**Institution: Newcastle University**

**Unit of Assessment: 19 Business and Management Studies**

**Title of case study: The economic evaluation of the risk to human life and health: shaping government policy and procedures**

## 1. Summary of the impact

Research carried out at Newcastle has developed the understanding of the economic value of the risks to human life across a range of public services, especially transport and health. The model pioneered at Newcastle changed the way in which the risk to human life is calculated. Rather than simply calculating the loss of economic output as a result of injury or death, it takes into account individuals' 'willingness to pay' in order to reduce mortality risk. The model has dominated the terms of UK policy discussion in areas in which safety is a central concern. The research has directly shaped the development of government policy and associated guidelines for a range of departments and organisations, particularly through its inclusion in the HM Treasury Green Book.

## 2. Underpinning research

### Research context

Newcastle University is home to a group recognised as international leaders in the area of the economics of safety, health, the environment and risk. Those whose work are featured here are Sue Chilton (at Newcastle since 2000), Mike Jones-Lee (1977-2009; Emeritus Professor, 2009-), Hugh Metcalf (2000-), Jytte Seested-Nielsen (2010-) and Cam Donaldson (2002-2010).

### Establishing preference-based values for policy guidance

The work at Newcastle into the economics of safety and risk has centred on establishing 'preference-based values' (PBV). These put a value on the risk to human life by looking at how much people would actually be willing to pay (WTP) in order to prevent casualties occurring in different situations (for example, Grant 2). This includes an amount to reflect pain, grief and suffering, as well as the lost output and medical costs associated with injuries or fatalities. This approach begins from the premise that it is not possible to prevent every accident or save every life, and that therefore statistical analysis should be used to calculate the value of reducing the average number of deaths. The use of the WTP measure represents a significant advance on earlier methods, which were based solely on estimates of the loss of economic output resulting from the death or injury of a person. By taking into account what people would be willing to pay in order to prevent deaths in the first place, the Newcastle research shifts the focus from loss to prevention (for example, Grant 6) **(1-6)**. The figures derived through this method have been used by various public bodies in their appraisal of the consequences of policy options, thereby playing a key role in determining which policies will be implemented.

### Establishing willingness to pay in road and rail safety

A 1998 report for the UK Department of Transport and the Regions **(1)** demonstrated the benefit of having a single value for a fatality reduction that could be used by all government departments. The report also argued for a significant update in the way that the figure should be calculated **(1-2).** The economic analysis took into account the broad range of impacts of accidents/fatalities and proposed a new methodology to define how much a small risk is worth to an individual person. Following the Ladbroke Grove rail disaster in 1999, Chilton, Jones-Lee and other Newcastle-based staff were the lead investigators on a major study commissioned by the UK Health and Safety Executive (Grant 3) to value the benefits of health and safety control **(3).** A later paper was influential in bringing rail safety policy into line with the policy that applied to road traffic **(4)**.

### Extending research into new areas

Having initially established the PBV and WTP concepts, research at Newcastle refined the methodology and expanded its use across a range of public services, particularly in the area of air pollution. In 2004, Chilton *et al*. produced a report for DEFRA which put an economic value on the benefits to health of reducing air pollution **(5)**. The rationale for this study was to enable the costs and benefits of a policy to reduce air pollution to be compared using the same unit, of a monetary value.

This value was obtained by finding out what those at risk of ill health as a result of air pollution

would be willing to pay to reduce this risk. The WTP-based value of preventing, for example, a respiratory hospital admission was estimated as being in the range of £1,310 to £7,110, and the value of preventing an average of 2 or 3 days of breathing discomfort every year throughout a person's life was estimated as being in the range of £1,280 to £5,580 **(5)**. Following this, the team become involved in an international research project to analyse the damage costs of air pollution, funded by the NEEDS (New Energy Externalities Developments for Sustainability) project of the European Commission (Grant 4), and a project to examine life expectancy gains from air pollution reduction in the UK and Poland, funded by the British Academy (Grant 5).

