

**Economic Valuation of Air Quality
in the Regional Municipality of
Hamilton-Wentworth**

R. Andrew Muller, Ph.D.
Alan A. Diener, M.A.

Dept. of Economics, McMaster University
Hamilton, Ontario, Canada
L8S 4M4

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1. Introduction

Air pollution in Hamilton-Wentworth is responsible for several diverse negative effects. It has been established that air pollution can affect human health (2,6). These health effects include increased hospital admissions due to the exacerbation of cardiac and respiratory diseases, as well as increased mortality. As well as adverse health effects, air pollution in the Region of Hamilton-Wentworth is blamed for bad odour, particulate deposition (black fallout), and poor visibility. In evaluating any policy that would reduce air pollution, it is useful to compare the policy's costs to its benefits expressed in monetary units. Since there is no market available that places values on the benefits of improved air quality, we must undertake non-market valuation methods.

In this paper we used a stated preference method known as Choice experiments (CE) are one such method. In a choice experiment respondents are asked to rank well-defined alternative scenarios involving air quality and a payment vehicle. Each alternative is described using various levels of the attributes of air quality. Statistical methods may then be used to infer willingness to pay for improved air quality.

The objective of this study was to ascertain both the relative importance placed by the residents of Hamilton-Wentworth on four specific attributes of air quality (health effects, bad odour, black fallout and poor visibility) and to assess their willingness to pay for well defined changes in these attributes. To accomplish this we used a mail survey to administer a choice experiment. This report summarizes the methods used in the survey and the basic results obtained. Detailed analysis of the data is left for future research.

2. Methods

2.1. Choice of Approach

The contingent valuation method (CVM) can be used to elicit people's willingness to pay for improvements in air quality resulting from a public project or policy. In a typical contingent valuation survey respondents are asked to consider a scenario describing the potential benefits of a hypothetical policy. They are then asked how much they would be willing to pay for that policy to be implemented. One of the drawbacks of the contingent valuation method is that no clear

method exists to evaluate changes in the individual components of a bundle of goods or attributes. Mitchell and Carson (12) provide a detailed review of the contingent valuation method.

The stated-preference choice experiment (CE) approach is a recently developed alternative to contingent valuation (CV) which may avoid many of the difficulties of contingent valuation studies. Choice experiments allow us to value bundles of attributes and to assess the tradeoffs amongst the attributes that individuals may be willing to make. In a CE, the status quo and a number of alternatives are described by their attributes. Respondents then rank the alternatives from most preferred to least preferred. Using appropriate statistical techniques (multinomial logit regression), one can infer from the responses an index function which best predicts the observed choices (7,11). The technique employed builds on the conjoint metric analysis methodology developed in the field of marketing by Louviere (10) and introduced into the environmental economics literature by Adamowicz and Louviere (1) and Schulze(13).

2.2. Questionnaire Design

The questionnaire used in this study appears in Appendix C. It contained three sections. The first section was intended to measure respondents' concerns about air quality relative to other social issues, to familiarize them with the air quality attributes being evaluated, and to elicit information about their past experiences with the attributes. The second section contained the choice experiment scenarios and the final section elicited demographic information. Feedback from a number of HAQI participants and faculty of McMaster University was helpful in the design of the questionnaire. Section 2.3 provides more detail on the design of the choice experiment.

2.3. Choice Experiment Scenarios

2.3.1 Air Quality Attributes

The attributes employed in questionnaire included health effects, defined as hospital admissions due to cardio-respiratory diseases and increased mortality, number of days of black fallout, number of days of bad odour and number of days of poor visibility. In order to estimate willingness to pay a fifth attribute, a change in monthly taxes or rent, was included in the

description of each alternative. We decided to use three levels of each attribute. The middle level of each attribute was based upon the current estimated level of occurrence. The other two levels were based on a one-third reduction and a one-third increase of the current levels. Table 1, extracted from the questionnaire, shows how each of these levels was defined.

Table 1: Levels of the attributes employed

Attribute	Current Situation	About One-third Better	About One-third Worse
Bad Odour	4 days of bad odour per month	3 days of bad odour per month	5 days of bad odour per month
<i>Black Fallout (BFO)</i>	3 days of black fallout per month	2 days of black fallout per month	4 days of black fallout per month
<i>Visibility</i>	3 days of poor visibility per month	2 days of poor visibility per month	4 days of poor visibility per month
Health Effects	18 extra hospital admissions per month and 2 extra deaths per month, compared to perfectly clean air	12 extra hospital admissions per month & 1 extra death per month, compared to perfectly clean air	24 extra hospital admissions per month and 3 extra deaths per month, compared to perfectly clean air

The description of the current situation was based on the following considerations.

- **Hospital Admissions:** Burnett (2) calculated the percentage of total admissions for various cardiac and respiratory diseases that would be attributable to air pollution in Ontario. Using this information along with actual data on hospital admissions in the Regional Municipality Hamilton-Wentworth (4), we inferred a base level for hospital admissions due to air pollution in the Region. Appendix B gives the details of the method used.

