



# I'M SPEAKING



**8TH NOVEMBER 2023**



**SHEFFIELD**

**“Soundscapes and  
Wellbeing: Exploring the  
impact of Noise Pollution  
on Mental Health”**

**HCA** | UK  
HEARING  
CONSERVATION  
ASSOCIATION

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# Outline

**1. Background**

**2. Methods**

**3. Main findings**

**4. Significance for public health and the promotion of a healthy ageing process**

**5. Animated short film (3')**

# 1. Background

The screenshot shows the top portion of a journal article page. On the left is the journal logo for 'Journal of Mental Health', Volume 31, 2022 - Issue 5. A search bar on the right contains the text 'Enter keywords, authors, DOI, etc'. Below the journal information are two buttons: 'Submit an article' (green) and 'Journal homepage' (purple). On the left side, there are statistics: 3,740 Views, 1 CrossRef citation to date, and 1 Altmetric. The article title is 'Noise pollution and mental health' by Martin Guha, an Editorial. The article details include 'Pages 605-606 | Received 19 Jun 2022, Accepted 22 Jun 2022, Published online: 12 Oct 2022'. There are links for 'Cite this article', the DOI 'https://doi.org/10.1080/09638237.2022.2118694', and a 'Check for updates' button. At the bottom, there are buttons for 'Full Article', 'Figures & data', and 'References'.

The extent to which the effects of noise on mental health are omitted from research is irritating. There are many studies where noise pollution has simply not been taken into account. Thus, for example, Bravo-



“

“IF YOU CAN'T MEASURE IT,  
YOU CAN'T IMPROVE IT.”

”

—PETER DRUCKER

# 1. Background

The aims were to:

a) explore **the link between environmental noise and depression** in Cheshire and Merseyside, and

b) investigate potential **localised patterns and differences** according to area-level deprivation.

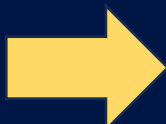
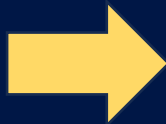
## 2. Methods

 GOV.UK

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Department  
for Environment  
Food & Rural Affairs



### Noise mapping Geographic Information Systems (GIS) datasets

#### Rail noise

- [Laeq 16h](#): indicates the annual average noise levels for the 16-hour period between 0700 – 2300
- [Lden](#): indicates a 24 hour annual average noise level with separate weightings for the evening and night periods
- [Lnight](#): indicates night time annual average noise level results in dB, where night is defined as 2300 - 0700

#### Road Noise

- [Laeq 16h](#): indicates the annual average noise levels for the 16-hour period between 0700 – 2300
- [Lden](#): indicates a 24 hour annual average noise level with separate weightings for the evening and night periods.
- [Lnight](#): indicates night time annual average noise level results in dB, where night is defined as 2300 - 0700

## 2. Methods

### Quality and Outcomes Framework Indicators: Depression prevalence (QOF\_4\_12)

Daras, Konstantinos <sup>ID</sup>, Rose, Tanith, Tsimpida, Dialehti and Barr, Benjamin <sup>ID</sup> (2023) *Quality and Outcomes Framework Indicators: Depression prevalence (QOF\_4\_12)*. [Data Collection]

Data Catalogue DOI: [10.17638/datacat.liverpool.ac.uk/2170](https://datacatalogue.liverpool.ac.uk/2170)

Original Record Link: <https://pldr.org/dataset/2ldz5>

## Description

### Summary

This indicator measures the percentage of patients with a diagnosis of depression. Patients are of all ages, and numbers are given for consecutive years since 2011, across areas of England.

### Technical description

The percentage of patients with a diagnosis of depression. GP practices reporting extreme depression prevalence are excluded from the calculation. Quality and Outcomes Framework (QOF) data by GP practice and year were provided by the data owners (NHS Digital). These data were used to calculate weighted averages of the indicator by Lower Super Output Area (LSOA).

