

# Dental Insurance, Income and the Use of Dental Care in Canada

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## ABSTRACT

Using recent Canadian health survey data, we investigated the effect of socioeconomic status on patients' use of dental services and dental insurance coverage. Our results point to an important socioeconomic gradient in the use of dental services. The probability of receiving any dental care over the course of a year increases markedly with dental insurance, household income, and level of education. Among those receiving at least some dental care, however, a person's general oral health — not financial factors — largely determined visit frequency. The insurance effect appears to operate through a reduction in price paid at point of service, not decisions by those with high anticipated need for dental care to selectively purchase insurance. Indeed, those with poorer self-assessed oral health, as well as those from Quebec (where dental benefits are subject to personal income tax) and those over 65 years of age (who have likely lost employer-provided coverage) were less likely to be insured.

**MeSH Key Words:** dental care/economic; health services needs & demand; health services research; insurance, dental

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In contrast to the situation for physician and hospital-based services, which are largely publicly funded, Canadians are generally responsible for financing their own dental care, either through private insurance or by direct payment. Given the effectiveness of dental services in improving oral health, and the importance of oral health to general health-related quality of life,<sup>1</sup> the system of private financing raises questions about the equity of distribution of dental services. In particular, to what extent do individuals' financial resources, including income and dental insurance coverage, affect their use of dental services? Is it the case, for instance, that those with limited means and no insurance coverage pay out-of-pocket to receive regular dental care? The evidence suggests that the answer to the latter question is “no.” Using

data from the Statistics Canada National Population Health Survey (NPHS), Millar and Locker<sup>2</sup> reported that income and insurance are important determinants of a person's decision to visit a dentist over the course of a year. In particular, other factors being equal, the highest-income Canadians were almost 3 times as likely to visit a dentist relative to the lowest income Canadians. Similar differences were found among those with and without dental insurance. Less affluent, uninsured Canadians are therefore markedly less likely to receive regular dental care than their affluent, insured counterparts. Other analysts have found similar results for different jurisdictions and different time periods.<sup>3,4</sup>

In this paper, we extend Millar and Locker's analysis of the distribution of dental care in Canada in several ways. First, we

investigate the effect of household financial resources on the number of dental consultations in the past year, while controlling for a variety of other factors such as age, sex, education and oral health. Although the results of Millar and Locker<sup>2</sup> suggest that income and insurance affect the probability of visiting a dentist, it is unclear how these and other variables affect the *frequency* of use of such services. For instance, are insured individuals more likely to be frequent users of dental care? How do visits vary over a person's lifetime? Are those with poorer oral health getting more dental care? Our model addresses precisely such questions.

Our second contribution is more subtle. Millar and Locker<sup>2</sup> found that insured patients were much more likely to receive dental care than non-insured patients. It is unclear, however, to what extent this association operates through the normal insurance response (i.e., insurance lowers the direct cost of care to patients and hence increases use) rather than through those with poor oral health purchasing insurance (i.e., "adverse selection"). We have investigated this question by developing a model of the probability of dental insurance coverage as a function of, among other factors, self-assessed general oral health status. If those with poorer oral health are no more likely than those with excellent oral health to report dental insurance coverage, then selection effects are probably not driving the positive association between insurance and use of dental services.

Third, we created our models using more recent data. Whereas Millar and Locker<sup>2</sup> used data from the 1996–1997 NPHS, we used data from the 2003 Statistics Canada Canadian Community Health Survey (CCHS), which had a sampling frame similar to that of the NPHS and which requested information on use of dental services, dental insurance and oral health.

