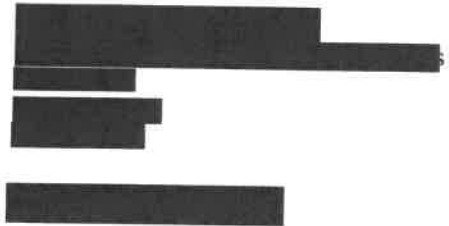


# PhD proposal form

The completed form should be emailed, and the signed version posted to:



**Applicant:—student**

Forename  
Surname  
Telephone No.  
Email  
Postal Address


**Applicant(s):— academic supervisor**

Please enter details for a primary supervisor(s) in the economics discipline, and if applicable, for a second academic supervisor i, having first secured their agreement:

Title  
*(Dr., Prof., Mr. Ms.) etc.)*  
Forename  
Surname  
Telephone No.  
Email  
Department/School

	Primary supervisor (economics)	Supervisor 2
	Dr.	Dr.
	Economics	Economics

**Co-Applicants:— institutional/research centre co-supervisors**

If applicable, enter details of proposed supervisors(s) primarily affiliated to institutions/agencies/research centres related to this proposal, who will act as co-supervisor(s), having first secured their agreement:

Title  
*(Dr., Prof., Mr. Ms.) etc.)*  
Forename  
Surname  
Telephone No.  
Email  
Institution/Centre  
Postal Address

	Institution Supervisor 1	Institution Supervisor 2	Institution Supervisor 3

**Graduate Research Committee (GRC):**

1. Chair	
2.	
3.	
4.	

<b>Research topic/project title:</b>	Climate Change, Health Outcomes and Adaptation: An Econometric Analysis Using Big Data.
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<b>Start date:</b>	01/09/2022	<b>End date:</b>	01/09/2026
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**Funding:**

Is the research topic/project funded?	yes
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If 'yes' please detail the funding source (e.g., funding institution and particular funding stream)	Hardiman Research Scholarship
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Breakdown of funding:	Year 1	Year 2	Year 3
Fellowship/stipend	18,500	18,500	18,500
Other project funds	0	0	0
Annual total	18,500	18,500	18,500
<b>Total funding secured (Years 1 to 3)</b>	<b>55,500</b>		

**Note: Fees covered by Hardiman Scholarship.**

## **1. Research topic/project abstract**

Climate change is expected to lead to changes in the prevalence of extreme temperatures and destructive weather events, with potentially significant effects on human health (Costello et al, 2009). To date, numerous studies have shown a link between extreme temperatures and mortality (Deschenes, 2014). However, the effect of temperature on health outcomes that do not result in mortality (i.e., morbidity) has, for the most part, been overlooked in the economics literature (White, 2017) and have yet to be demonstrated in a country with a temperate climate. Furthermore, little attention has been paid to understanding the specific channels or mechanisms through which human health is affected by extreme weather. Moreover, a critical challenge in assessing the human health threats posed by climate change is the degree to which 'adaptation is possible' over the longer term. Understanding these behavioural and adaptation responses will be key in developing policy to limit the harmful health effects of climate change. Therefore, the objective will be to investigate the causal relationship between temperature and morbidity in a high-income country with a mild climate and explore factors determining adaptation decisions in responses to extreme temperatures which may be consequential for human health. This will be addressed through a research agenda comprising three inter-related research papers. The first paper will estimate the causal relationship between temperature and morbidity. The second paper will investigate short-run forms of adaptation behaviours that may mediate the temperature-morbidity relationship. The third paper will investigate the role of local environmental factors in potentially limiting the adaptive capacity of communities. Overall, the proposed PhD will provide a comprehensive assessment of the impact of extreme temperature on health outcomes and the role of adaptive behaviours. Policy Implications will include evidence to support public health planning under climate change, and adaptation policy.

