GIG CYMRU NHS WALES
Iechyd Cyhoeddus Cymru
Public Health Wales

Heat Mortality Monitoring in Wales

Annual Surveillance Report 2024

13th November 2025

Key Findings

Even short heat episodes associated with increased mortality in Wales.
Although Wales did not experience a national heatwave in 2024, a brief heat period from 28 July to 2 August was associated with a statistically significant rise in daily deaths, particularly among older adults.

Older adults and urban populations at risk.
People aged 85 and over experienced the highest mortality rates, and urban areas saw more than triple the death rate compared to rural regions. However, the link to heat needs to be investigated.

Summer mortality was higher than average, but the link to heat remains uncertain.
While Wales recorded more deaths in summer 2024 than the five-year pre-pandemic average, the report cautions against attributing this increase solely to heat exposure. Further analysis is needed to understand the role of heat versus other seasonal or demographic factors.

Executive Summary

Heat periods

- There were **no national heatwaves** declared in Wales in 2024, however localised heatwave thresholds were met in Aneurin Bevan, Cardiff and Vale and Swansea Bay University Health Board areas between the 29th of July and the 1st of August 2024.
- A national heat period was defined as the **28th of July to the 2nd of August 2024**.

Overall mortality

- During the heat period there were an estimated **557 deaths** (95% CI: 511-603).
- **Mean daily mortality was 93 deaths** (95% CI: 87-99), significantly higher than the 84 deaths (95% CI: 82-86) observed outside the heat period (all non-heat period days in summer 2024). Whilst there is a statistically significant increase in daily deaths during the heat period, causality cannot be inferred due to the lack of adjustment for confounders and absence of longitudinal comparison.
- A total of 10,310 all-cause deaths were recorded in Wales during summer of 2024, exceeding the five-year pre-pandemic average of 9,839 deaths (95% CI: 7,386–9,832), indicating a significant increase in summer mortality of 2024.

Demographic factors

- There were significant differences in mortality by age, with the highest observed among adults aged 85 and over with **39 deaths per 100,000** (95% CI: 26-52).
- There was no observed variation in mortality by sex.
- No statistically significant differences in all-cause mortality was observed across Welsh Index of Multiple Deprivation (WIMD quintiles); however, the second most deprived quintile (Quintile 2) recorded the highest rate (3.4 per 100,000), while the least deprived (Quintile 5) had the lowest (2.6 per 100,000).

Geographical variation

- Urban areas experienced significantly higher all-cause mortality of **48 deaths per 100,000** (95% CI: 37–59) compared to rural areas of **14 deaths per 100,000** (95% CI: 8–19).
- There was no statistically significant variation observed between health boards.

Settings

- Hospitals accounted for the highest proportion of all-cause deaths (45%) followed by deaths at home (31%) and in care homes (17%), however there was no statistical significance to this variation by place of death.

Contents

1. Introduction

Climate change is increasingly impacting public health, with rising temperatures posing a significant threat to human life. In Wales, as in other parts of the United Kingdom, heatwaves have become more frequent and intense, leading to increased mortality rates [1, 2]. The summer of 2024 in Wales was cooler than average since 2015 with a mean temperature of 14.25°C, which is 0.38°C below 1991-2020 average, primarily due to a south-shifted jet stream bringing cold Artic air to the UK in June and July [3]. In addition to strengthening efforts to address climate change, it is crucial to prioritise adaptation measures to safeguard public health, prevent fatalities, and minimise the health impacts of extreme heat events and the broader effects of climate change. The Well-being of Future Generations (Wales) Act 2015 provides a crucial legislative framework for addressing climate adaptation across the health and social care sector [4].

Recent studies have highlighted the severity of heat-related mortality in the UK. In England and Wales, during the five heat periods between June and August 2022, there were 3,271 excess deaths, representing a 6.2% increase above the five-year average [5]. The impact of heat on health is not uniform across populations, with elderly individuals, those with pre-existing medical conditions, and socially vulnerable groups being at higher risk [6]. Also, research has shown that heat-related mortality is highly heterogeneous geographically. A small-area assessment in England and Wales estimated an average of 791 excess deaths attributable to heat annually, with standardised excess mortality rates of 1.57 deaths per 100,000 person-years. The minimum mortality temperature varied across regions, ranging from 14.9°C to 22.6°C, indicating the need for localised approaches to heat-health management [1].

