Institution: University College London		
Unit of Assessment: 13 – Architecture, Built Environment and Planning		
Title of case study: Improving health and tackling climate change: supporting rapid decarbonisation via the World Bank, over 23 medical associations, and the NHS		
Period when the underpinning research was undertaken: 2009-2018		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Tadj Oreszczyn	Professor of Energy and Environment	1989-present
Steve Pye	Associate Professor	2011-present
Paolo Agnolucci	Associate Professor in Resources and Environmental Economics	2012-present
Ian Hamilton	Reader in Energy Epidemiology	2015-present
Paul Ekins	Professor of Resources and Environment Policy	2009-present
Michael Davies	Professor of Building Physics and Environment	2004-present
Melissa Lott	Research Fellow	2013-present
Jonathan Chambers	Research Fellow	2013-2017
Harry Kennard	Research Fellow	2015-present
Matthew Winning	Research Fellow	2012-present
Nicholas Hughes	Senior Research Fellow	2015-present
Carole Dalin	Principal Research Fellow	2016-present
Robert Lowe	Professor, Chair of Energy and Building Science	2006-present
Jonathan Taylor	Lecturer	2001-2005
Marcella Ucci	Associate Professor in Environmental and Healthy Buildings	2007-present
Paul Ruyssevelt	Professor, Chair of Energy & Building Performance	2011-present
Andrew Smith	Principal Research Fellow	2013-2021
Eleni Oikonomou	Senior Research Fellow	2010-present
Period when the claimed impact occurred: 2015-2020		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact (indicative maximum 100 words)

Bartlett research on the economics, finance and health factors relating to climate change informed the 'Lancet Countdown: Tracking Progress on Health and Climate Change', which works to place health at the centre of governments' understanding of and responses to climate change. Through this publication, and its uptake in policy and industry, this research has: i) been the basis for decisions on fossil fuel divestment of international associations totalling close to USD100,000,000; and ii) underpinned the NHS net zero emissions strategy and implementation plan. Further impacts are seen in the Countdown's impact on the World Bank's investment in climate-sensitive health projects, through debate in the House of Lords, and through the Countdown's reach of an estimated 1,800,000,000 members of the public across 54 countries.

2. Underpinning research (indicative maximum 500 words)

A rapidly changing climate has dire implications for every aspect of human health. The Paris Agreement, which came into effect in November 2016, presents a remarkable opportunity to respond to and mitigate climate change at all levels.

Bartlett research has focused on the health co-benefits of mitigating climate change and the adaptation required to maintain a healthy population. This has included extensive research into specific health co-benefits of energy efficiency in buildings - e.g. moisture-related asthma

dust mites **[a]**, particulates **[b]**, temperature related excess winter **[c]** and summer deaths **[d]**, and, more recently, radon and energy efficiency **[e]**. Bartlett research has integrated these individual mechanisms into models now used to plan national and regional low carbon transitions that maximise health co-benefits. This multi-disciplinary research developed a collaborative working relationship between built environment and energy experts at the Bartlett and health experts at UCL and the London School of Hygiene & Tropical Medicine.

Such research has led to the Bartlett playing a leading role in a global research programme to map the world's progress in tackling climate change and its effects on global health. Initially Bartlett research fed into The Lancet, 'Public health benefits of strategies to reduce greenhouse-gas emissions: household energy' (2009) **[f]** and then 'Health and climate change: policy responses to protect public health' (2015) **[g]**. This special issue in 2015 led to the Lancet commissioning an annual special issue of the journal called the Countdown, published just ahead of the annual UN climate negotiations. It is an original analysis by more than 80 authors from over 35 academic and UN institutions, drawing on data from reputable sources, and looking at more than 40 indicators organised within five sections **[h]**. Researchers at the Bartlett have led sections 3 (Mitigation actions and health co-benefits) and 4 (Economics and finance) since the Countdown's inception in 2015. Bartlett researchers have also held formal strategic roles, steering the direction of the Lancet Countdown, as two of the eight Board Members and as current Lancet Countdown Executive Director (Hamilton).

