GIG CYMRU NHS WALES
Iechyd Cyhoeddus Cymru
Public Health Wales

Cold Weather Morbidity Monitoring in Wales

Annual Surveillance Report 2025

22nd May 2026

Key Findings

Caveat: These findings are descriptive surveillance signals in 999 and A&E data, and do not imply causation or individual care-pathway effects.

Cold spells in 2024/25 did not increase overall emergency calls or hospital admissions but some specific health problems rose.

Total 999 calls and A&E attendances were slightly lower during cold spells, and hospital admissions showed no change. However, calls for cardiac or respiratory arrest were higher during cold periods, and falls increased in the days after cold spells.

Older adults were most affected by cold-related health issues.

People aged 65 and over had more 999 calls for breathing difficulties, mental health concerns, and unconsciousness during cold and lag periods. These patterns suggest older adults remain particularly vulnerable to cold weather impacts.

Working-age adults (17–64 years) also showed measurable post-cold increases in emergency 999 calls.

Breathing difficulty and falls-related 999 calls were higher among working age adults after cold spells.

Females showed a specific cold-related health issue.

An increase in 999 calls for unconscious or syncope was observed in females during the lag period, suggesting females may be slightly more vulnerable to delayed effects of cold weather for this health issue.

Emergency hospital admissions did not change significantly.

Despite increases in some 999 call categories, there was no corresponding increase in emergency admissions during cold or lag periods.

Executive Summary

Indicator	Overall significance of immediate impact of cold in general population*	Overall significance of delayed impact of cold in general population*	Demographics with statistically significant incidence rate ratio	Demographics to monitor (elevated incidence rate ratio, not statistically significant)
999 – Total number of calls			-	-
999 - Breathing difficulties			Aged 17 to 64 and 65 and over	-
999 - Cardiac or respiratory arrest			-	Aged 0 to 16
999 – Chest pains			-	-
999 – Cold exposure			-	-
999 – Collapse with unknown problem			-	Aged 0 to 16
999 – Falls			Aged 17 to 64	-
999 – Headache			-	-
999 – Inhalation of CO/hazardous chemicals			-	-
999 – Mental Health			Aged 65 and over	Aged 0 to 16
999 – Overdose or poisoning by ingestion			-	-
999 – Stroke			-	-
999 – Unconscious or syncope			Aged 65 and above, and Females	-
Accident and Emergency attendance (A&E) – Total attendances			-	-
Emergency admissions via A&E			-	-

Elevated incidence rate ratio, statistically significant

Monitor (Elevated IRR, not statistically significant)

No increase

Not tested due to small numbers or Insignificant IRR -

Purpose and scope.

This annual surveillance report describes patterns in emergency healthcare activity in Wales during winter **2024/25** across three predefined periods: **cold** (days with Wales mean ≤ 2 °C for ≥ 2 consecutive days), **lag** (up to 7 days post-cold), and **baseline** (all other days within 31 Oct–31 Mar). The objective is to inform public health action. Findings are **descriptive** and **do not imply causation**.

For this first annual cold weather morbidity report, we used a simple, transparent incidence rate ratio approach with predefined periods, rather than more advanced methods, to prioritise operational surveillance needs, reproducibility, and clarity whilst the system and data infrastructure mature.

Seasonal context.

Wales experienced **78 cold days, 46 lag days, 28 baseline days,** and a prolonged January cold spell; the season overall was milder than recent averages but included distinct cold episodes. Analyses were undertaken at the national level using daily mean temperature.

All-cause activity.

- **999 calls (all categories):** lower during cold than baseline (**IRR 0.96; 95% CI 0.95–0.97; p < 0.001**); no evidence of difference during the lag (**IRR 1.01; 95% CI 1.00–1.03; p = 0.11**).
- **A&E attendances (all-cause):** lower during both cold (**IRR 0.97; 95% CI 0.96–0.97**) and lag (**IRR 0.98; 95% CI 0.97–0.99**).
- **Emergency admissions via A&E:** no statistically significant differences in cold or lag periods.

Specific 999 call categories with higher rates.

- **Cardiac or respiratory arrest:** higher during cold (**IRR 1.15; 95% CI 1.04–1.26**).
- **Falls:** higher during the lag (**IRR 1.05; 95% CI 1.01–1.09**).

Age-specific signals.

Older adults (≥ 65 years) showed the clearest signals:

- **Breathing difficulties:** higher in cold (**IRR 1.05; 95% CI 1.01–1.11**) and lag (**IRR 1.13; 95% CI 1.08–1.19**).
- **Mental health:** higher in lag (**IRR 1.24; 95% CI 1.01–1.53**).

Unconscious/syncope: higher in cold (**IRR 1.13; 95% CI 1.04–1.22**) and lag (**IRR 1.12; 95% CI 1.03–1.22**).

Working-age adults (17–64 years) also showed measurable post-cold increases in emergency 999 calls. **Breathing difficulty** call rates were higher during the lag period (IRR 1.12; 95% CI 1.05–1.21), and **falls-related calls** were also elevated (IRR 1.12; 95% CI 1.02–1.23).

Sex-specific signals

Among females, there was a small but statistically significant increase in reports of unconscious or syncope during the lag period (**IRR 1.10; 95% CI 1.01–1.20**).

Populations and services.

No significant differences in A&E attendance were observed by age, sex, deprivation (WIMD) or rurality at all-Wales level. A statistically significant increase in all categories-specific 999 call rates was observed in **Cwm Taf Morgannwg UHB** during the lag (**IRR 1.05; 95% CI 1.01–1.09**); local factors were not examined in this report.

Interpretation for surveillance.

- The system detected **lower all-cause activity** during cold periods with **targeted increases** in specific clinical categories and **stronger signals in older adults**.
- **Emergency admissions** did **not** show corresponding increases during cold or lag periods.

Key limitations.

- **Indoor conditions and wider health and wellbeing impact unmeasured:** no data on indoor temperature, fuel poverty, or housing quality; “cold homes” cannot be identified; limited to 999 and A&E data.
- **Seasonal confounding:** winter morbidity is influenced by concurrent factors (e.g., respiratory infections, service pressures) not adjusted for here.
- **Geography and exposure:** national temperature series may mask local micro-climates; analyses are not stratified by health board temperature.
- **Statistical power:** finite numbers of cold/lag days and small strata may yield imprecise estimates; selected near-signals (e.g., IRR ≥ 1.2 with 95% CI including 1) are flagged for monitoring rather than confirmation.
- This descriptive surveillance report does not conduct formal between-group comparisons, as its purpose is to describe patterns; any hypotheses generated may then inform future analytic epidemiology research.

Planned methodological enhancements.

Future cycles will: (i) explore **Distributed Lag Non-linear Models (DLNMs)** to better capture delayed/non-linear temperature–health relationships; (ii) consider adjustment for **key confounders** (e.g., influenza activity); and (iii) consider **sensitivity analyses** using alternative seasonal/comparator definitions to test robustness.

Contents

1. Background

Cold weather can pose serious public health risks, causing 'excess' deaths in winter compared to the rest of the year. Cold weather can contribute to hypothermia, falls and injuries, heart attacks, strokes, respiratory diseases, poor mental health, such as depression, and carbon monoxide poisoning from poorly maintained or poorly ventilated boilers, cooking and heating appliances [1-6]. The winter of 2024/25 in Wales was slightly milder than the 1991–2020 average, with a mean temperature anomaly of +0.5°C, driven by a very warm December despite a colder January. So, on average, temperatures during winter 2024/25 were 0.5°C warmer than the 1991–2020 average [7].

Rainfall was around 94% of average, though December was wetter than normal [7]. Two named storms, Darragh (December) and Éowyn (January) brought severe winds, with Éowyn the most significant UK windstorm in over a decade [7-8]. This pattern reflects a broader climate trend of milder and wetter winters linked to climate change [9].

This report assesses the immediate and delayed impact of cold weather on emergency healthcare demand in Wales by analysing 999 calls, Accident & Emergency (A&E) attendances, and emergency hospital admissions via A&E during the cold and the subsequent lag periods, compared to non-cold period (baseline days). The findings aim to inform public health planning and climate adaptation strategies by identifying patterns in cold-related health service use across demographic and geographic groups.

2. Methods

Morbidity data for 999 calls were sourced from Welsh Ambulance Service Trust (WAST) and, Accident & Emergency (A&E) attendances, and emergency hospital admissions via A&E attendances from Digital Health Care Wales (DHCW) covering winter season of 2024/2025 (31st October 2024 – 31st March 2025).

The cold-season surveillance window was defined as 31st October 2024 – 31st March 2025 to align with the *UKHSA Cold-Health Alert core season*, during which national (England only, not Wales) monitoring and operational guidance for cold-related health impacts are in place. Our baseline comparator comprises non-cold days within this same window, to control for contemporaneous winter drivers of morbidity and health-care utilisation. Out-of-season comparators may conflate temperature with broad seasonal differences and are more aligned with excess-winter-mortality frameworks. We included 31st October as a one-day buffer to ensure complete capture of the first qualifying cold episode and its lag where episodes straddle the turn of the month.

Temperature data was sourced from Open-Meteo for the same period. Population data for Wales were derived from the Office for National Statistics (ONS) 2024 mid-year population estimates. Health board populations were estimated by aggregating local authority level 2024 mid-year estimates. Lower layer Super Output Area (LSOA) level 2024 population estimates were aggregated to calculate population totals by Welsh Index of Multiple Deprivation (WIMD) quintile (WIMD 2025) and rural-urban classification. Rural-urban status was assigned using the ONS 2021 Rural-Urban Classification for small area geographies.

2.1. Cold weather definition

In England, UK Health Security Agency (UKHSA) and the Met Office issue Cold Weather Alerts when the average temperature falls below 2°C for more than 48 hours [10]. For this analysis, cold spells in Wales were defined using the same temperature threshold, and lag periods were defined as the seven days following the end of a cold spell [10–13]. The three periods were defined as:

- **Cold period**: days when the average temperature in Wales was ≤ 2 °C for at least two consecutive days;
- **Lag period**: up to seven days following the end of a cold spell unless there is a cold spell before the seventh day;
- **Baseline**: non-cold-period days, all days outside the cold and lag periods.