This report aims to quantify and evaluate the impact of heat on mortality in Wales during the summer heat episodes of 2024. It examines variations in mortality by age group, sex, health board, death place category, rural urban classification, and socioeconomic status (as measured by Welsh Index of Multiple Deprivation (WIMD) quintiles). The analysis compares 2024 mortality data with the five-year average (excluding the COVID-19 pandemic years) to assess the excess mortality attributable to heat..

2. Methods

Mortality data sourced from Digital Health Care Wales (DHCW) covering the period from 2016 to 2024 for the months of June to September. Temperature data was sourced from Open-Meteo for the same period. Welsh health boards, age, sex, Welsh Index of Multiple Deprivation (WIMD), and urban/rural population data for crude death rate comparisons were obtained from mid-year population estimates for Wales provided by the Office for National Statistics (ONS).

2.1. Heatwave definitions

A heatwave in Wales is defined as at least three consecutive days with maximum temperatures meeting or exceeding 25°C. For Cardiff and Vale and Aneurin Bevan University Health Boards (UHBs), the threshold is 26°C [7]. If any health board meets its threshold, that period is used as the reference "heat period" for all of Wales in the analysis. This is referred in this report as a heat period.

For this report, where the Central Mean Temperature in Wales was 20°C or higher, it was also classified as a heat period. To capture the impact of the initial increase in temperatures as well as any lag effect on mortality after the heat period, one day before and one day after each heat period was added to this definition [8].

Non-heat period days (the comparator) represents all days outside of the heat period days in summer 2024.

2.2. Study Population

The study population includes all deaths where the deceased person's place of death was recorded as Wales, as defined by the current census boundaries. These deaths are classified as Welsh deaths and form the basis for analysis within this report.

2.3. Data Analysis

All data analyses for this surveillance report were conducted using R version 4.4.5 within the RStudio environment. Mortality data for Wales were imported into RStudio. Key variables included year, age, sex, health board, socioeconomic status, rural urban classification, and place of death category.

Daily meteorological data for Wales and Welsh health boards, including maximum and mean temperatures for the report period, were sourced from Open-Meteo and integrated into the analysis. Heat periods were defined and linked to the mortality dataset to assess the impact of extreme heat on mortality outcomes. Additionally, mid-year population estimates were matched to the mortality data by relevant demographic and geographic categories to enable the calculation of crude mortality rates.

Descriptive epidemiological methods were employed to examine mortality associated with extreme heat events. The analysis included calculations of absolute counts, crude rates, proportions, means, long-term averages, and 95% confidence intervals (CI) to support comparisons across population subgroups.

3. Summary of findings

3.1. Heat period

During the summer of 2024, national temperatures in Wales did not meet the criteria for a heatwave or heat period. However, three health boards (Aneurin Bevan, Cardiff and Vale, and Swansea Bay UHBs) recorded localised heatwave episodes between 29th July and 1st August, with Swansea Bay's episode ending on 31st July. As a result, there was **one heat period** for Wales in 2024 and this was defined as the 28th of July to the 2nd of August 2024 in this report.

3.2. Overall mortality

During the summer of 2024 there were an estimated 557 all-cause of deaths (95% CI: 511 to 603) associated with the 6 days of heat episode across Wales (28 July to 2 August 2024). The mean daily number of deaths in Wales during the heat period was 93 (95% CI: 87 to 99) compared to 84 deaths at (95% CI: 82 to 86) on non-heat period days. The comparator (84 deaths/day) represents the average daily mortality across all non-heat period days in summer 2024. The mean daily deaths were significantly higher during the heat period. Figure 1 shows the trend in mortality during summer months of 2024 in Wales. Whilst there is a statistically significant increase in daily deaths during the heat period, causality cannot be inferred due to the lack of adjustment for confounders and absence of longitudinal comparison.

