfunded and lacking comprehensive coverage (Ontario Educational Communications Authority 2018). These restrictions result in minimal allocations of public funds, and often result in patients being underserved and dental professionals being unde funded for the services they provide their public-program patients.

An accompanying research paper, "Comprehensive Dental Care in Canada: The Choice Between Denticaid and Denticare," puts forward two policy options for the expansion of dentistry into Canadian public health are: ( ) a universal dental care program for all Canadian residents, referred to as denticare and (2) a public dental insurance plan for all Canadian children and uninsured adults, referred to as denticaid. The aim of this paper is to explain the methods used to stim te the annual clinical costs of the denticare and denticaid options if 2019 were he ye r of implementation. While this paper is explicitly about the methods of deriving the gross cost of each program, the accompanying research paper explores what th net program expense could be after cost-sharing and redistribution measures have been considered.

Previous research has lready established that Canadians face growing inequity in oral health outcomes and greater affordability obstacles to accessing preventive and restorative denta services (Canadian Academy of Health Sciences 2014; Locker et al. 2011; Ramraj et al. 2013). If access to oral health care is conceptualized as a policy problem, then a major consideration for remedying such inequality is what it will cost and how th government will pay for it. This paper answers the former question using a ground up technique called micro-costing, which identifies the likely resources used by patients n the program and then sums each unit cost in a given year to generate the est mated annual clinical cost (Jacobs et al. 1999, 3–4). The application of micro-costing o the dental care setting was informed by previous research conducted by the Grattan Institute in Australia (Duckett, Cowgill and Swerissen 2019). The micro-costing approach allows for the construction and costing of original denticare and denticaid programs from scratch, rather than inferring the annual cost from existing public dental programs.

2. SOURCES OF CANADIAN ORAL HEALTH DATA

Micro-costing requires extensive data on the use patterns of particular dental services and procedures, as well as a gauge of the typical cost per service. As medical records have become digitized, Canada's health-care system produces a plethora of administrative datasets describing patient costs and use patterns. However, the e is no standardized framework across all provincial/territorial health systems for which health data variables are collected, and how they are collected (Stinson 2018 6–7). Most provinces produce administrative datasets recording claims for phy ician services, hospital admissions, pharmaceutical claims, long-term care data and provincial laboratory services made under the public system (Medlior 2018). The major item missing from this list is patient-level records on dental care use. The only dental ecords that would be captured in these sources would be dental services rendered in a hospital setting or if a patient accessed a physician for a dental-related sue Since under the *Canada Health Act* (1985) dental procedures that require a hospital setting are part of medicare, dental services outside of medicare are also outside he collection scope of provincial administrative data programs.

In the absence of dental record-level data readily collected for academic research, survey data are routinely collected across Canada on a ariety of oral health topics. Statistics Canada runs two national health surveys that collect oral health variables: (1) the Canadian Community Health Survey (CCHS); and (2) the Canadian Health Measures Survey (CHMS). The CCHS is a phone survey that relies on self-reported variables on the individual's oral health status, their denta visit frequency, their reasons for not visiting the dentist and their dental insurance posse sion. The caveat is that oral health and insurance variables are an optional omponent of the CCHS which individual provinces can request Statistics Canada to c llec n their jurisdiction. Therefore, no single cycle of the CCHS has oral health and insurance variables that can be compared among all of Canada during the same yea Oft n, these variables are reported as data describing all Canadians; however, only one or two provinces may have been the sample size for each cycle's dental findings.

The CHMS is another periodic Statistics Canada survey that collects oral health data from Canadians across the country. Data are collected in a two-step process involving first a personal interview at each respondent's home and then a visit to a mobile examination site. At the CHMS mobile sites, a wide variety of medical screening tests and samples are collected including a dental examination by dental professionals on loan from the Canadian F rces The caveat is that while the CHMS is run annually, the oral health compo ent is run very infrequently. The last CHMS oral health data were collected between M rch 2007 and February 2009. The next scheduled oral health collection date is set for 2022-23 (Statistics Canada 2019c). This infrequency means that in the interim, policy makers discussing the future of oral health care on a pan-Canadian scale must rely on potentially outdated data. If a province wishes to examine its own oral health issues, it must rely on data from when it was last surveyed in the CCHS or extrapolate based on neighbouring provinces' statistics.

Dental records on procedures and use could be extracted from private insurance claim records but these are proprietary datasets. Government researchers have had some

success in retrieving private claims data. Alberta Health's 2016 review of dentistry in the province included a summary table of the most frequently billed dental services. So, while data on Canadian dental practice activity do exist, compiling these data for the purposes of academic research is a cumbersome task. This paper makes use of both the 2009 CHMS oral health statistics and multiple cycles of the CCHS to estimate the cost of both a universal first-dollar coverage public dental program (denticare), and a public dental insurance scheme for Canadian children and privately uninsured adults (de ticaid). Despite the previously stated limitations in collection frequency and scale, these surveys represent the best available population dental data from within Canada and are heavily relied on for this costing exercise. In cases where neither the CHMS nor th CCHS contains the necessary data to inform key assumptions and costing elements, data from other high-income jurisdictions with similar oral health policies uch as the United States and Australia, will be used.

3. MICRO-COSTING METHODS FOR UNIVERSAL DENTAL CARE COVERAGE (DENTICARE)

The annual total cost of denticare was estimated as the product of four key variables: (1) the expected number of Canadians using dental se vices in a given year; (2) the expected number of visits per year; (3) the probability of various dental treatments being used per visit and (4) the expected price of dental treatments. Data from Statistics Canada's 2016 Census, 2019 population projections and the 2007/09 CHMS were used to estimate the number of Canadians using dental services The CCHS was used to estimate the number of dental visits per year. Survey data from Brennan and Spencer (2006) were used for the probability of various dental trea ments being used per visit. Last, the expected price of dental services was estimated from provincial fee guides across Canada. The following four subsections detail the data manipulations and assumptions made to micro-cost the denticare program. Equation 1 details the mathematical formula for the program's gross clinical cost.

EQUATION 1: SUMMATION FORMAT FOR THE EXPECTED ANNUAL CLINICAL COST OF DENTICARE.

$$Annual\ Cost = \sum_{i=1}^{j}\sum_{j=1}^{14}[(pop_i \times partrate) \times expvisit_i \times servprob_{ij} \times price_j] \quad (1)$$

- i denotes the subpopulation which is disaggregated by age and household income bracket
- j denotes the dental treatment category
- pop is the Statistics Canada headcount of population i
- $partrate$ is the rate of Canadians participating in dental care in a given year
- $expvisit$ is the expected number of visits in a year by ndiv duals in population i
- $servprob$ is the probability of service j being performed in a given visit for individuals in population i
- $price$ is the fee for service j dental professionals w uld be permitted to bill to the public system

As equation 1 depicts, the expected payout o dental services was calculated using 14 major dental treatment categories. The equati n produces the expected payout of population i using dental treatment category j. In Canada, dental associations produce fee guides which organize the list of services into 10 broad categories. Using survey data from Brennan and Spencer (2006) some of the treatment probabilities were provided for multiple major sub-categories of dent l work. For example, this paper includes data on costs for amalgam and compo ite resin fillings, which are both under the broad category "restoration". Table 1 outlines the 14 dental treatment categories that are costed as being covered under the dentica e program.

TABLE 1: DENTAL TREATMENT CATEGORIES TO BE INCLUDED IN BOTH DENTICARE AND DENTICAID OPTIONS (BRENNAN AND SPENCER 2006; MANITOBA DENTAL ASSOCIATION 2019)

Treatment Category	Description	Treatment Examples
Diagnostic	These procedures refer to radiograph imaging taken to assess the patient's oral health. Diagnostics can also include lab testing to determine disease pathology.	Two periapical x-ray images
Endodontics	A dental specialty focused on treating pulp disease.	Root canal therap – ne canal
Examination	Clinical examination and diagnosis of soft and hard oral tissue. New patients receive a specific new-patient exam. Subsequent visits are referred to as recall examinations.	Complete o al ex m – permanent dentation
Basic Restoration: a. Amalgam b. Composite Resin	The clinical repair of caries, tooth trauma or pain control procedures. Caries are extremely common in Canada and common restorations use either an amalgam or composite resin filling.	Amalg m restoration non-bonded – permanent molar surfaces
Extraction	An oral and maxillofacial surgery in which erupted teeth are removed from the patient's mouth.	R movals, erupted teeth, uncomplicated
Crown/Bridge Restoration	Crowns are hollow caps used to cover damaged or dec yed teeth. Bridges are a fixed dental prosthesis tha rep ce missing teeth.	One crown – porcelain/ceramic/poly glass
Fluoride Treatment	Fluoride is a prophylactic chemical treatm nt to p vide extra protection against decay.	Rinse fluoride
Dentures: a. Lower Partial b. Upper Partial	Dentures are artificial replacements for both t eth and gums.	Mandibular lower denture
Periodontics	A dental specialty focused on treating the supporting structures (gums) of eeth.	Root planing – one unit of time
Prevention	This procedure is c lloquially eferred to as the "cleaning", whereby a dent l profes ional polishes and/or scales tooth surfaces. Tooth ealants e also a common preventive measure	Polishing procedure – one unit of time
Sedation	The appl cation of n anesthesia agent to sedate the patient during com lex procedures.	Two units of nitrous oxide
Orthodontics	A dental specialty that corrects the mispositioned jaws and tee h	Appliances, removable, space regaining

This paper considered a high-cost scenario in which all uncertain variables were set to the maximum po sible value, and a low-cost scenario set to the minimal possible values based on priors from survey data. A baseline cost scenario was constructed which contained values set at either the average of various data observations or a midway point between the l mits of the high- and low-cost scenarios. These three scenarios constitute a cost-sensitivity analysis for the proposed denticare program.

