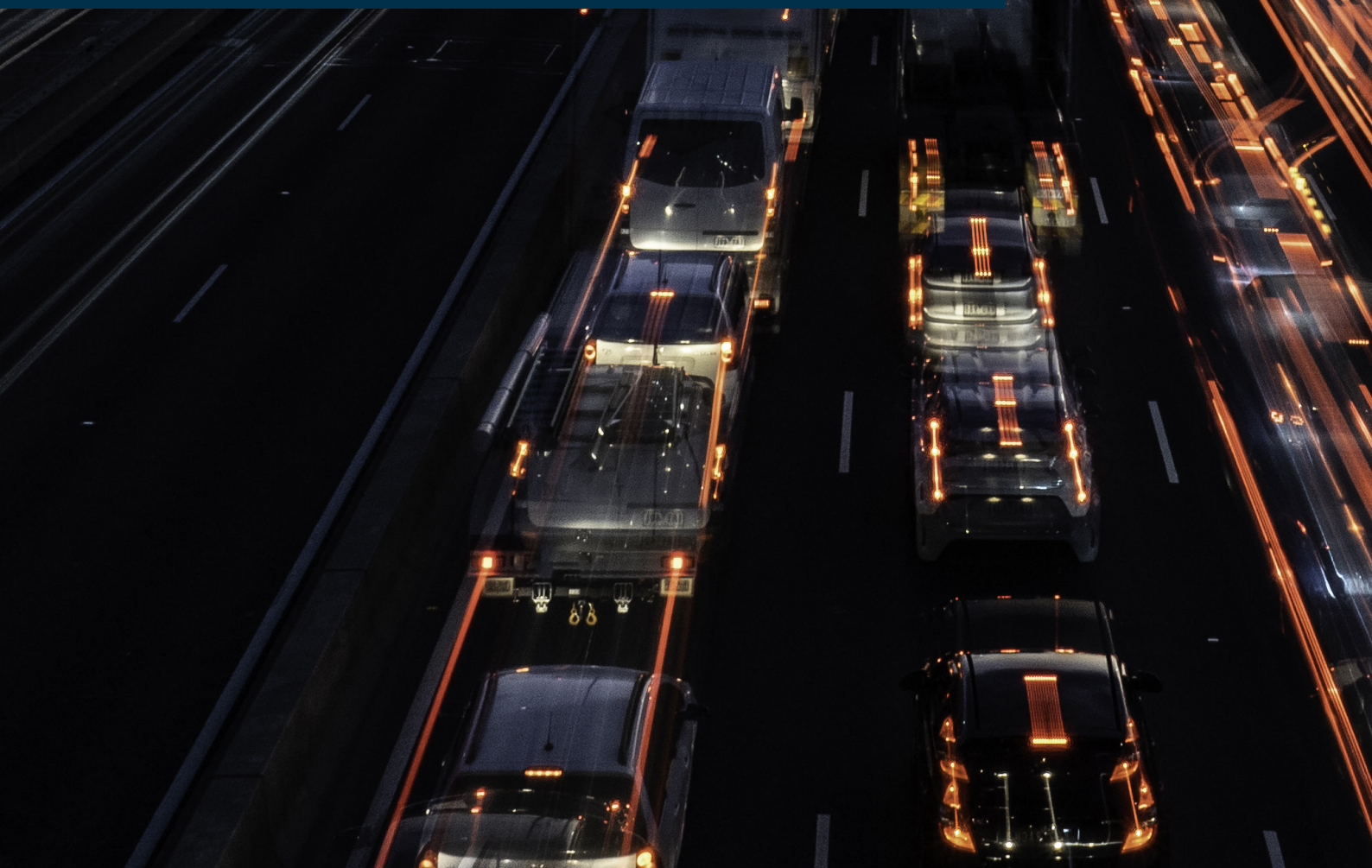




Road-traffic Noise Pollution and Mental Health

**Mapping High-Exposure Areas in
Hampshire and the Isle of Wight
Integrated Care System (ICS)**



Executive Summary

Transportation noise pollution significantly impacts mental health across Hampshire and the Isle of Wight's 1.78 million residents, with Portsmouth experiencing critical exposure levels 38% above WHO guidelines. This research reveals that noise doesn't just add to mental health problems - it amplifies the impact of social disadvantage. Our evidence-based mapping identifies clear geographic and demographic targets for intervention, enabling cost-effective, place-based strategies that address both environmental stressors and underlying social vulnerabilities.

