THE WALKERTON INQUIRY

Commissioned Paper 15

VALUE-OF-LIFE ESTIMATES IN AN ECONOMIC COST ASSESSMENT

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Abstract

This paper discusses the issues of placing values on illness and loss of life. On the one hand, it is unreasonable and unrealistic to measure the costs of a crisis like that in Walkerton without accounting for human costs. But on the other hand, it is impossible to evaluate in tangible terms the intangible worth of the lives of particular individuals.

The paper, however, discusses a method whereby one can place a value on the risk of illness and lost lives from any future incidents of water contamination. The paper draws on numerous studies that have statistically derived *ex ante* measures of the value of life and illness to estimate that the value of the lives that could be lost and the illnesses that could be suffered in another water contamination crisis is approximately $90.8 million.

The author's companion study, Walkerton Inquiry Commissioned Paper 14, *The Economic Costs of the Walkerton Water Crisis*, shows that the tangible costs of the crisis amounted to over $64.5 million. This paper concludes, therefore, that the total cost at risk from a future water contamination event like Walkerton's – that is, the sum of the tangible costs plus the statistical value of lives lost and illnesses suffered – could be valued at about $155 million.

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1 Introduction

Attempting to measure the costs of a crisis like that of Walkerton without recognizing the illness and loss of life it caused is both unreasonable and unrealistic. But how can we measure those human costs? To place values on the human costs would require evaluating in tangible terms the intangible worth of particular individuals' lives. That is clearly impossible.

Moreover, to be consistent with the economic theory of value, any such valuation would imply that the particular individuals would be indifferent between accepting death or accepting a sum of money equal to the estimated value of life – an absurd proposition. In usual circumstances, no finite sum of money would be sufficient to make a person indifferent between accepting death and accepting the money.

But making such a partial assessment tells barely half the story. In this brief report, therefore, I discuss the complex, intangible issues of placing values on illness and loss of life. I then demonstrate a method whereby we can incorporate those human values into an assessment of the costs that would be at risk from any future incidents of water contamination.

This report is a companion piece to my main report to this Inquiry,[1] the terms of reference for which were to estimate the tangible costs of the Walkerton crisis. In that study I estimate those costs at approximately $64.5 million. But in that report, I deliberately avoid estimating the "cost" of the lives actually lost as a result of the Walkerton crisis. That report is limited to the tangible costs – those that can be measured directly.

2 The *Ex Ante* Value of a Life

The risk nevertheless exists that lives may be lost in the future from contaminated water. While it is pointless to try to estimate, *ex post*, the value of a life, as we have seen above, it is quite a different thing to ask what society is willing to

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[1]John Livernois, 2002, *The Economic Costs of the Walkerton Water Crisis* (Toronto: Ontario Ministry of the Attorney General), Walkerton Inquiry Commissioned Paper 14, Walkerton Inquiry CD-ROM, <www.walkertoninquiry.com>.

pay to reduce, *ex ante*, the risk of a lost life. Common sense suggests that people would be willing to pay something to reduce the risk of death. And countless economic studies have shown, not only that individuals *are* willing to pay to reduce the risk of death, but also that the amount they are willing to pay is substantial.[2] I draw a distinction, therefore, between the *ex post* and the *ex ante* values of life, arguing that while the former is not estimable the latter is, in the sense of a demonstrated willingness to pay to save a statistical life.

We can infer the *ex ante* value of a "statistical" life by using estimates of people's willingness to pay to reduce the risk of death. Let us suppose, for illustration, that in a group of 100,000 people the average person is willing to pay $50 to lower the probability of a random death in that group from seven deaths per 100,000 population to six deaths per 100,000 (that is, to save one statistical life). Then the total willingness to pay is $5 million for the group. From this we can infer that the value of a statistical life is $5 million.[3]

How great are the estimates of an *ex ante* statistical life? Estimates of the implied value go as high as $24 million per statistical life but are more frequently in the $5 million to $12 million range.[4] The variation in estimates is due to variation in the data sources and in the level of risks being assessed. Most published estimates are based on studies of U.S. wage data, a complete survey of which is available in Viscusi 1992.[5] In those studies, the wages paid in various occupations are related to the level of risk of death, while controlling for other job and labour market characteristics that influence the wage rate. The objective is to estimate the risk premium implicit in compensation packages.[6] Only one study surveyed in Viscusi, that by Cousineau, et al.,[7] is based on Canadian data. That study estimates an implied statistical value of life to be $5.4 million, as scaled up to year 2000 dollars by the consumer price index.