As with the existing medicare system, each province has its own regulatory body for dental professionals, which recommends prices per dental service. Equation 1 is therefore applied to each province using provincial- and territorial-level demographic and use data, as well as the suggested dental fees from each province's dental association. All provincial and territorial annual costs are summed to produce the total national cost. In the following subsections, the methods for generating each variable in equation 1 will be explained.

3.1. THE EXPECTED NUMBER OF CANADIANS USING THE PROGRAM

National census data collected by Statistics Canada in 2016 were used to determine the headcount of individuals in each province and to disaggregate them by income and age demographics. The year of reference for this cost estimation started at 2019, so 2016 counts were used to generate the relative distribution of individuals in each age-income demographic, and then multiplied by Statistics Canada's 2019 overall provincial population estimates (Appendix Table A1). Frequencies were determined through cross-tabulation of the 2016 Census public use microdata file. Since this is a two-variable disaggregation, income frequencies were determined first (Appendix Table A2) and multiplied by 2019 headcounts (Appendix Table A3).

The age variable was cross-tabulated with household income to determine the age frequencies of each income bracket in each province. Once th total headcounts of individuals in each province were calculated, they were mul iplied by the percentage of individuals expected to participate in dental care annually. The 2018 CCHS determined that nationally, about 74.7 per cent of Canadians visit the dentist while others avoid dental care (Statistics Canada 2019d), but this rate tends to vary with income. Lower income people both with and without insurance tend o have lower levels of reported dental visits compared to the affluent. As the introduction of universal dental care is likely to elicit behaviour change from the removal of cost barriers, the variable $partrate$ was subject to a sensitivity analysis. Table 2 outlines the participation rates for each scenario by income category. The low-cost scenario represents a situation where participation does not change from the status quo. The baseline cost scenario is where all participation increases to the measured levels of those w th insurance in all income groups. The high-cost scenario models the case whe e all income groups participate at the same rate each year – the highest level observed in Canada.

TABLE 2: SENSITIVITY ANALYSIS FOR THE ANNUAL PARTICIPATION RATE OF CANADIANS VISITING THE DENTIST IN A GIVEN 12-MONTH PERIOD

Scenario	Income: 0-19K	Income: 20-39K	Income: 40-59K	Income: 60-79K	Income: 80K+
Low Cost	49.6%	57.0%	64.7%	68.0%	78.4%
Baseline	69 4%	79.2%	82.8%	85.8%	88.5%
High Cost	88.5%	88.5%	88.5%	88.5%	88.5%

3.2. THE EXPECTED NUMBER OF VISITS TO A DENTAL PROFESSIONAL PER YEAR

Next, it was necessary to determine that of those people visiting the dentist ($partrate_i$), how many t mes a year they were expected on average to visit the dentist ($expvisit_i$). In the lite ature, there is considerable debate about the number of times an individual typic lly needs to see the dentist, particularly for a recurrent recall examination. Evidence is undecided between once a year or every six months for a recall exam. Also, within a given visit a dentist may perform the recommended treatment within the same day of the recall exam. However, if the treatment is advanced, it may necessitate an extra visit, potentially resulting in either two or three visits per year if advanced treatment is required.

The variable $expvisit_i$ was calculated using the CCHS question "when was the last time you visited the dentist?" The survey offers respondents several choices: less than one year, one to two years, two to three years, three to four years, four to five years, five or more years and never. To derive the expected number of visits per year, the response variables were treated as visit values. For example, "one to two years" was treated as one visit per year. "Two to three years" was treated as one visit per two years or a value of 0.5 visits per year and so forth. For the response "less than one year" the associate numeric value was unclear. It implies more than once in a given year but as previously mentioned, it can range depending on number of recall visits, and if a separate appoin ment is warranted for advanced treatment. So the response "less than one year" was subjected to a sensitivity analysis, where the value of two visits per year (on verage every six months) was used in the low-cost scenario, 2.5 visits per year (on average every five months) was used in the base scenario and three visits per year (on average every four months) was used in the high-cost scenario. The frequency of re pondents to each question was tabulated by age and income and then multiplied by their corresponding value and summed to generate the total expected annual visits for individuals in population i.

Since CCHS dental variables are not collected in every province in each survey cycle, to capture the potential variances in dentist use across the provinces and territories CCHS microdata files from 2015-16, 2014 and 2012 were used to calculate provinces' expected dental visits. 2015-16 CCHS reported on Newfoundland and Labrador and Alberta. 2014 CCHS reported on Ontario and 2012 CCHS reported on Manitoba. Since the CCHS dental section has not been measured in all provinces in recent years, missing provinces of similar GDP, similar participation rates (Millar and Locker 1999) and geographical proximity to reported provinces used their expected values. The full results are summarized in Table 3.

TABLE 3: EXPECTED ANNUAL VISITS UNDER BASELINE PARAMETERS CALCULATED FROM THE CANADIAN COMMUNITY HEALTH SURVEY1

Age and Jurisdiction		Less than $20,000	$20,000 to $39,999	$40,000 to $59,999	$60,000 to $79,999	$80,000 or m re
AB, BC, Territories[2]	**Less than 5**	2.35	2.26	2.31	2.18	2 38
	5 to 11	2.35	2.13	2.22	2.12	2 32
	12 to 17	2.12	2.06	2.27	2.18	2 34
	18 to 24	1.92	1.78	1.77	1.86	2 03
	25 to 44	1.63	1.61	1.79	1.74	2.03
	45 to 64	1.66	1.56	1.88	1 92	2.10
	65 and up	1.22	1.56	1.83	93	2.06
Atlantic Canada[6]	**Less than 5**	2.64	2.85	2.48	1.94	2.35
	5 to 11	2.40	2.58	2.31	1.81	2.26
	12 to 17	2.05	2.11	2 20	2.37	2.40
	18 to 24	1.79	2.06	1 6	1.48	2.07
	25 to 44	1.39	1.60	78	1.95	2.13
	45 to 64	1.19	1.36	1.5	1.76	2.08
	65 and up	0.87	1.11	1.51	1.56	1.96
ON & QC[3]	**Less than 5**	2.11	1.52	2.36	2.36	2.48
	5 to 11	2.01	1.70	2.27	2.30	2.43
	12 to 17	2.01	2. 4	2.30	2.35	2.42
	18 to 24	1.63	1.91	1.89	2.04	2.19
	25 to 44	1.61	1.50	1.81	1.90	2.15
	45 to 64	1.4	1.70	1.91	2.09	2.24
	65 and up	1. 0	3.34	1.88	2.08	2.16

1 Values for ages 11 and below were derived from values for ages 12 and above using Microsoft Excel's forecasting function (FORECAST.ETS[...]), where the y axis values were the values for individuals 12 and up, and the x axis values were given an arbitrary numeric scale for the two age periods preceding 12 and up.

2 Author's calculation from Canadian Community Health Survey 2015-16 Public-Use Microdata File (Statistics Canada 2016).

3 Author's calculation from Canadian Community Health Survey 2014 Public-Use Microdata File (Statistics Canada 2014).

Age and Jurisdiction		Less than $20,000	$20,000 to $39,999	$40,000 to $59,999	$60,000 to $79,999	$80,000 or more
SK & MB[4]	**Less than 5**	2.57	1.60	1.84	2.18	2.36
	5 to 11	2.32	1.71	1.95	2.20	2.29
	12 to 17	2.15	2.09	2.01	2.24	2
	18 to 24	1.66	1.65	1.74	1.90	1 97
	25 to 44	1.51	1.59	1.78	1.88	2 03
	45 to 64	1.37	1.62	1.83	1.89	2.05
	65 and up	1.08	2.82	1.48	1.62	1.94

3.3. THE PROBABILITY OF A DENTAL TREATMENT PERFORMED PER VISIT

A comprehensive study on service frequencies at the level of each dental service type has not been produced on a Canadian population. For his variable, values from a 2006 longitudinal study in Australia by Brennan and Spencer were used. However, their study did not disaggregate the population by income, only age. So, for this study, it was assumed that no variation existed for the average number of services per visit between those in the same age bracket but differ nt income brackets. Table 4 shows the frequencies of treatment category usage across age groups.

TABLE 4: AGE GROUP FREQUENCIES OF SERVICES RECEIVED UNDER EACH TREATMENT CATEGORY PER DENTAL VISIT OBSERVED IN THE AUSTRALIAN POPULATION (BRENNAN AND SPENCER 2006)

Treatment Category	Service Use Frequency acr ss Each Age Group						
	Less than 5	5 to 11	1 o 17	18 to 24	25 to 44	45 to 64	65 and over
Amalgam*	0.011	0.03	0.041	0.051	0.104	0.125	0.082
Composite resin*	0	0 124	0.281	0.424	0.424	0.375	0.350
Crown/Bridge*	0	0	0	0.018	0.057	0.112	0.097
Radiograph	0.059	0. 87	0.182	0.505	0.395	0.295	0.230
Endodontics*	0	0.035	0.045	0.093	0.138	0.148	0.096
Examination	0 918	0.727	0.547	0.545	0.477	0.386	0.415
Extraction*	0	0.086	0.097	0.084	0.066	0.064	0.091
Fluoride	0	0.159	0.181	0.105	0.098	0.078	0.069
Partial Lower De ture*	0	0	0	0	0	0.0064	0.0290
Partial Upper D nture	0	0	0	0	0.0024	0.0174	0.0312
Periodonti s*	0	0	0.004	0.010	0.019	0.025	0.016
Preventi n	0.095	0.309	0.368	0.345	0.285	0.250	0.253
Sed tion	0	0.038	0.037	0.062	0.044	0.035	0.029
Orthod t cs*	0	0.011	0.147	0.015	0.003	0	0

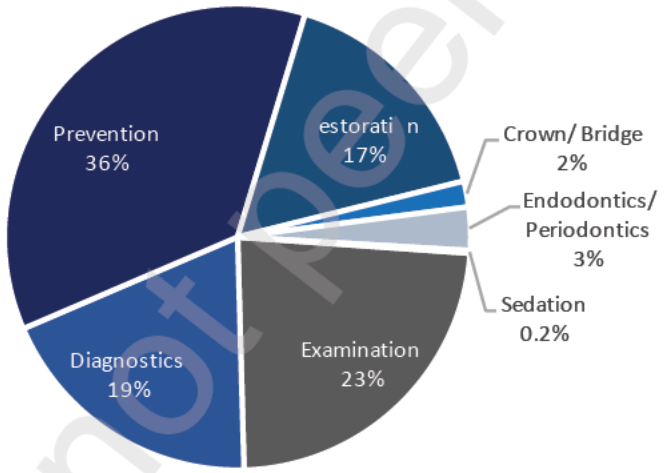
*Subject to a sensitivity analysis in 2019 because it is assumed that untreated, unaffordable dental issues diagnosed prior to implementation would be dealt with immediately following implementation. Low cost = X0.00; Baseline = X1.15; High cost = X1.20.