- **Bad Odour Days¹:** We based the estimate of bad odour days on occurrences of total reduced sulphur (TRS) at the Beach Blvd. monitoring station. The five-year average of number of days with one or more hours over 10 ppb (49 days per year) was divided by 12 and rounded off to yield an estimate of 4 bad odour days per month under the current situation.
- **Poor Visibility Days:** The estimate of poor visibility days was based on five-year average of number of days with one or more hours of the Air Pollution Index (API) being 25 or greater at the Elgin/Kelly monitoring station (14 days per year). Since these events generally only occur during the five months of April, May, June, September and October we expressed this as 3 days per month. The months of July and August may also experience poor visibility days due to factors not captured in the API. We have estimated that these summer poor visibility days occur at the same rate as the spring and summer poor visibility days and for purposes of this analysis have grouped them together.
- **High BFO days:** BFO is not monitored and the only measure which may capture BFO would be a monthly dustfall measure. Since this estimate cannot be used to ascertain the number of days of occurrences, the estimate of high BFO days was based on the number of complaints registered, with the Ministry of Environment and Energy, from the Beach strip area. The five year average of 36 days of complaints per year was divided by 12 in order to derive the estimate of 3 black fallout days per month

2.3.2 Payment Vehicle

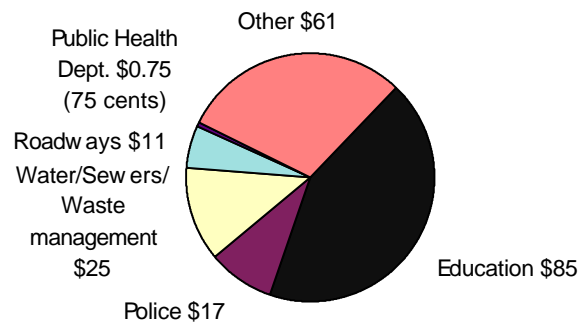
In order to assess willingness to pay, a fifth attribute, a monthly change in property taxes or rental payments was used. Each alternative specified either an increase, a decrease, or no change in monthly property taxes or rental payments. Since property taxes are used to finance

¹The methods employed in the estimation of the base levels of bad odour days, poor visibility days, and high BFO days was based on consultation with Ontario Ministry of Environment and Energy staff.

local services they were employed as the payment vehicle. Since not all respondents would be homeowners, the payment vehicle was described as a change in monthly property taxes *or* rent. In order to put the potential tax change in context, respondents were informed as to what the average household in the Region pays in property taxes on a monthly basis and the proportion of this amount that is spent on various goods and services (3,14). Figure 1, which was extracted from the questionnaire, illustrates the breakdown and the services employed.

Figure 1

Shares of Regional Taxes
Total taxes paid = \$200 per month



Sources: Regional Municipality of Hamilton-Wentworth, 1996 Budget; City of Hamilton, Current Estimates, 1996.

2.3.3. Factorial Design

There are 243 possible ways of combining three levels of five attributes to form choice scenarios. Since it was impractical to ask respondents to rank all of these, we used a one-ninth partial factorial design to choose 81 scenarios which we then divided into nine choice sets. Each choice set contained the current situation as the first choice, followed by three alternative scenarios.

In order for each respondent to face the spectrum of the tax changes employed, and in order to vary the tax levels amongst choice sets, six different versions of the questionnaire were

designed. In all other respects the questionnaires were identical. Table 2 reports the tax levels that were used in each version of the questionnaire.

Table 2: Increase or Decrease in Property Tax by Choice Set and Version

Choice Set	Version					
	A	B	C	D	E	F
1 (Q23)	\$50	\$5	\$10	\$15	\$20	\$25
2 (Q24)	\$15	\$20	\$25	\$50	\$5	\$10
3 (Q25)	\$5	\$10	\$15	\$20	\$25	\$50
4 (Q26)	\$20	\$25	\$50	\$5	\$10	\$15
5 (Q27)	\$5	\$10	\$15	\$20	\$25	\$50
6 (Q28)	\$25	\$50	\$5	\$10	\$15	\$20
7 (Q29)	\$10	\$15	\$20	\$25	\$50	\$5
8 (Q30)	\$10	\$15	\$20	\$25	\$50	\$5
9 (Q31)	\$15	\$20	\$25	\$50	\$5	\$10

The amount shown is the size of the property tax increase or decrease specified in each case. For example, question 23 of version B (shown in this appendix) contains either an increase or decrease of \$5 as the tax change.

2.4. Pilot studies

Two pilot studies were undertaken. In the first, we mailed 30 questionnaires to a random sample of residents in the City of Hamilton. This study demonstrated that, despite the complexity of the choice sets, we might expect a response rate of about 30%. In the second pilot study we administered the questionnaire to a sample of 189 undergraduate economic students at McMaster University. This study demonstrated the feasibility of the computational technique employed to estimate the willingness to pay for improvements in the air quality attributes. All air quality attributes and the payment vehicle were robust and strongly significant in the pilot data. The implied willingness-to-pay for a one-third reduction in health risk was about \$50 per month. A

one-third improvement in health risk was valued approximately three times as highly as a one-third improvement in odour, four times as highly as a one-third improvement in black fallout and about six times more highly than a one-third improvement in visibility. It must be noted, however, that the student sample was clearly not representative of Hamilton-Wentworth residents.

2.5. Sample selection

We decided to administer the survey by mail because the complexity of the ranking exercises made it infeasible to conduct the survey by telephone and the cost of personal interviews would have been prohibitive. We followed the first two steps of the protocol established by Dillman (5). The final version of the survey was sent to 1908 households within the Regional Municipality of Hamilton-Wentworth. The sample was randomly chosen from the regional tax assessment rolls as of December 1995. The survey packages, which included a copy of the questionnaire, a cover letter (included in Appendix C), and a prepaid return envelope, were mailed out on February 10, 1997.² Each of the six questionnaire types was mailed out to 333 residents. In order to encourage responses, we informed recipients that each respondent who returned a completed questionnaire by February 28th would be entered into a draw for one of ten \$25 gift certificates to the local department store, or mall, of their choice. One week after the initial packages were mailed out we sent out a follow-up postcard reminding those who had not yet sent in a survey to please to do so, and thanking those who already had.