## 3. References to the research


1. Chilton, S., Covey, J., Hopkins, L., Jones-Lee, M., Loomes, G., Pidgeon, N., Spencer, A. (1998). 'New research on the valuation of preventing fatal road accident casualties'. In DETR (ed.): *Road accidents Great Britain 1997,* 28-33. The Stationery Office, London (available on request).
2. Carthy, T., Chilton, S., Covey, J., Hopkins, L., Jones-Lee, M., Loomes, G., Pidgeon, N., Spencer, A. (1999). 'On the contingent valuation of safety and the safety of contingent valuation, part 2: The CV/SG 'chained' approach'. *Journal of Risk and Uncertainty*, 17(3), 187-213. DOI 10.1023/A:1007782800868 (ABS List 2010 4*).
3. Chilton, S., Dolan, P., Jones-Lee, M., Loomes, G., Robinson, A., Carthy, T., Covey, J., Spencer, A., Hopkins, L., Pidgeon, N., Beattie, J. (2000). 'Valuation of benefits of health and safety control: Final Report'. Health and Safety Executive. Available at: http://www.hse.gov.uk/research/crr_pdf/2000/crr00273.pdf (accessed 24/09/13).
4. Chilton, S., Covey, J., Hopkins, L., Jones-Lee, M., Loomes, G., Pidgeon, N., Spencer, A. (2002). 'Public perceptions of risk and preference-based values of safety'. *Journal of Risk and Uncertainty*, 25(3), 211-232. DOI: 10.1023/A:1020962104810 (ABS List 2010 4*).
5. Chilton, S., Covey, J., Jones-Lee, M., Loomes, G., Metcalf, H. (2004). 'Valuation of health benefits associated with reductions in air pollution: Final report'. DEFRA: Crown Copyright. Available at: http://archive.defra.gov.uk/environment/quality/air/airquality/publications/healthbenefits/airpollution_reduction.pdf (accessed 24/09/13).
6. Seested-Nielsen, J., Chilton S., Jones-Lee, M. and Metcalf, H. (2010). 'How would you like your gain in life expectancy to be provided? An experimental approach'. *Journal of Risk and Uncertainty*, 41(3), 195-218. (ABS List 2010 4*). REF2 Output: 161708.


### Table of Relevant Grants

| | Principal Investigator(s) | Grant Title | Sponsor/ Funder | Period of Grant | Value to Newcastle |
|---|---|---|---|---|---|
| 1. | Mike Jones-Lee | The valuation of benefits of additional health & safety control | Health and Safety Executive | November 1994 | £587,356 |
| 2. | Mike Jones-Lee | Developing the method of "willingness to pay" for assessment of community preferences for health care priorities | Commission of the European Communities | March 1995 | £10,450 |
| 3. | Mike Jones-Lee and Sue Chilton | Follow-up project on roads vs. rail vs. domestic fires vs. fires in public places relativities study | Health and Safety Executive | Jan-Jun 2000 | £37,190 |
| 4. | Sue Chilton / Hugh Metcalf | NEEDS - new energy externalities developments for sustainability | Commission of the European Communities | Sept 2004-Aug 2008 | £14,689 |
| 5. | Sue Chilton | Valuing life expectancy gains from air pollution | British Academy | May 2007-Dec 2007 | £5,180 |

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| | | reduction in the UK and Poland | | | |
| 6. | Cam Donaldson / Sue Chilton / Mike Jones-Lee / Hugh Metcalf / PM Shackley / John Wildman | The societal value of health gains | National Co-ordinating Centre for Research Methodology | Oct 2004-Dec 2007 | £424,832 |

## 4. Details of the impact

### Continued impact on appraisal and evaluation in central government

The Newcastle approach continues to form the basis for cost benefit analysis in the public sector. This is demonstrated by its inclusion in HM Treasury's 'Green Book' **(IMP1)**. The Green Book provides guidance on how to assess the economic consequences of decisions. It thus provides the template for policy-making across the full range of government and public service concerns. Revisions were made in 2011 and the WTP model remains a key part of this document. It states: *"A benefit of some proposals is the prevention of fatalities or injuries. The appropriate starting point for valuing these benefits is to measure the individual's WTP for a reduction in risk of death"* **(IMP1p61)**.

Government departments' use of the values of risks to life and health in their appraisals can be found in a 2008 report to the Inter-departmental Group on Value of Life and Health. This includes a number of references to the use of Newcastle research in policy-making: DEFRA's use of Chilton *et al's* research **(5)** in their assessments; Home Office use of the Carthy *et al*. research **(2)** to derive values for certain serious crimes; and the Food Standards Agency's use of the work of Jones-Lee *et al*. on the pure value of living **(IMP2p8)**. In addition, the Department of Communities and Local Government's (DCLG) review of building regulations in 2010 calculated the quality adjusted life year using the Newcastle model. It specified that money needs to be provided to ensure the maintenance of standards in building conversion, as the risk cost ranges from £45,000-£63,000 **(IMP3p6)**.

### Continued impact on transport policy

Transport policy is the area in which governments most explicitly and most acutely face issues of safety and risk. Newcastle research continues to have impact in this area. The Department for Transport's (DfT) online resource states that the Transport Analysis Guidance (TAG) *"should be seen as a requirement for all projects/studies that require government approval. For projects/studies that do not require government approval, TAG should serve as a best practice guide".* TAG guidance **(IMP4)** refers explicitly to the Chilton *et al.* research **(1,3)**. Newcastle has also been involved in a response to the DfT in relation to an evaluation of the need to update the calculations of the values of prevented fatalities and injuries **(IMP5)**. Following the Chilton *et al*. report **(3)**, the Rail Safety and Standards Board changed the way it valued the prevention of a fatality in its appraisal of safety measures **(IMP6)**. On the basis of the report's recommendations, the valuation applied to road safety was also applied to rail safety. This was supported by further research undertaken by Jones-Lee *et al*., the final Taking Safe Decisions programme report being published in 2009 **(IMP7)**.