4 Author's calculation from Canadian Community Health Survey 2012 Public-Use Microdata File (Statistics Canada 2012).

Using Australians as a statistical sample from which to draw probabilities applied to Canadians comes with considerable assumptions about the two populations. The oral health needs of both populations are assumed to be similar for several reasons. Wh n looking at the overall frequencies observed in each treatment category, the pattern in Australia appears to show examination, diagnostics, restoration (composite resin, amalgam) and prevention as the top four services most frequently used, and dentures as the least frequently used.

In Canada, a look at dental claims data reveals very similar frequencies. Figure shows the distribution of dental claims in Alberta in 2015 by treatment category Prevention, examination, diagnostics and restoration are also the top four services used, and denture claims were too small to even appear on the chart. Sedation, endodontics and periodontics were at very low frequencies in both populations

FIGURE 1: DISTRIBUTION OF 2015 DENTAL CLAIMS IN ALBERTA BY TREATMENT CATEGORY (ALBERTA HEALTH 2016)



Another behavioural effect to consider is that according to the CHMS, 16 per cent of Canadians who did go to the dentist in a given year reported not acquiring the recommended tr atment for their diagnosed dental needs because of the cost (Statistics Canada 2010) If cost is eliminated, there will likely be a short-term surge in demand for dental services in the first year after dental care cost barriers are rescinded. This would be a one time surge atop increased participation by people who skipped the dentist altogether be ause of the cost of a visit. To account for this, service frequencies for more adva ced dental treatment categories were subject to a sensitivity analysis in the year 2019 to reflect a spike in demand (Table 4). This assumption has been validated in previ us estimates of public dental care programs by Canada's Parliamentary Budget Office (2019a, 2019b).

3.4. THE PRICE OF DENTAL SERVICES ACROSS CANADA

Many provincial dental associations publish a suggested fee guide for their members, but in the absence of any binding legislation currently in Canada, dentists do not always follow it. It can be assumed that like public health care, public dental care would be subject to binding fee schedules. The government of Canada also produces fee schedules for dental professionals treating patients covered under Health Canada's Non-Insured Health Benefits (NIHB) program. This is a federal dental insurance program for Indigenous peoples in Canada. To gauge the cost per denta services at the sub-national level, this study was granted access to the 2019 dental fee guides from Manitoba, Alberta, British Columbia and Nova Scotia. All other provinces except Quebec had sections of their 2015 fee guides published in a public report by the Alberta government in 2016. For the provinces that did not release their 2019 guide, the 2019 fees were estimated by determining the average annual rate of price increase for the provinces where both a 2015 and 2019 guide was available to compare. Other sources of clinical costs include lab fees for advanced procedures such as crowns, dentures and periodontics. These can be quite expensive and are subject to highly variable market pricing that is dependent on the individual patient's treatment plan. These are often not included in dental fee schedules due to price nconsistencies. For this paper, a lab fee guide from the Alberta Workers' Compensation Board was used to estimate lab fees associated with denture treatment (2018). Other prices were taken from dental laboratory industry sources (Procter and Gamble 2020; Royal Orthodontic Laboratories Inc. 2017). Orthodontics was costed out at the typical annual instalment amount for metallic braces, which is outlined by the NIHB regional fee grids. This would be an annual payment of $2,284.17 in 2019, consistent across the country, over the course of multiple years of wearing braces. Table 5 summarizes all the 2019 province/territory fees used in this study.

TABLE 5: SERVICE PRICES IN 2019 DOLLARS FOR EACH PROVINCE AND TERRITORY. THESE VALUES ARE USED FOR THE BASELINE SCENARIO

Treatment Category (j)	Code	Specific Dental Procedure	Service Price$_j$												
			AB[5]	BC6	SK[+]	MB[7]	ON[8]	QC[9]	NS[10]	NL[+]	NB[+]	PE[+]	YK[11]	NU[12]	NW[13]
Amalgam	21222	Amalgam restoration non-bonded – Permanent molar two surfaces	$140.76	$179.00	$190.10	$166.10	$235.00	$119.03	$171.00	$163.34	$167.79	$168.47	$156.78	$126.04	$130.45
Composite Resin	23111	Permanent anterior, bonded technique - One surface	$136.51	$124.00	$138.88	$131.10	$156.00	$94.59	$121.00	$150 6	$143.09	$125.22	$136.73	$134.86	$134.86
Crown/ Bridge	27201	One crown - Porcelain/ ceramic/poly glass	$1,325.44	$1,292.00	$1,255.09	$1,283.10	$1,269.00	$1,259.97	$1,2 1.00	$1,382.07	$1,243.79	$1,172.12	$1,314.68	$1,284.64	$1,312.10
Diagnostics	2141**	Two periapical X-ray images	$45.08	$23.70	$29.91	$29.00	$34.00	$31.45	$24.00	$28.25	$30.51	$27.92	$29.65	$39.33	$39.52
Endodontics	33111	One canal	$662.15	$456.00	$505.23	$474.80	$511 00	666 51	$445.00	$513.92	$482.74	$442.59	$490.03	$538.40	$557.24

5 (Alberta Dental Association & College 2019)

6 (British Columbia Dental Association 2019)

7 (Manitoba Dental Association 2019)

8 (Ontario Dental Association 2019)

9 (Indigenous Services Canada 2019d)

10 (Nova Scotia Dental Associa on 20 9)

11 (Indigenous Services Can da 20 9e)

12 (Indigenous Serv ces Ca da 2019c)

13 (Indig nous Services Canada 2019b)

Treatment Category (*j*)	Code	Specific Dental Procedure	Service Price$_j$												
			AB[5]	BC6	SK[+]	MB[7]	ON[8]	QC[9]	NS[10]	NL[+]	NB[+]	PE[+]	YK[11]	U[12]	NW[13]
Examination	1103	Complete oral exam – Permanent dentation	$101.48	$67.50	$105.43	$108.70	$135.00	$117.91	$93.00	$105.06	$105.33	$106.44	$124. 7	$88.68	$91.78
Extraction	71101	Removals, erupted teeth, uncomplicated	$134.33	$123.00	$135.99	$128.40	$160.00	$99.45	$134.00	$119.83	$112.45	110.89	$120.09	$89.62	$89.56
Fluoride	12111	Rinse fluoride	$28.99	$14.60	$20.28	$20.00	$7.00	$26.00	$13.00	$20.28	$20.28	$20.28	$22.00	$29.82	$26.84
Lower Denture	51102	Mandibular lower denture	$1,363.00	$1,327.00	$1,398.57	$1,451.00	$1,618.00	$1,478.74	$1,508.00	$1 39 .57	$1 398.57	$1,398.57	$1,341.50	$1,290.03	$1,290.03
Upper Denture	51101	Maxillary upper denture	$1,363.00	$1,398.00	$1,339.03	$1,359.40	$1,390.00	$1,272.64	$1,345.00	$ 339.03	$1,339.03	$1,339.03	$1,276.79	$1,290.03	$1,290.03
Periodontics	43421	Root Planing - One unit of time	$297.68	$269.50	$264.75	$278.80	$282.00	$283.00	$268 00	$299.27	$291.94	$267.98	$283.04	$292.20	$294.55
Prevention	11101	Polishing procedure - One unit of time	$59.84	$37.50	$33.18	$41.40	$31.00	$35.63	$30.00	$35.69	$27.23	$34.16	$31.88	$24.95	$23.08
Sedation	92412	Two units of nitrous oxide	$82.05	$82.61	$77.27	$93.10	$ 5 00	$70.55	$74.35	$76.25	$87.74	$75.24	$81.60	$56.18	$48.45
Orthodontics	P1200 (NIHB)	NIHB orthodontic policy	$2,284.17	$2,284.17	$2,284.17	$2,284 17	$2,284. 7	$2,284.17	$2,284.17	$2,284.17	$2,284.17	$2,284.17	$2,284.17	$2,284.17	$2,284.17

* 2019 fees for SK, NL, NB and PE were estimated from 2015 e s published in the 2016 Alberta Dental Review.

** The province of Nova Scotia (NS) does not have a published fee for the coded procedure 2141, so the second most frequent code 2112 (Radiographs - periapical - two images) was used instead.

Where a 2019 fee guide was not made available for this study, the 2019 fees of these provinces were estimated from the 2015 fee levels and the observed average annual rate of increase in provinces that provided both 2019 and 2015 fee guides. As Table 6 illustrates, varying levels of annual price change rates are observed across the provinces. This was determined by comparing 2015 fee guides to 2019 fee guides w th the growth rate formula of equation 2 to determine the value of r. This generated the observed rate of increase for each dental service category, observed in three diffe ent provinces (Table 6).