3. Results

3.1 General

Of the 1,908 surveys mailed out 259 were eventually removed from the sample primarily because the recipients had moved (see Table 3). While some of the remaining sample may also

²Questionnaire types A, C, D, and E were each sent to 333 residents. Questionnaire type B was sent to 243 residents, and questionnaire type F was sent to 323 residents. Due to a clerical error, the same number of each type of questionnaires were not sent out. There were enough of each type returned such that the results were not significantly affected.

have moved or otherwise been incapable of responding, we used 1649 as the base for calculating the response rate. A total of 515 completed surveys were returned, by March 19, 1977 resulting in a response rate of 31%.

Table 3: Breakdown of entire mailout

Total questionnaires mailed out		1908
Removed from sample:		
returned undelivered/moved	246	
deceased	7	
incapable	5	
misprint	1	
Total removed from sample:		259
Sample remaining		1649
returned completed		515
response rate:		31% (515/1649)
Notes: Deceased: these were either returned unopened and marked as deceased, or phoned in by a relative after receiving the postcard Incapable: blind, mentally challenged or elderly, as informed by a relative via letter or phone call Some of the non-respondents were also likely to belong to one of the above groups.		

Section B, the ranking of the choice sets, was incomplete in 99 of the 515 returned questionnaires. The demographic profile of respondents not completing the choice sets differed from the remainder of the sample in only three respects. They were of an older average age, lower income, and lower educational attainment. Appendix A reports results for selected questions. An electronic file containing all results is submitted with this report.

3.2 General Attitudes towards Air Quality

Appendix A presents the results to selected questions from section A of the questionnaire. Air quality in Hamilton-Wentworth is perceived to be poor. Table A2 shows that the majority of the respondents (58%) thought the air quality in their neighbourhood was somewhat worse or much worse than the rest of Southern Ontario. Only 15% of the respondents thought that air quality in their neighbourhood was better than the rest of Southern Ontario. The majority of the respondents were either very concerned or extremely concerned about each of the four air quality attributes. Respondents were most concerned with health effects, with 81.2% of the respondents reporting they were very concerned or extremely concerned. Concern for the remaining attributes was also high, with 70.4%, 58.0% and 56.0% of respondents reporting they were very concerned or extremely concerned about black fallout, bad odour and poor visibility, respectively. Note that these attributes had not yet been formally defined when the questions about level of concern were posed.

When asked to compare how serious an issue they believed air quality to be in comparison to other issues most people stated that they believed the level of taxes and snow clearing were less or equally as serious an issue as air quality. On the other hand, most of the respondents stated that they believed that the level of crime, the quality of the educational system, and the level of unemployment to be equally or more serious issues than air quality.

3.3. Willingness to Pay

Using the respondents' first choices in the ranking of the choice sets, willingness to pay for a one-third improvement in each of the attributes was calculated. Some of the respondents ranked some of the choice sets in ways that violated consistency conditions. Some may have ranked an alternative that was dominated by others improperly, or they may have ranked two alternatives the same. These respondents were removed from the sample that was used to calculate willingness to pay. This sub-sample had similar characteristics to the excluded sample (see Table A1)

Table 4 provides preliminary estimates of willingness to pay for improvements in air quality (11) based on the 186 questionnaires that showed complete consistency in answering Section B. The estimates reported in Table 3 are based on McFadden's conditional logit model

(11) applied to the first ranked choices only. Additional work will be required to determine whether these estimates are sensitive to changes in functional form or the fraction of the sample analysed. The estimated model implies that respondents were willing to pay approximately \$58 per month to decrease the number of hospital admissions for cardio-respiratory diseases from 18 to 12 per month and decrease the number of extra deaths from 2 per month to one per month, \$23 per month to decrease the number of days with black fallout per month from 3 to 2, \$19 per month to decrease the number of monthly bad odour days from 4 to 3, and \$14 in order to lower the number of monthly poor visibility days from 3 to 2 per month. All of the estimated coefficients were statistically significant at conventional levels.

Although as might be expected, respondents valued improvements in health most highly, these estimates imply that respondents also place substantial value on reducing the nuisance and aesthetic effects of air pollution. The WTP for a reduction in black fallout was 40% as great as WTP for improved health effects. WTP for improved odour and visibility were less but still substantial at 33% and 25% of the value of the improvement in health effects, respectively (see Table 4).

Table 4: Willingness to Pay for Air Quality Improvements

Attribute	WTP (\$/month)	Index (health=100)
Health	\$58	100
Black fallout	\$23	40
Bad odour	\$19	33
Poor Visibility	\$14	25

4. Conclusion

Residents of Hamilton-Wentworth are generally concerned about the effects of air quality, particularly about the health effects. Most respondents believe that the air quality in the Region is somewhat worse than the rest of Southern Ontario. Respondents consistently rated health effects as their most serious concern. Black fallout, bad odours, and poor visibility were ranked second third and fourth respectively. The ranking of attributes by willingness to pay is consistent with the rankings obtained in questions 2-5 and question 21. Respondents appeared to be willing to pay between \$50 and \$13 for a one-third improvement in each of the attributes. Further research will

be required to investigate the stability of these estimates and the demographic determinants of willingness to pay for improvements in air quality. The data set developed as a result of the survey is now available for further research.

