How the utilization of eye exams has responded to changes in coverage in the Ontario Health Insurance Plan

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Abstract

The present paper examines how the utilization of eye exams has responded to the decrease in the coverage level of that service that took place in 1998 in Ontario. Starting in April 1998, for people aged 20 to 64, the Ontario Health Insurance Plan paid for only one eye examination per patient every two years and for one every year for those under 20 or 65 and more. It is expected that any decrease in the coverage of eye exams will lead to utilizing less due to the increase in the price of that service. Regular OLS and probit regressions are used with data from two surveys: the National Population Health Survey (NPHS) of 1996-97, done before the change, and the Canadian Community Health Survey (CCHS) of 2002-03, done after the change. The results show that significant changes took place among various income and age groups.

1. Introduction

Public and private spending on health care in Canada for the year 2007 was estimated at $160 billion, which was 10.6% of the GDP of that year. From that amount, $113 billion, or 70.6%, was financed by the public sector (Canadian Institute for Health Information, 2008), in accordance with the *Canada Health Act.* Under the *Canada Health Act,* all "medically necessary" services must be covered under the provincial and territorial governments' health insurance plans (Beach *et al.*, 2006, p. 1). The cost of the health care system has been the source of a major debate in Canada for a long time. Every year, a considerable proportion of governments' budgets is assigned to health care for people across Canada. Meanwhile, the growth rate of spending has been significantly above inflation for the last decade and it is likely to remain that way for at least three major reasons: population aging, population growth especially from new immigration, and advanced technology.

As the population ages the demand for health care services increases. An aging population can also put pressure on the government purse from the revenue side. More old individuals mean fewer individuals at work and therefore less revenue for the government.

Every year, Canada attracts a considerable number of immigrants from various countries. Since all Canadian provinces have a public health care system in place, it is the government's responsibility to provide health care services for the new immigrants. While some research has shown that immigrants are healthier and use less health service on average than other Canadians (see Denton et al., 2009), they also pay less taxes because their incomes are low. So the net effect of immigration on health public finance

is probably negative. In addition, because of barriers to entry, many immigrants who were employed in health occupations in their home country are not allowed to contribute to the supply of health services in Canada.

Finally, providing the advanced technology to treat the patients better and more effectively requires spending more money. We are witnessing rapid and considerable innovations in many severe illness-related technologies, such as advanced equipment for heart surgeries. Thus, the effective supply of health care to the society requires spending chunks of money to replace the obsolete equipment or install the new ones.

In addition to all these factors that put pressure on the governments, the increasing demand to reduce the waiting time for getting some treatments forces the governments to employ more resources such as family physicians, nurse practitioners, other nurses, specialists and equipments.

Increased health care costs have forced the governments to re-think the system and to find ways to reduce expenses in an efficient way. In the mid-1990s, health care costs decreased on a relative basis[1] while they increased in absolute value, (see Canadian Institute for Health Information, 2005). According to Stabile and Ward (2006), this is due to the important cuts in the public funding of the health care system.

One important kind of public fund cut consists in reducing the coverage of some services, either for the whole population or for some sub-groups of the population. For example, the coverage of eye exams, physiotherapy services, chiropractic services and speech therapy was reduced in many provinces at various moments during the last decade (See Stabile and Ward, 2006). The question that is studied in this paper is how the pattern

[1] By relative basis we mean that the growth of health spending in Canada in mid-1990s is lower than the overall pattern of spending over the 1975 to 2004 period.

of usage changed following one particular event: the decrease in the coverage of eye exams in Ontario that took place in 1998.

It is expected that after taking out some of the publicly-covered services from the basket of "medically necessary" services, the reactions of individuals will change. Increasing the price of any service, due to de-listing, by any economic prediction should lead to a decrease in the demand for that service. From the policy analyst point of view, if the de-listing of those services has affected the poor population, then the inference can be drawn that the decision to decrease the level of coverage for eye exams has not been successful and that it needs some other complementary plans to reduce the adverse effects, like reimbursing the poor families. From another perspective, the moral hazard effects of health insurance can be traced in part. The analysis can shed some light on the issue of the private health market in Canada by providing some stylized facts about the attitudes of individuals in the use of eye exams.

The concerns regarding the distributional effects and health outcomes of changing coverage are of critical importance but they are not the only purpose of this paper. The other important result that can be obtained from this study is related to the critical debate that is running these days across most of the provinces in Canada about the introduction of a private health care system along with the public one.

Stabile and Ward (2006) have examined changes in the utilizations of de-listed services using three cycles of the National Population Health Survey (NPHS) for1994-95, 1996-7 and 1998-9, and one cycle of the Canadian Community Health Survey (CCHS) for 2001, for all Canadian provinces. They focused on how de-listing health care services has affected the behaviour of individuals by using dummy variables representing the de-

listed services. They found that de-listing reduced the probability of visiting a physiotherapist or optometrist, while there was no effect on the probability of using chiropractor services. Also, among those who used services at least once, they found that the number of physiotherapist and speech therapist visits was affected positively by de-listing, while chiropractic services were affected negatively. For the inconsistent results, Stabile and ward provide two possible explanations. First, they argue that for certain services there is a lack of supply and that excess demand due to the effective price of zero results in shortages. But after imposing positive prices and therefore reducing the shortages, even though fewer people use these services, individuals who are most needy (and can afford the services) increase their use. Second, by referring to Kahneman and Tversky's (1979) work, they argue that "people may behave differently towards having health care services de-insured than they may behave when the services are insured". (Stabile and Ward, 2001, p.12)

Regarding the results on eye exams, the overall demand for eye exams decreased after the policy change, but there was an increase in the use of optometry services for individuals with income greater than $30,000. In addition, they looked at the effect on youth, defined as population under 20, and found that delisting had decreased the probability of seeing an optometrist, but there was no difference between the probabilities of use for children versus the rest of the population. [2]

In the context of the United States where no universal public insurance exists, it is worth noting that there is also some evidence that changes in eligibility strongly affect the demand for health services. Card et al. (2008) studied the impact of becoming eligible to Medicare insurance coverage on various elderly subgroups (based on income, education,

[2] Children are still covered under the OHIP.

and ethnicity) in different states of USA for 1999 to 2003. They used the National Health Interview Survey (NHIS) to analyze changes in self-reported access to care, and in the number of doctor visits and hospital stays. They found that the beginning of Medicare eligibility after age 65 leads to increased demand for health care services among the elderly.

