Choice experiment survey to estimate the economic value of visibility improvement for Canadians

Executive Summary

Choice experiment survey to estimate the economic value of visibility improvement for Canadians Final Report

Prepared for Environment and Climate Change Canada

Supplier name: Kantar

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Environment and Climate Change Canada (ECCC) commissioned Kantar to design and conduct a choice experiment survey in order to assess the economic value that Canadians' associate with a noticeable visibility improvement, expressed in monetary willingness-to-pay per household for a 1-unit deciview (DV) change. The findings of this study are meant to refine the accuracy and representativeness of the economic values associated with visibility in the Air Quality Valuation Model (AQVM2), whose estimates are used in cost-benefit analyses of air pollution regulations.

Cette publication est aussi disponible en français sous le titre: Enquête par la méthode de choix multi-attributs pour estimer la valeur économique d'une amélioration de la visibilité auprès des Canadiens

1. Executive Summary

1.1   Research Purpose and Objectives

Air pollution can lead to haze that can reduce or obscure visibility and economic literature has established that reduced visibility can be associated with reduced citizen well-being along with lost revenues in the areas of outdoor recreation and/or tourism. To improve visibility, it is necessary to reduce pollution levels, which can come at a cost to Canadian consumers. Generally, these costs are indirect and come in the form of additional expenses incurred by businesses for installing pollution control devices on vehicles and manufacturing equipment. The additional costs to businesses are eventually passed on to Canadians through higher prices on everyday items such as food, electricity, and transportation. Reducing pollution and thus improving visibility means that Canadians will experience unavoidable increases to general cost of living.

To estimate the value of changes in pollution levels, Environment and Climate Change Canada (ECCC) currently uses the Air Quality Valuation Model (AQVM2). This model measures the impacts of pollution on visibility, crop productivity, and cleaning costs for households.

The current inputs into the visibility module within AQVM2 use data that was last collected in 2002 in the lower mainland of British Columbia only and were applied throughout Canada. Furthermore, the existing empirical literature pertaining to the valuation of visibility improvement is very limited, especially in Canada. The collection of current and more methodologically robust data will allow ECCC to provide more accurate information to decision-makers, which is consistent with ECCC's responsibilities, Treasury Board Secretariat's guidelines on cost-benefit analysis under the Cabinet Directive on Regulation and the Government of Canada's commitment to evidence-based decision-making.

The overall objective of this research was to obtain current and robust data regarding Canadians' willingness to pay (WTP) for improved visibility that can better characterize the differences that may exist across the Canadian population. The findings of this study will be used to refine the accuracy and representativeness of the economic values associated with visibility in AQVM2, whose estimates are used in cost-benefit analyses of air pollution regulations.

1.2   Summary

A discrete choice experiment was undertaken with the goal of understanding how attributes of visibility, health risk and annual cost to household affect WTP per household for a 1-unit DV change. The levels chosen for investigation for this study are outlined in Table 1.2.a. below.

Table 1.2.a. Visibility Attributes and Levels

Visibility (Deciview/Visual Range)	Health Risk	Annual Household Cost
9 DV (155-160 km)	Low	$30 ($2.50 per month)
13 DV (105-110 km)	Moderate	$60 ($5.00 per month)
17 DV (70-75 km)		$90 ($7.50 per month)
21 DV (45-50 km)		$180 ($15.00 per month)
25 DV (30-35 km)		$360 ($30.00 per month)
29 DV (20-25 km)		None
33 DV (10-15 km)		

Visual stimuli (pictures) were used to depict various levels of visibility to the respondents. As there is no "typical" visibility for Canada, a wide visual range was chosen for testing (5-35 DV) to allow for evaluation of the most likely air quality scenarios in Canada.

The Air Quality Health Index (AQHI) was used to represent health risk to respondents and two levels of health risk were included in the final design: low and moderate. No constraints were imposed on which health risk levels could be combined with which visibility levels.

A complete enumeration approach was used while designing the choice sets. The complete enumeration approach was chosen as it better addresses the objective of the research: to estimate a robust nationally-averaged WTP value (annual $ per Canadian household) for a 1-unit deciview (DV) change and to identify statistically significant variables in explaining the willingness to pay.

A design with balanced alternative effects (complete enumeration) does a better job of estimating the specific visibility levels in the context of the price, whereas a design with imbalanced alternative effects (full factorial) would be better for estimating the gaps.