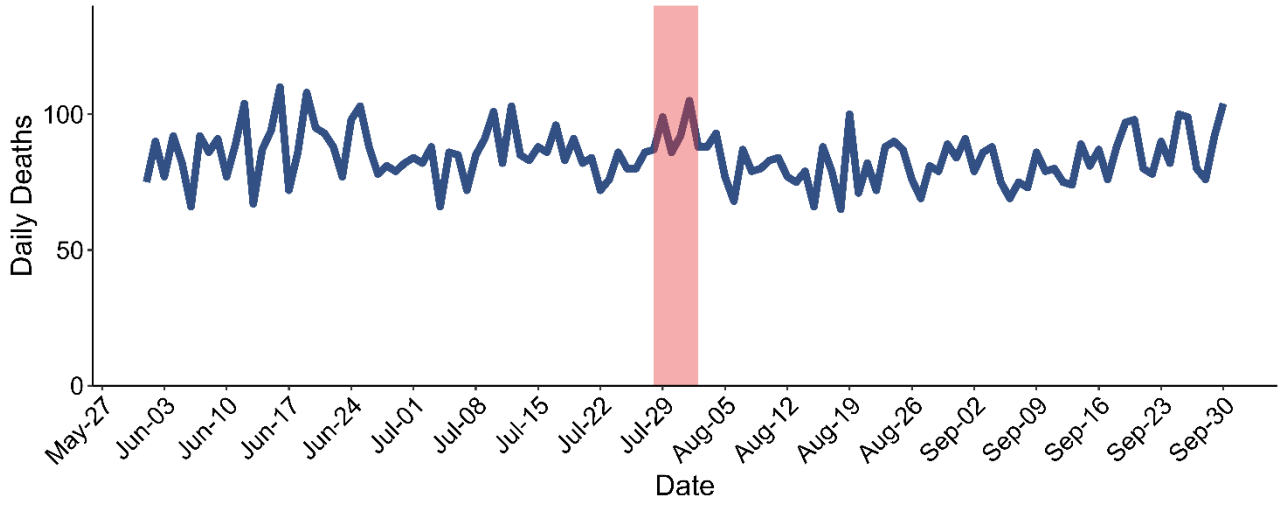

Figure 1 – Daily number of all-cause deaths in Wales, summer months (July to September) 2024. The line represents the daily number of deaths and red shading depicts the heat period (± one day either side of the period).

There were 10,310 recorded all-cause deaths in Wales over the summer of 2024. This is higher than the average of 9,839 deaths (95% CI: 7,386 to 9,832) observed over the five-year baseline period (2016–2019 and 2023), which excludes the pandemic years. The number of all-cause deaths in 2024 exceeds the expected range based on previous years.

However, we did not conduct a comparison of heatwave exposure with previous years, and therefore this does not mean that the increase in mortality was due to the 6-day heat period in 2024 (Figure 2).

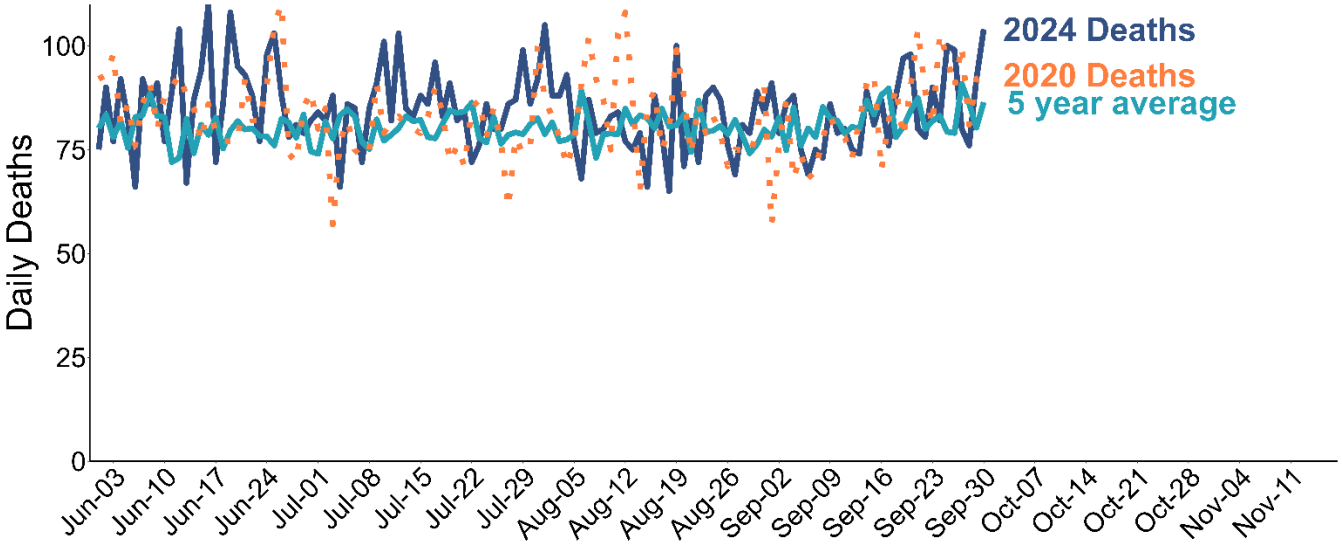

Figure 2 – Daily number of deaths in Wales, summer 2024, and the mean daily deaths for the period 2016-2023 (excluding the pandemic years 2020-2022).