Our research is similar to the Stabile and Ward's study, except that it focuses only on Ontario and on one change: the decrease in eye examination coverage in 1998. Two separate periods are compared, 1997 and 2003, that is, before and after the policy change. In comparison to the Stabile and Ward's study, in this paper, the long run effect is considered since after a policy change it usually takes time for people to react to the new change. We compare the patterns across various demographic groups as well as for individuals with different health and income statuses. An additional contribution, compared to Stabile and Ward is that we take a close look at the pattern of eye exam usage separately for males and females.

According to the Ontario Ministry of Health, the coverage of eye exams was changed in 1998. On the OHIP website[3], it is said that "Beginning on April 1, 1998, OHIP will pay for one periodic eye examination per patient, once every two years for people aged 20 to 64, and annually for those under age 20 and age 65 and older." There are some exceptions to this new regulation, e.g. for those with infected eye problems. Based on this information, the population ages 20 to 64 is expected to be affected more than the other age categories. Appendix 4 shows the text of the OHIP document describing the change.

[3] http://www.health.gov.on.ca/english/public/pub/pub_menus/pub_ohip.html

The rest of this paper is organized as follows. Section two provides a descriptive analysis of the data. Section three introduces the model specification and the variable definitions. In section four the empirical results are interpreted and discussed. The last section concludes the paper.

2. Data and descriptive statistics

This paper uses the public use data for one cycle of the National Public Health Survey (NPHS) for 1996-97, which was collected during the period of June 1996 to August 1997, before the change in coverage, and for one cycle of the Canadian Community Health Survey (CCHS) for 2002-03, collected during the period of May 2002 through December 2002, after the change in coverage.[4] The National Population Health Survey (NPHS), a longitudinal survey, re-interviewed a group of Canadians every two years between 1994 and 1999. The initial wave of data collection took place from June 1994 to June 1995 while the data for cycle 2, used in this study, were collected during the period of June 1996 to August 1997. In general, the NPHS covers household and institutional residents in all provinces and territories, except persons living on Indian reserves, on Canadian Armed Forces bases, and in some remote areas (NPHS Overview, 1996/97). The National Population Health Survey (NPHS) Program was designed to collect information related to the economic, social, demographic, occupational and environmental correlates of health.

The Canadian Community Health Survey (CCHS) is a cross-sectional survey that collects information related to health status, health care utilization and health

[4] Reference: www.statcan.ca/english/sdds/document/3226_D17_T9_V2_E.pdf

determinants for the Canadian population (CCHS 3.1 Public Use Microdata File User Guide). It operates on a two-year collection cycle; the first year of the survey (cycle ".1", i.e., 2000-01, is a large sample, general population health survey, designed to provide reliable estimates at the health region level; the second year of the survey (cycle ".2"), i.e. 2002-03, has a smaller sample and is designed to provide provincial level results on specific focused health topics. The data for cycle 2 of CCHS, used in this study, were collected between May 2002 and December 2002.

NPHS and CCHS public use data have differences in defining categories for some variables, such as age group, level of income, and the highest level of education attained. However, in general, the two surveys are comparable in terms of the variables that are included. Tables A.1.1 A.1.2, A.1.3, and A.1.4 of Appendix 1 show the various categories of income, age, marital status and education for the two surveys. The dataset for CCHS cycles do not cover the individuals under age 11 years old. At the end, these surveys increase our knowledge of the relationship between health status, health determinants, and health care utilization. Both surveys include questions regarding the number of visits to optometrists.[5] All of the needed changes have been done to those variables to make them consistently usable in the regressions.[6] Income was categorized in five levels due to the limitation on income levels in the 2003 CCHS which are including "less than $15,000", "15,000-30,000", "30,000-50,000", "50,000-80,000" and "$80,000 plus".[7] Education level was categorized in four levels including "less than secondary",

[5] Eye visits are defined as an individual who have "seen" or "talked to" an optometrist or ophthalmologist in the past 12 months. An eye specialist includes ophthalmologists and optometrists.
[6] See appendix 1 for the various categories under NPHS and CCHS.
[7] The income classes in real terms do not match between 1997 and 2003, i.e. $15,000 in 2003 is worth less than $15,000 in 1997. We calculated the inflation rate for 1997-2003 period based on the consumer price index (CPI) in Ontario. If we apply the inflation rate of 2.20057 percent (average inflation rate for 1997-

"secondary graduation", "other post secondary", and "post secondary graduation". Age was grouped into 5 categories. Due to the limitation on 1996-97 NPHS marital status was defined in two categories, married and non-married. Table A.2.1 of the appendix shows the definitions of the variables. The distributions of eye visit for different variables are shown in tables A.2.2, A.2.3, A.2.4, A.2.5, and A.2.6 of Appendix 2. Both the NPHS and CCHS present 12 levels for eye visits, where 12 indicates 12 visits and more per year.[8]

All of the needed changes have been done to those variables to make them consistently usable in the regressions.[9] Income was categorized in five levels due to the limitation on income levels in the 2003 CCHS. Age was grouped into 15 categories. Due to the limitation on 1996-97 NPHS, marital status was defined in two categories, married and non-married. And finally education was defined in seven categories. Table A.2.1 of Appendix 2 shows the definition of the variables. The distributions of eye visit for different variables are shown in tables A.2.2, A.2.3, A.2.4, A.2.5, and A.2.6 of the appendix. Both the NPHS and CCHS present 12 levels for eye visits, where 12 indicates 12 visits and more per year.

After controlling for missing data, we came up with 8095 and 35796 observations for the 1996-97 and 2002-03 samples respectively. Table 1 shows the means and standard deviations of the variables used in the analysis. As can be observed in Figure 1 and in the tables of Appendix 2, there is a high concentration of the number of visits for eye examinations around 0 and 1. More specifically, Table A.2.2 shows that 61 and 56 percent did not have any visit to an eye doctor for 1996-97 and 2002-03, respectively, and