## 2. Methods

There are 7 domains of deprivation, which combine to create the Index of Multiple Deprivation (IMD2019):

### Income

(22.5%)



Measures the proportion of the population experiencing deprivation relating to low income

#### Supplementary Indices



**Income Deprivation Affecting Children Index (IDACI)**

measures the proportion of all children aged 0 to 15 living in income deprived families



**Income Deprivation Affecting Older People Index (IDAOPI)**

measures the proportion of those aged 60+ who experience income deprivation

### Employment

(22.5%)



Measures the proportion of the working age population in an area involuntarily excluded from the labour market

### Education

(13.5%)



Measures the lack of attainment and skills in the local population

### Health

(13.5%)



Measures the risk of premature death and the impairment of quality of life through poor physical or mental health

### Crime

(9.3%)



Measures the risk of personal and material victimisation at local level

### Barriers to Housing & Services

(9.3%)



Measures the physical and financial accessibility of housing and local services

### Living Environment

(9.3%)



Measures the quality of both the 'indoor' and 'outdoor' local environment



## 2. Methods

- Descriptive statistics in a cross-sectional study design
- Geographically weighted regression (GWR)
- Generalised structural equation spatial modelling (GSESM)

### 3. Main findings

Summary statistics of **road noise coverage (%)** per LSOA and dB in Cheshire and Merseyside ICS in 2020

| Sub ICB              | Number of LSOA | Mean road noise 55-59.9 dB | Mean road noise 60-64.9dB | Mean road noise 65-69.9 dB | Mean road noise 70-74.9 dB | Mean road noise ≥75 dB |
|----------------------|----------------|----------------------------|---------------------------|----------------------------|----------------------------|------------------------|
| Cheshire             | 446            | 11.57                      | 5.60                      | 2.95                       | 1.85                       | 0.67                   |
| Halton               | 79             | 17.13                      | 8.24                      | 4.37                       | 2.68                       | 1.56                   |
| Knowsley             | 98             | → 32.84                    | 10.26                     | → 6.45                     | → 3.93                     | → 2.43                 |
| Liverpool            | 298            | 11.17                      | 4.75                      | 3.26                       | 3.25                       | 1.01                   |
| South Sefton         | 111            | 12.64                      | 5.56                      | 3.92                       | 3.67                       | 1.03                   |
| Southport and Formby | 78             | 3.27                       | 2.21                      | 2.08                       | 1.35                       | 0.11                   |
| St Helens            | 119            | 17.04                      | 6.05                      | 3.51                       | 2.44                       | 0.95                   |
| Warrington           | 127            | 30.93                      | → 13.08                   | 5.75                       | 3.50                       | 2.06                   |
| Wirral               | 206            | 13.87                      | 6.05                      | 3.90                       | 2.96                       | 1.28                   |



### 3. Main findings

Summary statistics of **rail noise coverage (%)** per LSOA and dB in Cheshire and Merseyside ICS in 2020

| Sub ICB              | Mean rail noise<br>55-59.9 dB | Mean rail noise<br>60-64.9dB | Mean rail noise<br>65-69.9 dB | Mean rail noise<br>70-74.9 dB | Mean rail noise<br>≥75 dB |
|----------------------|-------------------------------|------------------------------|-------------------------------|-------------------------------|---------------------------|
| Cheshire             | 1.20                          | 0.65                         | 0.38                          | → 0.19                        | → 0.07                    |
| Halton               | → 2.35                        | → 1.58                       | → 1.35                        | 0.08                          | 0.00                      |
| Knowsley             | 1.74                          | 1.12                         | 0.85                          | 0.01                          | 0.00                      |
| Liverpool            | 0.83                          | 0.47                         | 0.56                          | 0.02                          | 0.00                      |
| South Sefton         | 0.87                          | 0.53                         | 0.00                          | 0.00                          | 0.00                      |
| Southport and Formby | 1.15                          | 0.99                         | 0.00                          | 0.00                          | 0.00                      |
| St Helens            | 1.06                          | 1.01                         | 0.44                          | 0.05                          | 0.00                      |
| Warrington           | 1.65                          | 1.03                         | 0.80                          | 0.15                          | 0.00                      |
| Wirral               | 0.69                          | 0.30                         | 0.00                          | 0.00                          | 0.00                      |