3.3. Demographic factors

During the heat period, there was a statistically significant difference in age-specific all-cause mortality rates. Individuals aged 85 years and older experienced the highest mortality burden, with 39 deaths per 100,000 population (95% CI: 26 to 52), indicating a significant impact of heat on this age group. Furthermore, when comparing older adults aged 65 years and above to those aged 15–64 years, the mortality rate was significantly higher in the older age group, with 11 deaths per 100,000 population (95% CI: 9 to 14) (Figure 3).

The median age at death during the heat episode was 79 years for females and 76 years for males. There was no significant difference in all-cause mortality rates per 100,000 population between males and females as reported in Table 1.

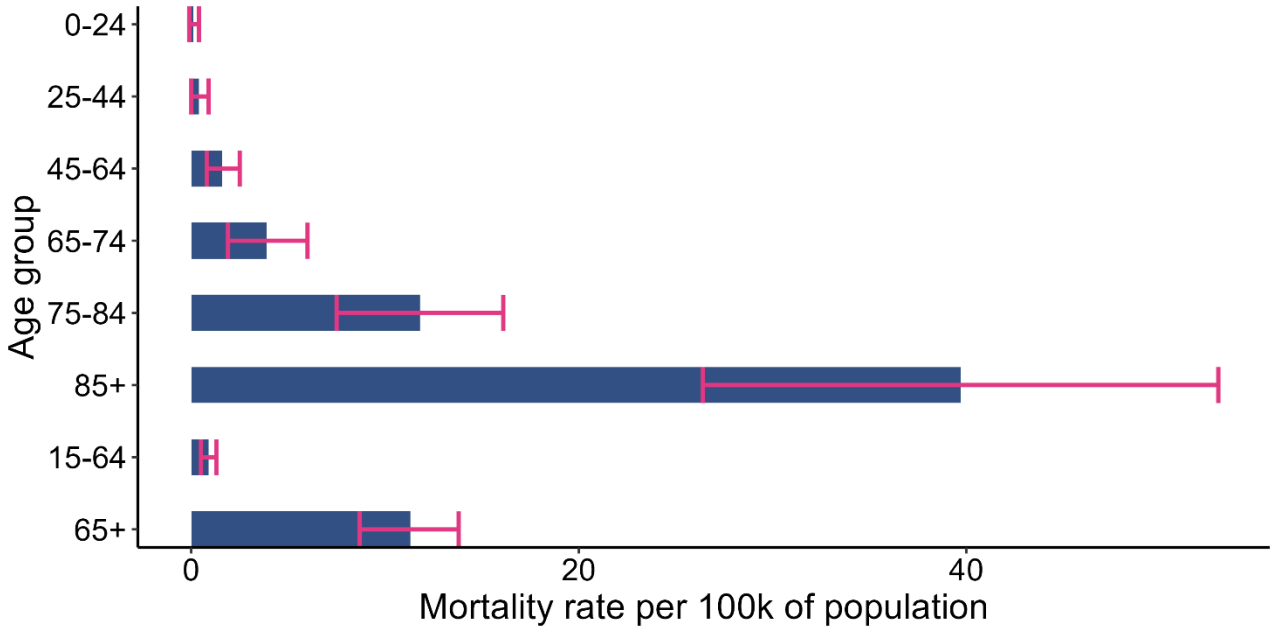

Figure 3 – All-cause deaths per 100,000 population by age group during the heat period in summer 2024. The pink lines represent the 95% confidence interval.

Table 1 – Summary of all-cause mortality by sex during the heat period in summer 2024.