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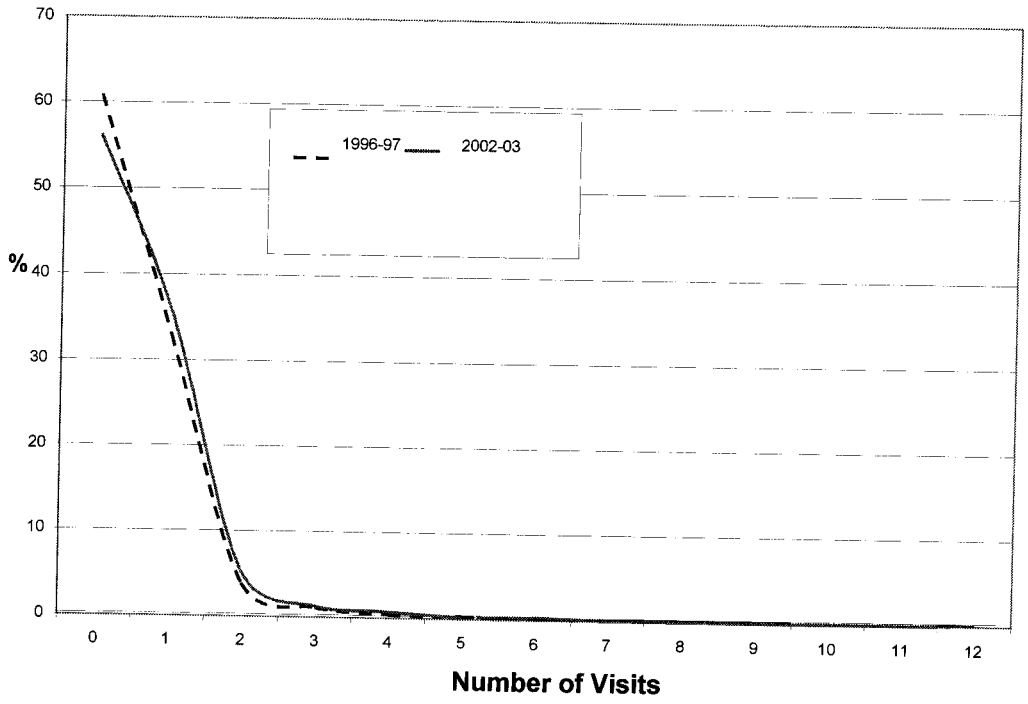
2003 period), $15,000 in 2003 is worth $17,093 in 1997. We are not able to adjust the income categories for all individuals in our sample because the data is the public use version.

[8] Right-truncating the number of eye doctor visits at 12 may affect the OLS results but not the probit model results.

[9] See Appendix 1 for the various categories under NPHS and CCHS.

33 and 36 percent had only one visit. For more than one visit, a decreasing pattern can be seen for both years except for 6 and 8 visits for the 2002-03 CCHS survey. For 12 and more visits there are 0.15 and 0.13 percent for 1996-97 and 2002-03, respectively. Figure 1 does not show any obvious change after implementing the policy. However, drawing any conclusion requires a more detailed analysis, in particular among various demographic groups.

Figure 1: Distribution of number of eye visits for 1997 and 2003



The data comparisons for the two periods are provided in Table 1. As can be observed, the incidences, i.e. at least one visit, and mean values of number of eye exam visits increased in 2002-03 (1.34 and 0.59) compared to 1996-97, (1.03 and 0.51). However, the standard deviation for both incidence and mean value of visits are larger in 2002-03 than in 1996-97, implicitly saying that even though the mean point for the

distribution of number of eye exams has shifted to the right, the tails of the distribution are fatter. In other words, the inequality in the number of eye exams within the population increased between 1996-97 and 2002-03.

Female and married individuals have a higher percentage of utilization than male and non-married individuals in 2002-03, compared to 1996-97. Also, the first three groups of individuals in terms of health status, i.e. poor, fair and good health, had more visits in 2002-03 than in 1996-97.

Concerning the income groups, we cannot observe any specific pattern. The first and last groups of income, i.e. less than $15,000 and more than $80,000 a year, increased their share of number of visits in 2002-03.

In terms of educational categories, it can be seen that the only group that significantly increased its use of eye exams in 2002-03 is the last group: post-secondary graduation. All other three groups have decreased their usage. And finally, age groups' utilization of eye exams shows a specific pattern: individuals aged over 50 increased their usage in 2002-03 compared to 1996-07.

Table 1: Data Comparisons over 1996/97 and 2002/03

	1996-97		2002-03	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Any optometry visit (Eye)	0.51	0.91	0.59	0.97
Eyevisit01*	0.39	0.49	0.44	0.496
Number of optometry visits conditional on going	1.03	1.04	1.34	1.07
Percent male	48.2		46.7	
Percent Married	41		46.6	
Percent in Income Categories:				
Less than 15k	7.3		8.4	
Between 15 & 30 k	17.3		16.0	
Between 30 & 50 k	26.2		21.6	
Between 50 & 80 k	31.6		26.3	
More than 80 k	17.7		27.7	
Percent in Education Attainments:				
Less than secondary	30.7		12.2	
Secondary graduation	14.6		14.7	
Other post secondary	33.4		6.1	
Post secondary graduation	21.2		67.0	
Percent in Heath Status:				
Poor	2.3		3.3	
Fair	7.2		10.7	
Good	25.8		30.5	
Very good	36.1		34.9	
Percent in five age categories				
Less than 20	6.1		5.1	
20-34	23.4		18.1	
33-49	32.8		25.7	
49-64	21.1		23.5	
65+	16.6		27.6	

*A dummy variable takes the value 1 when the respondent has visited the optometrist at least once, 0 otherwise.

Source: author's calculation

3. Methodology

The specifications used for this paper are based on the models proposed by Stabile and Ward (2006) and Duan et al. (1983) for the demand for medical care. However, one major difference is that we analyze and compare the results of two cross section datasets, while their approach is based on panel data.

We use two approaches in estimating the effect of changing eye exam coverage on the use of the services of optometrists: 1) ordinary regression and 2) probit regression which is appropriate for the case under which the dependent variable is a binary variable. Regarding the dependent variable, we take the number of eye visits (including zeros visits) in our first model and in the second model we distinguish between having and not having eye exams at all, i.e. zero or one. Under the latter case, we define a binary variable taking the value of 1 for those who visited an optometrist at least once and taking the value of zero for those who did not have any eye exam during the survey year.

Both of these models will be examined for the whole population over 11years old. The models that we estimate for examining the possible effect of decreasing the coverage of eye exams in the basket of "medically necessary" services are as follows:

$$\upsilon_{it} = \alpha + \beta X_{it} + \varphi Z_{it} + \varepsilon_{it} \qquad (1)$$

$$D\upsilon_{it} = \alpha + \beta X_{it} + \varphi Z_{it} + \varepsilon_{it} \qquad (2)$$

Where;

$\upsilon_{it} \equiv$ Number of visits by individual i, at year t (t is year for 1996-7, and 2002-3).

$D\upsilon_{it} \equiv$ A binary variable, where D takes on the value of 1 if individual i has had at least one eye exam, 0 otherwise.

X_{it} ≡ The individual characteristics at year t, including age, gender, marital status and level of education attained.[10]

Z_{it} ≡ The health-related characteristics, i.e. Health Descriptive Index (HDI).

