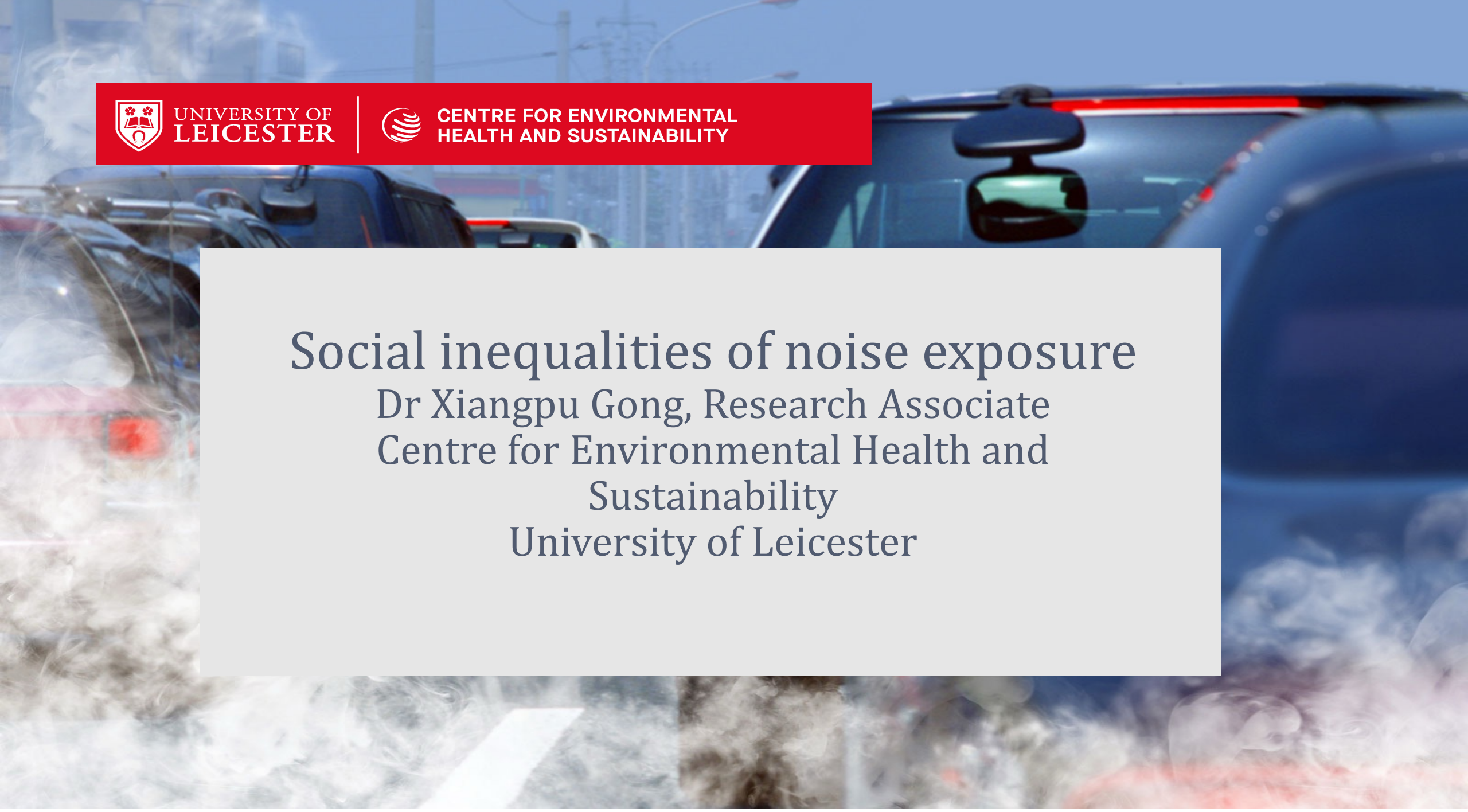

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Social inequalities of noise exposure