### Extension of impact into new policy domains

The Newcastle team's development of new methods of calculating a WTP-based measure has allowed the impact of their research to be extended into the healthcare sector. In work commissioned by the Scottish Government on the costs of alcohol misuse, the Newcastle model of calculation is used to describe the estimation of intangible costs. The work refers to the QALY value used by the Home Office in their policies on crime. This value, says the report, "*is based on a willingness-to-pay estimate to avoid some specific consequences of a road injury derived from data collected in 1997 (Carthy et al.1999)* **[(2)]***"* **(IMP8p75-76)**.

With regard to air pollution, the original research undertaken by Chilton *et al*. for DEFRA **(5)** has directly informed the UK-wide strategy's targets for reductions in the concentrations of nine major pollutants to be achieved between 2010 and 2020 **(IMP9)**. The strategy states: *"A major step change in the analysis … is that health outcomes have now been valued, following*

*recommendations by the IGCB [Interdepartmental Group on Costs and Benefits]. These recommendations drew upon recent research in the area, particularly the Defra-led study by Chilton et al (2004)* **[(5)]** *which aimed to identify the willingness to pay to reduce the health impacts associated with air pollution, using a survey-style contingent valuation approach"* **(IMP9p164)**. The research also features in DEFRA's 2013 best practice guidance regarding the methodology for estimating how changes in air pollutants affect health and environmental outcomes **(IMP10)**. It states: *"Values for a range of health endpoints have been agreed, following recommendations by the IGCB...The IGCB recommendations draw upon research in the area of air quality health impact valuation, particularly the study by Chilton et al (2004)* **[(5)]***. This study had been commissioned by Defra to provide empirical evidence on the willingness to pay to reduce the health impacts associated with air pollution…Following the publication of the Chilton et al (2004) study* **[(5)]***, Defra held a workshop for expert economists and epidemiologists to discuss the results of this study"* **(IMP10p16)**.

**5. Sources to corroborate the impact**


(IMP1) The Green Book: Appraisal and Evaluation in Central Government, HM Treasury, 2011 revised edition, London: TSO. Available at: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent (accessed 29/08/13).

(IMP2) Survey of the Value of Life/Health Used in Government Departments', Report to the Inter-departmental Group on Value of Life and Health, Institute for Transport Studies, University of Leeds, 2008. Available on request.

(IMP3) Department for Communities and Local Government (DCLG) (2012) Report of economic research related to the 2010 review of Building Regulations Parts A and C, ISBN 9781409833130. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/8402/2076721.pdf (accessed 19/07/13).

(IMP4) Department for Transport: Transport Analysis Guidance (TAG) Unit, Guidance documents – Expert: TAG unit 3.4: The Safety Objective (Updated August 2012) See section 'Benefits to Society Arising from Prevention of Road Accidents and Casualties: 2.1' (2.1.1, -2.1.4). Available at: http://www.dft.gov.uk/webtag/documents/expert/unit3.4.1.php (accessed 29/08/13).

(IMP5) NERA Economic Consulting (2011) Updating the VPF and VPIs: Phase 1 - Department for Transport. Available at: http://assets.dft.gov.uk/publications/pgr-economics-rdg-updatingvpfvpi-pdf/vpivpfreport.pdf (accessed 19/07/13).

(IMP6) Rail Safety and Standards Board (2007) *Safety Decisions Programme: The route to 'Taking Safe Decisions'.* Available at: http://www.rssb.co.uk/SiteCollectionDocuments/pdf/vtsicpresentations/RouteToTakingSafeDecisions.pdf (accessed 11/09/13).

(IMP7) Rail Safety and Standards Board (2009) *Taking Safe Decisions.* Available at: http://www.rssb.co.uk/SiteCollectionDocuments/pdf/Taking%20Safe%20Decisions.pdf (accessed 09/10/13).

(IMP8) The Scottish Government (2010) The Societal Cost of Alcohol Misuse in Scotland for 2007. Available at: http://www.scotland.gov.uk/Publications/2009/12/29122804/0 (accessed 29/08/13).

(IMP9) DEFRA in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland (2007) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland.* Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69337/pb12670-air-quality-strategy-vol2-070712.pdf (accessed 09/10/13).

(IMP10) DEFRA (2013) *Impact pathway guidance for valuing changes in air quality.* Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/197900/pb13913-impact-pathway-guidance.pdf (accessed 09/10/13).