Equation 2: The Annual Rate of Growth in Suggested Provincial Dental Fees

$$Price_n = Price_{2019} \times (1 + r)^n \quad \textbf{(2a)}$$

- r is the price growth rate determined in table 9
- n is the number of years after 2019

(2b)

Rearranged:

$$r = \left(\frac{Price_{2019}}{Price_n}\right)^{\frac{1}{n}} - 1$$

TABLE 6: CALCULATED OBSERVED ANNUAL RATE OF SERVICE PRICE CHANGE ACROSS CANADA

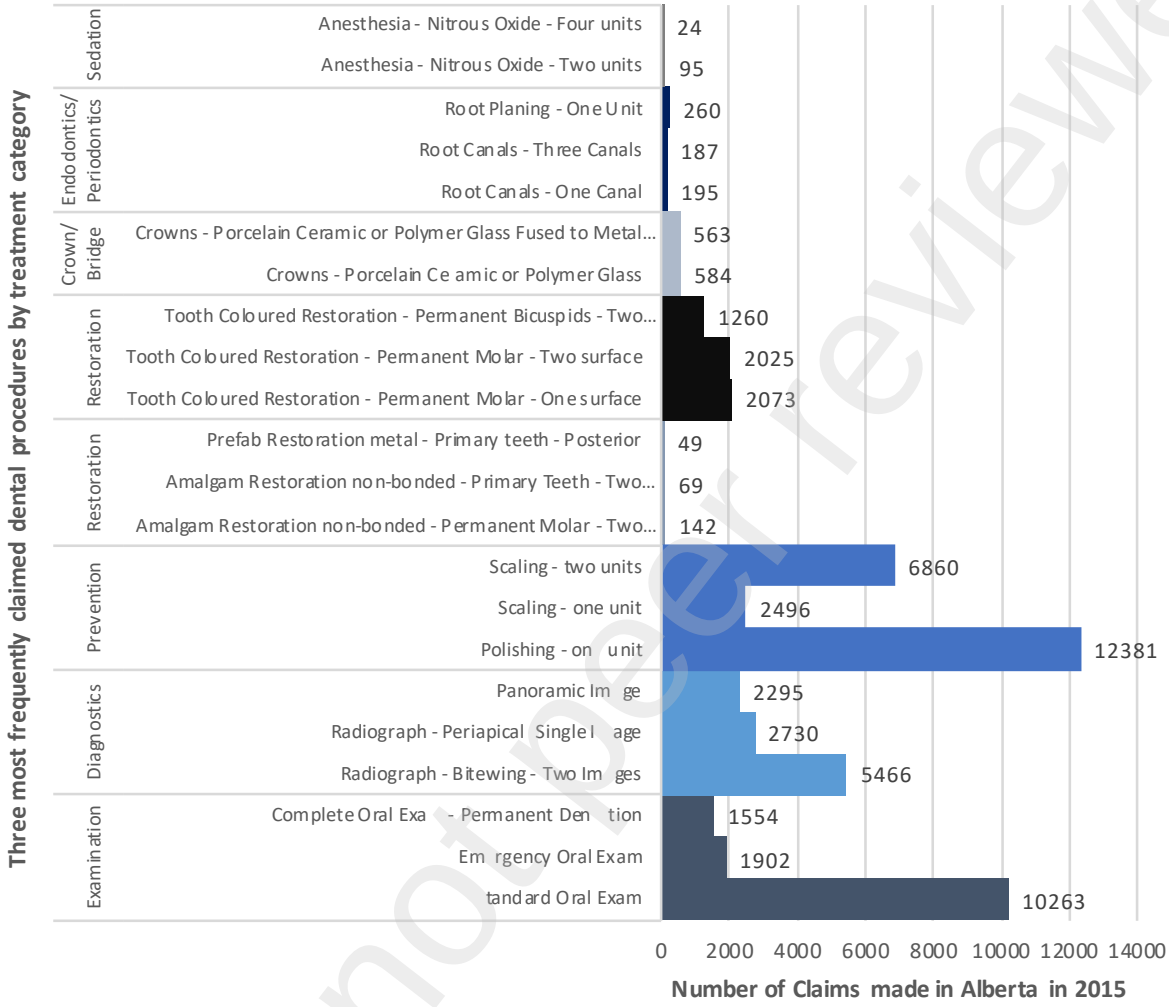
Province	Treatment Category	Service Code	2015 Fee[14]	2015 Inflated to 2019[15]	2019 Fee	Annual R te of Price C ang (r)
Nova Scotia	Examination	1103	$83.00	$88.98	$93.00	0 011
	Diagnostic	2112	$21.00	$22.51	$24.00	0 0162
	Prevention	11101	$27.00	$28.95	$30.00	0.0089
	Restoration	21222	$144.00	$154.38	$171 00	0.0259
	Endodontics	33111	$423.00	$453.48	$ 445.00	0.0047
	Periodontics	43421	$40.00	$42.88	$43.00	0.0007
	Crowns	27211	$639.00	$685.04	$711.00	0.0093
	Sedation	92412	$66.00	$70.76	n/a	n/a
	Average					0.0096
British Columbia	Examination	1204	$35.50	$38.06	$38.90	0.0055
	Diagnostic	2142	$23.60	$25.30	$23.70	-0.0162
	Prevention	11101	$34.10	36.56	$38.30	0.0117
	Restoration	21222	$156.00	$167.2	$187.00	0.0283
	Endodontics	33111	$425.00	$4 5.62	$472.00	0.0089
	Periodontics	43421	$ 32.90	$ 35.27	$ 45.50	0.0657
	Crowns	27201	$740.00	$793.32	$816.00	0.0071
	Sedation	92412	$73 90	$79.22	n/a	n/a
	Average					0.0159
Manitoba	Examination	1204	$44 0	$47.38	$48.90	0.0079
	Diagnostic	2142	$26.20	$28.09	$29.00	0.0080
	Prevention	11101	$38.20	$40.95	$41.40	0.0027
	Restoration	212 2	$139.50	$149.55	$166.10	0.0266
	Endodontics	33111	$429.20	$460.12	$474.80	0.0079
	Periodontics	43421	$47.20	$50.60	$53.80	0.0154
	Crowns	27201	$702.70	$753.33	$783.10	0.0097
	Sedation	92412	$84.40	$90.48	$93.10	0.0072
	Average					0.0107

The specific de tal procedure codes used to stand in for the specific price to represent each treatment category in the cost estimation represent the most commonly claimed dental procedures. The data to support this position came from the Alberta government's comprehensi e review of dentistry in 2016 (Alberta Health 2016). Figure 2 breaks down the top th ee services claimed within each treatment category.

14 2015 fees reported in the Alberta Dental Review (Alberta Health 2016).

15 2015 fees inflated to 2019 dollar value using the Bank of Canada's (2019) inflation calclulator.

FIGURE 2: MOST FREQUENTLY CLAIMED DENTAL PROCEDURES IN ALBERTA IN 2015 (ALBERTA HEALTH 2016)



The variable *servprice* was subjected to the sensitivity analysis. Denticare would require the administering order of government to reach an agreement on a binding fee schedule just as physicians and governments have done since Canadian medicare began. There is considerable uncertainty regarding what denticare fee schedules would look like. The suggested fee guide prices were used as the baseline scenario, and the high-cost and low-cost estimates were increased and decreased from the baseline price by 10 per cent respectively. This price range was informed by the 2016 Alberta Dental Review, which determined that there was considerable variation in the fees dentists charged. Polishing (one unit of time), for example, had an average price of $63.61, but the price ranged from $43.00 to $83.00 across Alberta dental practices in 2015 (Alberta Health 2016). This indicates that prices could range roughly 32 per cent below the average and 31 per cent above

3.5. FIVE-YEAR PROJECTIONS

Each province and territory's clinical costs were projected five-year post-implementati n in all three scenarios by applying the dental fee growth rates determined in Table 10 to future years' cost estimates. Statistics Canada calculated the annual rate of population growth for the following five years post-implementation. The rates for growth s enarios H1, M3 and L1 listed in Appendix Table A5 were used for the high-cost, baseline and low-cost scenarios respectively. The population growth rate was calculated each ear post-2019 using equation 3.

EQUATION 3: CALCULATIONS FOR THE ANNUAL GROWTH OF THE CANADIAN POPULATION

$$Population_n = Population_{2019} \times (1 + r)^n \quad (3)$$

- r is the growth rate that Statistics Canada determined for each province summarized in Table 12
- n is the number of years after 2019

To project future changes in service costs, the rate f price increase was calculated from changes between the 2015 and 2019 suggested fee schedules (Table 6). The highest, median and lowest rate of price increase was sed for each respective cost scenario (Table 7). Given that Canada has seen a usta ned increase in physicians' fees (Ariste 2015), this study did not consider a scenario in which dental fees were gradually reduced.

TABLE 7: ANNUAL DENTAL FEE GROWTH RATES FOR COST-PROJECTION SCENARIOS

Dental Treatment Category	Ave age Rat of Increase (Bas line)	Highest Observed Rate (High-Cost)	Lowest Observed Rate (Low-Cost)
Amalgam	5.13%	7.04%	4.39%
Composite	3.29%	5.09%	2.59%
Crowns	0.92%	1.06%	0.71%
Diagnostic	-0.07%	1.62%	-1.62%
Endodontics	0.67%	1.46%	-0.47%
Examination	0.34%	1.11%	-1.08%
Extraction	1.13%	2.25%	-0.59%
Fluoride	0.98%	1.59%	0.32%
Lower Den ures	2.78%	3.37%	2.19%
Upper Dentures	2.78%	3.37%	2.19%
Periodont cs	1.81%	6.57%	-0.94%
reve ion	-0.61%	1.17%	-4.76%
edation	0.41%	0.94%	0.72%
Orthodontics	2.78%	3.37%	2.19%

4. MICRO-COSTING DENTAL COVERAGE FOR CHILDREN AND UNINSURED ADULTS (DENTICAID)

A denticaid program would involve provincial/territorial governments providing a comprehensive public dental insurance plan for all children below age 12 and individuals without a private insurance plan. The methods for micro-costing such a scheme are similar to the denticare micro-costing model. Denticaid covers the same 14 dental treatment categories as denticare. The variables, such as the expected pr ce of dental services, the expected annual visits to dentists and the expected use of se vices per visit are treated the same in this model. However, the population variable s manipulated to account only for individuals without private dental insurance (equation 4). Individuals on an existing public plan would be put on this new public plan since they would otherwise not have dental insurance through private means.