## Methods

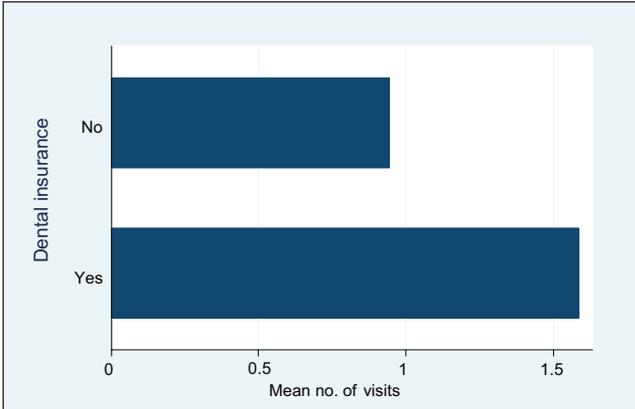
The public-use version of the 2003 CCHS contains detailed information on the health services use, health status and health risk factors of 134,072 Canadians.<sup>5</sup> The survey is intended to be representative of all persons living in private households and therefore excludes those residing in long-term care facilities, hospitals, Aboriginal reserves and penal institutions. Households were sampled by random-digit dialing, and data were collected by telephone interview with a randomly chosen household member. The survey used stratified multistage sampling, and lower-population regions such as the Atlantic provinces were oversampled. We therefore used sampling weights provided by Statistics Canada to ensure that descriptive statistics would be nationally representative.

We generated models of dental insurance coverage and use of dental services using data from the 108,861 CCHS respondents 25 years of age and older. In particular, we used probit regression to explore the effects

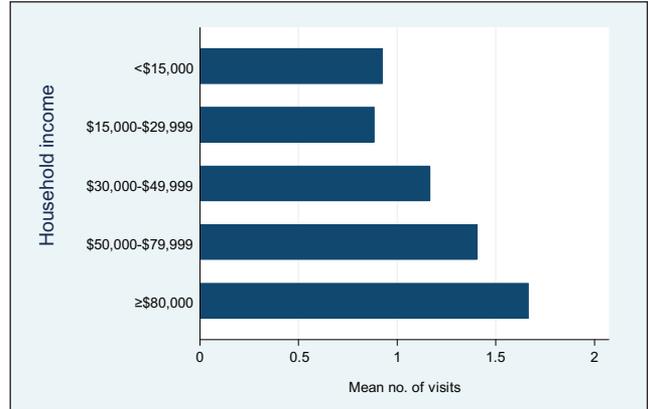
of general oral health status, household income, age, sex, education, marital status and province of residence on the probability of dental insurance coverage. Regression estimates the separate contribution of each explanatory factor on an outcome variable, while holding constant the influence of other factors. Why is this approach important? The unadjusted correlation between, say, income and probability of insurance reflects in part the positive correlation between income and education: highly educated people likely earn more and are also more likely to have access to dental insurance. The unadjusted correlation therefore likely overestimates the impact of income on the probability of insurance. Regression is a way of parcelling out the effect of income while holding constant the influence of education and other variables. We report the "pseudo  $R^2$ " of the model, a measure of the degree to which explanatory factors account for variations in the outcome variable. The pseudo  $R^2$  takes values from 0 to 1, with larger values reflecting better predictive performance.

In the CCHS, oral health was assessed with the following question: "In general, would you say the health of your teeth and mouth is: excellent, very good, good, fair, or poor?" Dental insurance was assessed with the following question: "Do you have insurance that covers all or part of your dental expenses?" We used the 2-part regression model<sup>6–8</sup> to estimate the effects of these variables on dental visits, which were assessed using the following question: "In the past 12 months, how many times have you seen, or talked on the telephone, about your physical, emotional or mental health with a dentist or orthodontist?" The 2-part model is a flexible way of modelling skewed individual-level health services use data, that is, data in which a large proportion of individuals have zero visits and a small proportion have numerous visits. The technique consists of a probit regression model of the decision to receive any dental care (at least 1 visit annually) and a separate linear regression of the log number of visits among those who receive care. The effect of an explanatory factor thus can be decomposed into separate effects on a "decision to receive care" component and a "frequency of visits conditional on receiving care" component. We used the probit and linear regression routines, along with their heteroskedasticity-robust covariance matrix estimators, as implemented in Stata version 9.1 (Stata statistical software, release 9, StataCorp LP, College Station, Texas; 2005).