Sex	Total Deaths (95% CI)	Rate per 100,000 population (95% CI)
Female	283 (250-316)	3 (2-4)
Male	274 (242-306)	3 (2-4)

No significant differences in all-cause mortality was observed across socioeconomic groups in Wales, as measured by the Welsh Index of Multiple Deprivation (WIMD). However, the highest mortality rate during the heat period was reported in the second most deprived quintile (WIMD Quintile 2), at 3.4 deaths per 100,000 population[1]. In contrast, the lowest rate was observed in the least deprived quintile (WIMD Quintile 5), at 2.6 deaths per 100,000 population (Figure 4).

[1] *The 2022 WIMD population estimates were used as the denominator in this analysis, as the 2024 estimates have not yet been published by the Office for National Statistics (ONS). While these estimates provide a reliable basis for analysis, any significant population changes between 2022 and 2024 may influence the precision of the findings.*

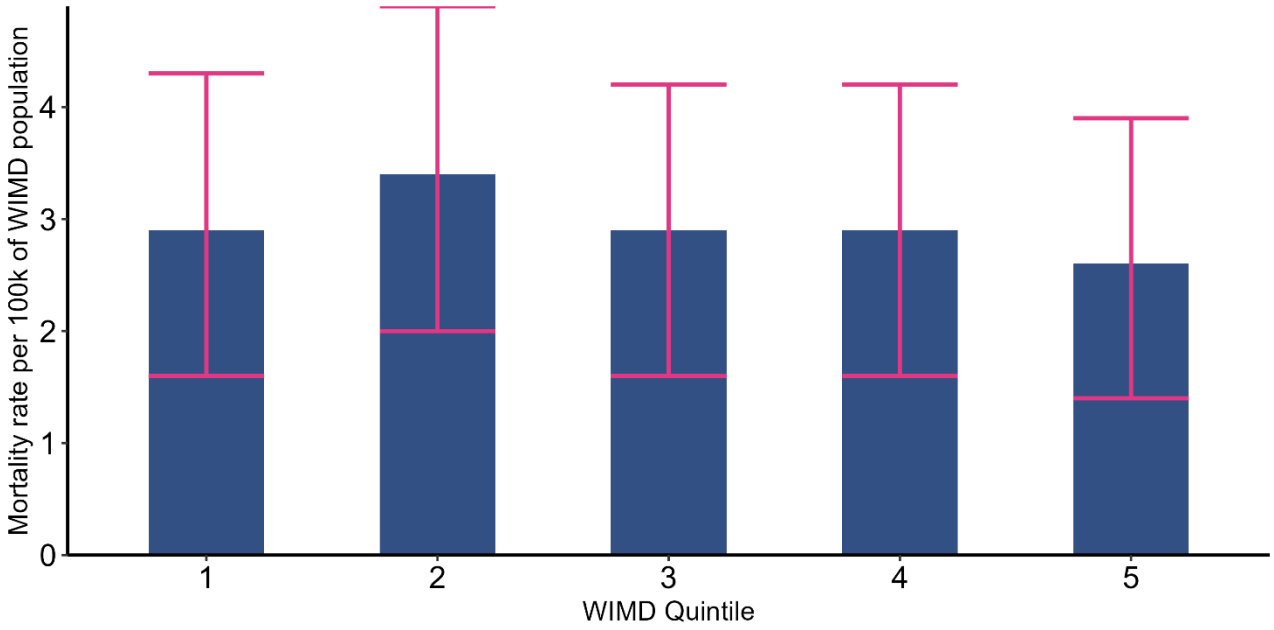

Figure 4 – All-cause mortality rate (per 100,000 population) by deprivation quintile (WIMD) during the heat period in summer 2024. 1= most deprived, 5= least deprived. The pink lines represent the 95% confidence interval.

3.4. Geographical variation

No significant differences in all-cause mortality rates per 100,000 population were observed across health boards (Figure 5).