Cold and lag periods were identified using the Wales regional series-Mean temperature (Wales central mean temperature). This national-level temperature was used to determine whether any intervals met predefined cold period threshold. If no all-Wales cold period was detected, regional (local health board) temperature series would then be assessed to identify any localised events not captured nationally.

2.2. Outcomes and Stratification

The analysis focused on health outcomes potentially related to cold exposure (see Table 1 for categories included) and was stratified by age group (0–16, 17–64, and 65+), sex, socioeconomic status (Welsh Index of Multiple Deprivation, WIMD, quintiles), and rural–urban classification. Due to data availability, WIMD and rural–urban breakdowns were only possible for A&E attendances. Geographical distribution of 999 calls was also assessed across Welsh health boards.

2.3. Data Analysis

All data analyses for this surveillance report were conducted using R version 4.5.1 within the RStudio environment using syndromic surveillance indicators to compare health outcomes. Outcomes and stratification variables were linked to Wales daily average temperature for the surveillance period with cold, lag and baseline reference period ((Table 1) defined to assess the immediate and delayed impact of cold weather.

The primary analytic approach was the calculation of **incidence rate ratios (IRRs)**, which provide interpretable measures of relative risk and allow direct comparison across periods with differing durations.

Although more advanced modelling approaches, such as Distributed Lag Non-linear Models (DLNMs), can characterise delayed and non-linear temperature effects, this first annual report intentionally uses a simpler IRR framework with predefined cold, lag, and baseline periods. This method is well-suited for rapid surveillance and descriptive epidemiology without requiring complex modelling assumptions. More complex models will be developed in future years as the system evolves, and data infrastructure strengthens.

Daily rates per 100,000 population were calculated for each period, along with 95% confidence intervals (CIs). **Person-time at risk** was computed by multiplying the population size by the duration of each period in days, ensuring that variations in exposure time (cold = 78 days; lag = 46 days; baseline = 28 days) were accounted for.

Rates were defined as:

Rate = Event count / Person-time = (Population × Days in period)

IRRs were estimated using the *rateratio* function from the *epitools* package in R[14], with the baseline period serving as the reference category. IRRs were calculated as:

$IRR_{cold\ vs\ baseline} = Rate_{cold} / Rate_{baseline}$

$IRR_{lag\ vs\ baseline} = Rate_{lag} / Rate_{baseline}$

Corresponding 95% CIs and p-values were reported, with statistical significance defined with a **p-value less than 0.05** and a **95% CI which did not include 1** [15]. It is important to note that absolute event counts alone do not reflect the strength of association due to differences in exposure duration. In a surveillance context focused on early signal

detection rather than causal inference, we pre-specify that effect estimates suggestive of moderate to large increases (e.g., IRR ≥ 1.2) will be highlighted even when 95% CIs include 1.

2.4. Consideration of Day-of-Week Effects and Data Suppression.

Daily fluctuations in 999 emergency calls and A&E attendances are common, with peaks typically occurring on Fridays and Saturdays, while hospital admissions tend to be lower on weekends. Importantly, there was no systematic bias in the distribution of cold episodes by day of the week, suggesting that day-of-week effects did not confound the findings.

To maintain confidentiality and data reliability, total counts fewer than five for 999 calls and A&E attendances were suppressed. Due to low numbers, calls related to cold exposure, and inhalation of carbon monoxide or hazardous chemicals were excluded from stratified analyses.

Table 1: Summary of all categories recorded from each data source [16].

999 Calls	Accident and Emergency Attendance
Total number of calls	Total number of A&E attendances
Breathing difficulties	Emergency admissions via A&E
Cardiac or respiratory arrest	
Chest pains	
Cold exposure	
Collapse with unknown problem	
Falls	
Headache	
Inhalation of CO/hazardous chemicals	
Mental Health	
Overdose or poisoning by ingestion	
Stroke	
Unconscious or syncope	

3. Summary of findings

3.1. Cold periods and winter trends.

Across Wales, during the winter season of 2024/2025, a total of **78 days** met the defined threshold for cold period, **46 days** met the criteria for lag period and **28 days** were classified as baseline period. January 2025 was the most affected month, with 27 days recording mean temperatures that met a cold period, marking it as the longest continuous period of cold episodes between 31st Oct 2024 - 31st March 2025 (Figure *1*).

When compared against the five-year average baseline, the overall winter of 2024/2025 was relatively mild across Wales (Figure *1* and Figure *2*). However, there were five distinct cold episodes during which mean temperatures fell below the long-term seasonal average (Figure *2*).

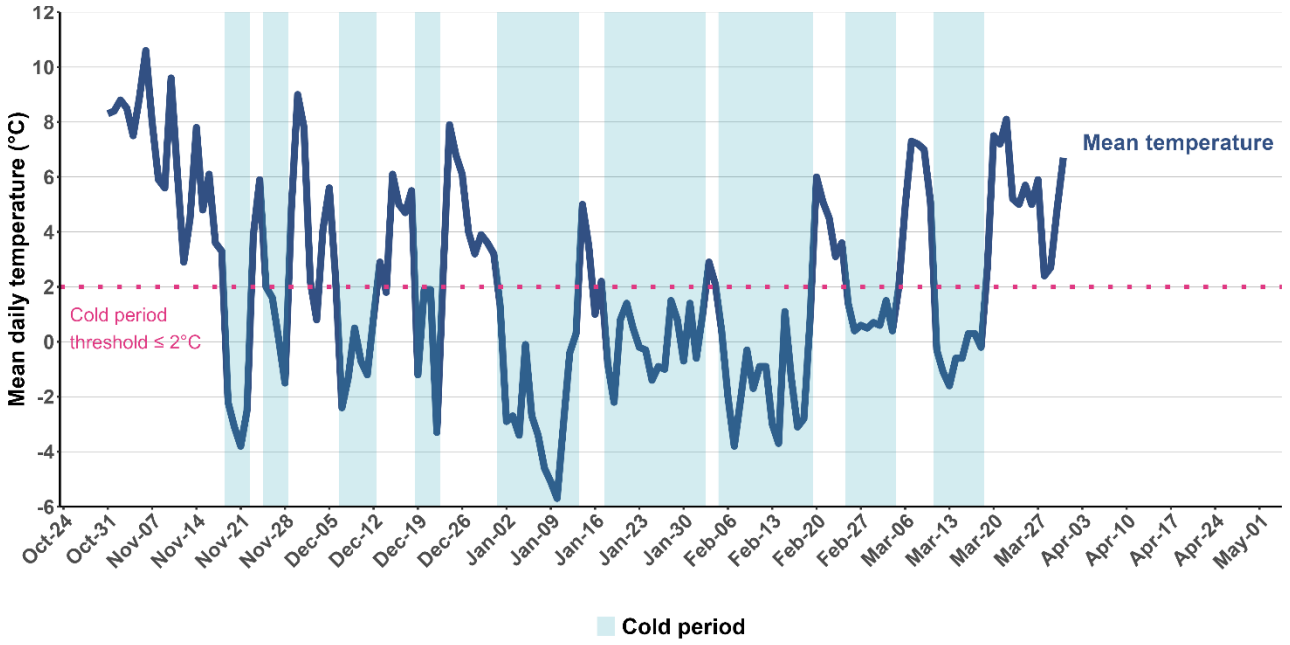


Figure 1 - Mean daily temperature (°C) in Wales for the 2024-25 winter (dark blue line) between 31st October 2024 and 31st March 2025 and cold period (aqua rectangles). The pink dotted line represents the cold period temperature threshold.[1]

[1] Cold period is defined as any two consecutive days or more in winter months with a mean daily temperature ≤ 2°C

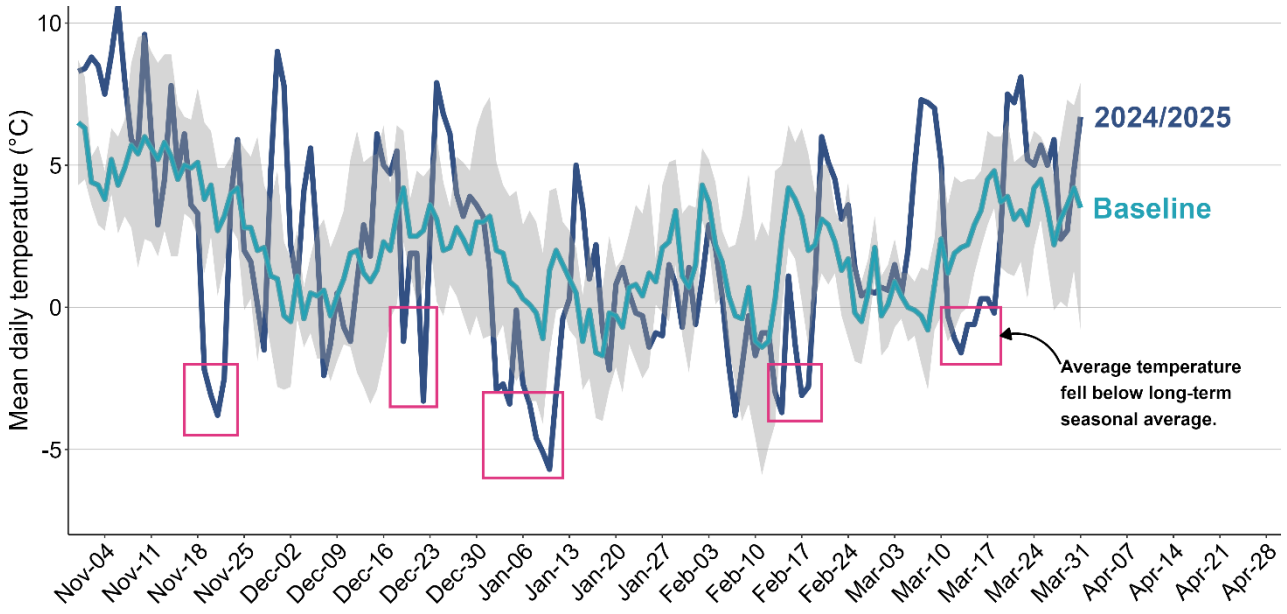


Figure 2 - Mean daily temperature (°C) in Wales during the 2024/2025 winter (royal blue line) relative to the five-year average (2019-2023, teal line) ± 95% confidence intervals (grey shading). The pink rectangle shows the five episodes where daily average temperature fell below the long-term seasonal average.