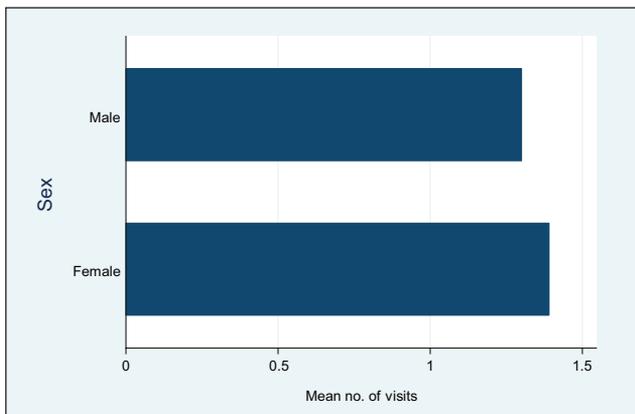
The variables for general oral health status were included in the regression models of dental visits to identify the "pure" effect of household income on visit frequency, that is, the effect of income, holding constant the influence of oral health. Because more affluent people likely have healthier teeth, and those with healthier teeth likely have fewer dental visits, failure to control for oral health might lead to underestimation of the pure effect of



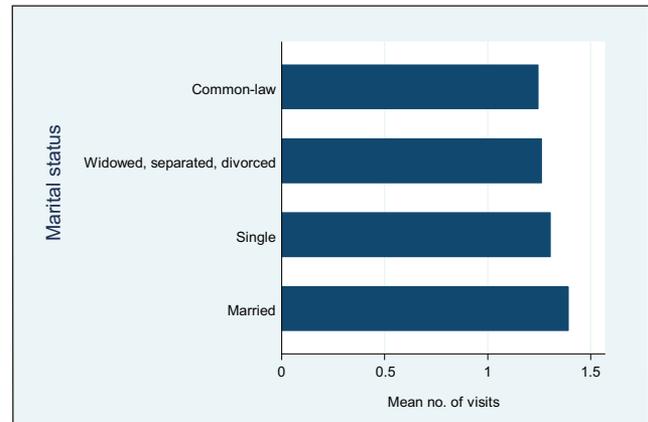
**Figure 1:** Mean annual frequency of dental visits by level of dental insurance.



**Figure 2:** Mean annual frequency of dental visits by household income.



**Figure 3:** Mean annual frequency of dental visits by sex.



**Figure 4:** Mean annual frequency of dental visits by marital status.

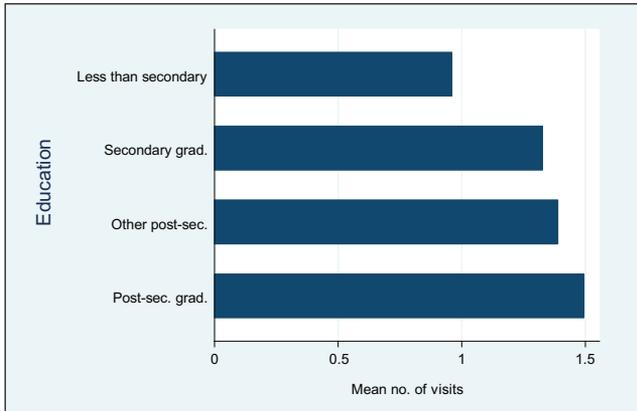
income on visits. One difficulty with including the oral health variables in the visits model, however, is that oral health might be partly determined by visit frequency. In other words, those who go to the dentist more often might have healthier teeth. This is not necessarily the case in our model, however; the CCHS asks about “general” oral health status, so it could be the case that oral health determines, rather than being determined by, visits made in the last 12 months. In any event, we estimated the visit models with and without the inclusion of the oral health variables to determine if this had any appreciable effect on the estimated effects of income and insurance on visits.

## Results

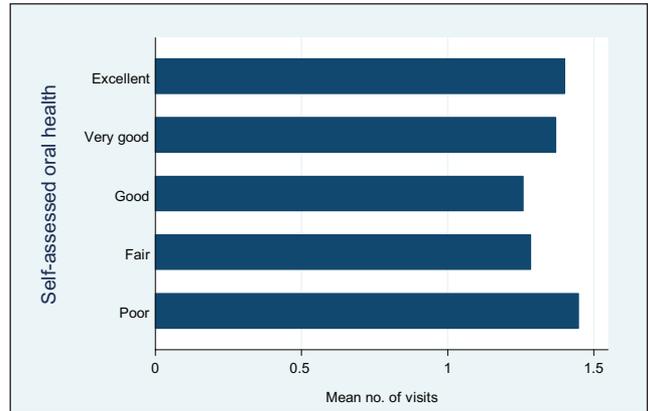
Before reporting the regression model estimates, we describe here the mean annual frequency of dental visits by the factors considered in our analyses. The mean number of dental visits was higher among those with dental insurance (Fig. 1), those with higher household income (Fig. 2), women (Fig. 3), those who were married (Fig. 4) and those with higher levels of formal educational