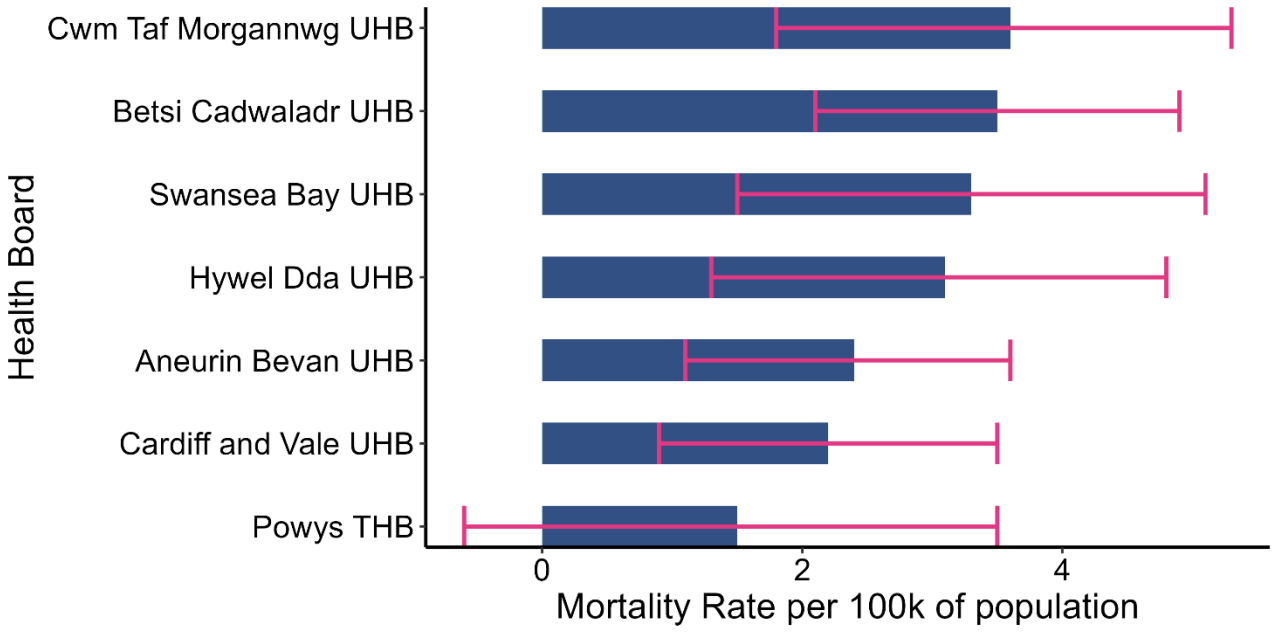

Figure 5 – All-cause mortality rate (per 100,000 population) by health board during the heat period in summer 2024. The pink lines represent the 95% confidence interval.

In 2024, there was a significant difference in all-cause mortality rates observed between urban and rural areas in Wales. Urban settings experienced significantly higher mortality rate, with an estimated 48 deaths per 100,000 population (95% CI: 37 to 59), compared to 14 deaths per 100,000 population (95% CI: 8 to 19) in rural areas (Table 2)[2].

Table 2 – All-cause mortality rate (per 100,000 population) by rural/urban classification during the heat period in summer 2024.

Rural Urban Classification	Total Deaths (95% CI)	Rate per 100,000 population (95% CI)
Rural	128 (106-150)	14 (8-19)
Urban	415 (375-455)	48 (37-59)
Unknown	14 (7-21)	-

[2] The 2022 rural-urban population estimates were used as the denominator in this analysis, as the 2024 estimates have not yet been published by the Office for National Statistics (ONS). While these estimates provide a reliable basis for analysis, any significant population changes between 2022 and 2024 may influence the precision of the findings.

3.5. Settings

There was no significant difference in the proportion of all-cause deaths by place of death in Wales. However, hospitals accounted for the highest proportion of these deaths (45%), followed by deaths occurring at home (31%) and in care homes (17%), as illustrated in Figure 6.