EQUATION 4: SUMMATION FORMULA FOR THE EXPECTED ANNUAL CLINICAL COST OF DENTICAID

$$Annual\ Cost_{ij} = \sum_{i=1}^{j} \sum_{j=1}^{14} \left[(pop_i \times partrate) \times e\ \ pvisit_i \times servprob_{ij} \times price_j \right] \quad (4)$$

$$pop = headcount\ \times\ \ ninsuredfreq$$

- $uninsuredfreq$ denotes the frequency of uninsured individuals in population i

The variable *uninsuredfreq* is the percentage of each population subgroup that does not have dental insurance according o CCHS survey data. The CCHS asked a binary yes/no question to the respondent, asking if they "have insurance that covers all or part of your dental expenses". Re pondents who answered yes were then asked whether it is a private or public plan. By cross-tabulating the raw survey numbers, respondents who answered no to the first question, and indicated a public plan on the second question, were summed together and subtracted from the total. This generated the percentage of individuals in each age and income demographic who do and do not have private dental insurance (T ble 8). CCHS data from 2012, 2014 and 2015-16 were analyzed to capture the diversity of dental insurance coverage across Canada. The population headcounts ($headcount$) were multiplied by the percentage of respondents without private dental insuranc ($un\ nsuredfreq$) and then multiplied by the participation rate ($partrate$).

TABLE 8: CALCULATED FREQUENCIES OF INDIVIDUALS ACROSS CANADA WITHOUT PRIVATE OR EMPLOYER-SPONSORED DENTAL INSURANCE WHO WOULD BE ELIGIBLE FOR THE PUBLIC INSURANCE PLAN. VALUES ARE USED FOR ALL 20 9 SCENARIOS AND ALL SUBSEQUENT LOW-COST ESTIMATES.

Province	Age	Less than $20,000	$20,000 to $39,999	$40,000 to $59,999	$60,000 to $79,999	$80 0 0 or m re
AB, SK, BC, MB[16]	**12 to 17**	71.43%	75.61%	53.16%	63.86%	37.74%
	18 to 24	54.67%	44.92%	45.97%	38.10%	25 31%
	25 to 44	65.24%	52.36%	36.66%	28.57%	15.22%
	45 to 64	76.75%	57.14%	39.62%	30.80%	16.77%
	65+	93.09%	85.47%	73.03%	66.38%	54.26%
ON QC, Territories[17]	**12 to 17**	87.50%	81.82%	52.38%	30 77%	13.73%
	18 to 24	85.71%	100.00%	71.43%	66.67%	62.50%
	25 to 44	91.67%	100.00%	95.24%	86.67%	64.71%
	45 to 64	95.83%	79.07%	50.00%	61.11%	37.04%
	65+	89.80%	83.86%	66. 2%	58.06%	68.25%
NFL, NS[18]	**12 to 17**	60.00%	73.91%	61 29%	51.85%	49.61%
	18 to 24	54.29%	44.19%	5.83%	75.00%	27.27%
	25 to 44	87.04%	60.44%	48.57%	37.80%	14.54%
	45 to 64	89.83%	71.51%	57.79%	51.15%	21.68%
	65+	93.94%	86 48%	63.91%	63.89%	47.90%
NB, PEI[19]	**12 to 17**	62.50%	62%	35.29%	18.18%	11.63%
	18 to 24	76.92%	73.68%	42.31%	52.17%	42.55%
	25 to 44	74.42%	52.78%	37.93%	31.58%	17.42%
	45 to 64	85.00%	2.67%	37.50%	23.26%	18.06%
	65+	92.59%	79.43%	59.03%	56.06%	54.35%

A sensitivity analysis was performed only on the rate of individuals opting into the public program during the five-year projections post-2019. This is an important behavioural effect to consider on the dental insurance market. In many jurisdictions with a mixed public/private health insurance system in place, there has been an assumption that the public option, if e panded, would crowd out the private sector. This effect has been difficult to quan ify over the years. For example, a 2019 study looking at the *Affordable Care Act* (ACA) introduction in the U.S. found that the percentage of employers offering employer-sponsored health insurance declined from 49.13 per cent (pre-ACA

16 Author's calculation from Canadian Community Health Survey 2015-16 Public-Use Microdata File (Statistics Ca ada 2016).

1 Author's calculation from Canadian Community Health Survey 2013-14 Public-Use Microdata File (Statistics Canada 2013).

18 . Author's calculation from Canadian Community Health Survey 2015-16 Public-Use Microdata File (Statistics Canada 2016).

19 Author's calculation from Canadian Community Health Survey 2014 Public-Use Microdata File (Statistics Canada 2014).

introduction) to 44.19 per cent (immediately post-ACA introduction), which is a rate of about five per cent opting from private to public health insurance (Abraham, Royalty and Drake 2019). Other estimates by Gruber and Simon (2007) have demonstrated crowd-out rates of up to 60 per cent. Another example of incremental crowd-out ha been recently observed in Australia between public and private hospital insurance enrolment (Australian Prudential Regulation Authority 2019). So, for the years 2020 to 2024, the values in Table 14 were used as the low-cost scenario frequencies for ea h year, representing a scenario where the rate of patients opting in is zero. For the baseline scenario, a five per cent increase was added to values from the previous year and for the high-cost scenario, the baseline rate was doubled to 10 per cent, owing to the wide range of observed outcomes among health insurance crowd-out studies

5. MICRO-COSTING RESULTS FOR DENTICARE AND DENTICAID

The gross clinical cost of denticare, calculated from equation 1, is estimated to be between $15.2 billion and $37.7 billion if the program had been implemented in 2019. This is the total of each province and territory providing first dollar coverage of non-cosmetic dental services. When the costs were projected five years post-implementation, the annual clinical cost was expected to rise to betwee $15.9 billion and $40.9 billion (Table 9). These projections are based on several population growth rate estimates by Statistics Canada and the observed annual rate of dent l fee guide price increases across several provinces. All annual costs are predicated on the assumption that dental fees would be price-controlled by binding fee guides negotiated between each province and their respective dental association.

TABLE 9: MICRO-COSTING RESULTS FOR DENTICARE. RESULTS PRESENTED IN MILLIONS OF 2019 C$.

Scenario		201	2020	2021	2022	2023	2024
Baseline	CAN (Total)	$27,030.97	$25,453.75	$25,784.35	$26,384.25	$27,003.32	$27,484.33
	NFL	$339.29	$305.62	$310.71	$313.63	$316.62	$319.70
	PEI	$88.00	$81.90	$83.87	$85.90	$88.00	$90.16
	NS	$547.86	$497.67	$505.31	$513.15	$521.21	$529.49
	NB	$460.45	$419.94	$426.19	$432.61	$439.20	$445.97
	QC	$5,857.43	$5,546.17	$5,652.83	$5,762.33	$5,874.77	$5,990.26
	ON	$11,310.92	$10,787.09	$10,758.26	$11,022.92	$11,296.20	$11,578.46
	MB	$839.37	$819.88	$840.54	$861.85	$883.86	$906.57
	SK	$1,484.18	$1,362.26	$1,386.75	$1,411.91	$1,437.78	$1,464.38
	AB	$3,017.99	$2,817.77	$2,944.83	$3,043.28	$3,145.57	$3,093.89
	BC	$3,013.07	$2,742.95	$2,801.31	$2,861.41	$2,923.32	$2,987.10
	YK	$24.52	$24.90	$25.23	$25.57	$25.92	$26.28
	NWT	$25.78	$26.27	$26.59	$27.10	$27.62	$28.16
	NU	$22.10	$21.34	$21.95	$22.58	$23.23	$23.90

Scenario		2019	2020	2021	2022	2023	202
High-Cost	CAN (Total)	$37,742.76	$34,922.01	$36,374.86	$37,906.11	$39,520.81	$40,967 6
	NFL	$471.05	$415.89	$425.71	$435.96	$446.65	$ 57 80
	PEI	$122.54	$112.07	$116.58	$121.32	$126.32	$131.58
	NS	$764.44	$680.97	$701.61	$723.20	$745.78	$769.43
	NB	$642.70	$575.28	$592.64	$610.79	$629	$649.65
	QC	$8,256.16	$7,671.33	$7,944.43	$8,230.73	$8,531.03	$8,846.16
	ON	$15,785.62	$14,802.63	$15,408.67	$16,046.92	$16 719.44	$17,428.42
	MB	$1,169.47	$1,124.98	$1,174.22	$1,226.21	$1,28 12	$1,339.15
	SK	$2,062.56	$1,864.44	$1,935.64	$2,010.36	$2 088.82	$2,171.24
	AB	$4,158.28	$3,799.61	$4,030.62	$4,276 61	$4,538.64	$4,560.64
	BC	$4,210.07	$3,778.32	$3,944.50	$4 119.8	$4,304.93	$4,500.41
	YK	$33.78	$34.22	$35.63	$37.12	$38.68	$40.34
	NWT	$35.59	$33.35	$34.43	$35.5	$36.75	$38.00
	NU	$30.51	$28.92	$30.17	$31.49	$32.88	$34.35
Low-Cost	CAN (Total)	$15,235.99	$15,383.43	$15,535 8	$15,694.38	$15,859.37	$15,962.73
	NFL	$187.06	$186.76	$186.	$186.31	$186.17	$186.07
	PEI	$49.01	$49.50	$50.0	$50.52	$51.07	$51.63
	NS	$300.42	$301.50	302 7	$303.93	$305.29	$306.73
	NB	$252.89	$253.87	$254.92	$256.05	$257.26	$258.54
	QC	$3,281.22	$3,302.11	$3,323.98	$3,346.84	$3,370.70	$3,395.58
	ON	$6,442.13	$6 501.69	$6,563.72	$6,628.27	$6,695.41	$6,765.19
	MB	$490.70	$495.88	$501.27	$506.86	$512.66	$518.67
	SK	$826.44	$834.76	$843.41	$852.38	$861.69	$871.34
	AB	$1,708.45	$1 740.06	$1,771.89	$1,804.93	$1,839.22	$1,806.63
	BC	$1,654.20	$1,673.51	$1,693.29	$1,713.81	$1,735.09	$1,757.14
	YK	$15.37	$15.47	$15.58	$15.70	$15.82	$15.94
	NWT	$15.13	$15.17	$15.21	$15.26	$15.32	$15.38
	NU	$ 2 98	$13.15	$13.32	$13.51	$13.69	$13.89

The gross clinical cost of denticaid, calculated from equation 5, is estimated to be between $8.2 billion and $20.9 billion if the program had been implemented in 2019. This is the total of each province and territory providing first-dollar coverage of non-cosmetic dental services When the costs were projected five years post-implementation, the annual clinical cost was expected to rise to between $8.6 billion and $36.9 billion (Table 10).