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Appendix A: Responses to Selected Questions

Table A1: Mean values of selected responses

Variable	entire sample (N= 516)	did not complete all of section B (N=99)	completed section B (N=417)	sample that committed no violations (N=186)
Q1 - air quality	3.8	3.8	3.8	3.8
Q2 - odours-concern	3.6	3.7	3.6	3.6
Q3 - bfo-concern	4.0	4.0	4.0	4.0
Q4 - visibility, concern	3.6	3.6	3.6	3.6
Q5 - health effects	4.3	4.2	4.3	4.4
Q6 - level of crime	2.2	2.4	2.2	2.2
Q7 - level of taxes	2.2	2.4	2.2	2.2
Q8 - clearing snow	2.3	2.3	2.3	2.3
Q9 - ed'n system	2.3	2.5	2.2	2.3
Q10 - unemployment	2.2	2.3	2.2	2.3
Q32 - age	52	62	50	47
Q33 - ed'n	3.5	3.0	3.6	3.9
Q36 - household size	2.8	2.3	2.9	3.0
Q39 - HC worker	1.8	1.9	1.8	1.8
Q40 - env. org.	1.8	1.8	1.8	1.8
Q41 - sex	1.5	1.6	1.5	1.6
Q42 - income	4.6	3.4	4.8	5.4
Q43 - how long lived	2.7	2.8	2.7	2.7
Q45 - own/rent	1.2	1.2	1.1	1.1
Q46 - physical activity	2.0	1.9	2.1	2.1

Table A2: Responses to selected questions in section A**
 (Numbers are the percentage of that particular response)

How would you describe the air quality in your neighbourhood compared to the rest of southern Ontario?
 (question 1)

N*	Much better than the rest of Southern Ontario	Somewhat better than the rest of Southern Ontario	The same as the rest of Southern Ontario	Somewhat worse than the rest of Southern Ontario	Much worse than the rest of Southern Ontario	Don't Know
508	2.5	12.8	18.8	41.5	16.9	6.0

How concerned are you about annoying odours/black fallout/poor visibility/health effects of air pollution in Hamilton-Wentworth? (questions 2-5)

Question	N*	Not at all concerned	A little concerned	somewhat concerned	very concerned	extremely concerned	don't know
annoying odours	511	4.3	11.8	25.0	36.0	22	0.4
black fallout	511	4.1	7.0	15.7	34.5	35.9	2.0
poor visibility	511	5.2	12.2	24.0	34.0	22.0	1.6
health effects	512	1.0	4.8	11.4	31.8	50.0	0.2

Do you think that the issue is a more serious issue, a less serious issue, or about as serious an issue as air quality (Questions 6-10)

Issue	N*	more serious issue	less serious issue	equally as serious an issue
the level of crime	509	32.4	11.2	55.0
the level of taxes	504	17.7	40.3	39.5
snow clearing	504	8.5	53.1	36.1
quality of educational system	505	28.3	16.3	53.3
level of unemployment	507	27.9	20.5	49.8

*some respondents did not answer all of the questions or may have recorded multiple responses and were excluded from these statistics

**see Appendix C (the questionnaire) for exact wording of the questions.

Appendix B: Estimation of the Health Effects

Burnett (2) examined the association of daily cardiac and respiratory admissions to 168 hospitals in Ontario with daily levels of particulate sulfates over a six year period. He found that there was an increase in cardiac admissions of 2.5% for those under 65 and 3.5% for those 65 and older and an increase respiratory admissions of 3.2% attributable to sulphate exposure. Using this information along with data on actual hospital admissions in Hamilton-Wentworth we were able to roughly estimate the number of admissions for cardiac and respiratory disease in the region attributable to sulfates. Since Burnett only considered sulfates, the actual estimate for cardiac and respiratory hospital admission attributable to all air pollution would be larger. Thus the estimate used in this analysis was a rather conservative one. The following table indicates the diseases and ICD9 codes that were used in our analysis.

Disease and associated ICD9 codes	Hospital discharges of Hamilton-Wentworth residents
<u>cardiac:</u>	
all ischemic, 410-414	3107
all other heart disease 390-398, 415-429..	1951
total cardiac	5108
<u>respiratory:</u>	
pneumonia, 480-486	961
copd, 491-496	978
asthma, 493	468
total respiratory	2407

Using Burnett's findings we were thus able to conclude that in Hamilton-Wentworth approximately 128 (2.5% of 5108) cardiac admissions and 77 (3.2% of 2407) respiratory admissions were attributable to sulfates for a total of 205 admissions. This results in 17.1 monthly admissions. However, many of the cardiac admissions would include those over the age of 65, as 3.5 % of admissions were attributable to sulfates. Due to that, and the fact that Burnett considered only sulfates the actual number for hospital admissions due to all air pollution would

be even higher. In light of that consideration, and since using an even number simplified analysis we defined the current estimate as 18 hospital admissions per month, for the purpose of the questionnaire.

Appendix C: The Cover Letter and Questionnaire

Feb 10, 1997

«NAME»
«ADDR1»
«ADDR2»
«ADDR3»«ADDR4»

Dear «NAME»:

People are concerned about many issues these days. Air quality is one of them. The governments of Hamilton-Wentworth, Ontario and Canada, together with representatives of other institutions and the general public, have undertaken the Hamilton Air Quality Initiative to study air quality in the region. On behalf of the Hamilton Air Quality Initiative, researchers at McMaster University have been asked to find out how people feel about air quality and other issues. This information is needed to help governments make good decisions. The best way to find out how people feel is to ask them. You have been selected to receive a questionnaire about *Attitudes Towards Air Quality in Hamilton-Wentworth*. Please help us by filling it in and returning it to us today.

You are one of a small number of people chosen randomly to represent all the households in the Region. We need your response so that the results will truly represent the attitudes of the citizens of Hamilton-Wentworth. Some of the questions may seem hard to answer. Please do not worry about this. Just complete the form as best you can. Every questionnaire completed and returned will improve the results of the survey.

We would like to show our appreciation for your help. If we receive your completed questionnaire by February 28, 1997, we will enter your name in a draw for one of ten \$25 gift certificates from the major department store or local shopping mall of your choice. The winner will be notified in the first week of March.

Your responses are completely confidential. The questionnaire has an identification number for administrative purposes only. Your name will never be connected to the data collected from the questionnaire.

If you have any comments about the questionnaire, please write them in the space provided on the last page of the questionnaire or on a separate piece of paper. If you have any questions about this project, please feel free to contact the Department of Economics at (905) 525-9140, extension 22765.