Table 2: Number of 999 Calls, A&E attendances, and emergency admissions via A&E, by category and period (winter 2024/25, Wales)[2].

Category	Baseline period Total	Cold period Total	Lag period Total
999 Calls			
Cold exposure	5	18	8
Inhalation of CO/hazardous chemicals	34	61	44
Headache	169	356	226
Collapse with unknown problem	490	1,394	802
Cardiac or respiratory arrest	552	1,762	984
Overdose or poisoning by ingestion	856	2,297	1,379
Mental health	1,058	3,009	1,772
Stroke	1,158	2,912	1,816
Unconscious or syncope	1,629	4,670	2,819
Chest pain	3,175	8,012	5,102
Falls	4,109	11,658	7,076
Breathing difficulties	4,568	11,608	7,683
Total 999 Call Incidents	32,589	87,188	54,145
A&E attendance			
Emergency admissions via A&E	30,036	81,666	47,078
Total A&E attendance	73,819	198,479	118,463

[2] Note that absolute event counts alone do not reflect the strength of association due to differences in exposure duration.

3.2. Total 999 Calls.

There was no evidence of the immediate and delayed impact of cold weather on overall 999 calls (all categories) for Wales during the cold period compared to baseline period (IRR: 0.96; 95% CI: 0.95–0.97; $p < 0.001$). Similarly, call rates during the lag period did not differ significantly from baseline (IRR: 1.01; 95% CI: 1.00–1.03; $p = 0.11$) (Figure 3).

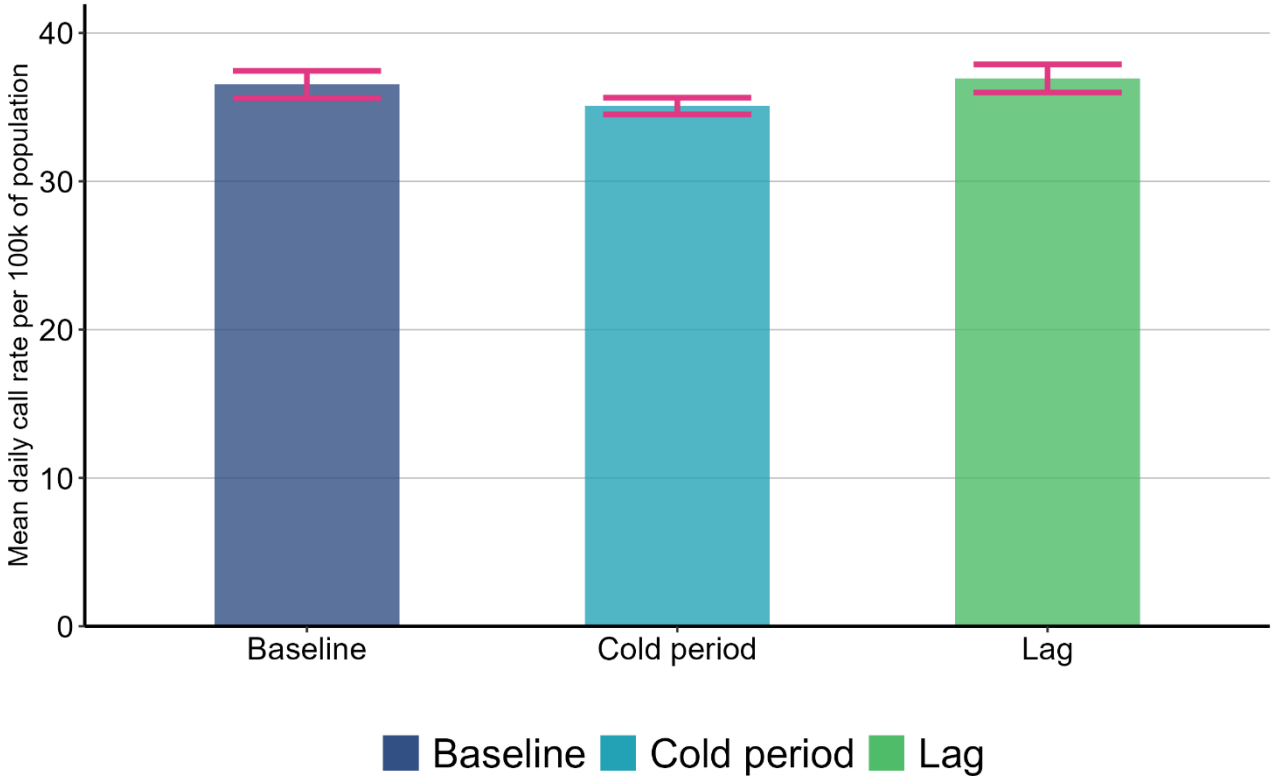


Figure 3 - Mean daily calls rates (per 100,000 population) for all call categories during cold (royal blue), lag (green), and baseline (teal) periods (± 95% confidence intervals (pink lines)).

3.2.1. Category specific total 999 calls.

To assess the immediate and delayed impact of cold weather on specific health outcomes, we compared the incidence of 999 calls across cold (78 days), lag (46 days), and baseline (28 days) periods. Statistically significant differences were observed in two categories:

- **Falls**: Call rates were significantly higher during the lag period compared to baseline (IRR: 1.05; 95% CI: 1.01–1.09; $p < 0.05$).
- **Cardiac or respiratory arrest**: Call rates were significantly higher during the cold period compared to baseline (IRR: 1.15; 95% CI: 1.04–1.26; $p < 0.05$).

These findings are illustrated in Figure 4 & Figure 5.

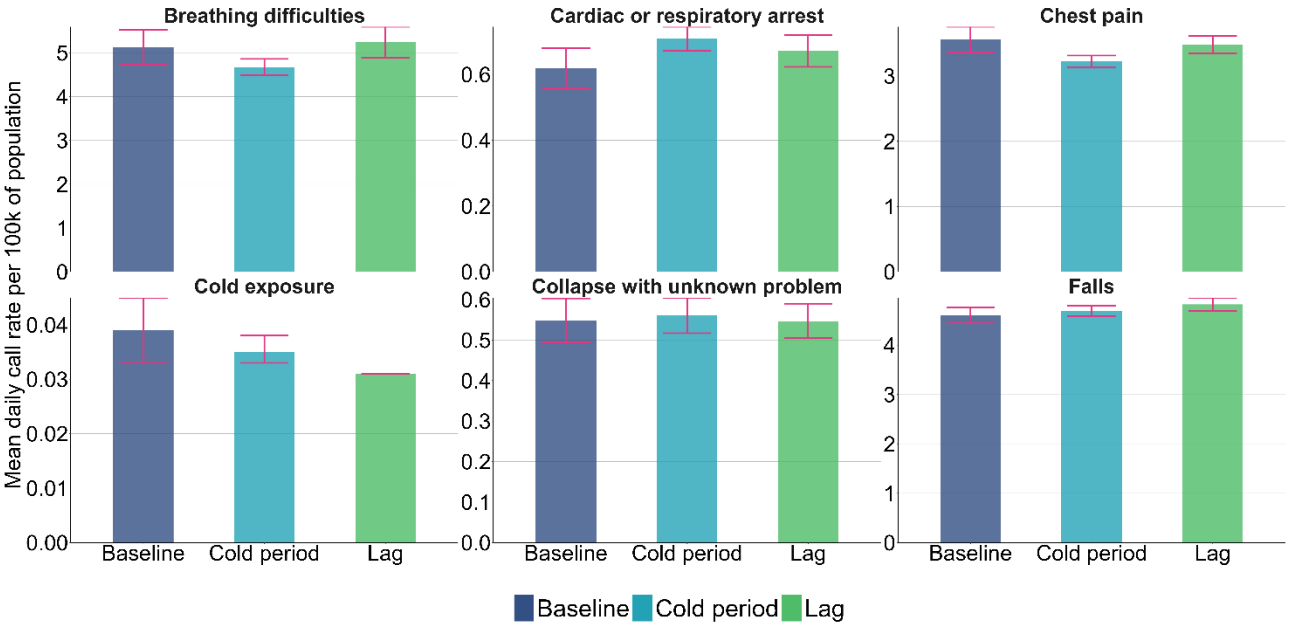


Figure 4 - Mean daily calls rates (per 100,000 of population) for 999 calls categorised as breathing difficulties, cardiac or respiratory arrest, chest pain, cold exposure[3], collapse with unknown problem and falls during baseline (royal blue bar), cold (teal bar) and lag(green bar) periods (± 95% confidence intervals(pink line)).

[3] Due to the absence of variability in the cold exposure 999 calls during the lag period, the mean daily rates per 100,000 population and their corresponding CI remain constant and do not reflect any observable fluctuation