ε_{it} ≡ error term.

The above regressions are estimated for two periods, 1996-97 and 2002-03. We are interested in possible structural changes in eye exam usage among various ages, incomes and gender groups, as well as among individuals with different levels of health status.

Equation (1) is estimated using standard OLS[11], while equation (2) is estimated by a probit model. Appendix table A.2.1 presents the description for the variables included in our models.

4. Results

The results of the regressions on number of visits are shown in Tables 3 and 4 and the results of the probit model are shown in Table 5. We conducted a heteroskedasticity test for both the OLS models of 1997 and 2003, using the Breusch-Pagan-Godfrey test and the Koenker version of the Berush-Pagan test. Both tests, as can be seen in Table 2, reject the null hypothesis homoskedastic error terms. Therefore, in the OLS regressions, we corrected the standard errors of the coefficients for heteroskedasticity using White's method.

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[10] Of course, having eye exam insurance can affect the demand for optometrist visits. However, we have not included having eye exam insurance, because the only available information on insurance in both NPHS and CCHS surveys is the existence of "having insurance covering cost of eye glasses" and not eye exams.

[11] Due to the particular nature of the number of eye exams as an integer value, we also ran the regression using the Negative Binomial approach (see Appendix Table A.3.1). The Negative Binomial results of both 1996-97 and 2002-03 are completely consistent with the OLS results.

We present our results by comparing the pattern of utilization among various groups for the two periods. Since the policy implications of the results of the model for individuals with different levels of income and health status are more important than other demographic characteristics, we focus our attention to those two categories.

Table 2: Heteroskedasticity test statistic values of the OLS regressions

	BPG test	Koenker version of BPG test
1997 regression	1641.74	67.29
2003 regression	5215.83	247.46

4.1. OLS results

As the results in Table 3 on the female dummy variable show, in both periods, females used more eye exams than males, and the difference in utilization is highly significant. In both periods, married individuals had a smaller number of visits than the non-married ones with a significant difference (for 1996-7 regression the difference is significant at 10% level of confidence). The magnitudes for the coefficients of the two periods are very close.

The reference group for the educational categories is less than secondary. As the results show, there is no change in the pattern of eye exam visits between the two periods. In both periods, individuals with secondary graduation used less eye exams, while those with other post secondary and post secondary graduation used more than the reference group. However, these results are not statistically significant. Among the various educational groups, the difference between the post-secondary graduations from the reference group is the only significant category for both periods. In other words, only the

category of post-secondary graduations has used more eye exams than the reference group significantly in both the 1996-07 and 2002-03 periods.

Individuals aged less than 20 are the reference group for age categories. The results for 1996-97 show that all other age categories used more eye exams than the reference group. However, only individuals aged more than 50 have a significant different usage than the reference group. For the 2002-03 period, there is an obvious change in the pattern of eye exam utilization such that the age groups of 20-35 and 35-50 years have decreased and those aged more than 50 have increased their usage compared to the reference group. The differences for all categories compared to reference group are significant except for ages 50-64 for this period.

Health status

Individuals with poor health are the reference category in both periods. Therefore the results on fair, good, very good and excellent health status should be compared to the poor health status.

In 1996-97, only individuals with fair health status had less eye visits than the reference group, while the other three groups, good, very good and excellent health groups, used more eye visits, even though the differences are not significant. On the other hand, in 2002-03, individuals with poor health have significantly increased their usage of eye visits compared to all other groups. The healthier the individuals are, the less use of eye exam they had in 2002-03. This result may appear contrary to the prediction of de-listing of the service that people with poor health are affected more. One explanation could be the non-elastic nature of demand for eye exams for individuals with poor health. To put it simply, an individual with poor health does not have any other possible

substitute to the eye exam. However, this explanation is based on the assumption of a strong correlation between the health status and eye problems: individuals with poor health status have eye problems as well. Maybe they are more likely to have eye problems. These could be side effects of medication, for example.

Income groups

An income level of less than 15,000 dollars is the reference for income groups. For 1996-97, only individuals with an income of $50,000-80,000 used more eye exams than the reference group, while the other income groups used less eye exams, but none of the differences are significant. For 2002-03, all income groups have had significantly more eye exams than the reference group. In other words, after implementing the policy change of reducing coverage of eye exams, individuals with higher levels of income had significantly more eye exams than individuals with lower levels of income. As can be seen, first of all, the coefficients for income groups are increasing with the income level, and second, the differences are significant. This result is consistent with the finding of Stabile and Ward (2006) and their explanation on easiness of shortage for some health services after de-listing and demanding more by the more needy affordable individuals.

The results from income groups imply that the coverage change for eye exams hit hardest the individuals with the lowest levels of income. From the policy implication point of view, this policy can be considered as having harmful effects. In other words, targeting the whole population (and not based on their affordability to pay) may not be a good policy.

Table 3: OLS results, with standard errors corrected for heteroscedasticity, of the number of optometrist consultations

	1996-97		2002-03	
	Coeff.	t-statistics	Coeff.	t-statistics
Female	0.118616	6.03	0.124071	12.45
Married	-0.05545	-1.88	-0.05435	-4.65
HDI				
Poor	**Reference**			
Fair	-0.00705	-0.08	-0.09818	-2.09
Good	0.027806	0.34	-0.15992	-3.59
Very good	0.025568	0.31	-0.20445	-4.62
Excellent	0.038489	0.47	-0.23592	-5.28
Income				
Less than 15k	**Reference**			
Between 15 & 30 k	-0.03195	-0.57	0.066371	2.82
Between 30 & 50 k	-0.01767	-0.33	0.088481	3.99
Between 50 & 80 k	0.008575	0.17	0.141767	6.34
More than 80 k	-0.02976	-0.58	0.161965	7.29
Education				
less than secondary	**Reference**			
Secondary graduation	-0.03583	-1.11	-0.01888	-0.88
Other post secondary	0.021088	0.69	0.021078	0.81
Post secondary graduation	0.082328	2.46	0.05655	2.96
Age				
Less than 20	**Reference**			
20 to 34	0.027869	0.81	-0.08673	-4.32
35 to 49	0.048557	1.09	-0.13327	-6.52
50 to 64	0.266457	5.34	0.02242	1.06
65 and more	0.509501	9.57	0.384092	16.52
Constant	0.287157	3.06	0.518898	10.07
# of observations	**8095**		**35796**	
R-square	**0.0432**		**0.0514**	

In Table 4 we re-estimated the model separately for men and women, again with standard errors corrected for possible heteroskedasticity in the error terms. As can be observed, the results for men and women are similar. However, a striking difference is in regard to the income levels. Women in all income categories in 1996-97 used less optometry services compared to women with less than $15,000, but the differences are

not significant. But in 2002-03, all of them increased their use of optometry services significantly compared to the reference group, or alternatively, the reference group has decreased its use of eye exam services compared to the all other higher levels of incomes after the policy change. For men, the coefficients for the income groups in 2002-03 are smaller than those for women. This suggests that low income women were more affected by the policy change than their male counterparts.