Yours sincerely

Andrew Muller
Professor

Attitudes Towards Air Quality in Hamilton-Wentworth

R. Andrew Muller and Alan A. Diener
Department of Economics,
McMaster University, Hamilton, Ont.
Tel: (905) 525-9140, x22765
Fax: (905) 521-8232

This survey is being conducted by McMaster University on behalf of the Hamilton Air Quality Initiative, which is a project being undertaken by the Regional, Provincial and Federal governments together with representatives from a variety of other organizations and citizens-at-large. Thank you for answering the survey.

We will be asking how the quality of the air in Hamilton-Wentworth affects you. Your participation is voluntary. If you would rather not answer a question please skip it. Your answers will be treated in strict confidence.

There are no right or wrong answers to this survey. Please answer each question the way you feel, not the way you think you ought to feel.

Section A

Q1. How would you describe the air quality in your neighbourhood compared to the rest of Southern Ontario? (Circle the number of your answer)

1	2	3	4	5	6
Much better than the rest of Southern Ontario	Somewhat better than the rest of Southern Ontario	The same as the rest of Southern Ontario	Somewhat worse than the rest of Southern Ontario	Much worse than the rest of Southern Ontario	Don't Know

Q2. How concerned are you about annoying odours due to air pollution in Hamilton-Wentworth? (Circle number)

1	2	3	4	5	6
Not at all concerned	A little concerned	Somewhat concerned	Very concerned	Extremely concerned	Don't Know

Q3. How concerned are you about black sooty material (black fallout) falling from the air in Hamilton-Wentworth? (Circle number)

1	2	3	4	5	6
Not at all concerned	A little concerned	Somewhat concerned	Very concerned	Extremely concerned	Don't Know

Q4. How concerned are you about poor visibility in Hamilton-Wentworth? (Circle number)

1	2	3	4	5	6
Not at all concerned	A little concerned	Somewhat concerned	Very concerned	Extremely concerned	Don't Know

Q5. How concerned are you about the health effects of air pollution? (Circle number)

1	2	3	4	5	6
Not at all concerned	A little concerned	Somewhat concerned	Very concerned	Extremely concerned	Don't Know

Many issues concern people these days. Some people are concerned about poor air quality. Other people are more concerned about other issues. Please indicate whether you think each of the following issues is a more serious issue than air quality, a less serious issue than air quality, or about as serious an issue as air quality.

- Q6. The level of crime: (circle the number of your answer)
1. MORE SERIOUS ISSUE THAN AIR QUALITY
 2. LESS SERIOUS ISSUE THAN AIR QUALITY
 3. EQUALLY AS SERIOUS AS AIR QUALITY
- Q7. The level of taxes: (circle number)
1. MORE SERIOUS ISSUE THAN AIR QUALITY
 2. LESS SERIOUS ISSUE THAN AIR QUALITY
 3. EQUALLY AS SERIOUS AS AIR QUALITY
- Q8. Clearing snow from and improving the paving of Regional roads: (circle number)
1. MORE SERIOUS ISSUE THAN AIR QUALITY
 2. LESS SERIOUS ISSUE THAN AIR QUALITY
 3. EQUALLY AS SERIOUS AS AIR QUALITY
- Q9. The quality of the educational system: (circle number)
1. MORE SERIOUS ISSUE THAN AIR QUALITY
 2. LESS SERIOUS ISSUE THAN AIR QUALITY
 3. EQUALLY AS SERIOUS AS AIR QUALITY
- Q10. The level of unemployment: (circle number)
1. MORE SERIOUS ISSUE THAN AIR QUALITY
 2. LESS SERIOUS ISSUE THAN AIR QUALITY
 3. EQUALLY AS SERIOUS AS AIR QUALITY

Q11. What do you consider to be the signs of good air quality?

Sometimes the air in Hamilton-Wentworth has a bad odour. People describe odours differently. Some odours are like rotten eggs, others are like coal, others are like acid. There may be other kinds of odour. Sometimes people go indoors to avoid the odour. Some areas of Hamilton-Wentworth are more affected than others.

- Q12. Have you ever experienced bad odour problems, such as those described above, in Hamilton-Wentworth? (circle number)
1. YES
 2. NO ; GO TO QUESTION 14
- Q13. If yes, how often, on average, over the past year? (circle number)
1. LESS THAN ONE DAY PER MONTH
 2. 1-3 DAYS PER MONTH
 3. 4-6 DAYS PER MONTH
 4. 7-10 DAYS PER MONTH
 5. MORE THAN 10 DAYS PER MONTH
 6. DAILY

Sometimes black sooty material falls out of the air onto outdoor furniture, houses and cars. This is often called black fallout. When there is black fallout people may have to clean their outdoor furniture and fixtures before using them. Some areas of Hamilton-Wentworth are more affected than others.

- Q14. Have you ever experienced this black fallout in Hamilton-Wentworth?
1. YES
 2. NO ; GO TO QUESTION 16
- Q15. If yes, how often (on average over the year)
1. LESS THAN ONE DAY PER MONTH
 2. 1-3 DAYS PER MONTH
 3. 4-6 DAYS PER MONTH
 4. 7-10 DAYS PER MONTH
 5. MORE THAN 10 DAYS PER MONTH
 6. DAILY

Sometimes the air in Hamilton-Wentworth is clear, sometimes it is not. At times there is a haze over the city like the one in the picture below. This poor visibility can be caused by air pollutants being trapped near the ground or by a chemical reaction in the air. Most poor visibility days occur in the spring, summer, and fall.