The growing difference between the low- and high-cost scenario estimates is due to the high and baseline cost scenarios assuming that there will be some percentage of individuals opting into the public plan from private insurance plans. This would be a rational choice consumers would make, assuming the public plan would offer comparable or better levels of coverage accompanied by less out-of-pocket cost. Out-of-pocket contributions such as co-payments and premiums are not part of the costing model in this paper, but this paper assumes any provincial premium on public dental insurance

could undercut private-sector premium rates, given that the public program would be offered on a not-for-profit basis.

TABLE 10: MICRO-COSTING RESULTS FOR DENTICAID. RESULTS PRESENTED IN MILLIONS OF 2019 C$.

Scenario		2019	2020	2021	2022	2023	2024
Baseline	CAN (Total)	$14,833.59	$15,170.78	$16,644.36	$18,167.14	$19,6 9.04	$20,968.13
	NFL	$140.93	$146.16	$163.79	$179.60	$195.13	$210.99
	PEI	$34.22	$35.28	$39.99	$44.90	$49.98	$55.29
	NS	$242.65	$251.78	$279.29	$306.89	$ 34.53	$363.05
	NB	$179.45	$182.17	$204.75	$227 93	$251.49	$275.76
	QC	$3,772.22	$3,798.47	$4,104.06	$4 413.3	$4,705.76	$4,994.58
	ON	$7,039.82	$7,158.91	$7,696.54	$8,350.23	$8,993.01	$9,644.18
	MB	$338.65	$400.34	$401.05	$448.62	$495.98	$523.97
	SK	$790.58	$800.87	$886.19	$969.36	$1,048.72	$1,065.97
	AB	$1,089.50	$1,152.13	$1,449 41	$1,638.11	$1,835.31	$1,905.69
	BC	$1,161.65	$1,198.08	$1,368 93	$1,533.82	$1,700.74	$1,866.17
	YK	$14.98	$16.28	$ 46	$18.66	$19.85	$21.04
	NWT	$15.58	$17.02	$18.	$19.77	$21.24	$22.73
	NU	$13.35	$13.30	$14.59	$15.93	$17.30	$18.71
High-Cost	CAN (Total)	$20,952.46	$22,575.53	$26,441.13	$30,341.26	$35,156.91	$36,912.11
	NFL	$199.14	$218.93	$258.32	$298.60	$337.26	$369.34
	PEI	$48.51	$54. 4	$66.98	$80.06	$93.86	$107.43
	NS	$344.66	$377.14	$444.22	$513.97	$580.88	$635.00
	NB	$255.23	$280.73	$343.44	$406.49	$471.87	$534.22
	QC	$5,366 4	$5,613.99	$6,398.62	$7,148.93	$7,828.86	$8,397.68
	ON	$9,905.74	$10,520.63	$12,143.59	$13,765.93	$15,219.33	$16,449.00
	MB	$480.63	$609.09	$736.36	$867.81	$1,114.67	$1,056.90
	SK	$1,110 9	$1,195.05	$1,408.19	$1,623.40	$1,960.84	$1,925.75
	AB	$1, 23.20	$1,777.56	$2,257.18	$2,777.33	$3,818.48	$3,652.17
	BC	$1,656.80	$1,862.58	$2,308.48	$2,772.57	$3,635.14	$3,680.64
	YK	$20.81	$23.86	$27.42	$31.08	$34.46	$37.42
	NWT	$21.68	$22.35	$25.77	$29.23	$32.34	$34.97
	NU	$18.58	$19.36	$22.56	$25.86	$28.92	$31.60

Scenario		2019	2020	2021	2022	2023	202
Low-Cost	CAN (Total)	$8,250.60	$8,324.73	$8,401.13	$8,480.76	$8,563.70	$8 628.6
	NFL	$78.48	$79.03	$79.59	$80.17	$80.76	81.38
	PEI	$18.38	$18.54	$18.70	$18.88	$19.06	$19.25
	NS	$134.36	$136.00	$137.69	$139.42	$141.19	$143.01
	NB	$95.37	$95.65	$95.96	$96.30	$96 67	$97.07
	QC	$2,074.55	$2,086.79	$2,099.64	$2,113.11	$2, 27.22	$2,141.98
	ON	$3,940.99	$3,975.25	$4,011.01	$4,048.30	$4 087.15	$4,127.60
	MB	$212.31	$214.44	$216.65	$218.95	$221.33	$203.51
	SK	$439.62	$444.09	$448.73	$453.54	$458.53	$463.63
	AB	$606.00	$616.90	$627.79	$639 12	$650.89	$662.28
	BC	$625.12	$632.46	$639.62	$647.05	$654.78	$662.66
	YK	$9.33	$9.38	$9.44	$9.50	$9.56	$9.63
	NWT	$8.67	$8.69	$8.70	$8.72	$8.74	$8.77
	NU	$7.43	$7.52	$7.61	$7.71	$7.81	$7.91

This detailed exploration into the micro-costing methods that generated the results of tables 9 and 10 demonstrates the versatility o the start-from-scratch costing approach. Through a minor manipulation of the populat on va iable, the resulting equations could use consistent data sources to estimate the cost of two profoundly different approaches to public oral health care. Using this app oach all service-level costs were disaggregated potential dental costs by age and income demographics. If a federal or provincial government wished to cost public dental programs other than the ones described in this study, such as funding preventive s rvices for low-income seniors, this model could generate a high, low and basel ne cost estimate for such a program.

6. DISCUSSION

As evidenced by the gap between low- and high-cost figures, this estimation model has uncertainty. This m del d picts three possible scenarios for two different public dental program design All scenarios' costs are the product of an augmented expected value formula which uses probability theory to predict the total cost most likely to be realized, given the model's parameters. These parameters were informed by Canadian survey data on annual dent l visitation frequency and household characteristics, and the probability of not having private insurance, given said household characteristics. As section two pointed out both the CHMS and the CCHS have their limitations in measuring these probabilities, especially on an up-to-date, pan-Canadian level.

Statistics Canada has two options for improving the dental data gap: (1) move the oral health comment of the CHMS into more frequent future cycles, rather than leave a knowledge gap of more than five years for policy-makers to base their decisions on; or (2) move the oral health, dental and insurance variables out of the optional questionnaire in the CCHS and collect these data from respondents across the country. This would allow researchers to make inter-provincial comparisons on oral health-care use and

access to public or private insurance. If data were collected across Canada, regression analysis could then factor more geographic variables into an exploration of oral health determinants. Furthermore, if dental reform is to be a national endeavour, data that inform the extent of the problem must be nationally representative. From a feasibility perspective, the CCHS is only a telephone survey, whereas the CHMS is much more involved with a mix of surveys and clinical examinations, and thus between the two options, expanding the CCHS dental variables nationally would be more realistic.

Possibly the most profound limitation to this model's accuracy is that in the absence of pan-Canadian service-level use data on dentistry, frequencies from an Australian survey had to be used in place. These frequencies were disaggregated by age only. This model could not account for any effect that income may have on the frequency a dental treatment category is accessed per visit. Australia also current y covers most dental treatments for children under the Child Dental Benefits Schedu e U e in children and youth may therefore be higher than what could be expected in Canada, whereas this is not the case in all provinces (Shaw and Farmer 2015). Future attempts at micro-costing dental care should consider generating Canadian-bas d data similar to Brennan and Spencer's 2006 study in Australia, which is now a 15 year old n dataset.

If Canadian governments wish to pursue an eviden e-in ormed public policy approach to dental care, they need a greater understanding and data surveillance about dental professionals' practice activity. Provincial gov nments should try to collect service-level data on dental use and dental practice activity. This could be accomplished either by establishing root access to dentists' billing data under the appropriate health information legislation or by administering periodic surveys to dental practices. The former approach would be a cumbersome process to undertake depending on whether a province's current health information legislation already extends to the collection of administrative data in dental care settings or ot.

7. CONCLUSION

Canadian governments currently fund a very limited suite of public dental programs which highlight sele tive enrolment requirements. A significant criticism of these programs is that hey are drastically underfunded (Mosby and Carstairs 2018). For example, in 2014 th NIHB program received only $231 million in federal funding to cover Indigenous dental needs (Canadian Dental Association 2017). Based on Statistics Canada's (2019) 2016 estimate of the Indigenous population, the government spent roughly $138 per Indigenous person. This report's cost estimation of denticare (Table 15) amounts to $737 per citizen, substantially increasing per capita funding for public dental programming in Canada. Both the programs costed in this report would prov de significantly higher funding for particularly vulnerable populations needing c mprehensive oral health care.

Based on the magnitude of clinical costs estimated in this study, achieving buy-in from all provinces and territories is a highly probable challenge for implementing either denticare or denticaid. Provincial debt-to-GDP is rising dramatically compared to the federal government. This is due mostly to rising health-care costs which provinces bear the

constitutional responsibility to fund (Office of the Parliamentary Budget Officer 2018). A highly indebted province would not likely adopt denticare or denticaid unilaterally without a cost-sharing agreement with the federal government.

