IDENTIFYING INEQUALITY THROUGH URBAN HEALTH INDICATORS: THE AUSURB-HI PROJECT

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INTRODUCTION

With climate change driving more frequent and severe heatwaves, alongside urban densification and a population projected to reach 49.2 million by 2066, safeguarding public health has become an urgent challenge.

The **Australian Urban Health Indicators** (AusUrb-HI) project addresses this challenge by integrating demographic factors, environmental conditions, and urban morphology data to pinpoint vulnerable regions.

APPROACH

AusUrb-HI developed urban health indicators at the Statistical Area level 1 (SA1) spatial resolution for the five most populous regions in New South Wales: Sydney, Wollongong, Albury, Tweed Heads, and Newcastle.

Considered data include existing Australian Census data, as well as derived urban indicators such as mean roof height, percentage of cool roofing, road and path density, and access to relevant services and facilities.

A **Heat Health Vulnerability Index** (HHVI) was created using a layered Principal Component Analysis (PCA) approach, combining 44 indicators of heat exposure, population sensitivity, and adaptive capacity.

The HHVI has been validated using linked health records from the NSW Ministry of Health, through the Secure Unified Research Environment (SURE).

RESULTS

The 2021 HHVI for Sydney in Figure 1 reveals distinct contributions from exposure, sensitivity, and adaptive capacity components. The analysis highlights that areas with higher heat exposure are often correlated with lower adaptive capacity, demonstrating the multi-faceted nature of urban heat vulnerability. The HHVI and underlying sub-indices pinpoint specific neighborhoods requiring targeted interventions to reduce heat-related health risks.

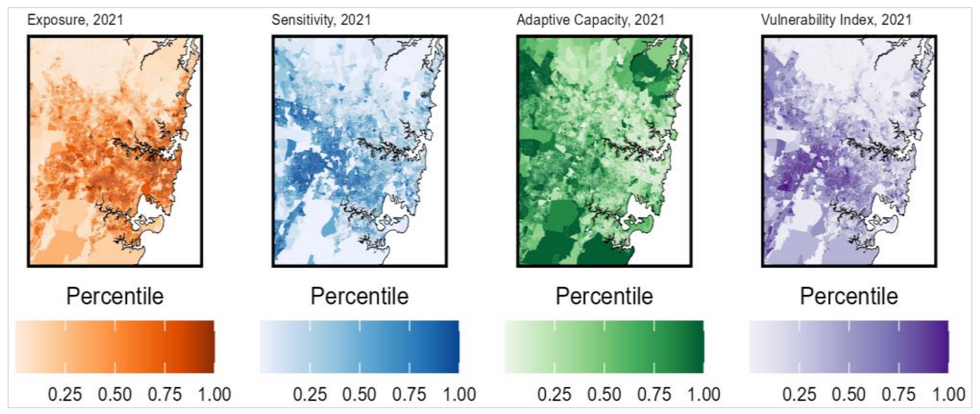

Figure 1: 2021 HHVI components across greater Sydney, highlighting contributions from exposure, sensitivity, and adaptive capacity.

A comparison of HHVI percentiles with the **Index of Relative Socio-economic Disadvantage** (IRSD) reveals regions where heat vulnerability diverges significantly from demographic-based socio-economic disadvantage in Figure 2.

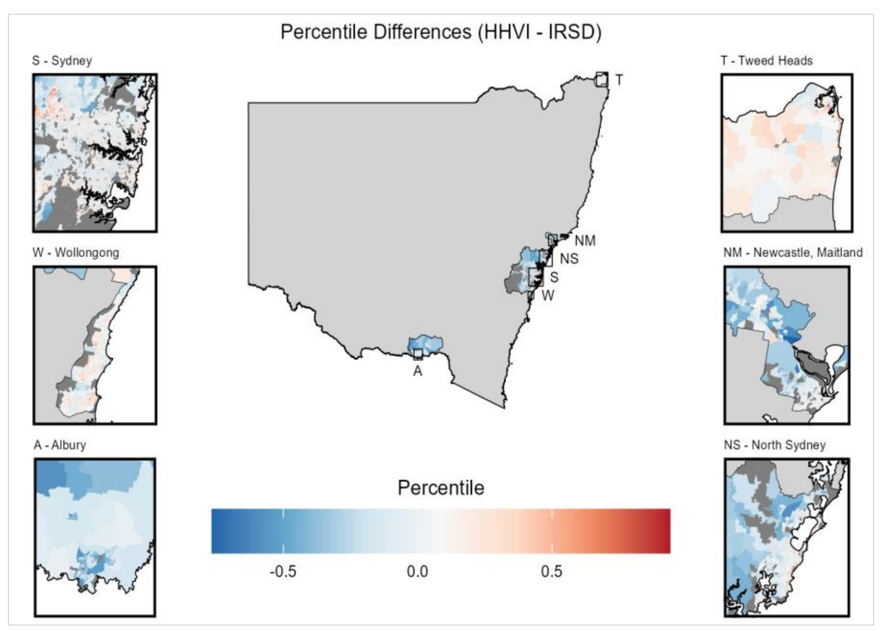

Figure 2: Difference between HHVI and IRSD percentiles.