[NOTE: THIS SPACE IN THE SURVEY WAS OCCUPIED BY A COLOUR PHOTOGRAPHIC OF A POOR VISIBILITY DAY IN HAMILTON-WENTWORTH]

A poor visibility day in Hamilton-Wentworth

- Q16. Have you ever noticed such poor visibility days in Hamilton-Wentworth?
1. YES
 2. NO ; GO TO QUESTION 18

- Q17. If yes, how often on average? (Consider only the spring, summer and fall months)
1. LESS THAN ONE DAY PER MONTH
 2. 1-3 DAYS PER MONTH
 3. 4-6 DAYS PER MONTH
 4. 7-10 DAYS PER MONTH
 5. MORE THAN 10 DAYS PER MONTH
 6. DAILY

Poor air quality can affect health. Some effects such as headaches or sore throats are minor. Others may be more serious. Some people in Hamilton-Wentworth suffer from breathing or heart conditions. Poor air quality can make these conditions worse. When air quality is poor, some people with these conditions must go to the hospital. Some heart and lung conditions made worse by air pollution are chronic bronchitis, emphysema, asthma, angina, and heart disease. Air pollution can also lead to premature deaths among people who are already sick. Children and seniors are more sensitive to these effects.

- Q18. Do you believe the quality of air in Hamilton-Wentworth has affected your health or the health of another member of your household? (Circle answer)
1. Yes
 2. No. Go to Question 20

- Q19. If yes, how often do you notice the effects of air quality on your health or the health of another member of your household? (Circle answer)
1. LESS THAN ONE DAY PER MONTH
 2. 1-3 DAYS PER MONTH
 3. 4-6 DAYS PER MONTH
 4. 7-10 DAYS PER MONTH
 5. MORE THAN 10 DAYS PER MONTH
 6. DAILY

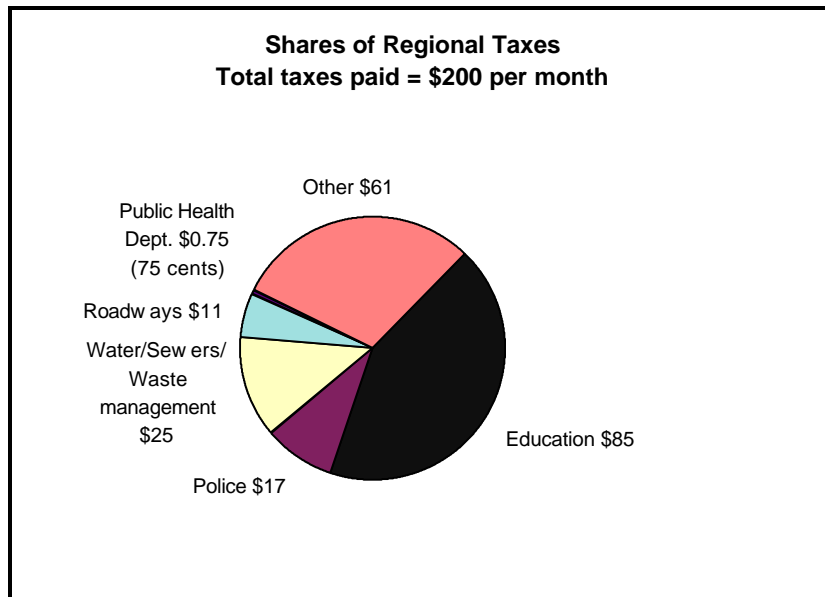
- Q20. Were you ever told by a doctor or any other health professional that you, or any of your family members, currently have any of the following lung or heart conditions? (check all that apply)

condition	you	another family member
asthma		
heart disease		
angina		
emphysema or chronic bronchitis		
any other breathing or heart disease		

Q21. We have discussed four attributes of air quality: bad odour, black fallout, poor visibility and health effects. Which is the most important to you? (Put a 1 beside it). Which is the least important to you? (put a 4 beside it) Of the remaining two attributes which concerns you the most? (Put a 2 beside it. Put a 3 beside the remaining attribute.)

- BAD ODOUR _____
- BLACK FALLOUT _____
- POOR VISIBILITY _____
- HEALTH EFFECTS _____

Property taxes collected in Hamilton-Wentworth are used to pay for many services. If you own your home you pay these taxes directly. If you rent your home your landlord uses some of your rent money to pay the taxes. In 1996, the typical household in Hamilton-Wentworth paid about \$200 per month in property taxes. Of this total, about \$85 was spent on education, about \$25 was spent on water services, sewers and waste management, about \$17 was spent on police services, about \$11 was spent on roadways, and about \$0.75 (75 cents) was spent on the Department of Public Health. (See chart below)



Q22. Some people believe property taxes are just about right, others believe that they are too high, others believe that they are too low. Do you think that property taxes are too high, too low, or about right? (Circle number)

1. TOO HIGH
2. TOO LOW
3. ABOUT RIGHT
4. DON'T KNOW

Section B

If we do nothing about pollution air quality may get worse. If we spend money to reduce pollution air quality may improve. The current level of each attribute that has been discussed in this survey is given in the table below. The following questions ask how you would balance changes in property taxes with changes in air quality. In each question, we will give you four choices. Choice A is always the current situation. Choices B, C and D are alternatives to the current situation. In each alternative, the attributes of air quality may be the same, about one-third better, or about one-third worse, than the current situation. The following chart shows what we mean.

Attribute	Current Situation	About One-third Better	About One-third Worse
Bad Odour	4 days of bad odour per month	3 days of bad odour per month	5 days of bad odour per month
Black Fallout (BFO)	3 days of black fallout per month	2 days of black fallout per month	4 days of black fallout per month
Visibility	3 days of poor visibility per month	2 days of poor visibility per month	4 days of poor visibility per month
Health Effects	18 extra hospital admissions per month and 2 extra deaths per month, compared to perfectly clean air	12 extra hospital admissions per month & 1 extra death per month, compared to perfectly clean air	24 extra hospital admissions per month and 3 extra deaths per month, compared to perfectly clean air

Reducing pollution can be expensive. Taxes may be needed to offset these costs. Therefore each alternative will also include a change in property taxes or rental payments for your entire household. Please remember that any money spent on increased taxes or rent cannot be spent on anything else. You can refer to the chart on page 7 to recall what is presently spent on some regional services.