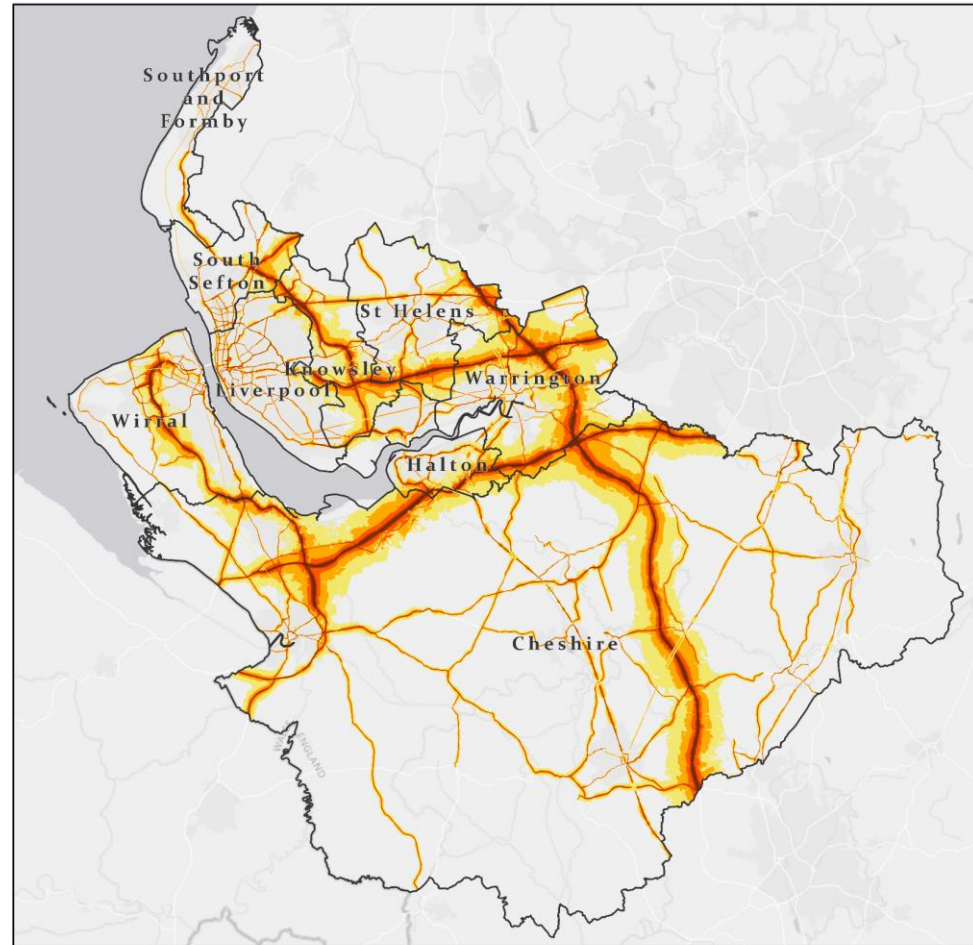
### 3. Main findings

Summary statistics of **total transportation noise coverage (%)** per LSOA and dB in Cheshire and Merseyside ICS in 2020

| Sub ICB              | Sum road and rail noise coverage minus their intersection                                   |
|----------------------|---|
| Cheshire             | 24.69   |
| Halton               | 36.69   |
| Knowsley             |  56.99   |
| Liverpool            | 24.96   |
| South Sefton         | 27.85   |
| Southport and Formby | 11.06   |
| St Helens            | 31.24   |
| Warrington           |  57.25 |
| Wirral               | 28.72   |

### 3. Main findings

Noise levels (Lden) of road and rail network in Cheshire and Merseyside ICS



#### Legend

Noise levels in decibels (dB)