Background and Context

Transportation noise pollution is a significant environmental health risk, linked to sleep disturbance, cardiovascular disease, cognitive effects, and mental health issues.^{1,2} In Hampshire and the Isle of Wight, key sources include road traffic, shipping, and aviation. While over 30 Air Quality Management Areas (AQMAs) have been established to address air pollution, noise pollution receives less attention, despite being a key focus for both the Department for Environment, Food and Rural Affairs (Defra) and the Department for Transport.^{3,4}

The Hampshire and Isle of Wight Integrated Care System (ICS) is a regional healthcare partnership that spans the entire geographical area of Hampshire and the Isle of Wight. It works to improve health outcomes across both urban and rural communities, coordinating efforts to address health challenges, including those related to road-traffic noise pollution.

The Hampshire Local Transport Plan 4, which covers Hampshire County Council, commits to developing Noise Action Plans to manage the harmful health effects of transport-related noise and working closely with the district councils to meet statutory obligations. However, current approaches do not consider the significant variations in noise-health relationships that are influenced by factors such as location and social context.³

This brief aims to highlight high-exposure areas to road-traffic noise within the ICS, helping guide policies and interventions to address the mental health impacts of noise pollution.

Mapping Impact on Population Health

This research by the University of Southampton aimed to:

1. **Map noise exposure patterns** across Hampshire and the Isle of Wight's 1.78 million residents
2. **Identify how noise interacts with social challenges** to affect mental health
3. **Provide evidence for targeted public health and policy interventions** addressing both environmental and social causes.

We analysed strategic noise mapping data, GP depression records, and multiple measures of area deprivation to reveal context-specific relationships between noise, depression and other social stressors across urban and rural areas.

Our research has identified links between noise, the prevalence of depression and socioeconomic factors, and can assist in identifying zones for targeted intervention, the zones where road traffic noise has the highest impact on residential populations (to be designated as **Noise Quality Management Areas**).

Key Findings

→ Portsmouth experiences critical noise exposure requiring immediate intervention

Portsmouth recorded the most severe exposure, with average noise levels of 54.4 dB L_{den} - representing a 38% increase in sound energy compared to the WHO's recommended limit of 53 dB L_{den} (Table 1). While this may seem like a small difference, decibels operate on a logarithmic scale: a 3 dB increase means a doubling of sound energy. Even a 1 dB reduction, though seemingly negligible in acoustic terms, can be meaningful from a public health perspective.¹

Hampshire, Southampton and the Isle of Wight had comparatively lower but still concerning average levels. Urban areas consistently experience 5-8 dB L_{den} higher noise levels than rural areas (Figure 1), and extreme variation across the region (ranging from 0 to 65 dB) highlights specific noise hotspots that can be precisely targeted for intervention.

→ The relationship between deprivation and depression is not consistent across rural and urban areas

The research reveals that current one-size-fits-all approaches miss critical opportunities for strategic intervention. In urban areas, income deprivation and health deprivation and disability were strongly associated with higher depression rates, highlighting the significant psychological burden of socioeconomic disadvantage in densely populated areas.

However, rural areas show different patterns (Figure 2). Higher income deprivation affecting children was associated with higher depression rates, indicating particular vulnerability in rural child welfare and its impact on residents' mental health. Both nighttime and 24-hour noise levels were significant direct predictors of depression in rural areas, showing that prolonged noise exposure throughout day and night affects mental health, especially where noise can be more disruptive in quieter rural settings.

→ Noise makes social disadvantage worse for mental health

This research provides the first evidence that in Hampshire and the Isle of Wight, noise pollution amplifies the mental health impact of types of socioeconomic deprivation – an important discovery that shows noise doesn't just add to mental health problems, but it makes other social issues worse. In rural areas, 24-hour noise exposure mediated 18.64% of the relationship between crime-related stress and depression, demonstrating that noise acts as a key pathway through which social problems affect mental health. This fundamentally changes how we should tackle mental health, showing we need to address noise and social problems together, not separately.