Dr Xiangpu Gong, Research Associate
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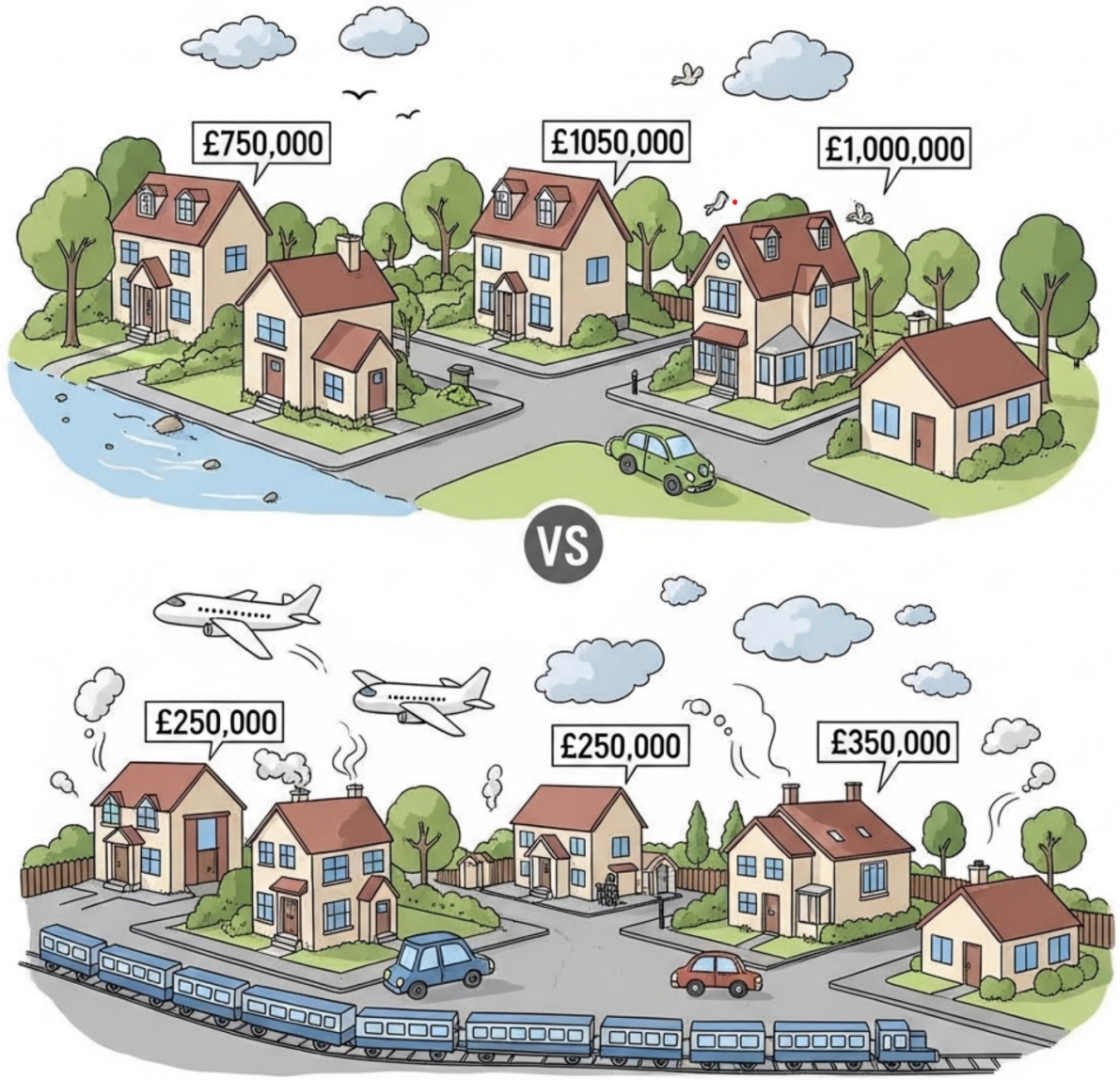
University of Leicester



Mechanism

- Why social inequalities of noise exposure may exist
- **Hedonic pricing model**: Because of the undesirable nature of aircraft noise exposure, houses in areas with higher noise levels tend to have lower market values (Nelson, 2008).
- **Political power hypothesis**: Marginalised communities lack voice in land-use decisions (Casey et al., 2017; Trudeau et al., 2023).