Regarding the health status results, as can be observed all female and male users did not have a significantly different pattern (at 10% percent confidence level) from the reference group in 1996-97, while in 2002-03, except for females with fair health status, all other categories for male and female show a significant decrease in their usage of eye visits.

Table 4: OLS result of the number of optometrist consultations, male and female (standard errors corrected for heteroscedasticity)

	1996-97				2002-03			
	Male		Female		Male		Female	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff	t-stat.	Coeff.	t-stat.
Married	-0.068	-1.39	-0.036	-0.95	0.004	0.22	-0.096	-5.57
HDI								
Poor	**Reference**							
Fair	-0.108	-0.67	0.083	0.97	-0.142	-2.00	-0.067	-1.07
Good	-0.093	-0.60	0.137	1.77	-0.209	-3.12	-0.123	-2.07
Very good	-0.084	-0.54	0.124	1.64	-0.254	-3.82	-0.168	-2.84
Excellent	-0.064	-0.41	0.131	1.71	-0.243	-3.62	-0.240	-4.01
Income								
Less than 15k	**Reference**							
Between 15 & 30 k	0.042	0.63	-0.083	-1.08	0.014	0.37	0.094	3.13
Between 30 & 50 k	0.022	0.37	-0.038	-0.50	0.051	1.41	0.113	3.90
Between 50 & 80 k	0.061	1.06	-0.025	-0.34	0.092	2.65	0.180	5.93
More than 80 k	-0.004	-0.07	-0.036	-0.48	0.110	3.22	0.201	6.59
Education								
less than secondary	**Reference**							
Secondary graduation	-0.020	-0.44	-0.049	-1.06	-0.007	-0.22	-0.033	-1.12
Other post secondary	0.018	0.44	0.027	0.58	-0.014	-0.41	0.047	1.24
Post secondary graduation	0.086	1.99	0.086	1.67	0.046	1.68	0.061	2.28
Age								
Less than 20	**Reference**							
20 to 34	-0.006	-0.13	0.069	1.36	-0.106	-3.81	-0.061	-2.09
35 to 49	-0.019	-0.29	0.118	1.87	-0.203	-7.28	-0.068	-2.27
50 to 64	0.212	2.87	0.326	4.64	-0.041	-1.41	0.079	2.58
Age 64+	0.432	5.72	0.594	7.88	0.303	9.22	0.447	13.66
Constant	0.409	2.60	0.263	2.57	0.635	7.78	0.553	8.41
Number of Obs.	3898		4197		16721		19075	
R-square	0.038		0.041		0.049		0.047	

4.2. Probit results

The results on probit coefficients are shown in Table 5 below. They indicate that females have a higher probability of having at least one eye visit than men in 2002-03 and in 1996-97 significantly. For 1996-97, the difference in probability of having at least

one visit between married and not-married individuals is not significant, while this difference is significant in 2002-03. However, in the 2002-03 period, married individuals have decreased their probability of having eye visits significantly.

In 1996-97, the individuals in other post secondary and post secondary graduation categories had a significantly higher probability of having at least one eye exam. For 2002-03, only the last category of education, i.e. post secondary graduation, shows a significant the higher probability than the reference group.

Age categories for the 1996-97 results show that except for individuals aged 20-35 all other categories have had significant difference in terms of their probability of having at least one eye visit. For this period, individuals aged 20-50 had a smaller probability and individuals age above 50 had a higher probability than the reference group of having at least one eye exam. This pattern makes sense totally because as the individuals get older they are more prone to eye problems.

For the 2002-03 period, the pattern changes considerably; only individuals aged more than 65 have a significantly higher probability of having an eye visit than the reference group. However, as we mentioned before, this group has been excluded from the coverage change of the eye exam. All other categories, except 50-64, have decreased the probability of having at least one eye visit exam than the reference group.

Health status

The probability of having at least one eye visit does not show any significant difference among various health categories for both periods. In the 1996-97 period, all categories had higher probability of having an eye exam than the reference group (poor health status); however, all the differences are insignificant. For 2002-03, the good, very

good and excellent categories decreased the probability of having an eye visit, with a significant effect only for the *excellent* category. The increase in probability for the fair category is not significant for this period.

Income groups

A specific pattern can be observed for the income categories in both periods. Even though all income groups had higher probability of having an eye exam than the reference group (less than $15,000), the differences are not significant for 1996-97. However, the probability of having eye exams increased significantly for all income categories without exception in 2002-03. This pattern indicates again that the low income group has suffered from this policy, as we saw previously in our OLS results.

Table 5: Probit model of use or not eye visit

	1996-97		2002-03	
	Coeff.	t-statistics	Coeff.	t-statistics
Female	0.218686	7.57	0.204613	14.87
Married	0.002033	0.06	-0.06598	-4.15
HDI				
Poor	**Reference**			
Fair	0.125699	1.15	0.007489	0.18
Good	0.176157	1.77	-0.04322	-1.09
Very good	0.130872	1.33	-0.0521	-1.31
Excellent	0.153216	1.55	-0.1018	-2.47
Income				
Less than 15k	**Reference**			
Between 15 & 30 k	0.032234	0.50	0.099893	3.40
Between 30 & 50 k	0.061592	0.99	0.145889	4.99
Between 50 & 80 k	0.109296	1.76	0.22982	7.73
More than 80 k	0.075191	1.12	0.293277	9.59
Education				
Less than secondary	**Reference**			
Secondary graduation	-0.00055	-0.01	-0.02287	-0.83
Other post secondary	0.100073	2.51	0.010976	0.31
Post secondary graduation	0.177192	3.95	0.099079	4.16
Age				
Less than 20	**Reference**			
20 to 34	-0.10026	-1.43	-0.24718	-7.30
35 to 49	-0.15545	-2.04	-0.3433	-10.01
50 to 64	0.27996	3.63	-0.03092	-0.90
65 and more	0.487794	6.40	0.439357	12.60
Constant	-0.74616	-5.97	-0.42236	-7.66
Log Likelihood	**-5238**		**-23462**	
LR Chi2 (17)	**373**		**2123**	
# of observations	**8095**		**35796**	
Pseudo R-square	**0.0344**		**0.0433**	

Marginal effects

Since probit models are nonlinear, their estimated coefficients are difficult to interpret[12]. Table 6 below presents the calculated marginal effects of the probit model for both years 1997 and 2003 at the means of the independent variables of the equation.