Table 1: Road Traffic Noise Exposure* and Depression Levels Across Hampshire and Isle of Wight, 2022

Area	24-Hour Noise Level (dB L _{den}) (min-max)	Night-time Noise Level (dB L _{night}) (min-max)	Depression Prevalence (%) (min-max)
Portsmouth City Council			
Urban areas	54.4 (0.0 - 64.7)	44.2 (0.0 - 55.2)	13.0 (0.0 - 16.8)
Areas covered by Hampshire County Council, Southampton City Council & the Isle of Wight Council			
Urban areas	51.0 (0.0 - 63.9)	41.4 (0.0 - 55.6)	14.2 (0.0 - 22.1)
Rural areas	46.1 (41.1 - 60.2)	38.3 (35.4 - 50.0)	13.0 (7.3 - 19.1)

Note: Portsmouth shows only urban areas as there are no rural areas within city boundaries.

* For our analyses, we used both the day-evening-night level (L_{den}) and the night level (L_{night}). The Lden level is a noise metric used to assess overall annoyance, calculated as the annual average A-weighted sound level over a 24-hour period. This measure includes a 5-decibel (dB(A)) penalty for evening noise (7 pm to 11 pm) and a 10 dB(A) penalty for nighttime noise (11 pm to 7 am). The L_{night} is a nighttime noise indicator that reflects the annual average A-weighted sound level during the night period (11 pm to 7 am), representing the total sound energy equivalent to the fluctuating noise levels experienced throughout that period.



Figure 1. Levels of Transport-related Noise Pollution in Hampshire and the Isle of Wight Integrated Care System (ICS) during 24-Hour Periods Based on Data from Strategic Noise Mapping 5

Key Statistics



Critical exposure levels: Portsmouth exceeds WHO guidelines by 38%, with some areas reaching 65 dB L_{den}, affecting thousands of residents daily



Urban-rural health disparity: Urban areas experience 5-8 dB L_{den} higher noise levels, with different pathways linking noise to depression in each setting



Regional health impact: Across 1.78 million residents, average daily noise exposure varies dramatically (0-65 dB), creating clear intervention hotspots



Preventive opportunity: Noise mediates 18.64% of crime-related deprivation -depression relationships in rural areas, highlighting environmental interventions as key to mental health prevention



Policy Implications

This research reveals a critical gap in current policy: noise pollution and mental health are often treated separately, despite strong evidence of their connection.² As a result, existing strategies miss important opportunities for more effective, integrated interventions.

The findings identify clear **geographic and demographic targets for action**. **Portsmouth** records the highest average daily noise level at **54.4 dB L_{den}** exceeding WHO safety guidelines. Urban areas consistently show **5–8 dB L_{den}** **higher noise levels** than rural areas, but the way noise interacts with deprivation varies:

- In **urban areas**, noise amplifies the mental health effects of **income and health deprivation**.
- In **rural areas**, noise worsens the impact of **child poverty and barriers to housing and services**.

This means we can now **map where noise and indicators of deprivation overlap**, creating clear opportunities for **targeted, place-based health interventions**. Urban areas with **high noise and socioeconomic deprivation** should be prioritised for immediate action. Rural areas require coordinated interventions addressing **noise, access to services, and family support**.

Such targeted interventions are likely to deliver better outcomes than blanket policies, with potential cost savings across multiple sectors - from reduced demand on mental health services to improved community safety. This research supports a cost-effective, location-specific strategy that aligns environmental, public health, and social policy goals.

“Noise pollution and mental health are often treated separately, despite emerging strong evidence of their connection.”



Recommendations for local government and policy makers

1. Target high-exposure, high-deprivation areas for immediate action

Use the spatial analysis from this research to identify neighbourhoods with both high noise exposure and socioeconomic deprivation. Prioritise these areas for interventions that reduce road traffic noise, especially where levels exceed WHO guidelines for average daily (L_{den}) and night-time (L_{night}) noise. Coordinate multi-agency responses that address both environmental stressors and wider determinants of mental health.