In general, the goal of the experimental design is two-fold:

1. Level balance – each level to appear the same number of times as each other level within an attribute.
2. Orthogonality – levels across attributes to be independent of each other in how they appear across choices.

In this study's design, the following constraints were implemented with the goal of a more realistic comparison for respondents:

- For each task, the baseline scenario was on the left with the test scenario on the right
- The test scenario always had better visibility than the baseline scenario.
- The baseline scenario always had $0 cost
- The test scenario always had cost of at least $30 per year.
- The baseline scenario always had visibility no better than 17 DV.
- The test scenario always had visibility no worse than 25 dv.

The discrete choice exercise was estimated using a Hierarchical Bayes Multinomial Logit model and was estimated using Sawtooth Software's CBC Hierarchical Bayes Module v5.5.6. The model used an iterative Monte Carlo Markov Chain approach to estimate the model for 200,000 iterations with the first 100,000 iterations used as a burn-in to calibrate the process and the last 100,000 iterations used to provide a robust estimate of the model. The final model estimated linear effects for visibility and annual household cost and categorical effects for the two levels of health risk. This model generated a robust estimate of the WTP per household for each one-unit decrease in the DV scale for the entire sample and for various subgroups of interest.

Two WTP values were calculated per respondent. The first WTP was when the heath risks are both moderate since we assume the baseline state has a moderate health risk. In this calculation, the overall utility of the health risk was zero since both the baseline and improved health risk level were the same. The second WTP value was the WTP for a one unit decrease in DV that results in a low health risk. This calculation included the change in utility in moving from a moderate risk to a low risk.

When health risk is zero, on average, Canadians are willing to pay $107.04 annually or $8.92 per month for an improvement of one DV to visibility. The median is $1.10 per month and the standard deviation is $21.27 per month indicating a wide variability in the amount that Canadians are willing to pay for 1 DV improvement in visibility.

There are noticeable differences among different demographic groups, more specifically, younger Canadians (18-34), households with children or with individuals with health conditions impacted by air quality and/or those who currently live in areas with high visibility are all willing to pay more than their respective counterparts.

Not unexpectedly, Canadians are willing to pay more when there is an associated improvement to health. On average, Canadians are willing to pay $581.76 annually or $48.48 per month for an improvement of one DV to visibility that includes a perceived associated decrease in health risk from moderate to low. There are noticeable differences among different demographic groups when it comes to WTP with an associated improvement to health. Specifically, younger Canadians (18-34), women, households with children or with individuals with health conditions impacted by air quality and/or those living outside of Atlantic Canada are all willing to pay than their respective counterparts.

In order to provide more clarity around the WTP differences with improved health risks, the analysis reviewed the ratio of WTP on its own, compared to WTP with an associated improvement to health risk. Absolute WTP values identify how much Canadians care about visibility and how much they care about health. The ratio analysis allows one to understand how much Canadians care about visibility compared with health. Not unexpectedly, virtually all Canadians care more about health than visibility however, the ratio analysis helps to identify Canadians that "care" more about visibility and these include middle aged Canadians (35-54), Atlantic Canadians, rural Canadians, and Canadians with children in the home and/or living in areas with good visibility (9 DV or less).

1.3   Methodology

The findings of this study are based on online surveys conducted from September 8 to 29th, 2020. The survey was conducted among Canadians aged 18 years and older. Respondents were randomly selected from an online panel and invited via email and/or personal online panelist dashboard to participate in the survey.   The results of panel surveys are considered a non-random sample, meaning they are not a random selection from the general population of Canada, rather they are a subset of people who are, in this case, people who have signed up to participate in online surveys. As such, margin of error does not apply.

The data have been weighted to reflect the demographic composition of the Canadian population for age, gender, region, education, and population of residence. Surveying was conducted in the respondent's official language of choice and took an average of 15 minutes to complete.

Contract Value

The total contract value for the project was **$122,887.15** including applicable taxes.

Statement of Political Neutrality

I hereby certify as a representative of Kantar that the deliverables fully comply with the Government of Canada political neutrality requirements outlined in the Communications Policy of the Government of Canada and Procedures for Planning and Contracting Public Opinion Research. Specifically, the deliverables do not include information on electoral voting intentions, political party preferences, standings with the electorate or ratings of the performance of a political party or its leaders.

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