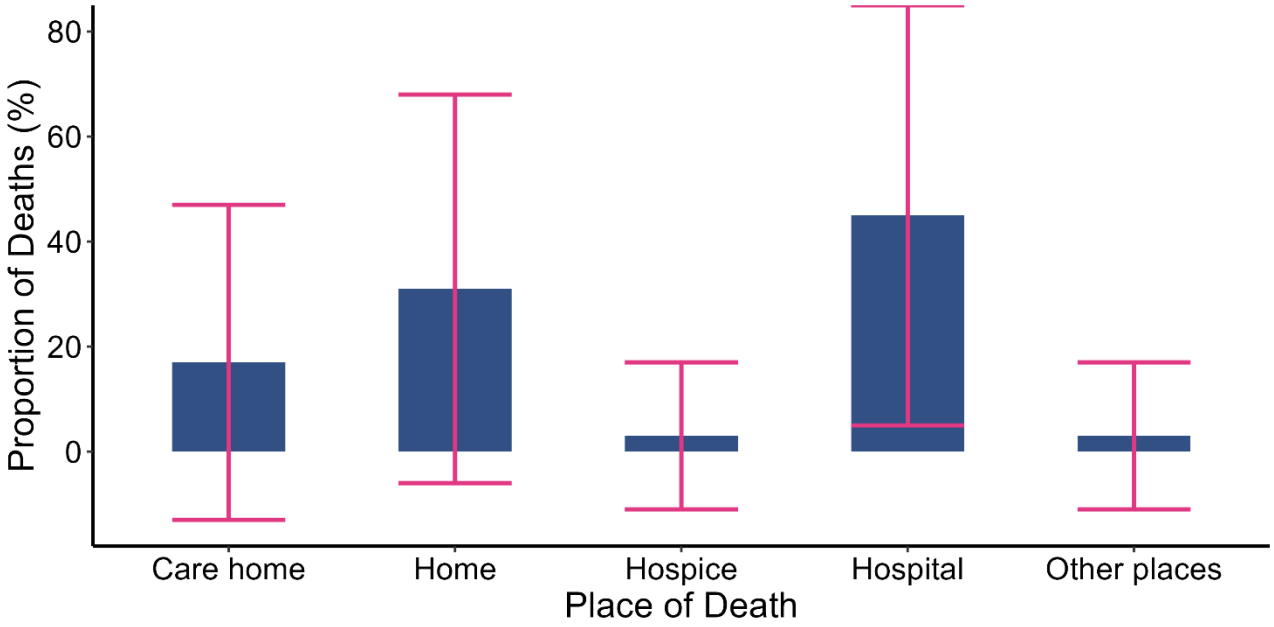

Figure 6 – Proportion of all-cause mortality by place of death during the heat period in summer 2024. The pink lines represent the 95% confidence interval.

4. Conclusion

The summer of 2024 in Wales was characterised by a short but impactful heat episode between 28th July and 2nd August, during which three health boards, Aneurin Bevan UHB, Cardiff and Vale UHB, and Swansea Bay UHB experienced localised heatwave conditions. Although national thresholds for a heatwave were not met, there were an estimated 557 deaths associated with the six days of heat period across Wales. The mean daily all-cause mortality during the heat period was notably higher than on non-heat days, indicating a measurable public health impact associated with elevated ambient temperatures.

The burden of all-cause mortality was disproportionately concentrated among older adults, particularly those aged 85 years and above. While no statistically significant differences were observed by sex, place of death, or socioeconomic status, urban areas experienced significantly higher mortality rates compared to rural settings. This urban-rural disparity may reflect differential exposure to environmental risk factors such as the urban heat island effect, as well as variations in population vulnerability and access to adaptive resources. These findings underscore the importance of enhancing heat-health surveillance, and the need for more descriptive and analytic epidemiology to monitor the population health impacts of a changing climate in Wales.

5. Recommendations

1. Maintain annual surveillance of heat-related mortality, comparing seasonal trends to previous years to detect emerging patterns of a changing climate to inform adaptive public health responses.

2. While elevated mortality was observed during the heat period, further analysis is required to determine the extent to which this is attributable to heat exposure versus other seasonal or demographic factors. We recommend the following improvements to strengthen the epidemiological assessment of heat-related health impacts across Wales:
   - Apply Distributed Lag Non-Linear Models (DLNM): To accurately quantify risk ratios and attributable fractions, DLNM should be used to capture both immediate and delayed health effects of heat exposure, as well as the non-linear nature of temperature-health relationships.
   - Broaden Heat Exposure Metrics: Move beyond the narrow definition of heatwaves to include sustained high temperatures, low night-time cooling, and cumulative heat exposure. These measures better reflect the full spectrum of thermal stress experienced by populations and are critical for identifying vulnerable periods and groups.

3. Alongside sharing publicly, present this report at the PHW Climate Change Surveillance Subgroup, where stakeholders from PHW, health boards, local authorities, Welsh Government, ONS, academia, and other partners can use this intelligence to inform public health action.