55-59.9 dB

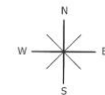
60-64.9 dB

65-69.9 dB

70-74.9 dB

≥75 dB

0 5 10 20 Kilometers



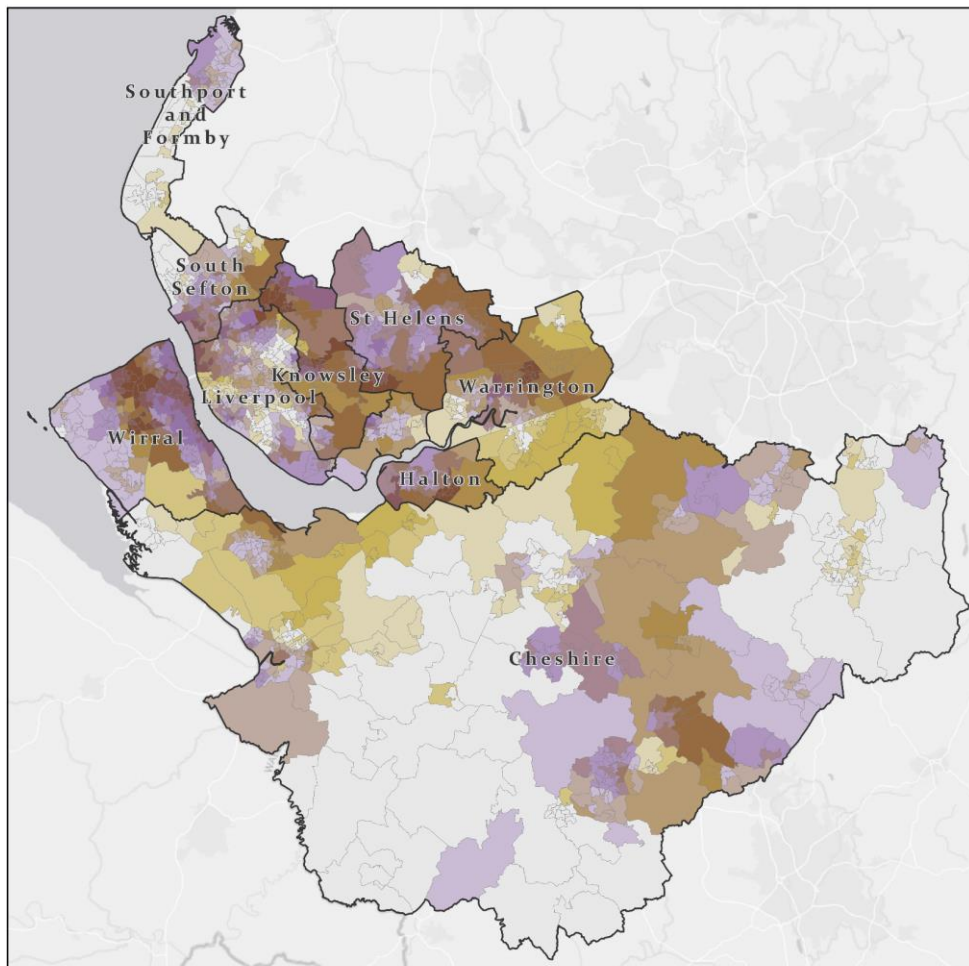
### 3. Main findings

Summary statistics of **recorded depression prevalence (%)** in Cheshire and Merseyside ICS in 2019

| Sub ICB              | Percentage of patients with a diagnosis of depression in 2019 recorded depression prevalence |
|----------------------|--|
| Cheshire             | 11.62  |
| Halton               | 14.66  |
| Knowsley             | 15.91  |
| Liverpool            | 12.74  |
| South Sefton         | 12.96  |
| Southport and Formby | 11.26  |
| St Helens            | 15.14  |
| Warrington           | 12.55  |
| Wirral               | 16.42  |

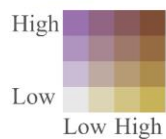
### 3. Main findings

Correlation of areas with transportation noise coverage ( $\geq 55$  Decibels) and depression prevalence in Cheshire and Merseyside ICS in 2019



#### Legend

- QOF Depression 2019
- Percentage of LSOA coverage with road and rail network noise ( $\geq 55$  Decibels)