## **2. Research topic/project description**

### **(a) Objectives**

The objective will be to investigate the causal relationship between temperature and morbidity in a high-income country with a mild climate and explore factors determining adaptation decisions in responses to extreme temperatures which may be consequential for human health. This will be addressed through a research agenda comprising three inter-related research papers. The first paper will estimate the causal relationship between temperature and morbidity. The second paper will investigate short-run forms of adaptation behaviours that may mediate the temperature-morbidity relationship. The third paper will investigate the role of local environmental factors in potentially limiting the adaptive capacity of communities.

### **(b) Justification**

Climate change is expected to lead to changes in the prevalence of extreme temperatures and destructive weather events, with potentially significant effects on human health (Costello et al, 2009). To date, numerous studies have shown a link between extreme temperatures and mortality (Deschenes, 2014). However, the effect of temperature on health outcomes that do not result in mortality (i.e., morbidity) has, for the most part, been overlooked in the economics literature (White, 2017). The existing economic research on temperature and morbidity is limited, mainly focusing on estimating 'reduced form' effects of extreme weather and climate change (Karlsson and Ziebarth, 2018; Agarwal et al, 2021; Mullins and White, 2019), which have yet to be demonstrated in a country with a temperate climate. This is important as the greatest overall temperature increases from climate change are likely to occur in northern latitudes (Beusch et al, 2022). Furthermore, little attention has been paid to understanding the specific channels or mechanisms through which human health is affected by extreme weather. For example, adaptation behaviours are an important mechanism in mediating the biological relationship, and, as a result, a critical challenge in assessing the human health threats posed by climate change is the degree to which 'adaptation is possible' (Deschenes, 2014). However, it is not well understood why some populations adapt so effectively in some dimensions of climate, while entirely failing to adapt in other contexts, and this remains a critical research challenge (Carleton and Hsiang, 2016).

### **(c) Methodology**

The proposed PhD will present a comprehensive econometric analysis of the relationship between temperature and morbidity using newly acquired high-quality big data and advanced econometric modelling techniques. Thus, notable feature of the proposed PhD will be the use of high-quality bespoke data to be constructed using the Hospital Episodes Statistics (HES) database. The HES database contains the universe of hospital attendances in England over a long period (10 years plus), in contrast to previous temperature-morbidity research which has typically been based on regional or unrepresentative data (White, 2017; Mullins and White, 2019; Agarwal et al, 2021). A primary reason for this gap is simply a lack of data. There is a limited number of countries with nationally representative hospital attendance dataset that identifies location of residence at a spatial or temporal scale fine enough for the type of analysis that will be used.

The first paper will estimate the causal relationship between temperature and morbidity using the HES database matched with high resolution weather data (Met Office, 2018) at a daily frequency with postcodes as the unit of analysis. A distributed lag panel data model will be employed to investigate the dynamic relationship between temperature, unplanned hospital attendances, and specific illness categories (e.g., cardiovascular). It will also examine differences across population subgroups (e.g., income) to identify factors driving differences in the estimated temperature-morbidity relationship.

Based on the results of [REDACTED], we expect to find while higher temperatures are in general associated with significant increases in hospital attendances and that there are distinct effects evident across the temperature distribution. In particular, while cold weather is associated with lower contemporaneous A&E attendances, this effect appears to be entirely attributable to displacement of A&E visits to subsequent weeks. In contrast, for hotter temperatures, we find evidence of substantial contemporaneous increases in weekly A&E attendances that are not offset by subsequent reductions. Essentially, paper one will aim to explore this relationship in greater detail, exploiting daily & highly localized A&E attendance records with additional socio-economic data to explore possible heterogeneity. For instance, we could expect those in areas of high deprivation experience higher rates of health impacts than the overall population. Similarly, we expect to observe an income gradient, in particular with low-income areas experiencing higher rates of health impacts than the overall population.

