

## Impact case study (REF3)

<b>Institution:</b> Newcastle University		
<b>Unit of Assessment:</b> 17 Business and Management Studies		
<b>Title of case study:</b> Calculating the economic value of the risks to human life: informing the practice of Cost-Benefit Analysis in government policy		
<b>Period when the underpinning research was undertaken:</b> 2000 to 2019		
<b>Details of staff conducting the underpinning research from the submitting unit:</b>		
<b>Name(s):</b>	<b>Role(s) (e.g. job title):</b>	<b>Period(s) employed by submitting HEI:</b>
Susan Chilton	Professor of Economics	2000 to date
Cam Donaldson	Professor of Health Economics	2002 to 2010
Michael Jones-Lee	Professor of Economics (Emeritus)	1997 to 2009 (2009 to 2021)
Hugh Metcalf	Senior Lecturer in Economics	2000 to 2020
Jytte Seested Nielsen	Reader in Economics	2011 to date
<b>Period when the claimed impact occurred:</b> August 2013 to December 2020		
<b>Is this case study continued from a case study submitted in 2014?</b> N		
<p><b>1. Summary of the impact</b> Newcastle University is home to a group of internationally recognised academic leaders in the economics of safety, health, the environment, and risk. Their pioneering research, using sophisticated quantitative methodologies based on ‘willingness to pay’ (WTP), has been highly significant in driving UK government policy where health and safety is a major concern. This approach enables the estimation of preference-based values (PBV) of preventing premature fatalities (VPF), and by extension the value of life years lost (VOLY). These values are used to monetise safety benefits arising from government-funded projects, in line with HM Treasury guidance on Cost-Benefit Analysis (CBA) and DEFRA guidelines on estimating the damage costs of air pollution. Newcastle’s research was central in the decision to change HM Treasury guidance in relation to workplace cancers and has led the UK Government to commit to commissioning a new primary study to provide direct empirical evidence to update its values for life expectancy gains. The reputation of Newcastle’s research has also led to an increase in demand for the team’s expertise in the private sector and internationally.</p>		
<p><b>2. Underpinning research</b> The pioneering work at Newcastle into the economics of safety and risk centres on establishing ‘preference-based values’ (PBV) to calculate the value of preventing death and injury. PBVs put a monetary value on the risk to human life by looking at how much people would be willing to pay (WTP) in order to prevent casualties occurring in different situations. Since 2000, the Newcastle team has conducted PBV/WTP research to estimate values for premature fatalities for a range of causes of premature death, in comparison to those for road accidents (PUB1,3, Grants 1 and 3); values of the benefits to health of reducing air pollution (PUB2, Grants 4 and 5); and values relating to health, especially preventing death from cancer (e.g. PUB4–6: Grants 2 and 6). Recent research (PUB4, Grant 7) shows that it is feasible and desirable to undertake new large-scale primary research to update the value of life years (VOLY).</p> <p><b>Premature fatalities and dread risks</b> Research led by Newcastle (PUB1, Grant 1) was the first to use sophisticated quantitative methodologies to estimate people’s PBVs of safety in different contexts (rail, domestic fires, and fires in public places) relative to the corresponding value for roads. The research provided indicative evidence demonstrating that differences in people’s perceptions of personal risk in different contexts were less pronounced than had been suggested by previous qualitative research, and therefore that the value differentials used in public policy making should be less pronounced. This research was extended in PUB3 and Grant 3 to additional contexts (e.g. murder, drowning, accidents in the home). Through the application of novel protocols, this was the first research to isolate and measure the effects of an individual’s dread of premature death by a specific cause from their perception of their personal risk of death from that cause. These findings validated the findings from PUB1 and Grant 1 and definitively demonstrated that differentials in WTP were less pronounced than previous research had suggested.</p>		

**Air pollution**

In 2004, the Newcastle team was commissioned by the Department for Environment, Farming and Rural Affairs (DEFRA) to calculate the economic values of the benefits to health of reducing air pollution (Grant 4). Through the application of a new methodology, PUB2 was the first study to enable a direct estimate of the value of life years (VOLY) lost due to air pollution from the perspective of WTP. Prior to this breakthrough, a VOLY could only be indirectly estimated from the value of preventing a fatality. This study enables the values for the acute (e.g. hospital admissions), chronic (e.g. changes in life expectancy) and morbidity (e.g. breathing problems) impacts of air pollution to be given a monetary value. Following this, the team were invited to participate in an EU research project to analyse the damage costs of air pollution (Grant 5).