This paper has provided policy-makers with a rigorous estimation of what reimbursing the clinical costs of either a universal denticare program or denticaid for children and uninsured adults would cost. These are the gross clinical costs before current pub ic dental expenditures were subtracted or cost-sharing mechanisms like co-pays and premiums were included.

APPENDIX TABLES

TABLE A1: POPULATION GROWTH ESTIMATES FROM STATISTICS CANADA'S 2016 CENSUS AND FIRST-QUARTER POPULATION ESTIMATES FOR 2019[20]

Province	2016	2019 (Q1)
Newfoundland and Labrador	519,716	523,79
Prince Edward Island	142,907	154,748
Nova Scotia	923,598	9 5 82
New Brunswick	747,101	772,094
Quebec	8,164,361	8,433,301
Ontario	13,448,494	1 ,446,515
Manitoba	1,278,365	1,360,396
Saskatchewan	1,098,352	1,168,423
Alberta	4,067,175	4,345,737
British Columbia	4,648,055	5,020,302
Yukon	35,874	40,369
Northwest Territories	41,786	44,598
Nunavut	35,944	38,787

TABLE A2: FREQUENCIES OF EACH PROVINCE AND TERRITORY'S HOUSEHOLD INCOME DEMOGRAPHICS[21]

Province/Territory	Relative Distribution of the Population by Household Income group (*2016 Census of the Population*)					
	Less than $20,000	$20,000 to $ 9,999	$40,000 to $59,999	$60,000 to $79,999	$80,000 or more	Total
Newfoundland and Labrador	0 055	0.154	0.135	0.126	0.530	100%
Prince Edward Island	0 065	0.150	0.162	0.162	0.461	100%
Nova Scotia	0.07	0.156	0.157	0.145	0.471	100%
New Brunswick	0 069	0.161	0.168	0.158	0.444	100%
Quebec	0.064	0.143	0.165	0.154	0.473	100%
Ontario	0.053	0.113	0.136	0.130	0.569	100%
Manitoba	0.062	0.125	0.149	0.146	0.517	100%
Saskatchewan	0.055	0.120	0.129	0.129	0.568	100%
Alberta	0.035	0.079	0.101	0.110	0.674	100%
British Columb	0.065	0.118	0.136	0.132	0.549	100%
Yukon[22]	0.043	0.103	0.095	0.095	0.664	100%
Northw t Terri ies	0.043	0.103	0.095	0.095	0.664	100%
Nun vut	0.043	0.103	0.095	0.095	0.664	100%

20 Calculated from the latest census of the Canadian population (Statistics Canada 2019b) and the first quarter 2019 population estimates published as of June 3, 2019 (Statistics Canada 2019a).

21 Author's cross-tabulation calculations from the 2016 Census Public-Use Microdata File (Statistics Canada 2016a).

22 The Census microdata file aggregates statistical results for all the territories. So, this paper applied the same demographic frequencies to Yukon, NWT and Nunavut.

TABLE A3: HEADCOUNTS OF EACH PROVINCE AND TERRITORY'S HOUSEHOLD INCOME DEMOGRAPHICS ESTIMATED FOR 2019[23]

Province/Territory	Absolute Distribution of the 2019 Population by Household Income Group (2016 Frequency X Q1 2019 Estimate)					
	Less than $20,000	$20,000 to $39,999	$40,000 to $59,999	$60,000 to $79,999	$80,000 or more	20 9 Q1 Estimate
Newfoundland and Labrador	28,710.77	80,780.11	70,457.99	65,985.08	27,7856	2,3790
Prince Edward Island	10,073.86	23,237.6	25,015.34	25,015.34	71, 05.87	154,748
Nova Scotia	69,387.83	150,313.8	151,586.9	139,730.5	454,3 2 9	965,382
New Brunswick	53,420.3	124,105	129,423.2	122,319	342,826.6	772,094
Quebec	540,826.1	1,207,184	1,389,347	1,302,828	3 993,115	8,433,301
Ontario	759,902.5	1,629,506	1,961,572	1,879,083	8,216,451	14,446,515
Manitoba	84,402.63	170,286	203,191.5	19 66	703,848.8	1,360,396
Saskatchewan	63,817.28	139,954.5	150,549.7	150,344.3	663,757.2	1,168,423
Alberta	154,252.9	344,996.5	439,311.8	477 509.3	2,929,667	4,345,737
British Columbia	326,951.1	591,619.9	681,824 6	663,988.7	2,755,918	5,020,302
Yukon	1,741.81	4,171.561	3,820 272	3,834.909	26,800.45	4,0369
Northwest Territories	1,924.279	4,608.568	,220 478	4,236.648	29,608.03	44,598
Nunavut	1,673.551	4,008.084	3,670 561	3,684.624	25,750.18	38,787

TABLE A4: AGE FREQUENCIES WITHIN EACH HOUSEHOLD INCOME GROUP IN ALBERTA. THIS SAME CROSS-TABULATION WAS CONDUCTED FOR ALL PROVINCES AND TERRITORIES.[24]

Age Group	Relative Age Distribu on of Household Income in Alberta (2016 Census of the Population)				
	Less than $20,000	20,000 o $39,999	$40,000 to $59,999	$60,000 to $79,999	$80,000 or more
Less than 5	0.068	0.060	0.063	0.072	0.068
5 to 11	0.088	0.077	0.093	0.089	0.096
12 to 17	0.059	0.058	0.063	0.065	0.075
18 to 24	08	0.079	0.082	0.082	0.090
25 to 44	0 266	0.216	0.265	0.304	0.326
45 to 64	0.318	0.205	0.230	0.233	0.278
65 and up	093	0.305	0.204	0.156	0.068
Total	100%	100%	100%	100%	100%

[23] Author's calculations from multiplying the frequencies calculated from the 2016 Census Public-Use Microdata File (Statistics Canada 2016a) and the first quarter 2019 provincial population estimates (Statistics Canada 2019a).

[24] Author's calculation from the 2016 Census Public-Use Microdata File (Statistics Canada 2016a).

TABLE A5: STATISTICS CANADA'S GROWTH RATES CALCULATED UNDER SEVEN SCENARIOS OF POPULATION GROWTH CHARACTERISTICS (STATISTICS CANADA 2015)

Region	Low-Growth Scenario	Medium-Growth Scenarios					High Growth Scenario
	L1	M1	M2	M3	M4	M5	H1
Canada	0.0045	0.0085	0.0085	0.0086	0.0086	0.00 5	0.0124
Newfoundland and Labrador	-0.0074	-0.0058	-0.0084	-0.0056	-0.0064	0.0007	-0.0036
Prince Edward Island	0.0044	0.0082	0.0096	0.0091	0.0047	0. 079	0.0117
Nova Scotia	-0.0025	-0.0003	0.0001	0.0002	-0.0026	0 0011	0.0022
New Brunswick	-0.0022	-0.0002	0.0001	-0.0002	-0 0021	0.0012	0.0021
Quebec	0.0027	0.0057	0.0052	0.006	0 0056	0.0065	0.0091
Ontario	0.0037	0.0081	0.0083	0.0093	0.007	0.0081	0.012
Manitoba	0.0054	0.01	0.0095	0.0104	0 0085	0.012	0.0139
Saskatchewan	0.0033	0.0069	0.0053	0 0023	0.0083	0.0129	0.0103
Alberta	0.0135	0.0176	0.0167	0186	0.0213	0.0142	0.0214
British Columbia	0.0049	0.0103	0.0119	0.0057	0.0106	0.009	0.0151
Yukon	0.0024	0.0065	-0 0009	-0.0008	0.0122	0.0212	0.0102
Northwest Territories	-0.002	0.0007	-0 0014	0.0046	-0.0051	0.0044	0.0035
Nunavut	0.0083	0.0108	01	0.0142	0.0091	0.0163	0.0139

REFERENCES

Abraham, Jean M., Anne B. Royalty, Coleman Drake. 2019. "The Impact of Medicaid Expansion on Employer Provision of Health Insurance." *International Journal of Health Economics and Management* 19: 317–340. https://doi.org/10.1007/s10754-018-9256 x.

Alberta Dental Association & College. 2019. "2019 Abbreviated Dental Guide." Accessed June 4, 2019. https://www.dentalhealthalberta.ca/wp-content/uploads/2019/01/Abbreviated-list-plain-language-descriptions.pdf.

Alberta Health. 2016. "Alberta Dental Review." Accessed June 2, 2019. https://open.alberta.ca/dataset/52597a1b-899d-4a2b-9651-d12272b2b3d2/resource/ecbd6cc7-33e8-48dd-bb9e-5a2502656e15/download/2016-alberta-dental-review february-2016.pdf.

Alberta Health Services. n.d. "Dental Clinics - Public Health." ht ps://www.albertahealth services.ca/findhealth/Service.aspx?id=1670.

Ariste, Ruolz. "Fee-Schedule Increase in Canada: Implication for Service Volumes among Family and Specialist Physicians." *Journal of Health and Human Services* 28 no. 3 (2015): 381–410. https://www.jstor.org/stable/pdf/43948679.pdf.

Australian Prudential Regulation Authority. 2019. "Pr vate Health Insurance Annual Coverage Survey." Accessed July 30, 2019. https://www.apra.gov.au/publications/private-health-insurance-annual-coverag -survey.

Bank of Canada. 2019. "Inflation Calculator." Accessed on July 20, 2019, https://www.bankofcanada.ca/rates/related/inflation-calculator/.

Brennan, D.S., and A.J. Spencer. 2006. "Practice Activity Patterns of Dentists in Australia: Trends over Time by Age f Patients." *Australian Institute of Health and Welfare: Dental Statist cs and Research Series* 32. https://www.aihw.gov.au/getmedia/2099a3c3-0154-45a1 9dfe-70a693a5f027/den-148-2000-practice-activity-trends.pdf.aspx?inline=true.

British Columbia Dental Assoc ation. 2019. "2019 Abbreviated General Practitioner's Suggested Fee Guide." Accessed June 4, 2019. http://yourdentalhealth.ca/Assets/Public%20Abbr viated%20GP%20Suggested%20Fee%20Guide.pdf.