The second paper will investigate short-run forms of adaptation behaviours, known as defensive or avoidance behaviours (Deschenes, 2014). Notably, the impact of short-term behavioural responses on health outcomes is contested. Behavioural responses may not necessarily be 'defensive', with many potential responses being utility enhancing, yet damaging to human health (White, 2017). [REDACTED] highlights that the dynamic relationship between temperature and morbidity is likely driven by behavioural mechanism, but remains agnostic on the specific behaviour. Using high resolution 'UK Road Traffic Statistics' (DOT, 2022) merged with the dataset developed for Paper 1 to investigate if mobility is an important mechanism within the relationship between temperature and morbidity using a similar model. While the strength of behavioural response may differ across socio-economic groups, we expect mobility to be a key behaviour that may worsen the health impacts of extreme temperatures due in part to individuals' desire to 'enjoy good weather'.

The third paper will investigate the role of local environmental factors in potentially limiting the adaptive capacity of communities to the health impact of extreme temperature. The analysis will also use the dataset from Paper 1 merged with highly localised data on land use (UKCEH, 2022) and air pollution (DEFRA, 2022), and employ a spatial panel data model. The effect of local land use (e.g., proportion of green/blue space) and local air pollution (e.g. road traffic pollution) on the resilience of communities to extreme temperatures will be tested. We expect that higher levels of air pollution and lower levels of green and blue space within a given area will be associated with greater health impacts. Moreover, these other environmental risks are likely to overlap with other socio-economic risk factors such as deprivation or low-income.

#### (d) Expected research outcomes

I will construct a number of datasets for each of the research papers: (1) Daily Weather dataset for England including variables on precipitation, humidity and precipitations; (2) a traffic volume dataset for England; (3) a dataset on urban land-use (Blue & Green Spaces) and air pollution. Finally, a number of bespoke datasets will be generated for each of research papers merging each of the dataset with the health outcomes. Although, we will not be able to make these datasets publicly available due to GDPR issues. As well, we aim to produce three journal articles: (1) Estimate causal relationship between temperature and morbidity and explore difference across population sub-groups; (2) Investigate if mobility is a key behavioural response that mediates the relationship between temperature and morbidity in England; (3) Explore the role of local environmental factors in potentially limiting the adaptive capacity of communities to the health impact of extreme temperature.

This PhD research will contribute to the knowledge-bases on both the impacts of climate change, with a focus on the non-deadly health impacts of extreme weather and climate change. Moreover, it will investigate this in a region that currently experiences mild extreme temperatures but will experience significant increases in frequency and severity of extreme temperature as a result of climate change. As well, little attention has been paid to short-term behavioural mechanism and other factors that determine longer run adaptation decisions that will mediate health impacts of extreme weather and climate change. We aim to identify specific behavioural response and factors that determine adaptation decisions of individuals and communities. Overall, the proposed PhD will provide a comprehensive assessment of the impact of extreme temperature on health outcomes and the role of adaptive behaviours. Policy implications of the research will include evidence to support public health planning for increased frequency of extreme weather under climate change, and support for policies aimed at mitigating harmful health effects of extreme temperatures.

#### (e) Bibliography

- Agarwal, S., Qin, Y., Shi, L., Wei, G. and Zhu, H. (2021) Impact of temperature on morbidity: New evidence from China. Available at SSRN 3807776.
- Beusch, L., Nauels, A., Gudmundsson, L., Gütschow, J., Schleussner, C.F. and Seneviratne, S.I. (2022) Responsibility of major emitters for country-level warming and extreme hot years. *Communications Earth & Environment*, 3(1), 1-7.
- Carleton, T.A. and Hsiang, S.M. (2016) Social and economic impacts of climate. *Science*, 353(6304).
- Costello, A., Abbas, M., Allen, A., Ball, S., Bell, S., Bellamy, R., Friel, S., Groce, N., Johnson, A. and Kett, M. (2009) Managing the health effects of climate change: Lancet and University College London Institute for Global Health Commission. *The Lancet*, 373(9676), 1693-1733.