**Calculating the value of preventing deaths from cancer**

In 2010, the Health and Safety Executive commissioned Newcastle to conduct a review of the cancer valuation literature. The review suggested that the effects of *latency* (the time lag between exposure to a carcinogen and possible death from cancer), and *dread* (of morbidity or other factors such as fear of recurrence, (in)voluntariness and (lack of) control, or a fear of cancer itself unrelated to its clinical and qualitative effects) may offset each other, so that there is effectively no premium for cancer. However, it concluded that an empirical study would have to be undertaken in the UK context to investigate further. As a result, HSE commissioned an empirical study from Newcastle on the influence of dread and latency on cancer risk values in the UK (Grant 6). Again, by pioneering a novel, experimental methodology (PUB4), the research found a greater public aversion to *mortality* (death) from cancer than death from road injury, but found that this was driven primarily by the *morbidity* (ill health associated with both fatal and non-fatal cancers) associated with cancer *prior* to death (PUB5). The study also challenged conventional academic assumptions and policy practice about peoples' time preferences with respect to mortality risks (PUB6).

**The need for updated values and methodologies in respect of life expectancy gains**

In 2017, the Newcastle team was invited to contribute to a cross-government workshop on Estimating the Monetary Value of a Life Year (VOLY). After this, a consortium of government departments commissioned a scoping study to ascertain the need for updated values and methodologies in respect of life expectancy gains. Following a competitive tendering process, Newcastle was commissioned in June 2018 to lead the study (Grant 7). The study confirmed that methodologies now exist which can generate theoretically robust, evidence-based, and updated valuations of risks to human life and health. Applying such values would lead to better and more informed policy decisions and would have major implications not only for the efficiency of government spending but also for equity in population wellbeing.

**3. References to the research**

An enduring feature of the research is that it continually generates grant income from UK government departments and agencies, along with high-quality publications in peer-reviewed journals (selected publications and grants detailed below). International recognition of the group's work is also evident. In 2019 Jones-Lee was honoured with a Society of Benefit Cost Analysis Outstanding Achievement Award to reflect his contribution to the field of cost-benefit analysis, and Chilton has recently been elected to the Board of Directors of this Society.

**Selected publications**

1. **Chilton, S.**, Covey, J., Hopkins, L., **Jones-Lee, M.**, Loomes, G., Pidgeon, N., and Spencer, A. (2002). 'Public perceptions of risk and preference-based values of safety', *Journal of Risk and Uncertainty*, 25(3), 211–232. <https://doi.org/10.1023/A:1020962104810>
2. **Chilton, S.**, Covey, J., **Jones-Lee, M.**, Loomes, G., and **Metcalfe, H.** (2004). 'Valuation of health benefits associated with reductions in air pollution: Final report'. DEFRA: Crown Copyright. (available on request)
3. **Chilton, S.**, **Jones-Lee, M.**, Kiraly, F., **Metcalfe, H.**, and Pang, W. (2006) 'Dread risks', *Journal of Risk and Uncertainty*, 33(3), 165–182. <https://doi.org/10.1007/s11166-006-0483-z>

4. **Nielsen, J. S., 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. <http://doi.org/10.1007/s11166-010-9104-y>
5. McDonald, R. L., **Chilton, S., Jones-Lee, M., and Metcalf, H.** (2016). 'Dread and latency impacts on a VSL for cancer risk reductions'. *Journal of Risk and Uncertainty*, 52(2), 137–161. <http://doi.org/10.1007/s11166-016-9235-x>
6. McDonald, R., **Chilton, S., Jones-Lee, M., and Metcalf, H.** (2017) 'Evidence of variable discount rates and non-standard discounting in mortality risk valuation'. *Journal of Environmental Economics and Management*, 2017, 82, 152–167. <https://doi.org/10.1016/j.jeem.2016.11.005>

#### Selected grants

	Grant Title	Funder/Sponsor	Dates	Amount (GBP)
1	Follow-up project on roads vs. rail vs. domestic fires vs. fires in public places relativities study	Health and Safety Executive (HSE)	January 2000 – June 2000	37,190
2	The Societal Value of Health Gains	National Coordinating Centre for Research Methodology	October 2004 – December 2007	424,832
3	Valuation of Health and Safety Benefits – Dread Risks	Health and Safety Executive	November 2001 – December 2005	197,700
4	Valuing Nature Network	Department for Environment, Food and Rural Affairs (DEFRA)	December 2011 – November 2012	47,819
5	NEEDS (new energy externalities developments for sustainability)	Commission of the European Communities	September 2004 – August 2008	14,689
6	Latency, Dread and Cancer Risks	Health and Safety Executive	June 2011 – March 2013	20,000
7	A Scoping Study on the Valuation of Risks to Life and Health: The Monetary Value of a Life Year (VOLY)	DEFRA, Department of Health and Social Care, Department for Transport, the Food Standards Agency, Food Standards Scotland, HSE, and the Home Office.	June 2018 – July 2019	70,833