[12] I am grateful to Professor Kathleen Day for this valuable comment.

These marginal effects measure the change in the probability of visiting an eye doctor when each dummy variable changes from 0 to 1. Based on the marginal effect calculated from the model in table 6, it can be observed that the probability of visiting an eye doctor increases by 1.1% and 1.4% for female and married people respectively for the 1996-7 regression. This probability for 2002-3 is much lower at 0.54% and 0.63%. Regarding marginal effects for various levels of Health Description Index (HDI), it can be observed that the probability of visiting an eye doctor for individuals for excellent health compared to the poor health for 2002-3 increases by 1.6%; this is the only significant category for the HDI. Also, the marginal effects for income categories show that the probability of visiting an eye doctor increases by 1.17%, 1.16%, 1.18%, and 1.21% for 2002-3 respectively for income 15000- 30000, 30000- 50000, 50000-80000 and more than 80000. However, the result for 1996-7 is not significant. Regarding education levels, other post secondary and post secondary graduation increase the probability of visiting an eye doctor by 1.5 and 1.7 % for 1996-7. For 2002-3 only post secondary has a significant impact which increases probability of visiting an eye doctor by 0.9 %. Finally, for the age categories, the results for 1996-7 show that categories 35-49, 50-56 and 65 and more increase the probability of visiting an eye doctor by 2.86%, 3.04% and 3% respectively. However, the result for 2002-3 suggests that the probability of visiting an eye doctor for age categories 20-34, 35- 49, and 65 and more is increased by 1.28, 1.28 and 1.36%, respectively.

Table 6: Marginal effect of Probit model of use or not eye visit

	1996-97		2002-03	
	Marginal effect	t-statistics	Marginal effect	t-statistics
Female	0.01101	7.57	0.00537	14.94
Married	0.01416	0.06	0.00626	-4.15
HDI				
Poor	**Reference**			
Fair	0.04304	1.15	0.0168	0.18
Good	0.03882	1.77	0.0156	-1.09
Very good	0.03802	1.33	0.01565	-1.31
Excellent	0.03854	1.55	0.01604	-2.48
Income				
Less than 15k	**Reference**			
Between 15 & 30 k	0.02484	0.50	0.01167	3.38
Between 30 & 50 k	0.02414	0.99	0.01161	4.97
Between 50 & 80 k	0.02408	1.76	0.01178	7.72
More than 80 k	0.02606	1.12	0.0121	9.59
Education				
Less than secondary	**Reference**			
Secondary graduation	0.01871	-0.01	0.01076	-0.84
Other post secondary	0.01538	2.51	0.01374	0.31
Post secondary graduation	0.01754	3.95	0.00931	4.17
Age				
Less than 20	**Reference**			
20 to 34	0.02637	-1.43	0.01276	-7.48
35 to 49	0.02862	-2.04	0.0128	-10.32
50 to 64	0.03036	3.63	0.01353	-0.9
65 and more	0.02992	6.40	0.01364	12.72
y = Pr(eyevisit01)	**0.38968726**		**0.43410309**	
# of observations	**8095**		**35796**	

Table 7 compares the results of the OLS and Probit models (Tables 3 and 5). For 1996-97, in terms of significance, a very different pattern can be observed for income groups, while there is no difference both in sign and significance for 2002-03. This pattern is true for the *married* variable as well for both years. However, for health status,

the year 2002-03 shows differences for the three levels even in sign, significance or both of them.

The education and sex variables are those with no difference at all for both years in terms of sign and significance. For the age levels, in 1996-97, there is a difference in sign for the "20-34" category, and in significance and sign for the "35-49" category. However, for 2002-03, a difference in significance for the "20-34" category and in sign and significance for the "50-64" category can be observed. Overall, the results are consistent. They do not contradict each other.

Table5: Comparing the results of OLS and Probit models for 1996-97 and 2002-03

	1996/97		2002/03	
	OLS	Probit	OLS	Probit
Female	No difference		No difference	
Married	- (significant)*	+ (insignificant)	No difference	
HDI				
Poor	**Reference**			
Fair	- (insignificant)	+ (insignificant)	- (significant)	+ (insignificant)
Good	No difference		- (significant)	- (insignificant)
Very good			- (significant)	- (insignificant)
Excellent			No difference	
Income				
Less than 15k	**Reference**			
Between 15 & 30 k	- (insignificant)	+ (insignificant)	No difference	
Between 30 & 50 k	- (insignificant)	+ (insignificant)		
Between 50 & 80 k	No difference			
More than 80 k	- (insignificant)	+ (insignificant)		
Education				
less than secondary	**Reference**			
Secondary graduation	No difference		No difference	
Other post secondary				
Post secondary graduation				
Age				
Less than 20	**Reference**			
20 to 34	+ (insignificant)	- (insignificant)	- (insignificant)	- (significant)
35 to 49	+ (insignificant)	- (significant)	- (insignificant)	- (significant)
50 to 64	No difference		+ (insignificant)	- (insignificant)
65 and more			No difference	

*significant at 10% level of confidence.

5. Conclusion

This paper has examined the possible changes in patterns of utilization of eye exam services in Ontario following the 1998 change in public coverage for some demographic groups by using two cross-section data from the 1996-97 NPHS and the 2002-03 CCHS.

Our results show that the most significant changes in demand for eye exams have occurred for various income and health status groups. Individuals with higher levels of income and better health status have increased their use of eye exams compared to individuals with low level of income and poorer health situation. From the standpoint of policy analysis, these changes in pattern of usage work against the main objectives of public health care system for which the target population of the public system is those with poorer heath and less income. The aforementioned patterns are true for the two specifications of the number of visits and the use of the service.

Separate modeling for men and women also indicates that the policy change hit harder the female users that male users. The pattern of use for optometry services changed considerably for women and the most striking change happened to women with different income levels. Policy change has reduced the usage of eye exam for women with low level of income, specifically less than $15,000, compared to all other income groups.

If we were to draw conclusions merely on the impacts of this policy change, we would rate this policy as poor and requiring more attention on the part of the government in this regard. However we do not know if eye health has deteriorated as a result of the policy change. More research needs to be done on that topic.