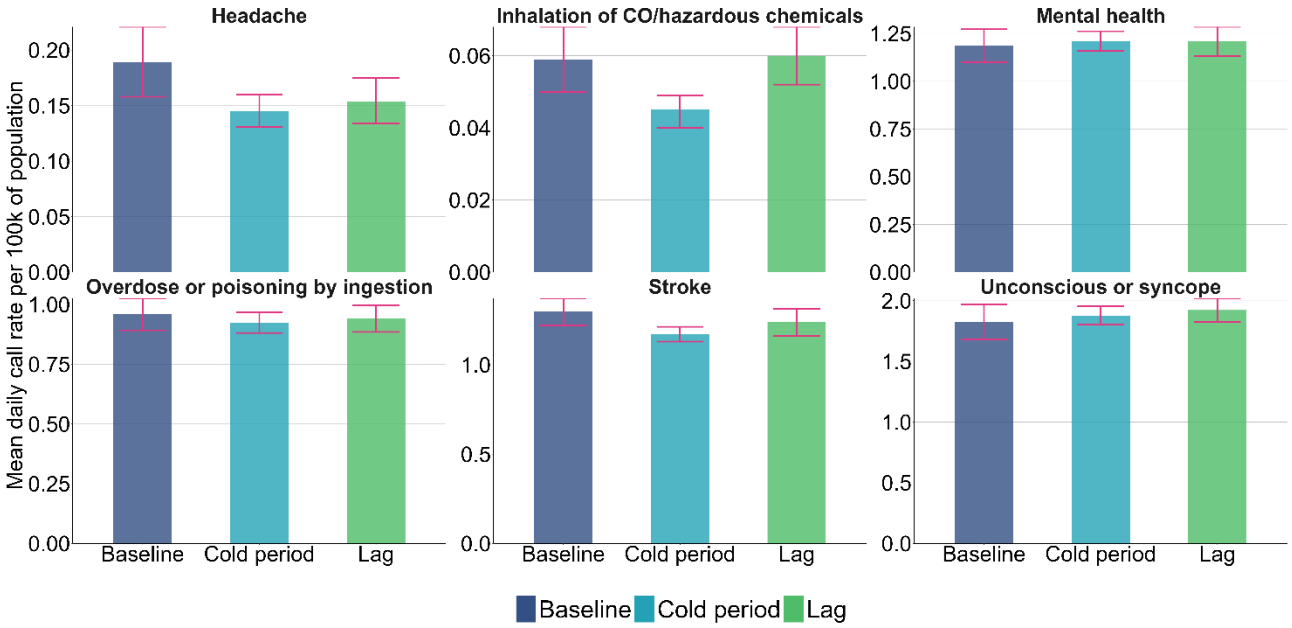


Figure 5 - Mean daily calls rates (per 100,00 of population) for 999 calls categorised as headache, inhalation of CO/hazardous chemicals, mental health and overdose or poisoning by ingestion, stroke and unconscious or syncope during baseline (royal blue bar), cold(teal bar) and lag(green bar) periods (± 95% confidence intervals(pink line))

3.2.2. Category specific 999 calls by age group.

This section summarises age-specific trends in 999 call rates across cold, lag, and baseline periods. While some findings were statistically significant, others showed no meaningful change and may reflect random variation.

Significant difference relative to baseline:

- **Breathing difficulties**
  - Amongst people aged 65+ years, there were higher breathing difficulty 999 call rates during the cold period compared to baseline period (IRR: 1.05; 95% CI: 1.01–1.11; $p < 0.05$).
  - Amongst people aged 17–64 years (IRR: 1.12; 95% CI: 1.05–1.21; $p < 0.05$) and 65+ years (IRR: 1.13; 95% CI: 1.08–1.19; $p < 0.001$), there were higher breathing difficulty 999 call rates during the lag period compared to baseline (Figure 6)[4].

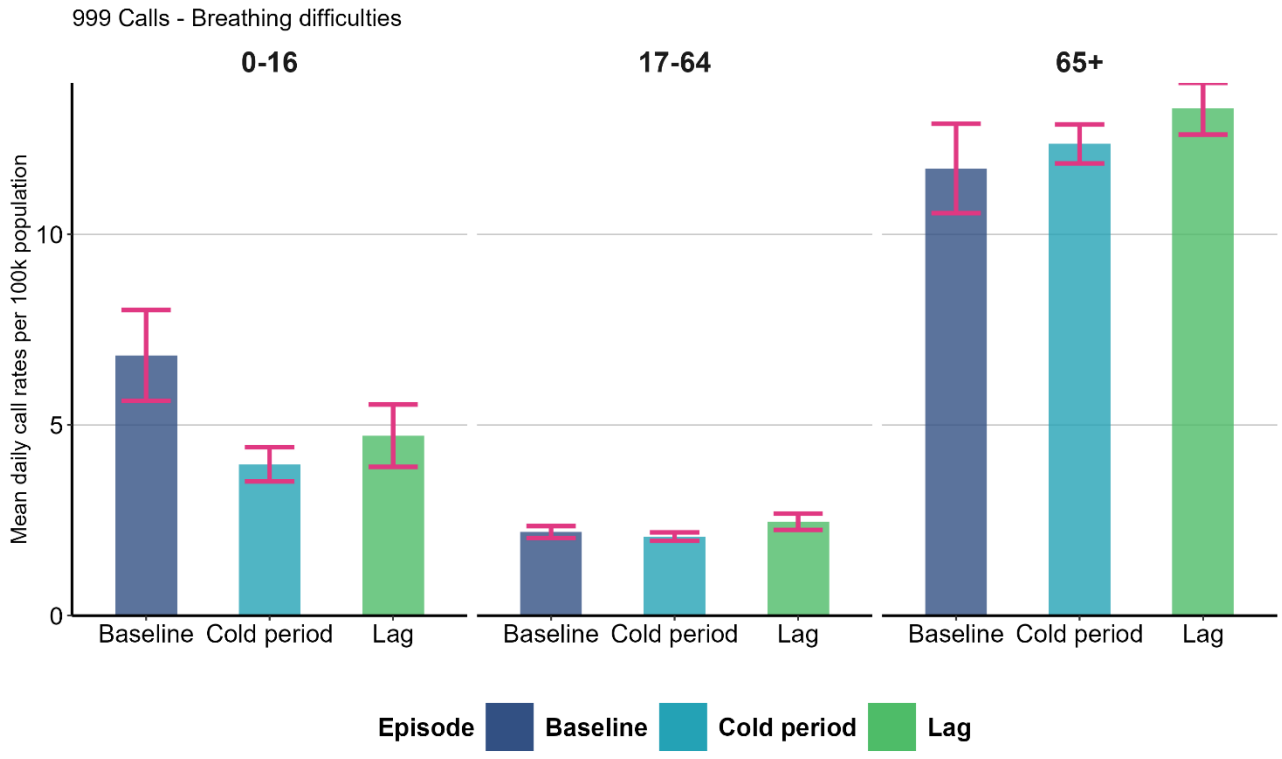


Figure 6 - Age-stratified mean daily call rates (per 100,000 population) categorised as 'Breathing difficulties' during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).

[4] Age information was not documented for 1,554(1.6%) of the 95,271 all category specific call recorded during this period

- **Falls**
  - Amongst people aged 17–64 years, there were higher falls-related 999 call rates during the lag period compared to baseline period (IRR: 1.12; 95% CI: 1.02–1.23; $p < 0.05$) *(*Figure 7A). Higher daily average call rates per 100,000 population in those aged 65 years and above require an expanded y-axis, which compresses the apparent confidence interval width for younger age groups (see Figure 8B).

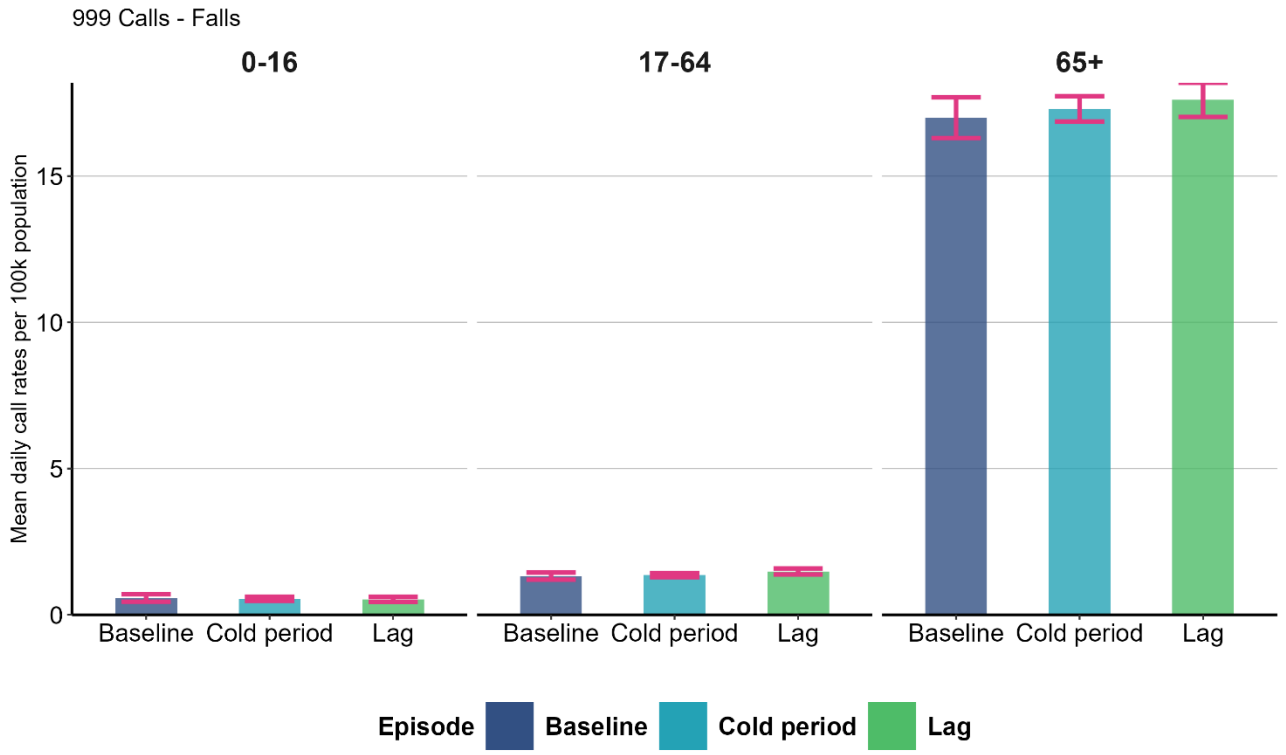


Figure 7A - Age-stratified mean call rates (per 100,000 population) categorised as 'Falls' during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line))[5].

[5] Higher mean call rates in the ≥65 age group require an expanded y-axis, which compresses the apparent confidence interval width for younger age groups.