6. Limitations

- This report focuses on mortality occurring during the defined heat period, with stratified analyses conducted by demographic characteristics, geographical variation, and settings. While seasonal trends in overall mortality across the summer months (June to September) have been examined to provide contextual background, the stratified analyses are restricted to the heat period and do not include direct comparisons with the non-heat period. Therefore, estimates of excess mortality should be interpreted with caution, as they do not account for baseline seasonal variation or other confounding factors that may influence mortality outside of extreme heat events. This limitation should be considered when drawing conclusions regarding causality or informing targeted public health policy and interventions.
- The increase in daily deaths during the heat period may be due to mortality displacements (commonly referred to as “harvesting”). This is a phenomenon where a short-term event (like a heatwave) causes deaths among vulnerable individuals (e.g., the elderly, those with pre-existing conditions) who might have died soon anyway. In this case, the heatwave accelerates their death by days or weeks, rather than causing a death that wouldn’t have occurred otherwise. Looking at the statistics in Wales, deaths appear to have dropped below baseline in the weeks following the heat period (Figure 1), with most deaths being among older, more vulnerable age groups. In 2024, there was a short heat period; harvesting often occurs after short, intense heatwaves, rather than longer or repeated heatwaves which tend to cause true excess mortality.

7. Appendix

Table 3 – Summary of all-cause mortality by age group during the heat period in summer 2024.

Age group	Total Deaths (95% CI)	Rate per 100,000 population (95% CI)
0-24	5 (<5-9)	0.1 (-0.1-0.4)
25-44	19 (10-28)	0.4 (0-0.9)
45-64	75 (58-92)	1.5 (0.7-2.4)
65-74	82 (64-100)	3.9 (1.8-6)
75-84	172 (146-198)	11.7 (7.4-16)
85+	204 (176-232)	39.5 (26.2-52.8)
15-64	97 (78-116)	0.8 (0.4-1.2)
65+	458 (416-500)	11.2 (8.7-13.7)

Table 4 – Summary of all-cause mortality by place of death during the heat period in summer 2024.

Place of Death	Total Deaths (95% CI)	Proportion (95% CI)
Care home	96 (77-115)	17% (-13%-47%)
Home	173 (147-199)	31% (-6%-68%)
Hospice	18 (10-26)	3% (-11%-17%)
Hospital	251 (220-282)	45% (5%-85%)
Other places	19 (10-28)	3% (-11%-17%)

Table 5 – Summary of all-cause mortality by deprivation quintile (WIMD) during the heat period in summer 2024.

WIMD	Total Deaths (95% CI)	Rate per 100,000 population (95% CI)
1	105 (85-125)	2.8 (1.5-4.1)
2	128 (106-150)	3.4 (2-4.9)
3	110 (89-131)	2.8 (1.5-4.1)
4	110 (89-131)	2.8 (1.5-4.1)
5	97 (78-116)	2.6 (1.3-3.8)
Unknown	7 (<5-12)	-

Table 6 – Summary of all-cause mortality by health board during the heat period in summer 2024.

Health Board	Total Deaths (95% CI)	Rate per 100,000 population (95% CI)
Aneurin Bevan UHB	85 (67-103)	2.4 (1.1-3.6)
Betsi Cadwaladr UHB	147 (123-171)	3.5 (2.1-4.9)
Cardiff and Vale UHB	68 (52-84)	2.2 (0.9-3.5)
Cwm Taf Morgannwg UHB	96 (77-115)	3.6 (1.8-5.3)
Hywel Dda UHB	72 (55-89)	3.1 (1.3-4.8)
Powys THB	12 (5-19)	1.5 (-0.6-3.5)
Swansea Bay UHB	77 (60-94)	3.3 (1.5-5.1)

8. References

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9. Further information and contact details.

About Public Health Wales

Public Health Wales exists to protect and improve health and wellbeing and reduce health inequalities for people in Wales. We work locally, nationally, and internationally, with our partners and communities.

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Feedback and contact information

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Voluntary Application of the Code of Practice for Statistics

This report by Public Health Wales is not classified as official statistics, but it voluntarily follows the UK Statistics Authority's Code of Practice for Statistics. We apply the principles of trustworthiness, quality, and value to ensure transparency, scientific integrity, and public benefit.

Trustworthiness: Produced by Public Health Wales analysts using reproducible and transparent methods.

Quality: Based on published Office for National Statistics (ONS) mortality data and meteorological data, analysed using standard epidemiological techniques.

Value: Provides evidence on the impact of extreme heat on mortality in Wales, supporting public health policy, emergency planning, and climate adaptation efforts.

We welcome feedback to support continuous improvement of future outputs.