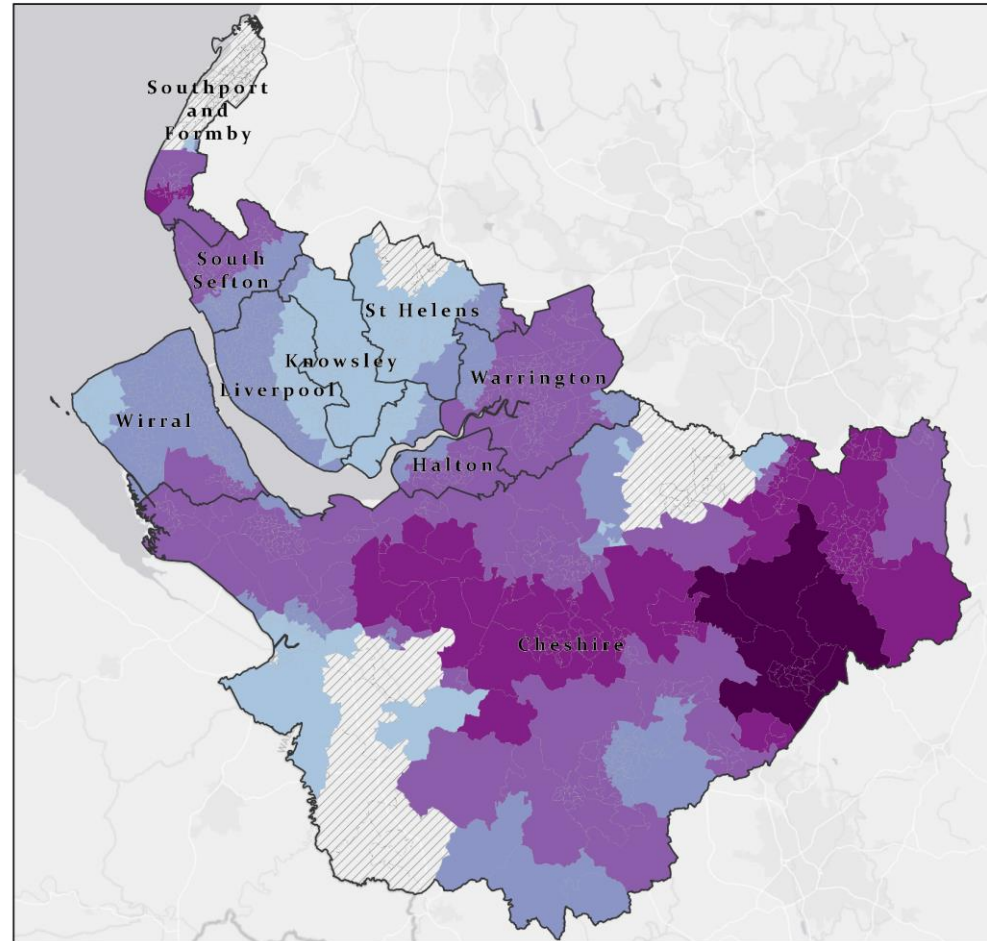


0 10 20 40 Kilometers



### 3. Main findings

Geographical weighted regression of transportation noise coverage ( $\geq 55$  Decibels) explaining depression prevalence in Cheshire and Merseyside ICS in 2019