Canadian Academy of Health Sciences. 2014. "Improving Access to Oral Health Care for Vulnerable P ople Living in Canada." Accessed June 4, 2019. https://cahs-acss.ca/wp-content/uploads/2015/07/Access_to_Oral_Care_FINAL_REPORT_EN.pdf.

Canadian Dental Association. 2017. "Publicly Financed Oral Health Programs in Canada." Accessed June 5, 2019. https://www.cda-adc.ca/stateoforalhealth/publicfinance/.

Canadian Institute for Health Information. 2019. "National Health Expenditure Trends, 1975 to 2019 – Series H." Accessed April 2, 2020. https://www.cihi.ca/en/national-health-expenditure-trends-1975-to-2019.

Duckett, Stephen, Matt Cowgill, and Hal Swerissen. 2019. "Filling the Gap: A Universal Dental Care Scheme for Australia." Grattan Institute. Accessed July 13, 2019. https://grattan.edu.au/wp-content/uploads/2019/03/915-Filling-the-gap-A-universal-dental-scheme-for-Australia.pdf.

Government of Canada. "Canada Health Act R.S.C., 1985 c. C-6." Accessed June 6 2019, https://laws-lois.justice.gc.ca/PDF/C-6.pdf.

Gruber, Jonathan, and Kosali Simon. 2007. "Crowd-Out Ten Years Later: Have Recent Public Insurance Expansions Crowded Out Private Health Insurance?" National Bureau of Economic Research Working Paper no. 12858. https://www nber-org.ezproxy.lib.ucalgary.ca/papers/w12858.pdf .

Health Canada. 2010. "Summary Report on the Findings of the Oral Health Components of the Canadian Health Measures Survey 2007-2009." Acce sed June 3, 2019. http://www.caphd.ca/sites/default/files/CHMS-E-summ pdf.

Indigenous Services Canada. 2019a. "Dental Benefits Guide: Non-Insured Health Benefits Program." Accessed July 6, 2019. https://www.can da.ca/en/indigenous-services-canada/services/first-nations-inuit-health/reports publications/non-insured-health-benefits/dental-benefits-guide-non-insured-health-benefits-program.html#a882.

———. 2019b. "Northwest Territories NIHB Regional Dental Benefit Grid: General Practitioners and Specialists." Accessed J ne 4, 2019. https://provider.express-scripts.ca/documents/Dental/Denta %20Benefit%20Grids/2019/Northwest%20Territories/NT%20GPSP-NIHB%20Regional%20Dental%20Benefit%20Grid%20%2820190201%29.pdf.

———. 2019c. "Nunavut NIHB Regional Dental Benefit Grid: General Practitioners and Specialists." Accessed June 4, 2 19. https://provider.express-scripts.ca/documents/Dental/Dental%20Benefit%20G ids/2019/Nunavut/NU%20GPSP-NIHB%20Regional%20Dental%20Benefit%20Grid%20%2820190201%29.pdf.

———. 2019d. "Quebec NIHB Regional Dental Benefit Grid: General Practitioners and Specialists." Acc ssed June 5, 2019. https://provider.express-scripts.ca/documents/Dental/Dental%20Be efit%20Grids/2019/Quebec/Quebec%20GPSP-NIHB%20Regional%20Dental%20Benefit%20Grid%20%28May%201-%202019%29.pdf.

———. 2019e "Yukon NIHB Regional Dental Benefit Grid: General Practitioners and Specialists." Accessed June 4, 2019. https://provider.express-scripts.ca/documents/Dental/Dental%20Benefit%20Grids/2019/Yukon/YT%20GPSP-NIHB%20Reg onal%20Dental%20Benefit%20Grid%20%2820190201%29.pdf.

Jacobs, Philip Marian Shanahan, Noralou P. Roos, and Michael Farnsworth. 1999. "Cost List of Manitoba Health Services." Manitoba Centre for Health Policy and Evaluation. Accessed July 18, 2019. http://mchp-appserv.cpe.umanitoba.ca/reference/costlist.pdf.

Locker, David, John Maggirias, and Carlos Quiñonez. 2011. "Income, Dental Insurance Coverage, and Financial Barriers to Dental Care among Canadian Adults." *Journal of Public Health Dentistry* 71(4). https://doi-org.ezproxy.lib.ucalgary.ca/10.1111/j.1752-7325.2011.00277.x.

Manitoba Dental Association. 2019. *2019 Fee Guide for General Practitioners.*

Medlior. 2018. "Canadian Provincial Administrative Health Data for Research: It's Better in Alberta." Accessed December 2, 2019. https://www.medlior.com/wp-content/uploads/2018/10/Canadian-Provincial-Administrative-Health-WP-V2.pdf.

Millar, Wayne J., and David Locker. 1999. "Dental Insurance and Use of Dental Services." *Health Reports* 11(1): 55–67. https://www150.statcan.gc.ca/n1/pub/82-003-x/1999001/article/4646-eng.pdf.

Mosby, Ian, and Catherine Carstairs. 2018. "Federal Policies Undermine Indigenous Dental Health." *Policy Options*. Accessed August 2, 2019, https://policyoptions.irpp.org/magazines/october-2018/federal-policies-undermine-indigenous d ntal-health/.

Nova Scotia Dental Association. 2019. "2019 Abbreviated Fee uide. Accessed June 4, 2019. https://nsdental.org/wp-content/uploads/2019/02/2019 Abbreviated-Fee-Guide.pdf.

Ontario Dental Association. 2019. "ODA Suggested Fee Guide." Toronto: Ontario Dental Association.

Ontario Educational Communications Authority. 2018. "Ontario's Dental Care: Biting off Myths." https://www.tvo.org/video/ontar os-dental-care-biting-off-myths.

Office of the Parliamentary Budget Officer 2018 "Fiscal Sustainability Report 2018." Accessed June 4, 2019, https://www pbo dpb.gc.ca/web/default/files/Documents/Reports/2018/FSR%20Sept%202018/FSR_2018_25SEP2018_EN_2.pdf.

———. 2019a. "Cost Estimate of Election Campaign Proposal: Dental Care for Low-Income Canadians." Accessed June 8, 2020. https://www.pbo-dpb.gc.ca/web/default/files/Documents/ElectionProposalCosting/Results/32772336_EN.pdf?timestamp=1591646752686.

———. 2019b. "Cost Estimat of Election Campaign Proposal: Dental Care for Uninsured Canadians." Accessed June 8, 2020. https://www.pbo-dpb.gc.ca/web/default/files/Documents/ElectionProposalCosting/Results/32975863_EN.pdf?timestamp=1568818986140.

Procter and Gambl 2020. "How Much Do Braces Cost?" Accessed February 28, 2020. https://oralb. om/en-us/oral-health/life-stages/braces/how-much-do-braces-cost#Pay

Quiñon z, Ca los. 2006. "A Political Economic History of Medical and Dental Care in Nunav t, Canada." *International Journal of Circumpolar Health* 65(2): 101–116. DOI: 10 3402/ijch.v65i2.18093.

Ramraj, Chantel, Laleh Sadeghi, Herenia P. Lawrence, Laura Dempster, and Carlos Quiñonez. 2013. "Is Accessing Dental Care Becoming More Difficult? Evidence from Canada's Middle-Income Population." *PLOS One* 8(2): e57377. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3577722/.

Royal Orthodontic Laboratories Inc. 2017. “Orthodontic and Orthopedic Appliances Price List.” Accessed February 28, 2020. https://royalortholabs.com/wp-content/uploads/2018/01/PriceList2017.pdf.

Shaw, Jodi L., and Julie W. Farmer. 2015. “An Environmental Scan of Publicly Financed Dental Care in Canada: 2015 Update.” Canadian Association of Public Health Dentistry. http://www.caphd.ca/sites/default/files/FINAL%20-%202015%20Environmental%20-%20ENGLISH%20%2016%20Feb%2016.pdf.

Statistics Canada. 2012. “Canadian Community Health Survey, 2012: Annua Component Public-Use Microdata File.” Accessed June 3, 2019. https://www.statc n.gc.ca/eng/dli/dli-collection.

———. 2014. “Canadian Community Health Survey 2014: Annua Component Public-Use Microdata File.” Accessed June 3, 2019. https://www.statcan.gc ca/eng/dli/dli-collection.

———. 2015. “Table 3.2: Average Annual Population Growth, Projected (2013/2014 to 2037/2038) According to Seven Scenarios, Canada Provinces and Territories.” Accessed June 7, 2019. https://www150.statcan.g .ca/n1/pub/91-520-x/2014001/tbl/tbl3.2-eng.htm.

———. 2016a. “2016 Census of the Population Public-Use Microdata File.” Statistics Canada Data Liberation Initiative. Accessed June 3, 2019. https://www.statcan.gc.ca/eng/dli/dli-collection.

———. 2016b. “Canadian Community Health Survey 2015-16: Annual Component Public-Use Microdata File.” Accessed June 3, 2019. https://www.statcan.gc.ca/eng/dli/dli-collection.

———. 2019a. “Table 17-10-0009-01 Population Estimates, Quarterly.” Accessed June 3, 2019. https://www150 tatcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000901.

———. 2019b. “2016 Census Profile.” Accessed June 3, 2019. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E.

———. 2019c. “Canadian Health Measures Survey (CHMS) – Content Information Sheet 2007-2023.” Accessed June 12, 2019. https://www.statcan.gc.ca/eng/survey/household/507 /informationsheet.

———. 2019d. “Health Fact Sheets: Dental Care, 2018.” Accessed June 8, 2020. https://www150.statcan.gc.ca/n1/pub/82-625-x/2019001/article/00010-eng.htm.

Stinson Catherine. 2018. “Healthy Data: Policy Solutions for Big Data and AI Innovation in Health.” Mowat Centre. Accessed December 2, 2019. https://munkschool.utoronto. a/mowatcentre/wp-content/uploads/publications/179_healthy_data.pdf.

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