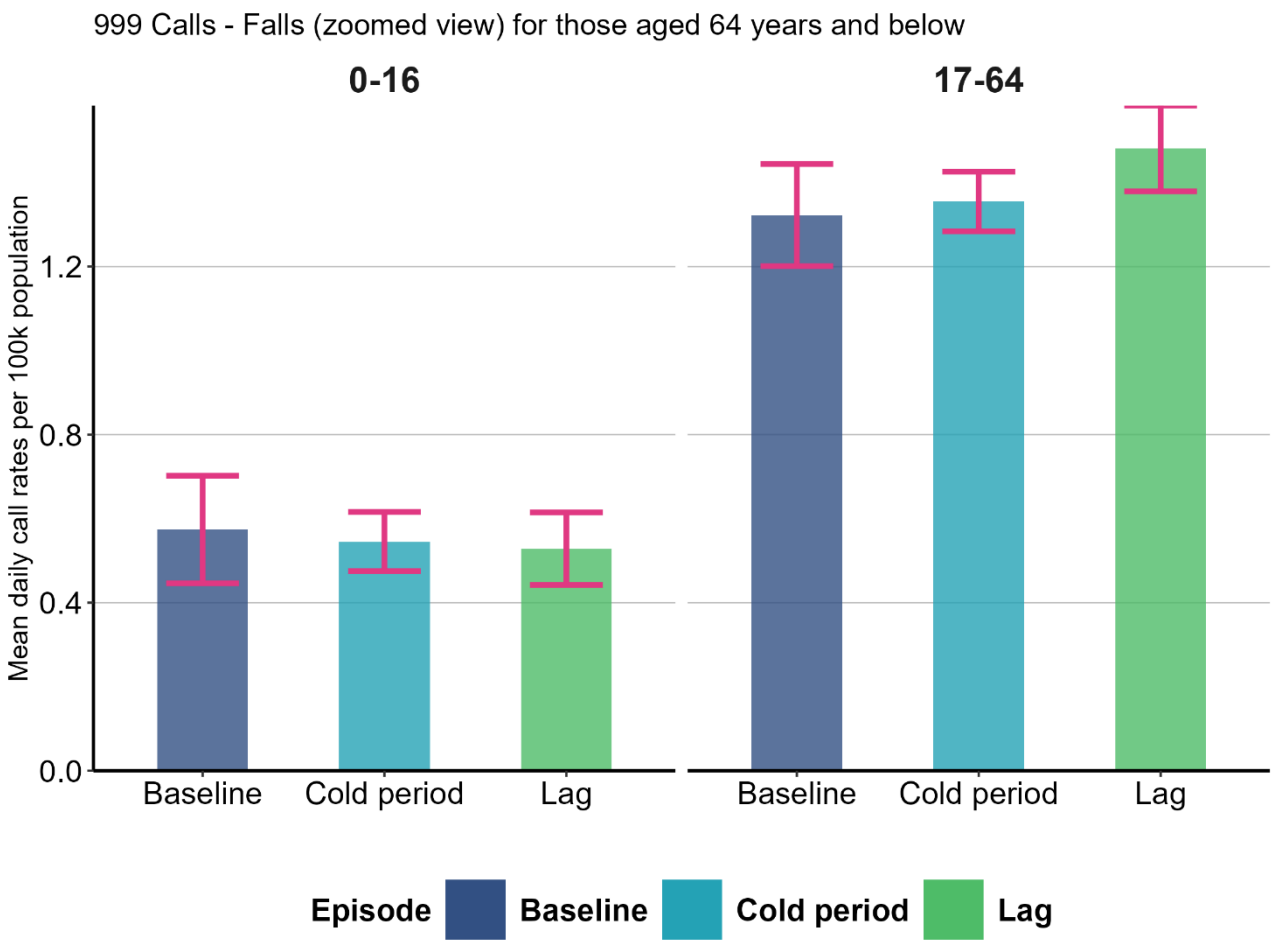


Figure 8B - Age-stratified mean call rates zoomed view for those aged 64 years and below (per 100,000 population) categorised as 'Falls' during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).

- **Mental health**
  - Amongst people aged 65+ years, there were higher mental health 999 call rates during the lag period compared to baseline period (IRR: 1.24; 95% CI: 1.01–1.53; $p < 0.05$) *(Figure 9)*.

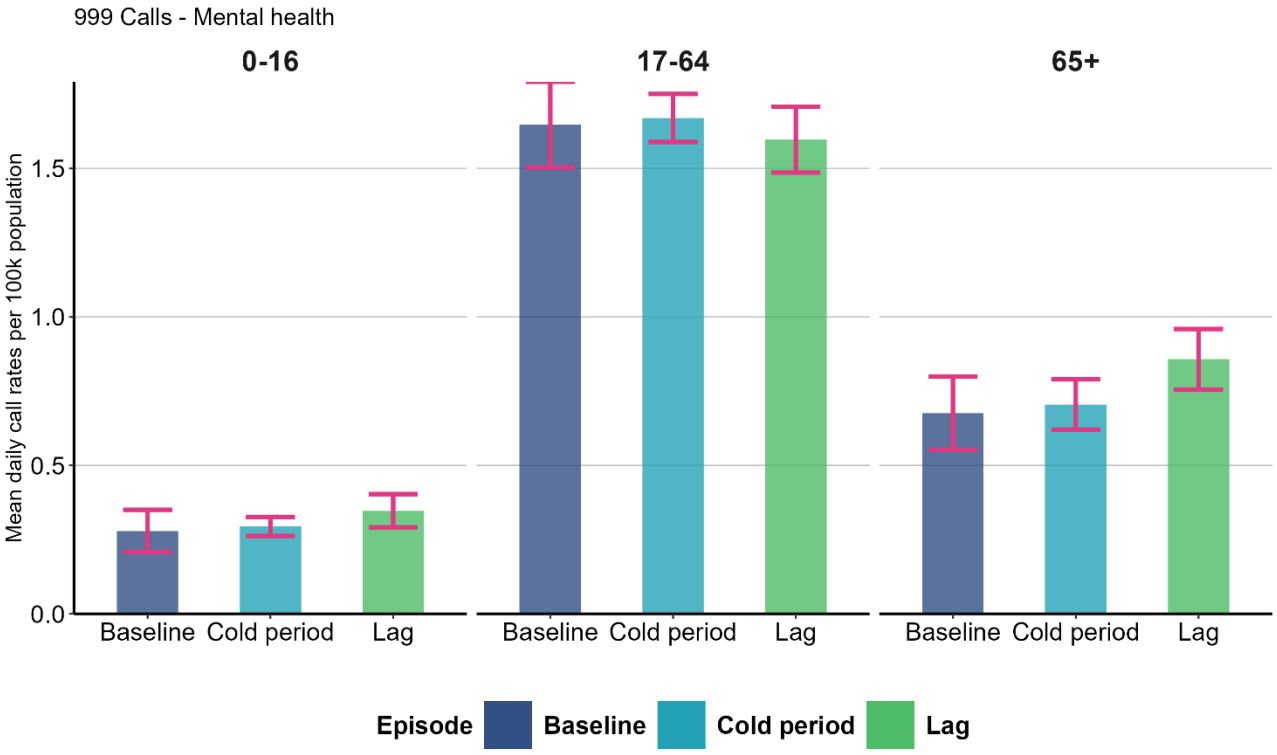


Figure 9 - Age-stratified mean daily call rates (per 100,000 population) categorised as 'Mental health' during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).

- **Unconscious or syncope**
    - Amongst people aged 65+ years, there were higher unconscious or syncope 999 call rates during both the cold period (IRR: 1.13; 95% CI: 1.04–1.22; $p < 0.05$) and lag period (IRR: 1.12; 95% CI: 1.03–1.22; $p < 0.05$) compared to baseline period (Figure *10*A). Higher daily average call rates per 100,000 population in those aged 65 years and above require an expanded y-axis, which compresses the apparent confidence interval width for younger age groups (see Figure *10*B).

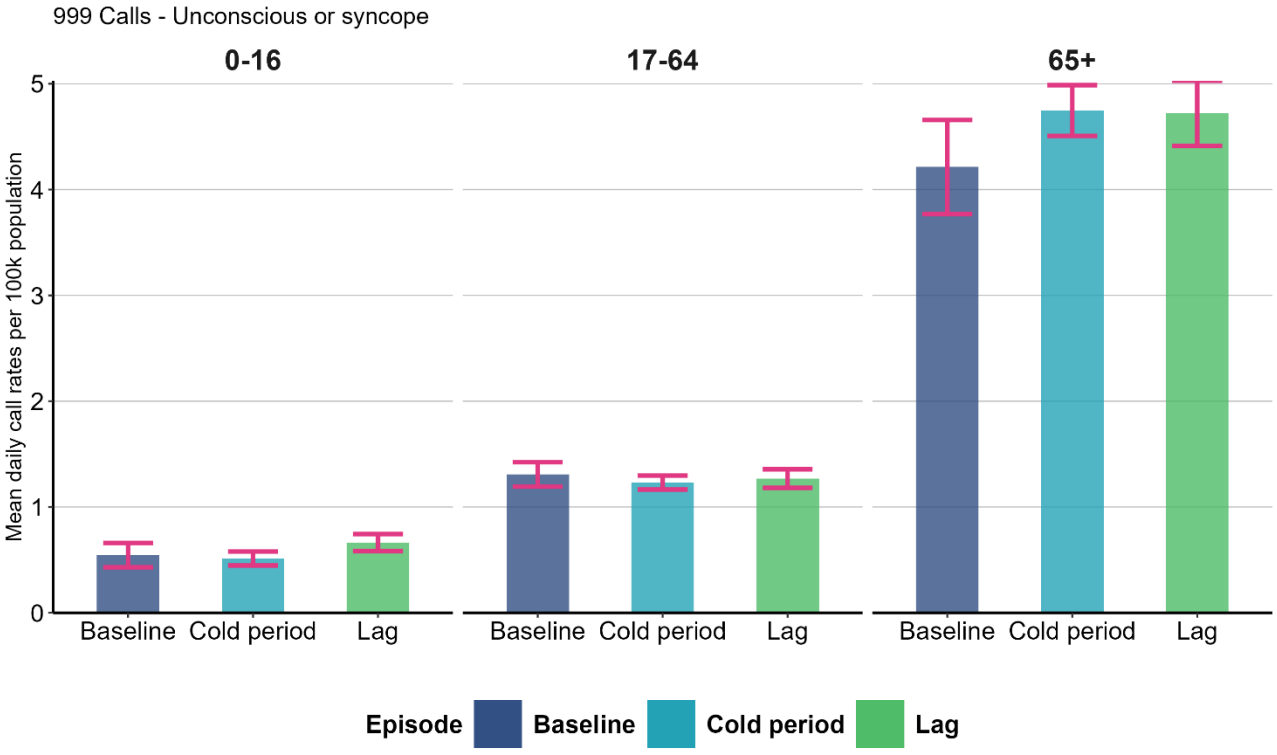


Figure 10A - Age-stratified mean daily call rates (per 100,000 population) categorised as 'Unconscious or syncope' during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).