The Bartlett produced the research for the majority of the indicators in **Section 3 of the annual report of the Lancet Countdown – Mitigation actions and health co-benefits** (led by Oreszczyn and Hamilton with support from Bartlett staff Davies, Kennard, Dalin, Winning). This was produced in partnership with the International Institute for Applied Systems Analysis, London School of Hygiene and Tropical Medicine, University of Oxford, and Yale. Section 3 evaluates and tracks evidence on the ancillary health benefits of climate change mitigation policies. The indicators led by Bartlett authors include the energy indicators (3.1.1-3.1.3 and 3.2), which analyse data from the International Energy Agency (IEA) and the World Health Organisation (WHO) (3.2) on the carbon intensity of the energy system, the energy supply and share of electricity generation for coal, low carbon energy and renewable energy, and energy use in the home (including cooking fuels). Each of these is linked to both greenhouse gas emissions and ambient and household air pollution. The Bartlett researchers produced data on the emissions from agricultural production and consumption (3.5). This includes modelling production and trade data from the Food and Agriculture Organisation (FAO) and emissions intensity factors for crops and livestock to estimate agricultural production and consumption emissions for each country, by animal or plant product. The Bartlett then also coordinated the collation of the entire section – meeting with all indicator authors and writing and editing all the content.

The Bartlett produced the research for the majority of the indicators within **Section 4 of the annual report of the Lancet Countdown – Economics and Finance** (led by Ekins, with support from Drummond and Hughes). Section 4 examines the consequences of climate change, looking at the costs to human health and the economy – including increased healthcare costs and decreased workforce productivity – as well as the benefits of avoiding the potential costs of inaction. The indicators include economic losses due to climate-related extreme events, loss of earnings from heat-related reduction in labour capacity, and costs of the health impacts of air pollution, which applies the value of a life year to premature mortality from air pollution (an indicator from Section 3). The Bartlett also produced indicators on investments and employment in low-carbon and high-carbon industries as well as fossil fuel divestment, analysing data from the IEA, the International Renewable Energy Agency (IRENA), IBISWorld and 350.org as well as net values placed on fossil fuels, modelling fossil fuel subsidies and carbon pricing mechanisms.

This research has developed the argument that sustainable energy systems require sustainable climate change solutions, which have considerable health co-benefits.

3. References to the research (indicative maximum of **six references**)

a) Ucci M, Pretlove SEC, Biddulph P, et al. The psychrometric control of house dust mites: a pilot study. *Building Services Engineering Research and Technology*. 2007;28(4):347-356. https://doi.org/10.1177%2F0143624407084731

b) Shrubsole, J. Taylor, P. Das, I. G. Hamilton, E. Oikonomou & M. Davies (2016) Impacts of energy efficiency retrofitting measures on indoor $PM_{2.5}$ concentrations across different income groups in England: a modelling study, *Advances in Building Energy Research*, 10:1, 69-83, https://doi.org/10.1080/17512549.2015.1014844

c) Oreszczyn T, Sung H. Hong, Ian Ridley, Paul Wilkinson. Determinants of winter indoor temperatures in low income households in England, *Energy and Buildings*, Volume 38, Issue 3, 2006, pp. 245-252, ISSN 0378-7788, https://doi.org/10.1016/j.enbuild.2005.06.006

d) Pathan, A. Mavrogianni, A. Summerfield, T. Oreszczyn, M. Davies. Monitoring summer indoor overheating in the London housing stock, Energy and Buildings, Volume 141, 2017, pp.361-378, ISSN 0378-7788, https://doi.org/10.1016/j.enbuild.2017.02.049

e) Hamilton I, Milner J, Chalabi Z, et al. Health effects of home energy efficiency interventions in England: a modelling study. *BMJ Open* 2015;5: e007298. https://doi.org/10.1136/bmjopen-2014-007298

f) Wilkinson, P., Smith, K., Davies, M., Adair, H., Armstrong, B., Barrett, M., Chalabi, Z. (2009). Public health benefits of strategies to reduce green house-gas emissions: household energy. *The Lancet*, 374 (9705). https://doi.org/10.1016/S0140-6736(09)61713-X

g) Watts, N., Adger, W. N., Agnolucci, P., Blackstock, J., Byass, P., Cai, W., Costello, A. (2015). Health and climate change: policy responses to protect public health. *The Lancet*, 386(10006), 1861–1914. https://doi.org/10.1016/S0140-6736(15)60854-6

h) Watts, N., Amann, M., Arnell, N., Ayeb-Karlsson, S., Beagley, J., Belesova, K., The 2020 report of The Lancet Countdown on health and climate change: responding to converging crises. *The Lancet*, 397 (10269), 71-170 https://doi.org/10.1016/S0140-6736(09)61713-X