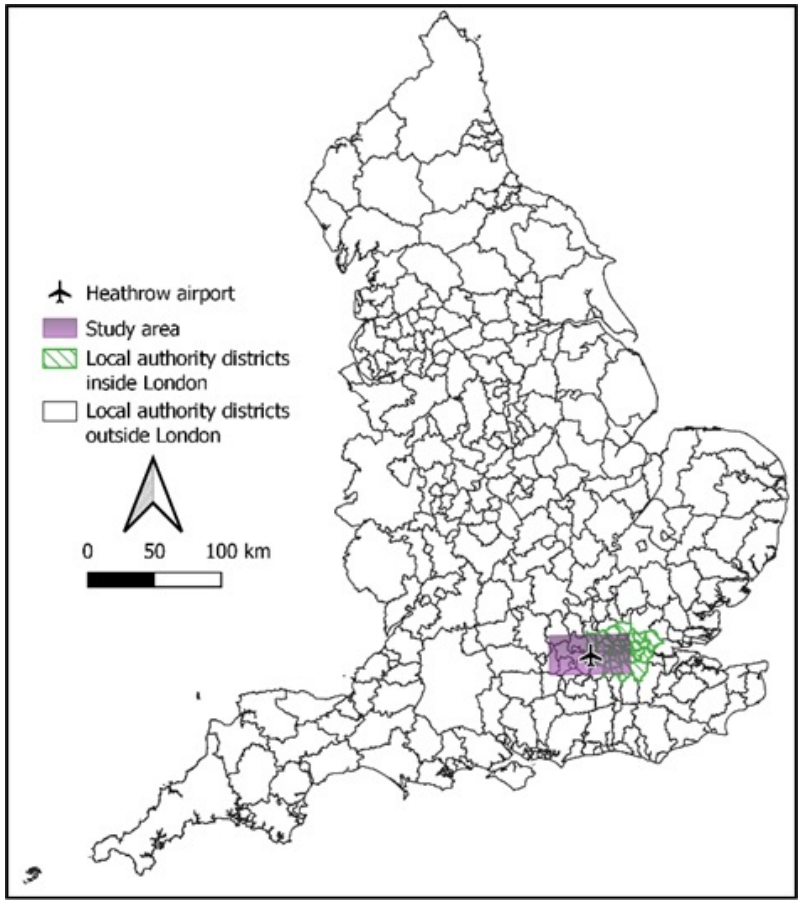
Previous Evidence - What We Knew Before

- **Limited and mixed evidence on UK**
  - Blanco & Flindell (2011) found positive noise-price relationships in Birmingham city centre and Sutton Coldfield but not in London city centre.
  - One previous Heathrow study (Tonne et al., 2018) which found wealthy, white residents were *more* likely to be exposed to aircraft noise.

- **Global evidence**
  - Systematic review evidence in the WHO European Region (Dreger et al., 2019):
  - Only 8 studies (2010-2017) met inclusion criteria;
  - Mixed and contradictory results both between and within studies;
  - Material deprivation: Studies using income, housing value, dwelling ownership showed higher noise exposure in lower socioeconomic groups
  - Education: Some studies found higher education linked to *more* noise exposure

Heathrow Study (Focusing on Aircraft Noise)

- Daily noise data for 155,000+ postcodes near Heathrow Airport (1 Jan. 2014 – 31 Dec. 2018).
- AEDT version 3b used for assessing aircraft noise levels
- Used metrics (Lday - daytime average, Leve - evening average, Lnight - nighttime average, and LAeq24 - 24-hour average) among other detailed non-standard metrics.
- Multiple Deprivation Measures: Material (Carstairs), health (avoidable deaths), energy (fuel poverty)
- Approximately 97 km east to west and 47 km north to south



- Night time noise contours (CAA)

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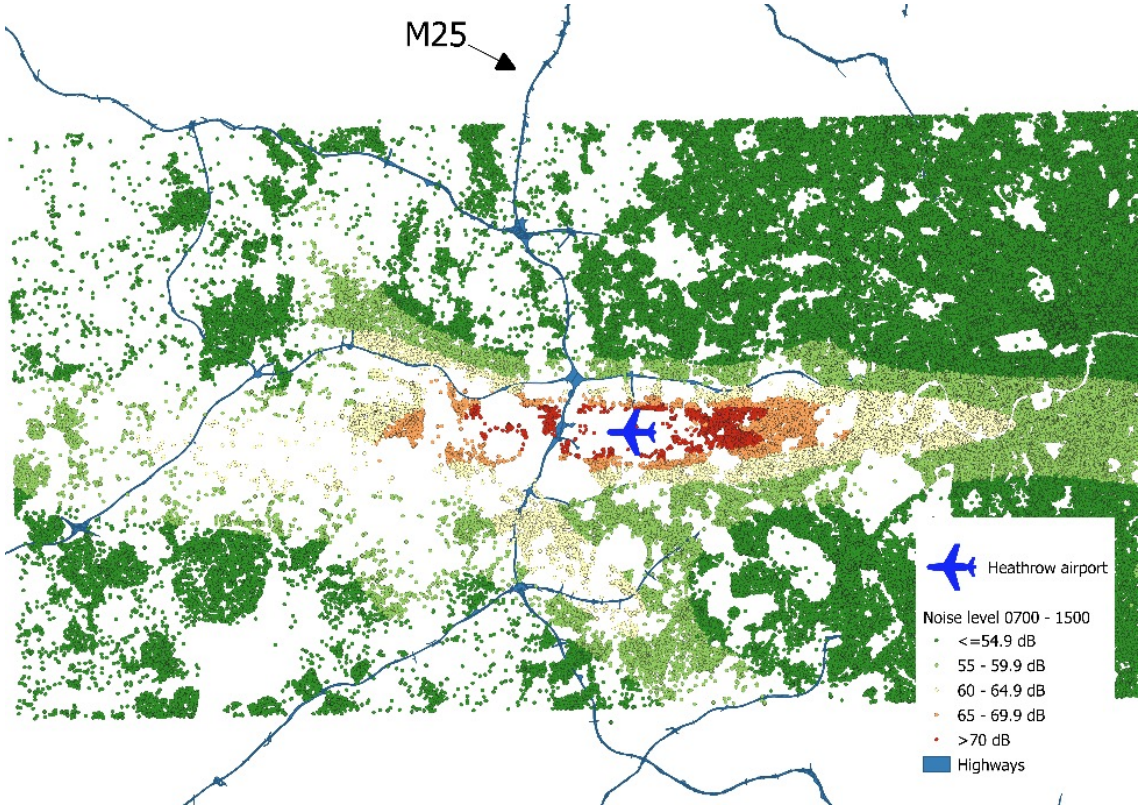
Aircraft noise 0700-1500h around London Heathrow Airport 2014