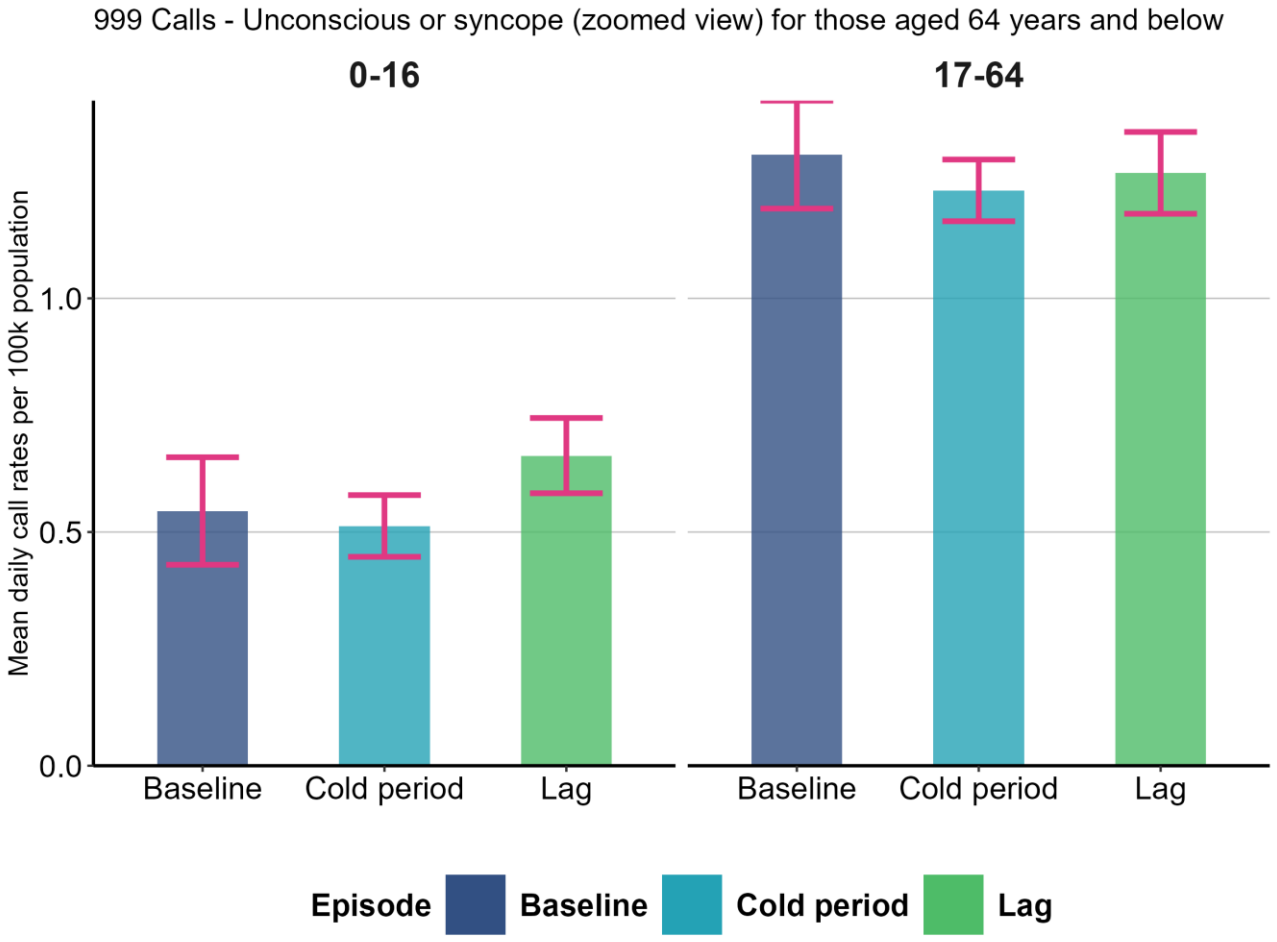


Figure 11B - Age-stratified mean daily call rates (zoomed in) for those aged 64 years and below (per 100,000 population) categorised as 'Unconscious or syncope' during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).

No statistically significant difference observed in the following:

- **Cardiac or respiratory arrest** *(Appendix 1)*
- **Chest pain** *(Appendix 2)*
- **Headache** *(Appendix 3)*
- **Mental health (0–16 years)** during the lag period relative to baseline: whilst not statistically significant, there was a moderate increase in call rates with an IRR 1.39 (95% CI: 0.91 – 2.13, p = 0.12) *(Figure 9)*. Whilst not statistically significant, the magnitude exceeds our *a-priori* 'signal' threshold (IRR ≥ 1.2) used in surveillance to flag potential emerging risks under low-power conditions.
- **Overdose or poisoning by ingestion** *(Appendix 4)*
- **Stroke** *(Appendix 5)*
- **Unconscious or syncope** *(Figure 10A)*

3.2.3. Category specific 999 calls by sex.

During the lag period relative to the baseline period, there was a statistically significant increase in the rate of 999 calls for 'Unconscious or syncope' among females (IRR 1.10; 95% CI 1.01–1.20; p < 0.05), whereas no such difference was observed for males. Figure 13[6] presents the underlying mean daily call rates, which support this pattern.

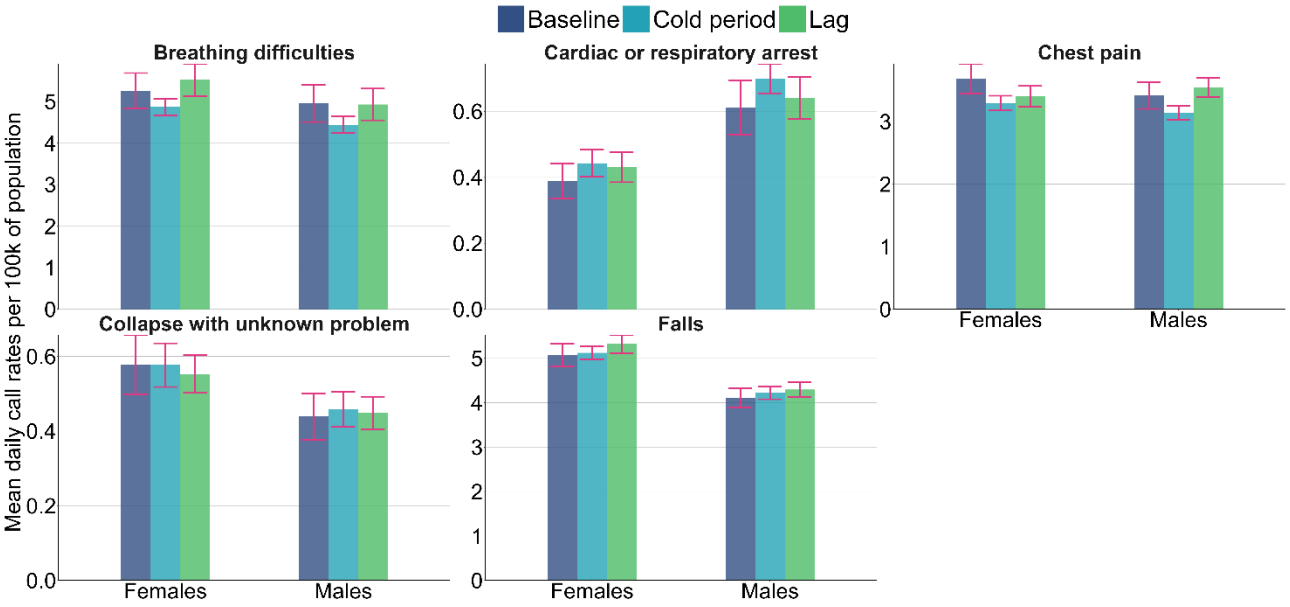


Figure 12 – Sex-stratified mean daily call rates (per 100,000 population) categorised as breathing difficulties, cardiac or respiratory arrest, chest pain, collapse with unknown problem and falls during baseline (royal blue bar), cold (teal bar) and lag(green bar) periods (± 95% confidence intervals(pink line)).

[6] Sex information was not documented for 1,134(1.2%) of the 95,271 category specific calls recorded during this period.

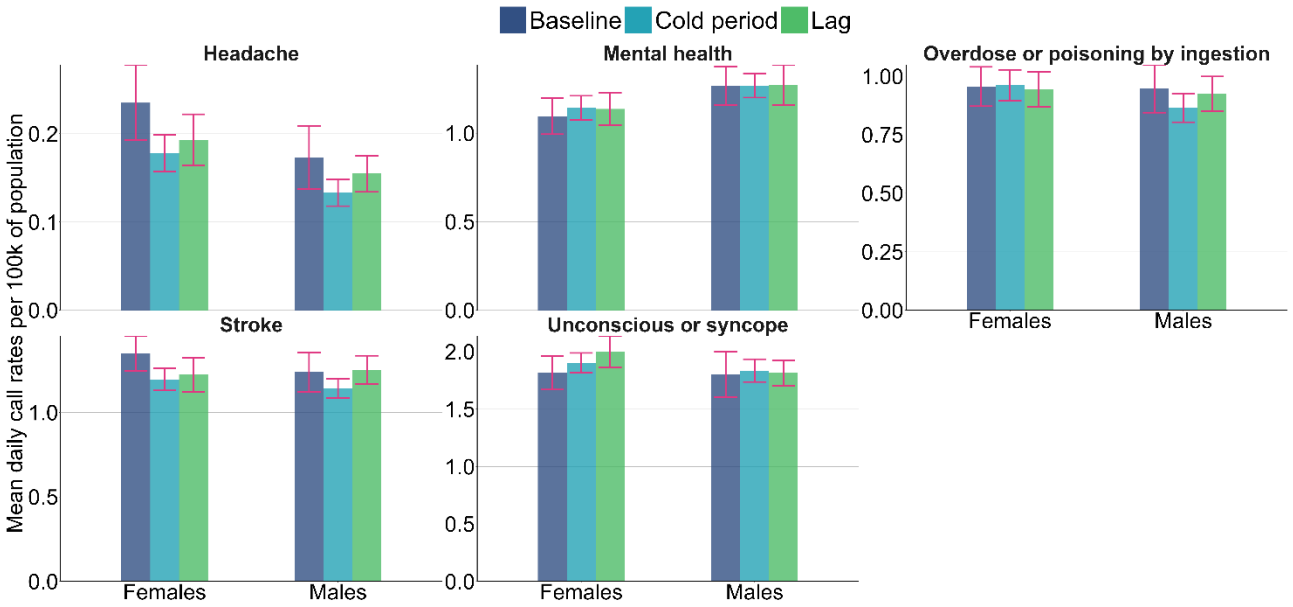


Figure 13 – Sex-stratified mean daily call rates (per 100,000 population) categorised as headache, mental health, overdose or poisoning by ingestion, stroke, and unconscious or syncope during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).