Appendices:

Appendix 1: Variable categories for the two surveys (1996-97 NPHS and 2002-03 CCHS)

Table A.1.1: Income categories for the two surveys

Assigned numbers	1996-97	2002-03
1	No income	No income
2	Less than 5000	15000-29999
3	5000-9999	30000-49999
4	10000-14999	50000-79999
5	15000-19999	More than 80000
6	20000-29999	
7	30000-39999	
8	40000-49999	
9	50000-59999	
10	60000-79999	
11	More than 80000	
99	Not stated	

TableA.1. 2: Age groups for the two surveys

Assigned numbers	1996-97	2002-03
1	0-3	12-14
2	4-5	15-19
3	6-9	20-24
4	10-11	25-29
5	12-14	30-34
6	15-19	35-39
7	20-24	40-44
8	25-29	45-49
9	30-34	50-54
10	35-39	55-59
11	40-44	60-64
12	45-49	65-69
13	50-54	70-74
14	55-59	75-79
15	60-64	80+
16	65-69	
17	70-74	
18	75-79	
19	80+	
96	Not applicable.	
97		Don't know
98		Refusal
99	Not stated	

Table A.1.3: Marital status for the two surveys

Assigned numbers	1996-97	2002-03
1	Married- Common- law partner	Married
2	Single	Common- law
3	Sep/wid/div	Sep/wid/div
4		Single/Never married
6		Not applicable
7		Don't know
8		Refusal
9	Not stated	Not stated

Table A.1.4: Education categories for the two surveys

Assigned numbers	1996-97	2002-03
1	NO SCH/SOME SEC	< THAN SECONDARY
2	SECONDARY GRAD	SECONDARY GRAD
3	OTHER POST-SEC	OTHER POST-SEC.
4	D/C-C C/TR/CÉGEP	POST-SEC. GRAD.
5	SOME UNIVERSITY	
6	BACHELOR	NOT APPLICABLE
7	MASTER/PHD/MÉD.	DON'T KNOW
8		REFUSAL
9		NOT STATED
96	NOT APPLICABLE	
99	Not stated	

Appendix 2: Definition of variables and distributions of eye exams

Table A.2.1: Definition of variables

Variables	Description
Dependent variables	
eye	Number of eye visit
eyevisit01	Binary variable, 1 for having any visit, 0 for not having any visit
Independent variables	
Male	Dummy variable, 1 if male, 0 if female
Married	Dummy variable, 1 if married, 0 otherwise
HDI (Health Descriptive index)	
Poor	Dummy variable, 1 if poor health, 0 otherwise
Fair	Dummy variable, 1 if fair health, 0 otherwise
Good	Dummy variable, 1 if good health, 0 otherwise
Very good	Dummy variable, 1 if very good health, 0 otherwise
Excellent	Dummy variable, 1 if excellent health, 0 otherwise
Income	
Less than 15k	Dummy variable, 1 if income less than 15k, 0 otherwise
Between 15k and 30k	Dummy variable, 1 if income between 15 and 30k, 0 otherwise
Between 30k and 49k	Dummy variable, 1 if income between 30 and 50k, 0 otherwise
Between 50k and 80k	Dummy variable, 1 if income between 50 and 80k, 0 otherwise
More than 80k	Dummy variable, 1 if income more than 80k, 0 otherwise
Education	
Less than secondary	Dummy variable, 1 if education level less than secondary, 0 otherwise
Secondary graduation	Dummy variable, 1 if education level is secondary graduation, 0 otherwise
Other post secondary	Dummy variable, 1 if education level is other post secondary, 0 otherwise
Post secondary graduation	Dummy variable, 1 if education level is post secondary graduation, 0 otherwise
Age	
Less than 20	Dummy variable, 1 if age less 20 years old, 0 otherwise
Between 20 and 34	Dummy variable, 1 if age is between 20 and 34 years old, 0 otherwise
Between 35 and 49	Dummy variable, 1 if age is between 35 and 49 years old, 0 otherwise
Between 50 and 64	Dummy variable, 1 if age is between 50 and 64 years old, 0 otherwise
64+	Dummy variable, 1 if age is more than 64 years old, 0 otherwise

Table A.2.2: Number of eye visits per year

Assigned numbers	1996-97		2002-03	
	Number of visits frequency	Percentage of total	Number of visits frequency	Percentage of total
0	5,310	60.83	24,021	56.26
1	2,882	33.02	15,286	35.80
2	336	3.85	2,183	5.11
3	97	1.11	557	1.30
4	35	0.40	293	0.69
5	26	0.30	98	0.23
6	15	0.17	118	0.28
7	8	0.09	13	0.03
8	3	0.03	34	0.08
9	3	0.03	7	0.02
10	1	0.01	31	0.07
11	0	0.00	1	0.00
12	13	0.15	55	0.13
Total	8,729	100	42,697	100

Table A.2.3: Distribution of eye visits by income group and year

Assigned numbers	Less than 15k		Between 15 & 30 k		Between 30 & 50 k		Between 50 & 80 k		More than 80 k	
	1996-97	2002-03	1996-97	2002-03	1996-97	2002-03	1996-97	2002-03	1996-97	2002-03
0	60.2	57.51	58.70	52.50	61.85	56.28	60.64	57.12	61.16	57.48
1	30.7	32.75	33	36.75	32.93	35.36	34.35	35.95	33.17	36.39
2	5.41	6.42	5.01	6.51	3.15	5.36	3.01	4.39	4.27	4.18
3	1.53	1.61	1.65	2.08	0.94	1.35	0.90	0.98	0.84	0.97
4	0.51	0.80	0.64	0.99	0.28	0.79	0.39	0.61	0.28	0.48
5	0.51	0.27	0.43	0.33	0.28	0.28	0.27	0.24	0.14	0.09
6	0.34	0.20	0.21	0.35	0.24	0.26	0.12	0.35	0.07	0.19
7	0.17	0.07	0.14	0.07	0.05	0.01	0.12	0.05	0.07	0.00
8	0.00	0.07	0.07	0.14	0.05	0.09	0.04	0.05	0	0.06
9	0.34	0.00	0.00	0.00	0.05	0.00	0.00	0.03	0	0.01
10	0.00	0.13	0.00	0.10	0.05	0.08	0.00	0.06	0	0.06
11	0	0.00	0	0.00	0	0.00	0	0.01	0	0.00
12	0.34	0.17	0.14	0.17	0.14	0.14	0.16	0.14	0	0.08
Total	100	100	100	100	100	100	100	100	100	100