Heathrow Study (Focusing on Aircraft Noise)

Results – association between aircraft noise and deprivation

- **Complex patterns**: Noise-inequality relationships varied by which deprivation measure was used.
- **Health inequality implication**: Higher avoidable mortality rates linked to higher aircraft noise exposure.
- **Nuanced material deprivation results**: No overall pattern, but least deprived areas had lowest *nighttime* noise.
- **No energy poverty associations**.
- **Ethnicity interactions**: Material deprivation patterns only emerged in areas with highest % non-white population.

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Outline

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Health & Place
Volume 92, March 2025, 103421

Inequality in exposure to daily aircraft noise near heathrow airport: An empirical study

Xiangpu Gong [a b], Nicole Itzkowitz [c], Glory O. Atilola [c], Kathryn Adams [a], Calvin Jephcote [a], Marta Blangiardo [c], John Gulliver [a b d], Anna Hansell [a b e]

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Highlights

- Associations between deprivation and aircraft noise were complex and varied by deprivation measure.
- Higher avoidable mortality rates (health inequality) were associated with higher aircraft noise exposures.
- There was no gradient between area-based deprivation (Carstairs index) and aircraft noise, but the least deprived areas had the lowest night-time exposures.
- There were no associations between aircraft noise and fuel poverty.

Abstract

Aircraft noise is an important source of environmental pollution and a burden on public health. We examined the association between three different area-level deprivation measures (Carstairs index 2011 only; yearly avoidable mortality rates 2014–2018 and

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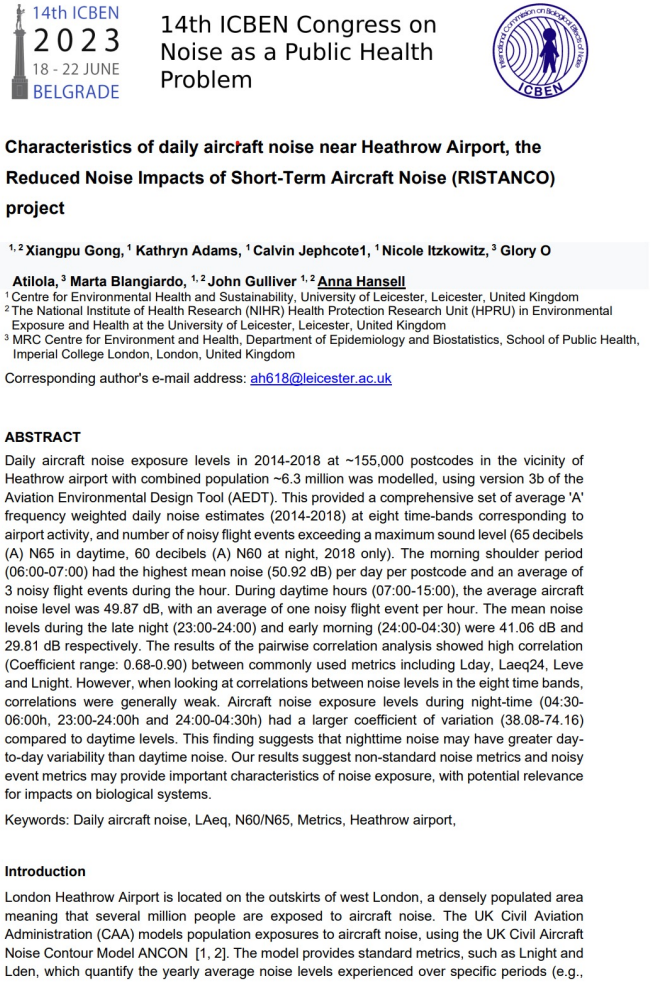
Heathrow Study (Focusing on Aircraft Noise)