3.2.4. Category specific 999 calls by health board.

During the lag period relative to the baseline period, there was a slight but statistically significant increase in all-category 999 call rates in Cwm Taf Morgannwg UHB (IRR 1.05; 95% CI 1.01–1.09; $p < 0.05$). Figure *14* presents the underlying mean daily call rates across Health Boards; these illustrate the pattern but do not display rate ratios.

Whilst this cannot be confirmed and therefore warrants further investigation, this may be due to factors such as variations in regional temperature, housing quality, population health, or service access.

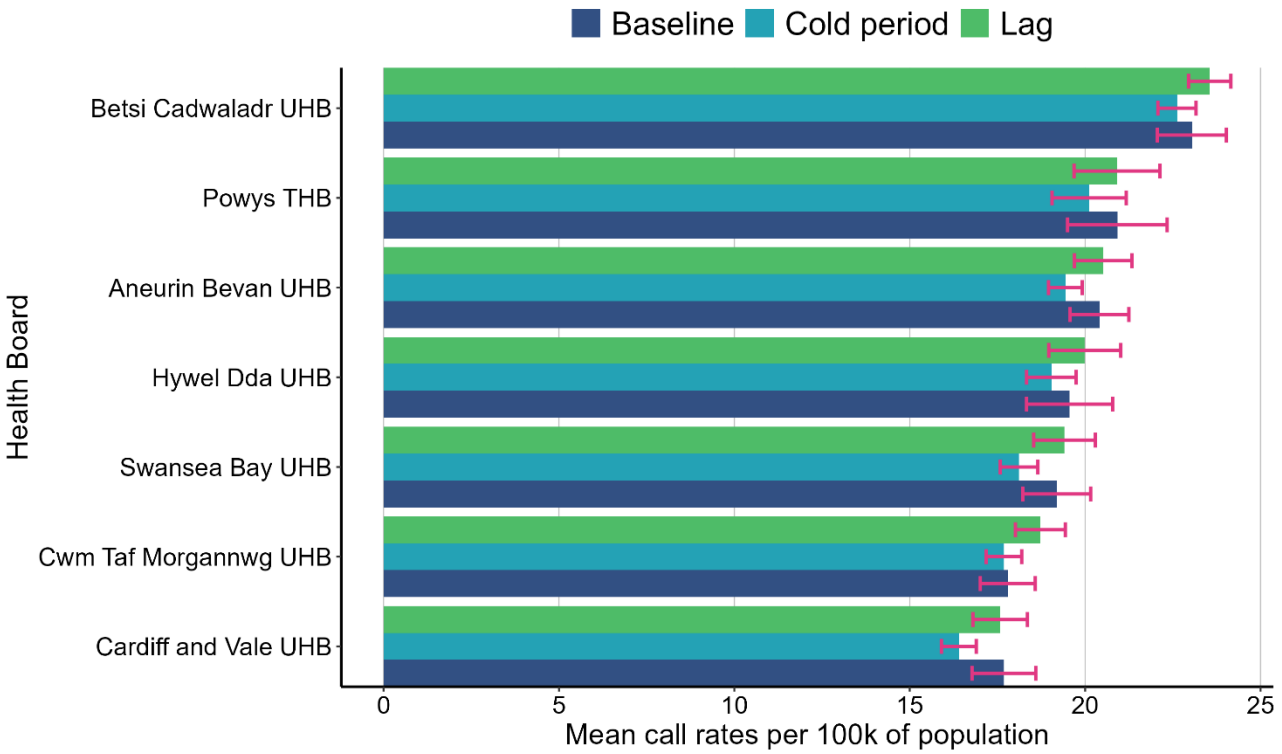


Figure 14 – Mean call rates (per 100,000 population) by Welsh health board during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).

3.3. Accident and emergency attendance.

There was no statistically significant difference in the immediate (cold period) or delayed impact (lag period) of cold weather on A&E attendance rates (Figure 13).

No statistically significant differences were observed across age groups (**Appendix 6**), sex (**Appendix 7**), deprivation levels (WIMD; **Appendix 8** [7]), or rural/urban classifications (**Appendix 9** [8]). While slight increases in attendance were noted among individuals aged 65+ during the lag period and among females during the cold period, these were not statistically significant.

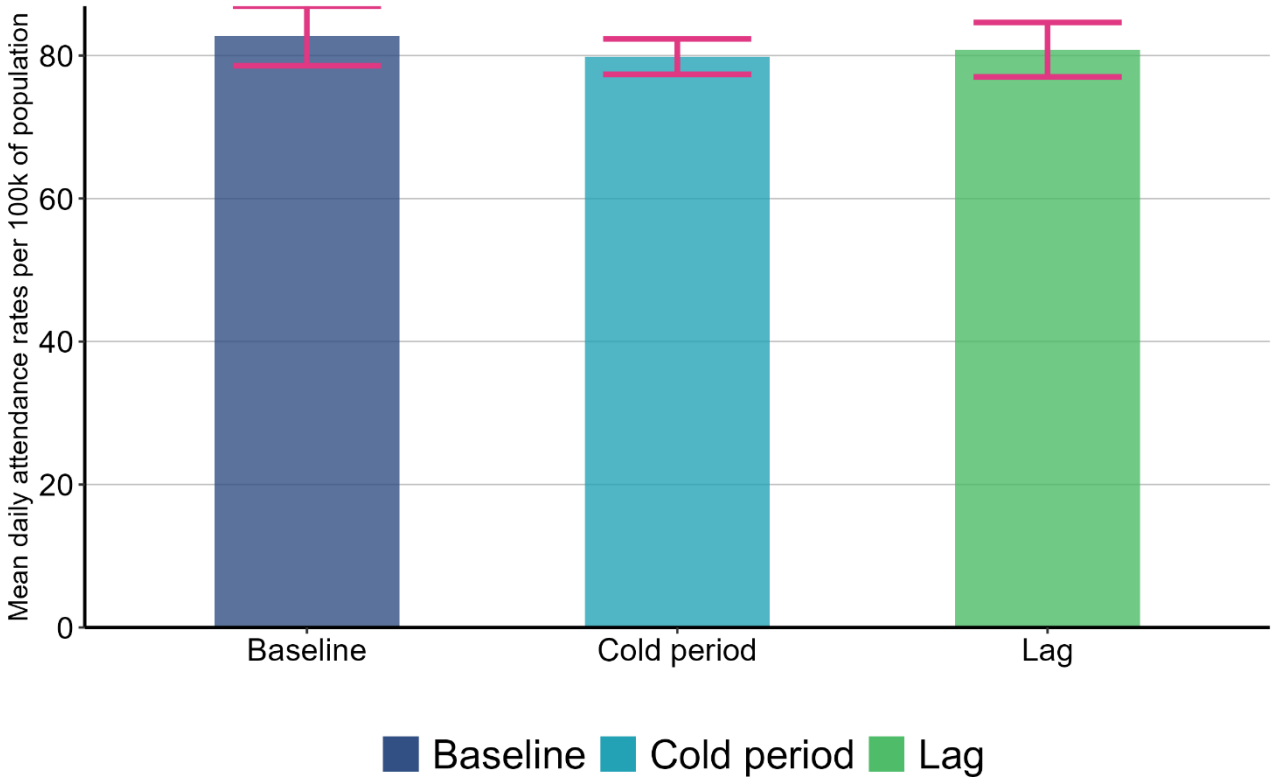


Figure 15 – Mean daily A&E (all cause) attendance rates (per 100k of population) during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).

[7] *Out of the 390,761 A&E attendance during this period, documentation for the WIMD was missing for 39,179 attendees.*

[8] Out of the 390,761 A&E attendance recorded during this period, rural-urban classification was not documented for 39,179 attendees.

3.4. Emergency hospital admission (all cause).

There was no evidence of the immediate or delayed impact of cold weather on emergency hospital admissions via A&E. (Figure *16*).