attainment (Fig. 5). Mean visit frequency had a U-shaped relation with self-assessed oral health status; specifically, mean visits were highest for those at the extremes of oral health (excellent and poor) and lower for those with intermediate values (very good, good and fair) (Fig. 6). Mean visit frequency increased with age until middle age. Visits dropped off markedly among older people, and stabilized at about 1 visit annually after age 65 (Fig. 7). Mean visit frequency varied markedly by province, with the highest rates observed in Ontario, Manitoba and British Columbia and the lowest rates in Quebec, Saskatchewan, Newfoundland and New Brunswick (Fig. 8).

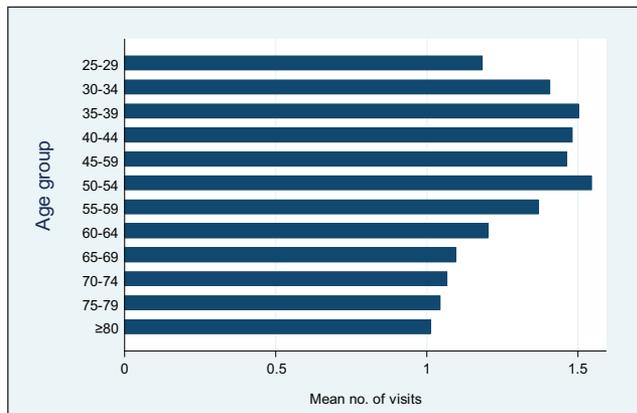
Estimates of the effect of oral health, income and other factors on the probability of dental insurance coverage are presented in Table 1. We report estimated effects in terms of absolute differences in probability of coverage between the group in question and the reference group. Hence, those with household incomes of \$80,000 or more were 34 percentage points more likely to have dental insurance than otherwise comparable individuals with household incomes less than \$15,000. This estimate appears to be precise: the 95% confidence interval around this estimate



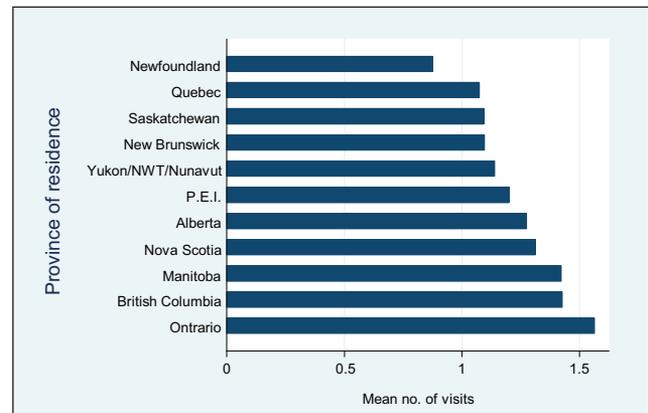
**Figure 5:** Mean annual frequency of dental visits by educational attainment.



**Figure 6:** Mean annual frequency of dental visits by self-assessed oral health.



**Figure 7:** Mean annual frequency of dental visits by age.



**Figure 8:** Mean annual frequency of dental visits by province of residence.

was 32 to 35 percentage points. Our results suggest that better self-assessed oral health was associated with a *higher* probability of dental insurance coverage. Other notable findings included a precipitous drop in dental insurance coverage at age 65 and markedly lower rates of dental insurance coverage in Quebec compared with the other provinces.

The estimates of the visit models both with and without oral health variables are reported in **Table 2**. The first notable finding is that oral health had opposing effects on the decision to receive care and the amount of care received among those receiving care: those with poor self-assessed oral health were 19 percentage points *less* likely to receive dental care relative to those reporting excellent oral health and again, holding constant insurance, income and other factors, among those receiving dental care, poor oral health was associated with 34% more visits. Dental insurance coverage seemed to have its primary effect on the decision to receive dental care, not on visit frequency. Specifically, insured individuals were 17 percentage points more likely to receive care, but among those receiving care, those with insurance had only 9% more visits than comparable individuals

without insurance. Similar patterns were observed for income: those with household incomes of \$80,000 or more were 25% more likely to receive dental care than otherwise comparable individuals with household incomes less than \$15,000. However, among those receiving care, high-income individuals had only 10% more visits than comparable low-income individuals. As expected, the estimates of the effect of income on the number of visits were attenuated when oral health was not controlled for. The omission of oral health had little effect on the magnitudes of the insurance effects or on the probability model estimates.