Results – characteristics of daily aircraft noise and policy implication (unpublished)

- Morning shoulder period (**06:00-07:00h; 50.92 dB**) and **23:00-24:00h (41.06 dB)** had higher noise levels than expected.
- 23:00-24:00h impacted nearly all postcodes.
- High noise levels during these periods may have health implications, particularly for sleep disturbance.
- Night-time noise (23:00-24:00h, 24:00-04:30h, 04:30-06:00) tends to vary more greatly than daytime periods
- **Policy implication**: The most restrictive period (23:30 - 06:00) is known as the Night Quota Period (NQP) and has limits on the number of movements which are set by the DfT.
- Night quota period may be insufficient to protect residents' 8-hour sleep



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14th ICBEN Congress on Noise as a Public Health Problem

Characteristics of daily aircraft noise near Heathrow Airport, the Reduced Noise Impacts of Short-Term Aircraft Noise (RISTANCO) project

[1, 2] Xiangpu Gong, [1] Kathryn Adams, [1] Calvin Jephcote1, [1] Nicole Itzkowitz, [3] Glory O Atilola, [3] Marta Blangiardo, [1, 2] John Gulliver [1, 2] Anna Hansell

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ABSTRACT

Daily aircraft noise exposure levels in 2014-2018 at ~155,000 postcodes in the vicinity of Heathrow airport with combined population ~6.3 million was modelled, using version 3b of the Aviation Environmental Design Tool (AEDT). This provided a comprehensive set of average 'A' frequency weighted daily noise estimates (2014-2018) at eight time-bands corresponding to airport activity, and number of noisy flight events exceeding a maximum sound level (65 decibels (A) N65 in daytime, 60 decibels (A) N60 at night, 2018 only). The morning shoulder period (06:00-07:00) had the highest mean noise (50.92 dB) per day per postcode and an average of 3 noisy flight events during the hour. During daytime hours (07:00-15:00), the average aircraft noise level was 49.87 dB, with an average of one noisy flight event per hour. The mean noise levels during the late night (23:00-24:00) and early morning (24:00-04:30) were 41.06 dB and 29.81 dB respectively. The results of the pairwise correlation analysis showed high correlation (Coefficient range: 0.68-0.90) between commonly used metrics including Lday, Laeq24, Leve and Lnight. However, when looking at correlations between noise levels in the eight time bands, correlations were generally weak. Aircraft noise exposure levels during night-time (04:30-06:00h, 23:00-24:00h and 24:00-04:30h) had a larger coefficient of variation (38.08-74.16) compared to daytime levels. This finding suggests that nighttime noise may have greater day-to-day variability than daytime noise. Our results suggest non-standard noise metrics and noisy event metrics may provide important characteristics of noise exposure, with potential relevance for impacts on biological systems.

Keywords: Daily aircraft noise, LAeq, N60/N65, Metrics, Heathrow airport,

Introduction

London Heathrow Airport is located on the outskirts of west London, a densely populated area meaning that several million people are exposed to aircraft noise. The UK Civil Aviation Administration (CAA) models population exposures to aircraft noise, using the UK Civil Aircraft Noise Contour Model ANCON [1, 2]. The model provides standard metrics, such as Lnight and Lden, which quantify the yearly average noise levels experienced over specific periods (e.g.,

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Health Consequences

Based on project conducted at CEHS using UK Biobank data

- **Cardiovascular Impact**
  - Cardiovascular MRI study suggests higher aircraft noise exposure, especially at night, is associated with adverse cardiac remodelling in the form of concentric LV hypertrophy and reduced LV systolic function.
  - Survival analyses suggest long-term aircraft noise exposure, also especially at night, is associated with higher risks of all-cause mortality and cardiovascular hospitalisations (unpublished).
  - **Sleep and Circadian Disruption**
  - Actigraphy evidence suggests individuals exposed to higher levels of aircraft noise experienced objectively higher levels of sleep disturbance and changes in sleep-wake cycles.
  - **Cognitive Health**
  - We found an association between road traffic noise exposure and incident Alzheimer's disease in this large cohort study.
  - There was also an association between aircraft noise and all-cause dementia, Alzheimer's disease and vascular dementia hospitalisation and deaths (unpublished).

Thank you!

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