There are nine sets of choices. For each set, we will ask which choice you like the best and which you like the least. Then we will ask which, of the remaining two choices you like the best. All of these questions deal with matters of opinion. There are no right or wrong answers and you do not have to explain any of your answers.

THESE CHOICE SETS DO NOT DESCRIBE ANY ACTUAL CHOICES FACING THE REGION OF HAMILTON-WENTWORTH RIGHT NOW. THEY ARE CONSTRUCTED ONLY TO HELP YOU TO DESCRIBE HOW YOU WOULD BALANCE THE VARIOUS ATTRIBUTES OF AIR QUALITY AND PROPERTY TAXES OR RENTAL PAYMENTS.

Q24. Choice Set 2

	State of the Environment			
Attribute	Choice A (Current Situation)	Choice B	Choice C	Choice D
Bad Odour	4 days of bad odour per month	One-third Better	One-third Better	Same as current situation
Black Fallout (BFO)	3 days of BFO per month	Same as current situation	One-third Better	One-third Worse
Poor Visibility	3 days of poor visibility per month	One-third Worse	Same as current situation	One-third Better
Health Effects	18 extra hospital admissions per month and 2 extra deaths per month, compared to perfectly clean air	Same as current situation	One-third Better	One-third Better
Monthly Property Taxes or Rent	\$200 per month for typical household	\$20 more taxes/rent	Same as current situation	\$20 less taxes/rent
Rank				

Please put a 1 under the choice you like BEST.
 Please put a 4 under the choice you like LEAST.
 Consider the remaining choices. Put a 2 under the one you like best. Put a 3 under the other one.

Q25. Choice Set 3

	State of the Environment			
Attribute	Choice A (Current Situation)	Choice B	Choice C	Choice D
Bad Odour	4 days of bad odour per month	One-third Better	Same as current situation	One-third Worse
Black Fallout (BFO)	3 days of BFO per month	One-third Worse	One-third Better	Same as current situation
Poor Visibility	3 days of poor visibility per month	Same as current situation	One-third Worse	One-third Better
Health Effects	18 extra hospital admissions per month and 2 extra deaths per month, compared to perfectly clean air	One-third Worse	One-third Better	Same as current situation
Monthly Property Taxes or Rent	\$200 per month for typical household	\$10 less taxes/rent	Same as current situation	\$10 more taxes/rent
Rank				

Please put a 1 under the choice you like BEST.
 Please put a 4 under the choice you like LEAST.
 Consider the remaining choices. Put a 2 under the one you like best. Put a 3 under the other one.

Q26 Choice Set 4

	State of the Environment			
Attribute	Choice A (Current Situation)	Choice B	Choice C	Choice D
Bad Odour	4 days of bad odour per month	Same as current situation	One-third Better	One-third Worse
Black Fallout (BFO)	3 days of BFO per month	Same as current situation	One-third Worse	Same as current situation
Poor Visibility	3 days of poor visibility per month	One-third Worse	Same as current situation	One-third Better
Health Effects	18 extra hospital admissions per month and 2 extra deaths per month, compared to perfectly clean air	Same as current situation	One-third Better	One-third Worse
Monthly Property Taxes or Rent	\$200 per month for typical household	\$25 more taxes/rent	Same as current situation	\$25 less taxes/rent
Rank				

Please put a 1 under the choice you like BEST.
 Please put a 4 under the choice you like LEAST.
 Consider the remaining choices. Put a 2 under the one you like best. Put a 3 under the other one.

Q27. Choice Set 5

	State of the Environment			
Attribute	Choice A (Current Situation)	Choice B	Choice C	Choice D
Bad Odour	4 days of bad odour per month	One-third Better	One-third Worse	Same as current situation
Black Fallout (BFO)	3 days of BFO per month	One-third Better	One-third Worse	Same as current situation
Poor Visibility	3 days of poor visibility per month	One-third Better	One-third Worse	Same as current situation
Health Effects	18 extra hospital admissions per month and 2 extra deaths per month, compared to perfectly clean air	Same as current situation	One-third Better	One-third Worse
Monthly Property Taxes or Rent	\$200 per month for typical household	\$10 more taxes/rent	Same as current situation	\$10 less taxes/rent
Rank				

Please put a 1 under the choice you like BEST.
 Please put a 4 under the choice you like LEAST.
 Consider the remaining choices. Put a 2 under the one you like best. Put a 3 under the other one.

Q28. Choice Set 6

	State of the Environment			
Attribute	Choice A (Current Situation)	Choice B	Choice C	Choice D
Bad Odour	4 days of bad odour per month	One-third Better	One-third Worse	Same as current situation
Black Fallout (BFO)	3 days of BFO per month	Same as current situation	One-third Better	One-third Worse
Poor Visibility	3 days of poor visibility per month	One-third Worse	Same as current situation	One-third Better
Health Effects	18 extra hospital admissions per month and 2 extra deaths per month, compared to perfectly clean air	One-third Worse	Same as current situation	One-third Better
Monthly Property Taxes or Rent	\$200 per month for typical household	\$50 less taxes/rent	\$50 more taxes/rent	Same as current situation
Rank				

Please put a 1 under the choice you like BEST.
 Please put a 4 under the choice you like LEAST.
 Consider the remaining choices. Put a 2 under the one you like best. Put a 3 under the other one.