The probability of receiving dental care declined over a person's lifetime, but among those who did receive care, annual dentist visit frequency increased with age. Visits were lower among men and higher among those with more education. The probability of receiving any dental care over the course of a year was lowest in Newfoundland, Quebec, Saskatchewan and New Brunswick, and highest in Ontario, Manitoba and British Columbia. Among those receiving dental care, mean visit frequency was lowest in Saskatchewan and Quebec and highest in Nova Scotia and British Columbia.

**Table 1** Estimated effects of income, oral health, age, sex, education, marital status and province of residence on the probability of dental insurance coverage

Explanatory variable		Sample mean	Estimated effect	95% CI	
Income	=1 if household income \$15,000 - \$29,999	0.191	-0.012	-0.026	0.001
	=1 if household income \$30,000 - \$49,999	0.231	0.133	0.120	0.145
	=1 if household income \$50,000 - \$79,999	0.248	0.273	0.261	0.285
	=1 if household income \$80,000+	0.219	0.336	0.324	0.347
	<i>reference: household income &lt; \$15,000</i>				
Oral health	=1 if self-assessed oral health very good	0.311	-0.022	-0.031	-0.012
	=1 if self-assessed oral health good	0.319	-0.052	-0.062	-0.042
	=1 if self-assessed oral health fair	0.110	-0.091	-0.105	-0.078
	=1 if self-assessed oral health poor	0.048	-0.147	-0.165	-0.129
	<i>reference: excellent self-assessed oral health</i>				
Age	=1 if age is from 35 to 44 years	0.205	0.034	0.022	0.045
	=1 if age is from 45 to 54 years	0.200	0.016	0.004	0.027
	=1 if age is from 55 to 64 years	0.176	-0.074	-0.086	-0.062
	=1 if age is from 65 to 74 years	0.132	-0.271	-0.283	-0.258
	=1 if age is ≥ 75 years	0.101	-0.287	-0.302	-0.273
	<i>reference: age from 25 to 34 years</i>				
Sex	=1 if male	0.457	-0.015	-0.023	-0.008
	<i>reference: female</i>				
Education	=1 if completed secondary education	0.176	0.041	0.029	0.052
	=1 if completed some post-secondary	0.062	0.048	0.032	0.064
	=1 if post-secondary graduate	0.529	0.047	0.037	0.057
	<i>reference: less than secondary education</i>				
Marital status	=1 if married or common-law	0.608	0.026	0.016	0.037
	=1 if widowed, separated or divorced	0.234	0.036	0.024	0.048
	<i>reference: single (never married)</i>				
Province or territory	=1 if from Prince Edward Island	0.015	0.041	0.008	0.074
	=1 if from Nova Scotia	0.037	0.096	0.072	0.120
	=1 if from New Brunswick	0.037	0.123	0.099	0.146
	=1 if from Quebec	0.206	-0.078	-0.099	-0.057
	=1 if from Ontario	0.330	0.166	0.147	0.185
	=1 if from Manitoba	0.056	0.130	0.108	0.152
	=1 if from Saskatchewan	0.054	0.114	0.091	0.136
	=1 if from Alberta	0.096	0.164	0.144	0.184
	=1 if from British Columbia	0.120	0.128	0.108	0.148
	=1 if from the Territories	0.018	0.263	0.240	0.287
	<i>reference: from Newfoundland</i>				
Number of observations		<b>89,760</b>			
Pseudo R <sup>2</sup>		<b>0.180</b>			

Source: Canadian Community Health Survey Cycle 2.1<sup>5</sup>  
 Note: CI = confidence interval

**Table 2** Two-part model estimates of number of annual dental visits, with and without the inclusion of oral health variables