As IRSD is rooted in demographic data, **deviations from HHVI indicate areas that may be disproportionately affected by heat** despite their relative socio-economic standing, emphasizing the importance of incorporating environmental and urban morphology factors into vulnerability assessments.

Boxplots of HHVI across remoteness levels (see Figure 3) reveal that major cities exhibit consistently higher vulnerability compared to inner regional areas, a trend influenced by elevated exposure levels in urbanized regions. A breakdown by IRSD further demonstrates that regions with **higher socio-economic disadvantage correspond to higher vulnerability**, highlighting the compounded risks faced by disadvantaged urban communities.

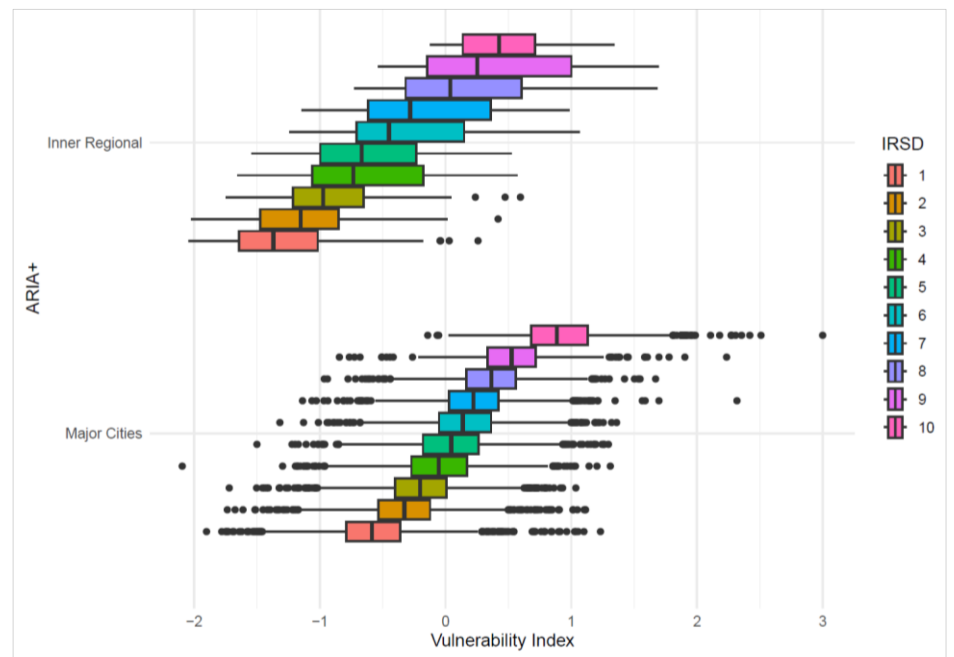

Figure 3: Boxplots of HHVI by remoteness, illustrating higher vulnerability in major cities and the influence of IRSD on heat risk.

Despite no deliberate attempt to calculate an urban heat island effect, combined information from climate exposure indicators place **major city regions almost consistently more vulnerable than inner regional locations**. Notably, disadvantaged inner regional populations are exceptions to this pattern (IRSD 7+).

DISCUSSION

Validation of the HHVI against emergency department (ED) admissions during heatwave events (Figure 4) shows its ability to identify vulnerable populations.

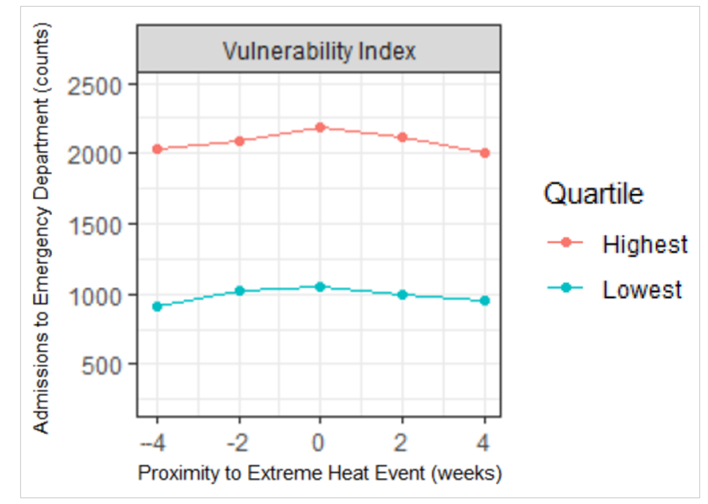

Figure 4: Average emergency department (ED) admissions by highest and lowest HHVI quartiles in the weeks surrounding heatwave events, 2016-2021.

Baseline ED admissions are consistently higher for regions in the highest HHVI quartile. Further, ED admissions increased by approximately 10% during heatwaves for the highest quartile, compared to only 6% for the lowest quartile, with this discrepancy increasing with HHVI percentile extremes.

CONCLUSION

The AusUrb-HI project demonstrates the power of integrating diverse datasets to develop comprehensive urban health indicators.

These indicators provide actionable insights for policymakers, urban planners, and health professionals, enabling targeted interventions to improve public health and community resilience.

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Work undertaken as part of the Australian Research Data Commons (ARDC) "Cross-NCRIS National Data Assets Program".

Scan the QR code provided for more information on the project.