4. Details of the impact (indicative maximum 750 words)

In 2018, WHO Director General Dr Tedros Adhanom Ghebreyesus said that "The Lancet Countdown on Health and Climate Change is an essential partner in driving global progress towards achieving the goals of the Paris Agreement, the most important health treaty of the century" **[1]**. Bartlett-led research has been central to The Lancet Commission and the Lancet Countdown in establishing a greater understanding of the health consequences of climate change. This has led to global organisational and policy change, demonstrated in a shift in the response of mainstream health institutions (i.e. medical colleges, health professional associations, health systems) to climate change. Such institutions have been historically hard to reach when discussing climate change, yet can play a leading role in utilising research to make positive climate-related decision making. This is because they: i) are required to contribute to the health adaptation response; ii) are a large contributor to emissions in high-income settings; and iii) have powerful influence on the public, the media, and policymakers.

4.1 Fossil fuel divestment of international associations

One of the indicators under the Countdown's 'Section 4 – Economics and Finance', tracks funds from health institutions divested from fossil fuels, finding that at least 23 national and international health associations, colleges and insurers have voted to cease fossil fuel investments since 2014.

The Royal College of General Practitioners (the UK's largest Medical Royal College, with over 53,000 members) provides an example of how Bartlett research through the Countdown

contributed to these decisions to divest. In 2018, their Trustee board announced divestment in fossil fuel companies, representing 5-6% of its GBP7,150,000 investment portfolio. As their Chair confirms **[f, g, h]** was integral to divestment decisions: "This research made it clear that the continued use of fossil fuels is harming the health of our patients. Based on this evidence from the Lancet Countdown, in addition to a wider recognition of the issues by our members and staff, the College made the decision that it would no longer invest in fossil fuel companies" **[2]**.

The total asset value of these 23 health institutions is estimated at USD42,000,000,000 and includes: the World Medical Association, a confederation of 115 National Medical Associations (representing 9,000,000 doctors around the world, some of whom have also made their own divestment commitments); the Royal Australasian College of Physicians (>25,000 members); the British Psychological Society (representing 21,500 UK psychologists); the New Zealand Nurses Organisation (representing 58,000 nurses in New Zealand); the HESTA Super Fund (>880,000 members); Berlin Doctors' pension Fund (>30,000 members); and Medibank and HCF, Australian private health insurers to 3,700,000 and 1,700,000 members, respectively.

The 2015 Countdown report provided the scientific rationale to engage the World Bank in funding health and climate change research. Over three years, the World Bank established a new methodology for screening its health investments for climate change impact, which increased the share of World Bank climate-sensitive health investments by 31%, corresponding to more than USD1,000,000,000 in developing country grants and loans. The Founding Lead of the World Bank Climate Change and Health Program cites the impact The Lancet had on these decisions: "Overall, the World Bank Climate Change and Health Program has increased the share of World Bank health investments that consider climate change from a baseline of virtually 0 to 31% for the 2018 financial year, corresponding to more than $1billion for climate-sensitive health investments. The publications of the Lancet Countdown have provided a robust peer-reviewed basis upon which this work was launched and has continued to contribute to its growth" **[3]**.

4.2 NHS net zero emissions strategy and implementation plan

This research is at the core of the 'Greener NHS' campaign. Following the launch of the 2019 Lancet Countdown that concluded "the health-care sector is responsible for about 4·6% of global emissions, a value which is steadily rising across most major economies" and air pollution predominately driven by fossil fuel burning was leading to 2,900,000 global deaths attributable to fine particle matter, the NHS Chief Executive approached the Countdown Executive Director to provide independent advice on when and how the NHS could achieve net zero. This led to an NHS net zero contract to UCL (GBP441,600). Bartlett researchers led on the independent advice on two of the four working groups, 'Estates & Facilities' and 'Travel & Transport' and joined the NHS Net Zero Expert Panel **[4]**.