Explanatory variable		Outcome variable											
		Oral health variables included in model					Oral health variables excluded from model						
		Probability of receiving dental care			Proportional change in number of visits among those receiving dental care			Probability of receiving dental care			Proportional change in number of visits among those receiving dental care		
		Estimated effect	95% CI		Estimated effect	95% CI		Estimated effect	95% CI		Estimated effect	95% CI	
Insurance	=1 if person has dental insurance	0.166	0.158	0.173	0.087	0.076	0.099	0.172	0.165	0.180	0.077	0.066	0.088
	<i>reference: no dental insurance</i>												
Income	=1 if household income \$15,000 - \$29,999	0.046	0.033	0.058	0.022	-0.003	0.048	0.052	0.040	0.065	0.001	-0.025	0.027
	=1 if household income \$30,000 - \$49,999	0.127	0.115	0.140	0.051	0.027	0.076	0.140	0.128	0.152	0.015	-0.010	0.039
	=1 if household income \$50,000 - \$79,999	0.189	0.176	0.201	0.069	0.044	0.093	0.207	0.195	0.219	0.023	-0.002	0.047
	=1 if household income \$80,000+	0.250	0.237	0.262	0.096	0.070	0.121	0.274	0.262	0.286	0.038	0.013	0.064
	<i>reference: household income &lt; \$15,000</i>												
Oral health	=1 if self-assessed oral health very good	-0.037	-0.047	-0.027	0.023	0.011	0.034						
	=1 if self-assessed oral health good	-0.122	-0.132	-0.112	0.085	0.072	0.098						
	=1 if self-assessed oral health fair	-0.145	-0.158	-0.132	0.202	0.181	0.222						
	=1 if self-assessed oral health poor	-0.194	-0.212	-0.177	0.344	0.306	0.382						
	<i>reference: excellent self-assessed oral health</i>												
Age	=1 if age is from 35 to 44 years	0.055	0.044	0.066	0.028	0.013	0.042	0.049	0.038	0.060	0.033	0.018	0.047
	=1 if age is from 45 to 54 years	0.046	0.035	0.057	0.051	0.035	0.066	0.035	0.024	0.046	0.062	0.046	0.077
	=1 if age is from 55 to 64 years	0.033	0.021	0.044	0.075	0.059	0.092	0.026	0.014	0.038	0.080	0.063	0.096
	=1 if age is from 65 to 74 years	0.037	0.024	0.051	0.092	0.072	0.112	0.034	0.021	0.047	0.091	0.071	0.111
	=1 if age is ≥ 75 years	0.013	-0.002	0.028	0.082	0.058	0.105	0.009	-0.006	0.023	0.083	0.059	0.106
	<i>reference: age from 25 to 34 years</i>												
Sex	=1 if male	-0.087	-0.094	-0.080	-0.038	-0.048	-0.028	-0.099	-0.106	-0.092	-0.023	-0.033	-0.013
	<i>reference: female</i>												
Education	=1 if completed secondary education	0.112	0.101	0.122	0.037	0.019	0.055	0.117	0.107	0.127	0.028	0.010	0.046
	=1 if completed some post-secondary	0.127	0.113	0.140	0.074	0.050	0.099	0.132	0.119	0.146	0.069	0.045	0.093
	=1 if post-secondary graduate	0.182	0.173	0.191	0.058	0.043	0.074	0.193	0.184	0.202	0.042	0.027	0.058
	<i>reference: less than secondary education</i>												
Marital status	=1 if married or common-law	-0.027	-0.037	-0.016	-0.049	-0.064	-0.034	-0.030	-0.040	-0.020	-0.039	-0.053	-0.024
	=1 if widowed, separated or divorced	-0.043	-0.055	-0.031	-0.017	-0.035	0.001	-0.045	-0.057	-0.033	-0.010	-0.028	0.009
	<i>reference: single (never married)</i>												
Province or territory	=1 if from Prince Edward Island	0.186	0.160	0.212	0.033	-0.019	0.085	0.185	0.159	0.211	0.036	-0.016	0.089
	=1 if from Nova Scotia	0.148	0.126	0.170	0.079	0.036	0.123	0.145	0.122	0.167	0.085	0.042	0.129
	=1 if from New Brunswick	0.091	0.067	0.115	0.006	-0.039	0.050	0.085	0.061	0.109	0.015	-0.029	0.059
	=1 if from Quebec	0.119	0.100	0.138	-0.054	-0.090	-0.017	0.117	0.098	0.136	-0.045	-0.081	-0.009
	=1 if from Ontario	0.216	0.197	0.234	0.060	0.024	0.095	0.205	0.187	0.224	0.079	0.044	0.115
	=1 if from Manitoba	0.112	0.090	0.134	0.012	-0.029	0.054	0.106	0.084	0.128	0.026	-0.015	0.067
	=1 if from Saskatchewan	0.069	0.046	0.092	-0.074	-0.115	-0.033	0.057	0.034	0.080	-0.052	-0.093	-0.011
	=1 if from Alberta	0.104	0.083	0.124	-0.039	-0.077	-0.001	0.095	0.074	0.115	-0.019	-0.057	0.019
	=1 if from British Columbia	0.193	0.175	0.211	0.063	0.026	0.101	0.184	0.166	0.202	0.085	0.047	0.122
	=1 if from the Territories	0.099	0.070	0.129	-0.018	-0.067	0.032	0.076	0.047	0.106	0.023	-0.027	0.072
	<i>reference: from Newfoundland</i>												
Number of observations		<b>89,760</b>			<b>51,865</b>			<b>91,511</b>			<b>52,561</b>		
Pseudo R <sup>2</sup>		<b>0.134</b>			<b>0.037</b>			<b>0.126</b>			<b>0.019</b>		