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[2] Twenty-three of the principal studies are surveyed in W. Kip Viscusi, 1992, *Fatal Tradeoffs: Public and Private Responsibilities for Risk* (New York: Oxford University Press).

[3] A. Myrick Freeman III, 1979, *The Benefits of Environmental Improvement: Theory and Practice,* for Resources for the Future Inc. (Baltimore: Johns Hopkins University Press).

[4] In their study of the economic costs of an *Escherichia coli* outbreak in Scotland in 1994, Roberts and Upton use values of life ranging from $1.8 million to $11.2 million. J.A. Roberts and P.A. Upton, 2000, *E. coli O157: An Economic Assessment of an Outbreak* (Edinburgh, United Kingdom: Lothian Health Board).

[5] Viscusi, cited above.

[6] The next most popular type of study is survey-based contingent valuation in which individuals are presented with a hypothetical situation and are asked to reveal their willingness to pay for risk reduction.

[7] J. Cousineau, R. Lacroix, and A. Girard, 1988, "Occupational Hazard and Wage Compensating Differentials," University of Montreal working paper [photocopy].

3 Estimating the Human Costs of Walkerton

In my main study for the Walkerton Inquiry,[8] I estimate the tangible costs of the Walkerton crisis to be about $64.5 million. However, it is clear from the above discussion that far more than a cost of $64.5 million is at risk from future water contamination. In particular, lives and health are also at risk.

Thus, to the question, "What were the tangible costs of the Walkerton water crisis?" the answer is $64.5 million. But to the question, "What is the total cost that is at risk from a future similar contamination?" the answer is less clear cut. We can, nevertheless, approach it by adding to the tangible costs – $64.5 million – both the value, *ex ante*, of a statistical life times the expected number of lives lost and the willingness to pay to avoid a statistical illness times the expected number of illnesses occurring.

If the expected number of lives lost is seven, and we use a mid-range estimate of the value of a statistical life of $8 million, then the total value of seven statistical lives is $56 million. If the expected number of serious illnesses is 2,321, and we use a rough estimate – for illustration only – of willingness to pay to avoid a statistical illness of approximately $15,000 per case,[9] the total is another $34.8 million. Thus the statistical value of the lives lost and the illnesses suffered because of the Walkerton crisis is approximately $90.8 million.

4 The Total Cost at Risk

The implication from the above calculations therefore is that the total cost at risk from a future water contamination event like the one experienced in Walkerton is the sum of the tangible costs of $64.5 million plus the statistical value of lives lost and illnesses suffered, at $90.8 million, and could thus be valued at about $155 million.

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[8] Livernois, cited above.

[9] I am not aware of any estimates of the value of a statistical *E. coli* infection so I adopt this $15,000 figure purely for illustrative purposes. It is a value consistent with the many estimates reported in Viscusi 1992 for the value of a statistical injury sustained on the job. I use the number of infection cases (2,321) estimated in the report of the Bruce-Grey Owen Sound Health Unit (BGOSHU), 2000, *The Investigative Report of the Walkerton Outbreak of Waterborne Gastroenteritis, May–June 2000*, October 10, 2000, [online], [cited November 13, 2001] <www.publichealthgreybruce.on.ca/_private/Report/SPReport.htm>.

If we knew the probability of such an event, we could more accurately predict the likelihood that such a cost might be incurred. More to the point perhaps, if we knew the extent to which an appropriate public expenditure program could reduce that probability, we could more easily predict the expected benefits (cost avoidance) of the program. Both of these issues, however, are beyond the scope of this project. As a result, I am able to conclude that a cost of about $155 million is at risk, should another water crisis like that of Walkerton occur, although I am unable to draw any conclusions about the size of that risk.

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