Table A.2.4: Distribution of eye visits by education group and year

Assigned numbers	less than secondary		Secondary graduation		Other post secondary		Post secondary graduation	
	1996-97	2002-03	1996-97	2002-03	1996-97	2002-03	1996-97	2002-03
0	62.02	50.92	63.48	59.05	60.24	59.49	57.51	56.44
1	31.83	37.46	31.02	33.49	34.11	32.23	35.56	36.34
2	3.46	7.08	3.80	5.15	3.58	5.33	4.60	4.63
3	1.33	1.99	0.76	1.10	1.00	1.33	1.05	1.19
4	0.44	1.26	0.25	0.51	0.37	0.83	0.47	0.62
5	0.36	0.34	0.42	0.17	0.22	0.32	0.23	0.21
6	0.08	0.48	0.17	0.19	0.22	0.28	0.23	0.25
7	0.12	0.05	0.08	0.02	0.07	0.05	0.12	0.03
8	0.08	0.11	0.00	0.06	0.00	0.00	0.06	0.08
9	0.04	0.00	0.00	0.02	0.04	0.00	0.06	0.01
10	0.00	0.11	0.00	0.10	0.04	0.00	0.00	0.08
11	0	0.00	0	0.00	0	0.00	0	0.00
12	0.24	0.21	0.00	0.13	0.11	0.14	0.12	0.12
Total	100	100	100	100	100	100	100	100

Table A.2.5: Distribution of eye visits by marital status and year

	Married		Non-married	
Assigned numbers	1996-97	2002-03	1996-97	2002-03
0	62.79	56.01	59.22	56.62
1	31.02	35.37	34.82	36.19
2	3.71	5.70	3.85	4.48
3	1.18	1.44	1.00	1.14
4	0.42	0.65	0.38	0.73
5	0.33	0.23	0.27	0.22
6	0.18	0.26	0.17	0.29
7	0.06	0.05	0.13	0.02
8	0.03	0.07	0.04	0.09
9	0.03	0.00	0.04	0.02
10	0.03	0.09	0.00	0.07
11	0	0.01	0	0.00
12	0.21	0.14	0.08	0.13
Total	100	100	100	100

Table A.2.6: Distribution of eye visits by health status (HDI) and year

Assigned numbers	Poor		Fair		Good		Very good		Excellent	
	1996-97	2002-03	1996-97	2002-03	1996-97	2002-03	1996-97	2002-03	1996-97	2002-03
0	65.96	50.09	60.86	50.03	59.17	55.53	61.43	57.29	60.62	60.18
1	28.72	35.25	33.79	37.98	35.18	35.65	32.79	35.96	32.38	34.75
2	2.66	7.89	3.79	7.29	3.54	5.59	3.66	4.54	4.27	3.48
3	0.53	2.57	0.34	2.03	0.91	1.46	1.03	1.10	1.51	0.73
4	1.06	1.80	0.00	1.17	0.62	0.81	0.27	0.54	0.39	0.35
5	0.53	0.60	0.69	0.47	0.24	0.23	0.17	0.20	0.39	0.08
6	0.00	0.60	0.17	0.39	0.05	0.33	0.24	0.21	0.22	0.19
7	0.00	0.09	0.34	0.08	0.05	0.04	0.14	0.02	0.04	0.01
8	0.00	0.26	0.00	0.05	0.05	0.14	0.03	0.04	0.04	0.04
9	0.00	0.00	0.00	0.03	0.05	0.00	0.00	0.02	0.09	0.01
10	0.00	0.17	0.00	0.23	0.00	0.09	0.03	0.02	0.00	0.07
11	0	0.00	0	0.00	0	0.00	0	0.00	0	0.01
12	0.53	0.69	0.00	0.26	0.14	0.15	0.21	0.06	0.04	0.08
Total	100	100	100	100	100	100	100	100	100	100

Appendix 3:

Table A.3.1.: Negative Binomial results of the number of optometrist consultations

	1996-97		2002-03	
	Coeff.	t-statistics	Coeff.	t-statistics
Female	0.237647	6.78	0.218997	13.92
Married	-0.08355	-1.93	-0.08582	-4.81
HDI				
Poor	**Reference**			
Fair	-0.01587	-0.12	-0.13063	-3.1
Good	0.053469	0.45	-0.21738	-5.52
Very good	0.053581	0.45	-0.29098	-7.33
Excellent	0.077185	0.65	-0.35171	-8.4
Income				
Less than 15k	**Reference**			
Between 15 & 30 k	-0.03924	-0.54	0.108597	3.37
Between 30 & 50 k	-0.01446	-0.2	0.145951	4.46
Between 50 & 80 k	0.04134	0.57	0.24059	7.17
More than 80 k	-0.0351	-0.44	0.287191	8.23
Education				
Less than secondary	**Reference**			
Secondary graduation	-0.07448	-1.26	-0.05252	-1.76
Other post secondary	0.039273	0.84	0.017213	0.44
Post secondary graduation	0.164103	3.11	0.08458	3.34
Age				
Less than 20	**Reference**			
20 to 34	0.07064	0.75	-0.18082	-4.49
35 to 49	0.094649	0.95	-0.30419	-7.46
50 to 64	0.536609	5.4	0.035848	0.89
65 and more	0.880986	9.12	0.555703	14.02
Constant	-1.19706	-7.76	-0.70919	-12.02
Log Likelihood	**-7571**		**-35892**	
LR Chi2 (17)	**422**		**2277**	
Number of Obs.	**8095**		**35796**	
Pseudo R-square	**0.027**		**0.0307**	

Appendix 4: OHIP Document describing the change in coverage

Beginning on April 1, 1998, OHIP will pay for one periodic eye examination per patient, once every two years for people aged 20 to 64, and annually for those under age 20 and age 65 and older. This applies whether an optometrist or physician performs the periodic eye examination.

For adults between the age of 20 and 64, an additional periodic eye examination is covered after one year if disease or trauma has caused significant change in vision.

All medically necessary eye examinations continue to be insured regardless of age or frequency. For example, treatments for infection, disease and injury are not affected by this change.

What is changing?

Beginning April 1, 1998, your optometrist or physician will be able to obtain information from the Ministry of Health on the date of your last periodic eye examination. This will assist him or her in determining if your current service will be paid for by OHIP.

What is not covered?

Patients who wish periodic eye examinations which are not eligible for OHIP coverage will be billed directly by the optometrist or physician. Additional fees may apply for other uninsured services, such as contact lens assessments.

In some cases, third party coverage from private insurance companies may repay the patient or pay for the services directly. Health care providers can identify the services that will not be paid by OHIP.

Source :http://www.health.gov.on.ca/english/public/pub/pub_menus/pub_ohip.html

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