- Deschenes, O. (2014) Temperature, human health, and adaptation: A review of the empirical literature. *Energy Economics*, 46, 606-619.
- DEFRA (Department for the Environment, Food and Rural Affairs) (2022) UK AIR: Air Information Resources. Available at: <https://uk-air.defra.gov.uk/data/> (Accessed 25 January 2022).
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- Karlsson, M. and Ziebarth, N.R. (2018) Population health effects and health-related costs of extreme temperatures: Comprehensive evidence from Germany. *Journal of Environmental Economics and Management*, 91, 93-117.
- Met Office (2018) HadUK-Grid Gridded and Regional Average Climate Observations for the UK. Centre for Environmental Data Analysis.
- Mullins, J.T. and White, C. (2019) Temperature and mental health: Evidence from the spectrum of mental health outcomes. *Journal of Health Economics*, 68, 102240.
- UKCEH (UK Centre for Ecology & Hydrology) (2022) UKCEH Land Cover Maps. Available at: <https://www.ceh.ac.uk/ukceh-land-cover-maps> (Accessed 25 January 2022).
- White, C. (2017) The dynamic relationship between temperature and morbidity. *Journal of the Association of Environmental and Resource Economists*, 4, 1155-1198.
- Gibney G, McDermott TKJ, Cullinan J, (2022) Extreme Temperature, Morbidity and Behaviour: Evidence from A&E Attendances in England, Centre for Economic Research on Inclusivity and Sustainability (CERIS) Working Paper Series, 2022/01.

### 3. Workplan

The objective here is to clearly demonstrate that thought has been given to the major components of the workplan, rather than being overly prescriptive.

Task No:	Task short title:	Task detail: (A short sentence)	Timescale: (No of months)
1	Literature Review	Conduct a literature review of extent literature	6
2	Apply for HES data.	Submit Application to NHS to access HES records.	2
3	Weather dataset generation	Data Cleaning and Generation of appropriate aggregated weather dataset.	3
4	Mobility dataset Generation	Generate dataset to measure mobility levels for each postcode.	3
5	Land-use & Air Pollution Dataset Generation	Generate dataset to measure land-use & air pollution for each postcode.	3
6	Data Cleaning, Merging and Analysis for Paper 1, 2, 3	Perform dataset merging, cleaning and analysis for each paper.	6
7	Prepare Papers for Publication & Presentation at Seminars	Draft working papers for both publication & presentation at academic seminars.	12
8	Coursework	Completion of Coursework	6
9	Write Thesis	Write Thesis for Final Submission	6

### 4. Publications

List up to five recent relevant publications in each case for:

#### (a) applicant (student)

- [REDACTED] Extreme Temperature, Morbidity and Behaviour: Evidence from A&E Attendances in England, Centre for Economic Research on Inclusivity and Sustainability (CERIS) Working Paper Series, 2022/01.

#### (b) primary NUI Galway supervisor

- [REDACTED] Adaptation to climate change: A review through a development economics lens. *World Development*, 104, pp.183-196.

- [REDACTED]. A review of adaptation to climate change through a development economics lens.
- [REDACTED]. The urbanising force of global warming: the role of climate change in the spatial distribution of population. *Journal of Economic Geography*, 21(4), pp.531-556.

**(c) institutional/research centre co-supervisor, if applicable**

- [REDACTED] Distance matters: Geographic accessibility and higher education participation decisions. In *Critical Perspectives on Economics of Education*(pp. 213-236). Routledge.
- [REDACTED] The Sustainability of Ireland's Health Care System. In *The Sustainability of Health Care Systems in Europe*. Emerald Publishing Limited.

**5. Signatures**

**Applicant (student):** [REDACTED] **Date:** [REDACTED]

**Primary supervisor:** [REDACTED] **Date:** [REDACTED]

**Institution/research centre**

**co-supervisor:** [REDACTED] **Date:** [REDACTED]  
If applicable