2. Develop place-based noise action plans

Design locally tailored noise mitigation strategies that go beyond current planning policies, which address transport-related noise impacts only for new developments, not existing residences.⁷ In urban areas, combine noise reduction with initiatives to reduce socioeconomic inequality; in rural areas, incorporate community safety concerns. Align plans of all Councils with Hampshire's Local Transport Plan 4 to integrate health, environmental, and social priorities.³

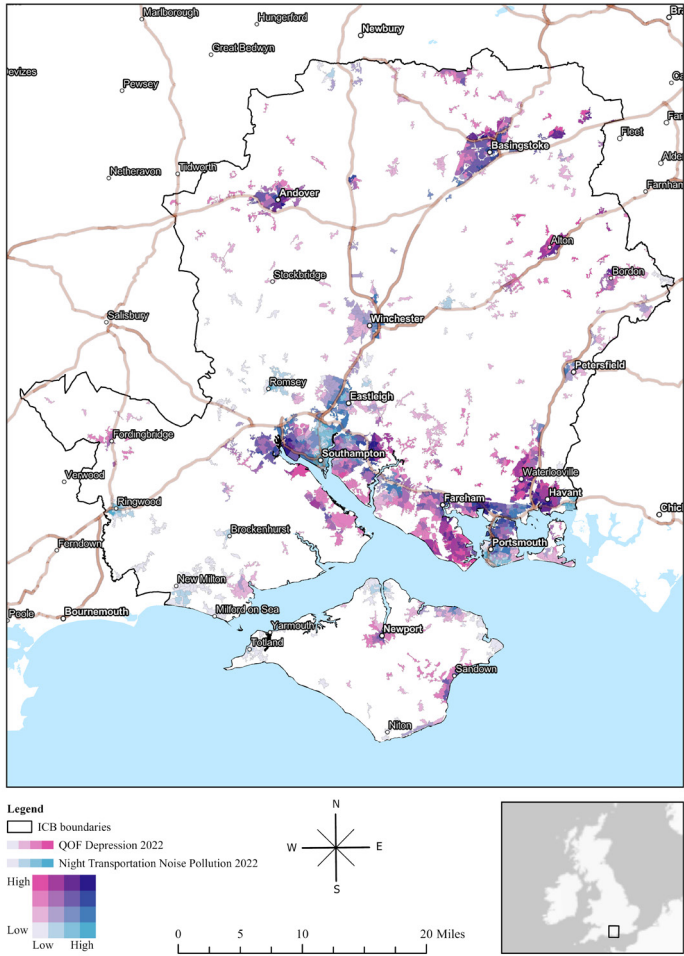
3. Strengthen cross-sector partnerships and policy integration

Establish formal partnerships between mental health services, public health, environmental health, transport planning, and community safety teams. Move from siloed working to integrated approaches that tackle both environmental noise and the underlying social vulnerabilities contributing to mental health risks.

4. Empower communities through engagement and co-design

Focus on areas where noise worsens existing social disadvantage and mental health outcomes.^{8,9} Actively engage residents to understand local experiences and co-design interventions that combine noise reduction with wider community wellbeing initiatives. Pilot how environmental improvements can strengthen social cohesion and resilience, especially in areas facing multiple forms of disadvantage.

Map of Hampshire and the Isle of Wight ICS Showing the Correlation Between Areas of Exposure to Transportation Night Noise Pollution and Depression Prevalence



Next Steps

Local authorities can use this evidence-based mapping to identify priority areas for immediate intervention. The research provides clear geographic targeting for Noise Quality Management Areas and demonstrates cost-effective pathways for integrated environmental and social interventions. For detailed area-specific data or to discuss implementation strategies, contact the research team.

Figure 2. Map of Hampshire and the Isle of Wight Integrated Care System (ICS) Showing the Correlation Between Areas of Exposure to Transport-related Night Noise Pollution and Depression Prevalence 6

Darker pink areas indicate higher depression prevalence, darker blue areas show higher noise exposure, and purple areas experience both high noise and high depression levels.

References and Further Information

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Primary Investigator: Dr Dalia Tsimpida

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This research provides the first evidence of how road-traffic noise interacts with social challenges to affect mental health in Hampshire and the Isle of Wight Integrated Care System, offering a foundation for developing targeted, place-sensitive interventions.



Find out more

Dr Dalia Tsimpida, Department of Gerontology, School of Economic, Social and Political Sciences, Faculty of Social Sciences
Email: d.tsimpida@soton.ac.uk