#### 4. Details of the impact

It is a fundamental duty of governments to implement policies that improve social welfare. Policies that affect risks to human life and health are often cross-cutting in departmental reach and are examples of how welfare can be improved. Through commissioned research, high-quality outputs, and the participation of its world-leading research experts in high-level policy committees, Newcastle's research has had a significant impact on government understanding and implementation of policy in this area. Newcastle's robust, transparent, and evidence-based values are used to inform project appraisal across a wide range of UK government departments and agencies. The research has brought about significant change in the following diverse areas:

##### **Work-related cancers: changing understanding and valuations in cost-benefit analysis**

Understanding the economic and wider impacts of work-related cancer is important to inform the Health and Safety Executive's regulatory decision making in respect to the case for proportionate risk management in the workplace. Prior to 2016, the HSE valued deaths from

cancer by applying a factor of 2 to the standard road-based VPF. However, as a direct result of the Newcastle findings – documented in PUB5 – that *‘there was no evidence to support HSE’s approach of applying a “x 2 multiplier” to the roads VPF’* [IMP1, p. 81], HSE now has robust evidence to justify valuing deaths from cancer at the same level as other premature deaths in cost-benefit analysis. In addition, HSE changed its advice on valuing the other health impacts of cancer, so that the morbidity associated with cancers was valued directly rather than implicitly within a broad ‘cancer premium’. This was due to Newcastle’s finding that *‘There was evidence that the greater aversion to cancer is associated with illness or morbidity prior to death that is associated with cancer, rather than dread of the cancer label per se’* [IMP1, p. 82].

#### **Air pollution: providing valuations for VOLY and hospital admissions**

DEFRA’s impact pathway assessments and damage costs are calculated using PUB2’s values for the value of life years (VOLY). The guidance [IMP2, p.16] states that *‘The value of life years lost due to the chronic effects of air pollution are monetised using values estimated in a study by Chilton et al. (2004) ... The value is £42,780 (2017 prices) and is based on life years lost being in normal health’*. Also, *‘Life years lost due to the acute effects of short term exposure to air pollution are valued at £22,110 per life year lost, also based on values estimated in a study by Chilton et al. (2004)’*. IMP2 also uses this source to calculate the value of hospital admissions, noting that *‘The research conducted by Chilton et al. (2004) ... also asked respondents about their willingness to pay to avoid hospitalisation and these values are used in damage cost pathways, rebased to current prices. The values are £8,296 for a respiratory hospital admission and £8,471 for a cardiovascular admission (2017 prices)’* [IMP2, p. 18].

#### **Project appraisal: valuations for avoidance of premature fatalities and injuries**

As noted in HM Treasury Green Book (A2.50, p. 72), *‘Monetary valuations of a VPF have been used in transport appraisals for several decades. They derive from research conducted on behalf of DfT’*. DfT continues to use values generated by Newcastle in its Web-based Transport Analysis Guidance (WebTAG). This is significant because development of cost-benefit analysis using WebTAG guidance is a requirement for all interventions that require government approval and serves as best practice for interventions that do not require government approval. Within the WebTAG, the mortality effects of changes in physical activity and the mortality effects of air pollution (NO<sub>x</sub> and particulate matter) are based on PUB2. The May 2019 WebTAG UNIT A3 Environmental Impact Appraisal [IMP3] states at para 3.4.5, p. 25, that *‘The valuations are based primarily on the health impacts of air quality pollutants ... A detailed derivation is contained within Defra’s Impact Pathway Approach [IMP2] guidance’*. This, as detailed above, clearly and extensively references PUB2.