Source: Statistics Canada. Canadian Community Health Survey Cycle 2.1<sup>5</sup>  
 Note: CI = confidence interval

## Discussion

Our results point to an important socioeconomic gradient in the use of dental services in Canada. We found that the probability of receiving any dental care over the course of a year and, to a lesser extent, the amount of care received increased with dental insurance, household income and level of educational attainment. The insurance effect appeared to operate through a reduction in price paid at point of service, not decisions by those with high anticipated need for dental care to selectively purchase insurance. Indeed, those with poorer self-assessed oral health were less likely to be insured.

Oral health had opposing effects on the probability of receiving any dental care and the amount of care received. We found that those with poorer oral health were *less* likely to receive dental care, an association that could reflect the consequences of failure to receive regular dental care. Among those receiving dental care, however, those with poorer oral health visited the dentist more frequently. Indeed, among those who used some dentist services, the primary determinant of dental visit frequency was oral health, which dominated the combined effect of income and insurance. Hence, financial factors were particularly important determinants of the decision to receive any care, but health care needs drove the intensity or volume of services delivered to those who did receive care. This finding has also been reported for other health services, including drug and physician services.<sup>9</sup>

One limitation of our study is the “noisy” measure of dental services use in the CCHS. Although it can distinguish those who did and those who did not access dentists’ services over the course of a year, it does not capture consultations with denturists, nor does it distinguish service intensity; indeed, reported encounters ranged from short telephone conversations to the provision of multiple procedures in a 3-hour appointment. The nature of this outcome measure therefore precludes analysis of the effects of income and insurance on the use of specific dental services. Millar and Locker<sup>2</sup> did, however, provide some evidence related to this relation. They found that the largest income- and insurance-related differences occurred in the use of routine dental care (checkups, cleaning and fillings).

The probability of receiving any dental care varied markedly by region, with a 22 percentage point difference in probabilities between those residing in Ontario and those residing in Newfoundland; Millar and Locker<sup>2</sup> reported similar differences. These differences could be driven in part by the regional supply of dentists. Specifically, a relatively small proportion of residents in provinces with the lowest dentist-to-population ratios in 2002 (namely Newfoundland, Saskatchewan and New Brunswick<sup>10</sup>) received dental care; conversely, a relatively

large proportion of residents of “dentist-rich” regions (Ontario and British Columbia) received dental care.

Our model of dental insurance produced some additional notable findings that corroborate those of Millar and Locker.<sup>2</sup> First, there was a markedly lower rate of dental insurance in Quebec than in the other provinces; second, the probability of coverage dropped off markedly for patients over age 65. The first result could be due in part to the fact that employer-provided health benefits have been subject to personal income tax in Quebec since 1993 but are not taxed elsewhere.<sup>11,12</sup> The second result is possibly due to the loss of employer-provided coverage upon retirement. One might expect that those who lose employer-provided group coverage would secure alternative, possibly non-group coverage. Coverage available to individual subscribers, however, is typically expensive and non-comprehensive because of problems associated with adverse selection. The prospects for dental insurance coverage for the large numbers of Canadians who expect to retire from the labour force over the next 2 decades do not look promising. ♦

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