The subsequent report 'Delivering a 'Net Zero' National Health Service' provides a detailed account of the NHS' modelling and analytics underpinning the latest NHS carbon footprint, trajectories to net zero, and the interventions required to achieve that ambition. The Head of Operations and Delivery, Greener NHS confirmed the important role Bartlett researchers played via the Countdown and further consultation in helping the NHS set its carbon targets and in planning the transition, stating that "Their evidence […] and advice about the energy systems impact of NHS decarbonising and issues of health co-benefits […] provided the NHS with key evidence that supported the publication of the NHS "Deliver[ing] a 'Net Zero' National Health Service" report" **[5]**. The report commits the NHS to the following targets:

- for the emissions the NHS control directly (the NHS Carbon Footprint), net zero by 2040, with an ambition to reach an 80% reduction by 2028 to 2032
- for the emissions the NHS can influence (the NHS Carbon Footprint Plus), net zero by 2045, with an ambition to reach an 80% reduction by 2036 to 2039 **[4]**

Estimated positive impacts from this commitment include:

- Reduction in the NHS's contribution of 4-5% of the UK's carbon footprint

- Reduction in the estimated 6,700,000,000 road miles each year created by patients and their visitors travelling to the NHS
- Promotion of public transport or walking and cycling to work, monitoring of waste generation and recycling rates, and installing more energy efficient heat and power sources **[6]**

The Lancet Countdown team summarises the significance of this shift, stating that: "the NHS sit on the frontline of public health, with 1,300,000 staff it is the country's largest employer as well as one of the world's top 10 employers, and accounts for 4% of England's carbon footprint […] The NHS has also shown a willingness to challenge itself by not only setting a 2040 net zero target for direct emissions, but an even more ambitious target of 2045 for emissions it can influence such as those in its supply chain" **[7]**.

4.3 Global policy and discourse on climate change and health

The global reach and influence of this research through the Countdown is shown by its inclusion in national policy and press and public events to coincide with the launch of its annual report. In December 2020, despite the enormous effect of the COVID-19 pandemic, 2,200 people signed up to the live event platform for the 2020 global and US launches of Lancet Countdown Report (with a further 1,200 views on The Lancet's Youtube channel), over 2,000 attendees at the Chinese launch, and a further 30 events across every world region. There were over 1,200 unique media stories, reaching over 1,000,000,000 members of the public in 44 countries **[8]**. The 2020 Lancet Countdown Report was ranked in the top 10 climate change articles most featured in the media (2020) **[9]**.

In the UK, the Countdown has held briefings for the Department for Health; Department of Business, Energy, and Industrial Strategy (and DECC, prior); Department of the Environment, Food, and Rural Affairs; and the Foreign and Commonwealth Office. In 2017, the Countdown co-hosted a policy event for MPs on its latest analysis, with the All-Party Parliamentary Group for Climate Change and the All-Party Parliamentary Group for Health. This led to a debate in the House of Lords on the 'Effects of climate change on health', which was punctuated with references to the Countdown's work **[10]**.

Bartlett research through the Lancet has influenced the policies of global health institutions and the NHS, and in turn, this is contributing to a global rethink of the relationship between health and climate change.

5. Sources to corroborate the impact (indicative maximum of 10 references)

1. *Extreme heat damaging our health and livelihoods and threatening to overwhelm hospitals around the world*, The World and Vietnam Report, 2018. https://bit.ly/3vxWtgc
2. Testimonial: Former Chair of the Royal College of General Practitioners.
3. Testimonial: Founding Lead, World Bank Climate Change and Health Program
4. *Delivering a 'Net Zero' National Health Service*, NHS 2020. https://bit.ly/3ceF3fQ
5. Testimonial: Head of Operations and Delivery, Greener NHS
6. *Greener NHS campaign to tackle climate 'health emergency'*, NHS 2020. https://bit.ly/3qwFYgF
7. *Lancet Countdown analysis aids NHS world-first net zero plan*, Lancet Countdown 2020. https://bit.ly/3qpMCVZ
8. *Reach and Impact of the Lancet Countdown*, Lancet Countdown 2020. (pdf)
9. *Analysis: The climate papers most featured in the media in 2020* https://bit.ly/30unO4B
10. House of Lords Debate Briefing https://bit.ly/30nTsRn