#### Legend

Local R-Squared

0 - 0.06

0.07 - 0.12

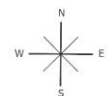
0.13 - 0.24

0.25 - 0.48

0.49 - 0.79

 <excluded>

0 5 10 20 Kilometers






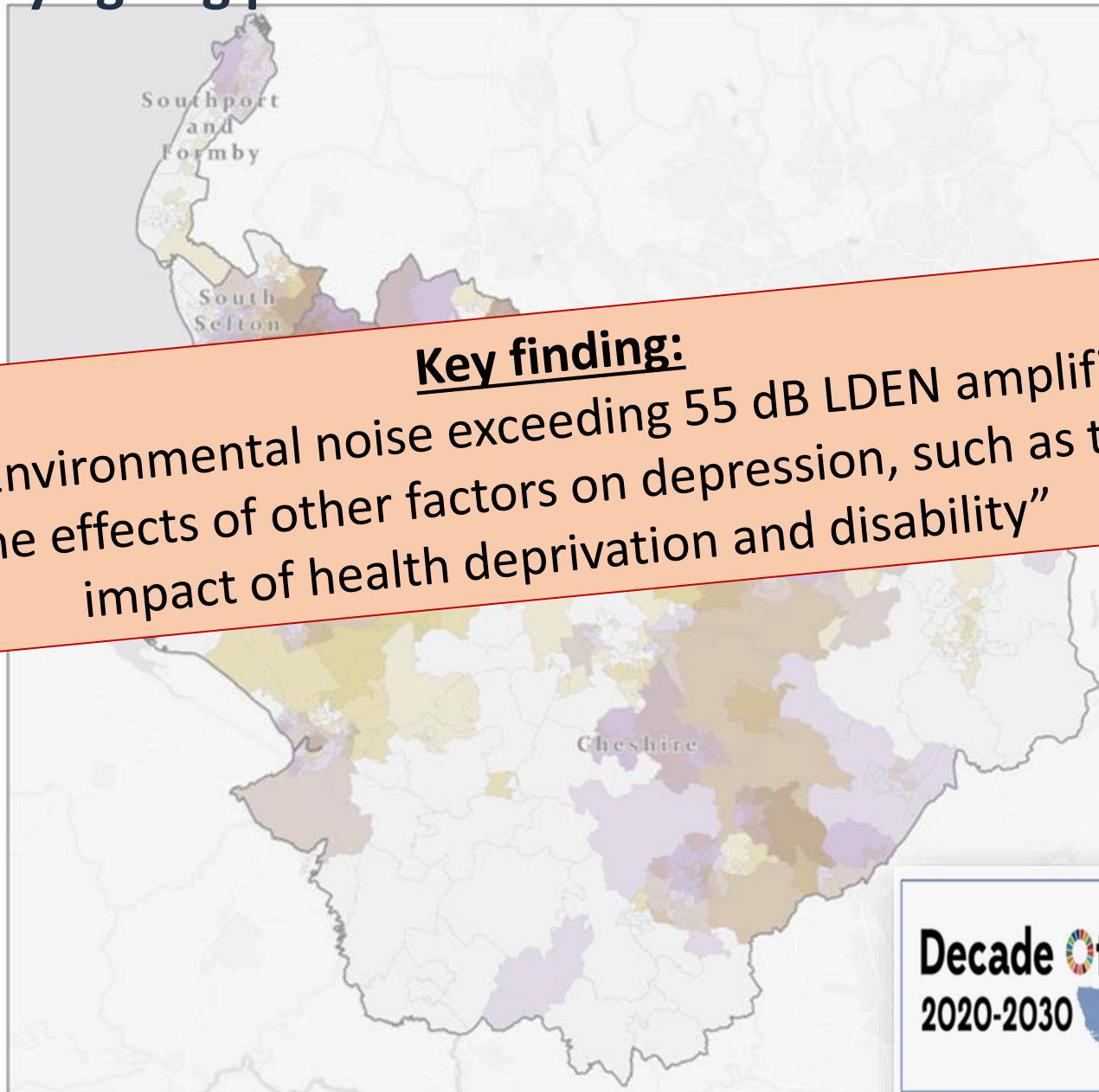
### 3. Main findings

| Transportation Noise per LSOA Predicting Depression |                          |          |                        |  |
|---|--------------------------|----------|------------------------|--|
| Variable  | Coefficient <sup>a</sup> | StdError | Robust Pr <sup>b</sup> |  |
| Environmental noise per LSOA                        | 0.015926                 | 0.002496 | 0.000000*              |  |

#### Calculation of Indirect Effect (Judd & Kenny Difference of Coefficients Approach)

| Variable                          | Step 1 Coefficient | Step 4 Coefficient | Indirect effect of transportation noise (step1-step4 coefficients)                             | Robust Pr |
|-----------------------------------|--------------------|--------------------|--|-----------|
| Education Skills and Training     | 0.024592           | 0.021382           | 0.00321  | 0.000000* |
| Health Deprivation and Disability | 2.427641           | 1.809736           |  0.617905 | 0.000000* |
| Living Environment Deprivation    | -0.008936          | -0.011395          | 0.002459   | 0.000000* |

## 4. Significance for public health and the promotion of a healthy ageing process



### Key finding:

“Environmental noise exceeding 55 dB LDEN amplifies the effects of other factors on depression, such as the impact of health deprivation and disability”

## 4. Significance for public health and the promotion of a healthy ageing process

To our knowledge, this is the first study in England

Tsimpida D. Tsakiridi A. (2023) Noise Pollution as a risk factor for mental health inequalities in England. *Lancet Regional Health* (in preparation for submission)

## 5. Animated short film (3')



# Acknowledgments

**Creative Lead:** Dr Dalia Tsimpida

**Script Contributors (alphabetically):** Clare Forshaw, Anastasia Tsakiridi.

**Production:** Savage and Gray Design Ltd

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