Q29. Choice Set 7

	State of the Environment			
Attribute	Choice A (Current Situation)	Choice B	Choice C	Choice D
Bad Odour	4 days of bad odour per month	One-third Better	One-third Worse	Same as current situation
Black Fallout (BFO)	3 days of BFO per month	Same as current situation	One-third Better	One-third Worse
Poor Visibility	3 days of poor visibility per month	One-third Worse	Same as current situation	One-third Better
Health Effects	18 extra hospital admissions per month and 2 extra deaths per month, compared to perfectly clean air	One-third Better	One-third Worse	Same as current situation
Monthly Property Taxes or Rent	\$200 per month for typical household	Same as current situation	\$15 less taxes/rent	\$15 more taxes/rent
Rank				

Please put a 1 under the choice you like BEST.
 Please put a 4 under the choice you like LEAST.
 Consider the remaining choices. Put a 2 under the one you like best. Put a 3 under the other one.

Q30. Choice Set 8

	State of the Environment			
Attribute	Choice A (Current Situation)	Choice B	Choice C	Choice D
Bad Odour	4 days of bad odour per month	Same as current situation	One-third Worse	One-third Better
Black Fallout (BFO)	3 days of BFO per month	One-third Better	Same as current situation	One-third Worse
Poor Visibility	3 days of poor visibility per month	One-third Worse	One-third Better	Same as current situation
Health Effects	18 extra hospital admissions per month and 2 extra deaths per month, compared to perfectly clean air	One-third Worse	One-third Better	Same as current situation
Monthly Property Taxes or Rent	\$200 per month for typical household	\$15 more taxes/rent	Same as current situation	\$15 less taxes/rent
Rank				

Please put a 1 under the choice you like BEST.
 Please put a 4 under the choice you like LEAST.
 Consider the remaining choices. Put a 2 under the one you like best. Put a 3 under the other one.

Q31. Choice Set 9

	State of the Environment			
Attribute	Choice A (Current Situation)	Choice B	Choice C	Choice D
Bad Odour	4 days of bad odour per month	One-third Better	Same as current situation	One-third Worse
Black Fallout (BFO)	3 days of BFO per month	One-third Better	Same as current situation	One-third Worse
Poor Visibility	3 days of poor visibility per month	One-third Better	Same as current situation	One-third Worse
Health Effects	18 extra hospital admissions per month and 2 extra deaths per month, compared to perfectly clean air	One-third Worse	One-third Better	Same as current situation
Monthly Property Taxes or Rent	\$200 per month for typical household	\$20 more taxes/rent	Same as current situation	\$20 more taxes/rent
Rank				

Please put a 1 under the choice you like BEST.
 Please put a 4 under the choice you like LEAST.
 Consider the remaining choices. Put a 2 under the one you like best. Put a 3 under the other one.

Section C:

Now we would like to ask you a few questions about yourself.

- Q32. In what year were you born?
_____YEAR
- Q33. What is the highest level of education you have completed? (Circle number)
1. LESS THAN GRADE 8
 2. ELEMENTARY SCHOOL, GRADE 8
 3. HIGH SCHOOL (GRADE 12 OR 13)
 4. POST SECONDARY (CERTIFICATE OR DIPLOMA)
 5. UNIVERSITY DEGREE (B.A., B.Sc.)
 6. POST GRADUATE (M.A., M.Sc., Ph.D.)
- Q34. What is your current employment status? (Circle number)
1. FULL TIME HOUSEWORK
 2. FULL-TIME PAID EMPLOYMENT
 3. PART-TIME PAID EMPLOYMENT
 4. SELF-EMPLOYED
 5. UNEMPLOYED
 6. RETIRED
 7. STUDENT
- Q35. Which number best represents your household type? (Circle number)
1. COUPLE WITH CHILDREN
 2. COUPLE WITHOUT CHILDREN
 3. LONE PARENT WITH CHILDREN
 4. NON-FAMILY, ONE PERSON
 5. NON-FAMILY, MORE THAN ONE PERSON
- Q36. How many people live in your household (including yourself)?
_____NUMBER
- Q37. How many are adults 18 years or older?
_____NUMBER
- Q38. How many of the adults are aged 65 or older?
_____NUMBER
- Q39. Are you currently employed, or have you ever worked in the health care field? (For example, medical doctor, nurse, health researcher, etc) (Circle number)
1. YES
 2. NO
- Q40. Do you support any environmental organizations (for example, Greenpeace, Earthroots, Pollution Probe) with time or money? (Circle number)
1. YES
 2. NO
- Q41. What is your sex? (Circle number)
1. MALE
 2. FEMALE
- Q42. Which range best represents the total income of your household in 1995, before taxes. (Circle number)
- | | |
|----------------------|-----------------------|
| 1. under \$20,000 | 6. \$60,000-\$69,999 |
| 2. \$20,000-\$29,999 | 7. \$70,000-\$79,999 |
| 3. \$30,000-\$39,999 | 8. \$80,000-\$89,999 |
| 4. \$40,000-\$49,999 | 9. \$90,000-\$99,999 |
| 5. \$50,000-\$59,999 | 10. \$100,000 or over |
- Q43. How long have you lived in your present home? (Circle number)
1. LESS THAN ONE YEAR
 2. 1-5 YRS
 3. MORE THAN 5 YEARS
- Q44. What type of dwelling do you live in? (Circle number)
1. DETACHED HOUSE
 2. SEMI-DETACHED HOUSE
 3. HIGH-RISE APARTMENT BUILDING
 4. LOW-RISE APARTMENT BUILDING (3 FLOORS OR LESS)
- Q45. Do you own your home or do you rent? (Circle number)
1. OWN
 2. RENT
- Q46. How many hours per week do you spend outdoors engaging in physical activity such as exercise gardening, or walking? (Circle number)
1. LESS THAN 5 HOURS
 2. 5-10 HOURS
 3. MORE THAN 10 HOURS

Q47. Please tell us about any part of this questionnaire that was hard for you to understand

Q48. Is there anything else you would like to say about air quality in Hamilton-Wentworth or about this questionnaire.