#### **Impact on policy formation, agenda-setting, and policy delivery: advisory roles**

Over the REF period, based on their research expertise and work conducted at Newcastle, Chilton and Nielsen have served as Expert Panel Members to governments. They have been directly engaged to contribute expert advice to high-level national and international bodies, overseas ministries, and the private sector. Their efforts have led to changes in the agendas, understandings, and approaches of these organisations. For example:

- **Joint Air Quality Unit/DEFRA Delivery and Impacts Independent Review Panel:** By invite, Chilton is a member of this panel, which is comprised of academics and civil servants. In 2017 the UK Government named 28 Local Authorities (LAs) that were required to produce local plans to improve air quality by reducing nitrogen dioxide. Chilton’s experience was sought and used particularly *‘in assessing what impact these changes may have on an area and its residents, and if the proposed options would actually deliver environmental benefits’* [IMP4].
- **DEFRA Economic Advisory Panel:** Since 2018, by competitive application, Chilton has been a member of this panel, which *‘provides independent challenge and support for Defra’s economic analysis and economics profession’* and *‘is a vital tool to ensure the Department’s economic analysis continues to be of high quality and impactful’* [IMP5].
- **The Environment Agency (EA):** Through commissioned work (Contract Ref 1070087322), Chilton supported the EA in developing their valuation of, and guidance



for, dealing with the mental health costs of flooding in project appraisals. This was essential for the EA as robust values were needed for the 2019 Public Spending Review.

- **Organisation for Economic Cooperation and Development (OECD) and European Chemicals Agency (EHCA):** Since 2016, Chilton and Nielsen have had extensive reach with their work on cancer risk values, through repeat invites to expert workshops hosted by OECD and EHCA relating to the health impacts of chemicals. In particular, their participation in expert workshops has increased understanding of the WTP approach to avoid negative chemicals-related health impacts
- **Danish Economic Councils** (an independent advisory body for policymakers) has drawn on Newcastle research, following an invited presentation by Nielsen in 2015. Newcastle research is cited extensively in their policy report on the *Value of a Statistical Life* [IMP6]. International uptake of Newcastle research has also led to involvement with the **Department of Transport** and the **Treasury** in New Zealand.
- **Private sector organisations** have also sought out Newcastle expertise. The gas pipeline industry did so on public perception of risk, and the consumer organisation Which? commissioned a review of its methodology for its Consumer Impact Index. The Senior Economist at Which? acknowledged the impact of the research by saying that they sought out Chilton and Nielsen because of their '*international reputations as recognised experts in benefit-cost analysis and the valuation of non-market goods*' [IMP7].

### **Influencing government discussions on the need for updated values and methodologies in respect of life expectancy gains**

As mentioned in Section 2, Newcastle academics contributed to a cross-government workshop on Estimating the Monetary Value of a Life Year (VOLY); this led to the commissioning of a scoping study to ascertain the need for updated values and methodologies in respect of life expectancy gains. The tender document specifically drew on PUB4 to justify the need for the research: '*a limitation in several studies aimed at valuing changes in life expectancy to date is that they have not specified how the life expectancy gain is generated (Nielsen et al 2010)*' [IMP8, p. 3]. Newcastle led the scoping study (Grant 7) and the findings of the resulting report were presented at a workshop hosted by the DfT for potential suppliers of a primary study to derive up-to-date values for the appraisal of life and health. Without the Newcastle findings, the UK government would not be undertaking this extremely significant piece of work, which will lead to better and more informed policy decisions and have major implications for the efficiency of government spending and equity in population wellbeing.

### **5. Sources to corroborate the impact**

**IMP1:** [Health and Safety Executive \(2016\) Costs to Britain of Work Related Cancer](#)

**IMP2:** [Impact Pathways Approach: Guidance for air quality appraisal, Department for Environment Food and Rural Affairs \(DEFRA\), January 2019 \(p.16–18\) and updated guidance July 2020.](#)

**IMP3:** [Department for Transport TAG UNIT A3 Environmental Impact Appraisal](#)

**IMP4:** Email from Joint Air Quality Unit, Department for Transport (DfT) and DEFRA, Feb 2018

**IMP5:** Department for Environment Food and Rural Affairs: [Recruitment for DEFRA's Economic Advisory Panel](#)

**IMP6:** Report from the Danish Economic Councils *Kapitel I Værdi af Statistisk Liv*  
Available at: [https://dors.dk/files/media/rapporter/2016/M16/m16\\_kap\\_i.pdf](https://dors.dk/files/media/rapporter/2016/M16/m16_kap_i.pdf) (in Danish)

**IMP7:** Testimonial from the Senior Economist at Which? (The Consumers' Association)

**IMP8:** Statement of Service Requirements for the Provision of a Scoping Study on the Valuation of Risks to Life and Health: the Monetary Value of a Life Year (VOLY)