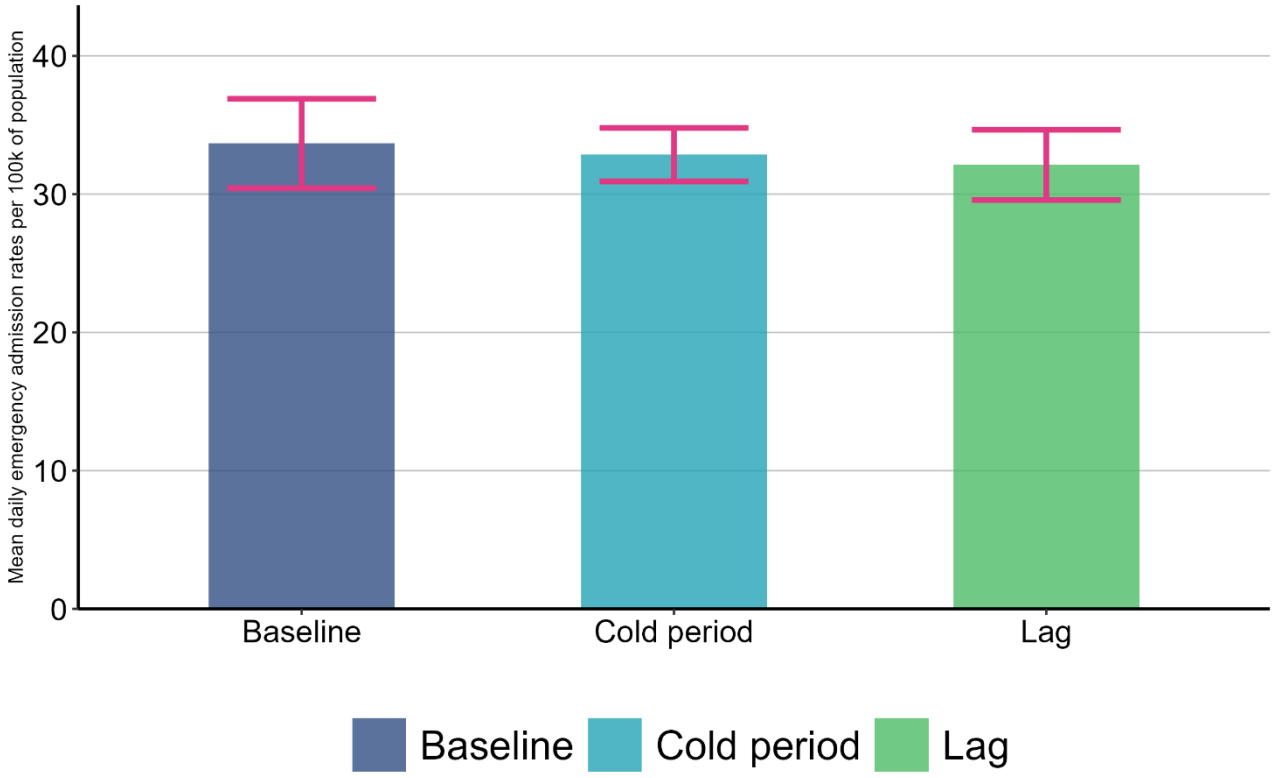


Figure 16 – Average daily emergency admissions (all cause) rate (per 100,000 of population) during baseline, cold and lag periods (± 95% confidence intervals (pink lines)).

4. Limitations

This report is subject to several methodological limitations. Findings are descriptive surveillance signals and should not be interpreted as causal estimates.

- **Interpretation and scope:** Analyses describe differences in rates across predefined cold, lag and baseline periods within the defined winter surveillance window. The findings support public health action but do not demonstrate causal effects of cold exposure. Generated hypotheses may then inform future analytic epidemiology research.
- **Temperature threshold definition:** Cold periods were defined using a fixed threshold (≤ 2 °C for ≥ 2 days). This may not capture all relevant cold-related health impacts, particularly in regions with different baseline temperatures or population vulnerability. The cold-spell definition is based on England's alerting threshold, which has not been validated for Wales.
- **Geographic and temporal granularity:** Analyses were conducted at all-Wales level using mean daily temperature. Regional micro-climates and localised cold events may not be reflected. Stratification by Health Board temperature was beyond scope.
- **Indoor environmental exposures:** Indoor temperature, heating adequacy, insulation, ventilation, time spent indoors, and behavioural adaptations were not measured. The data therefore cannot identify "cold homes" or quantify health risks related to indoor cold.
- **Housing and socioeconomic factors:** Existing evidence on cold homes in Wales[9] is recognised but cannot be assessed within the data used for this report; no linked indicators of housing quality, fuel poverty, energy efficiency or retrofit status were available, so population-level vulnerability to cold homes cannot be assessed.
- **Data suppression and exclusions:** Counts <5 were suppressed to protect confidentiality. Low numbers led to exclusion of some categories (e.g., cold exposure, carbon monoxide poisoning) from stratified analyses, potentially underestimating risks for small groups.
- **Unmeasured seasonal confounding:** Although day-of-week effects were considered, other winter drivers (respiratory virus activity, air quality episodes, service pressures, public holidays and behavioural changes) were not controlled for and may influence observed patterns.
- **Population assumption:** Population denominators were assumed to remain constant throughout the surveillance period. Short-term demographic movement (e.g., university termtime changes) cannot be captured.

[9] Cold homes in Wales: Is the satisfactory heating regime appropriate for health and well-being?

- **No pathway inference:** 999 calls, A&E attendances and emergency admissions are not patient-linked. The report therefore cannot infer care pathways (e.g., whether increases in 999 calls correspond to subsequent admissions).
- **Statistical power and "near-signals":** Small numbers in some strata reduce precision and widen confidence intervals. Some IRRs with 95% CIs that include 1 are highlighted when effect sizes (e.g., IRR ≥ 1.2) may represent potential surveillance signals, not confirmatory findings.
- **Modelling simplicity:** IRR comparisons do not model nonlinear or delayed effects of temperature. Future iterations should incorporate Distributed Lag Non-linear Models (DLNMs) and consider including contextual covariates for improved interpretability.
- **What this report can and cannot show:** It can describe differences in acute 999 and A&E healthcare activity during cold and post-cold periods and identify groups showing the largest signals. It can neither assess the wider health and wellbeing impacts[10] beyond 999 and A&E data, nor determine whether cold exposure caused these differences or identify which environmental, housing or social factors[11] underlie observed patterns.

[10] How home temperatures affect health and well-being in low-income households: Evidence from temperature monitoring and lived experience - World Health Organization Collaborating Centre On Investment for Health and Well-being

[11] A place to thrive: Creating healthier homes for children and families in poverty across Wales - World Health Organization Collaborating Centre On Investment for Health and Well-being

5. Conclusion

This surveillance report describes patterns in emergency healthcare activity in Wales during the winter of 2024/25 across predefined cold, lag and baseline periods. Although the season was milder overall, Wales experienced 78 cold days, including a prolonged January cold spell. Syndromic data from 999 calls, A&E attendances, and emergency hospital admissions were analysed to provide population health intelligence rather than causal inference.

The analysis identified specific health outcomes with higher call rates during cold and lag periods; most notably cardiac or respiratory arrest during cold spells, and falls, breathing difficulties, mental health concerns and unconsciousness during the lag period, particularly among older adults. These signals reflect patterns in service utilisation during cold episodes but do not indicate that cold exposure directly caused these outcomes.

In contrast, all-cause A&E attendances were slightly lower during cold and lag periods, and emergency admissions showed no statistically significant differences. Without linked patient-level data, the report cannot describe pathways from 999 calls through A&E to admission or determine whether cold-related morbidity was "managed" before hospitalisation.

Overall, these findings underscore the value of continued cold-weather morbidity surveillance to detect changes in health-service demand, identify potentially vulnerable population groups, particularly older adults, and support winter preparedness planning. Future surveillance cycles will benefit from enhanced modelling approaches and incorporation of additional context where possible, such as influenza activity, indoor temperature exposure, and housing-related risk factors.

6. Recommendations.

To strengthen public health surveillance of cold-related morbidity in Wales, we recommend the following actions:

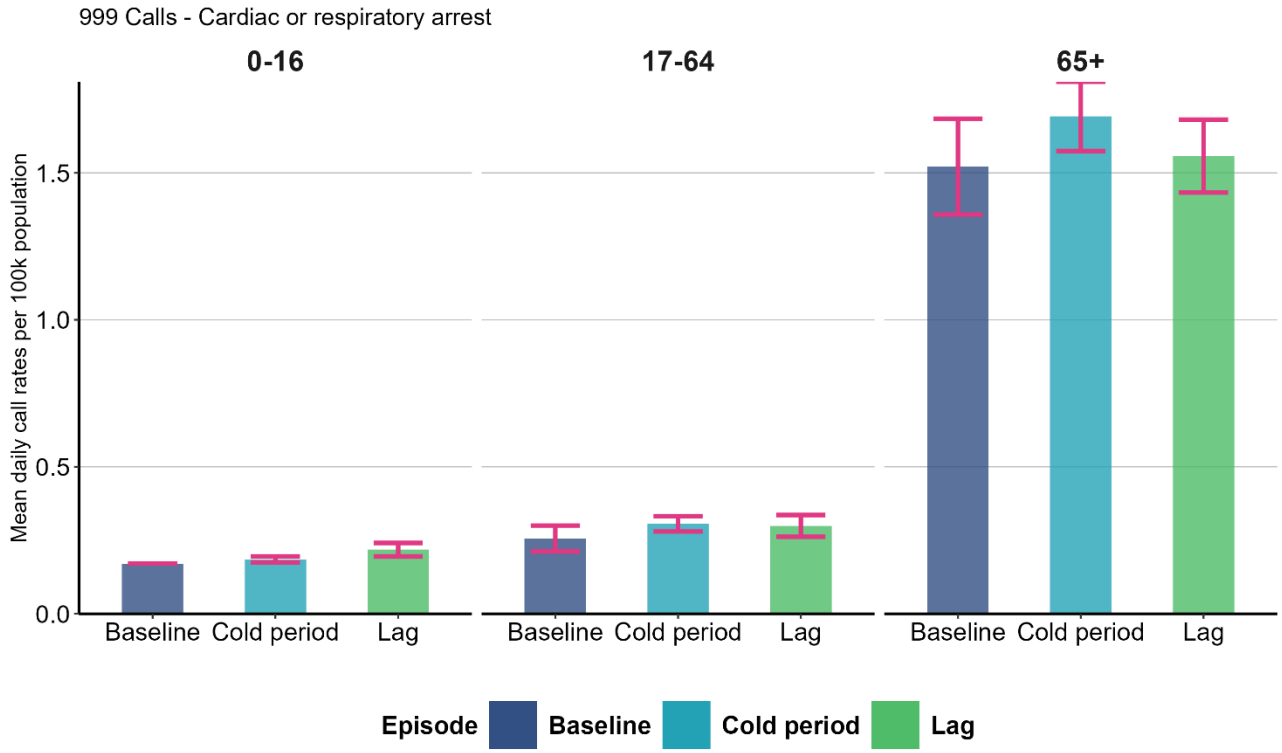
1. Share this report with members of the Public Health Wales Climate Change Surveillance Subgroup to inform consideration of public health actions and future surveillance priorities.

2. Although not statistically significant, the observed increase in 999 "mental health" call rates among children and young people (0–16 years) during the post-cold lag period (IRR = 1.39; 95% CI 0.91–2.13; p = 0.12) indicates a potentially meaningful signal that merits monitoring and targeted exploration in future surveillance cycles and research (e.g., finer age bands, school-term vs holiday stratification, and linkage with contextual factors such as service availability and severe weather timing).

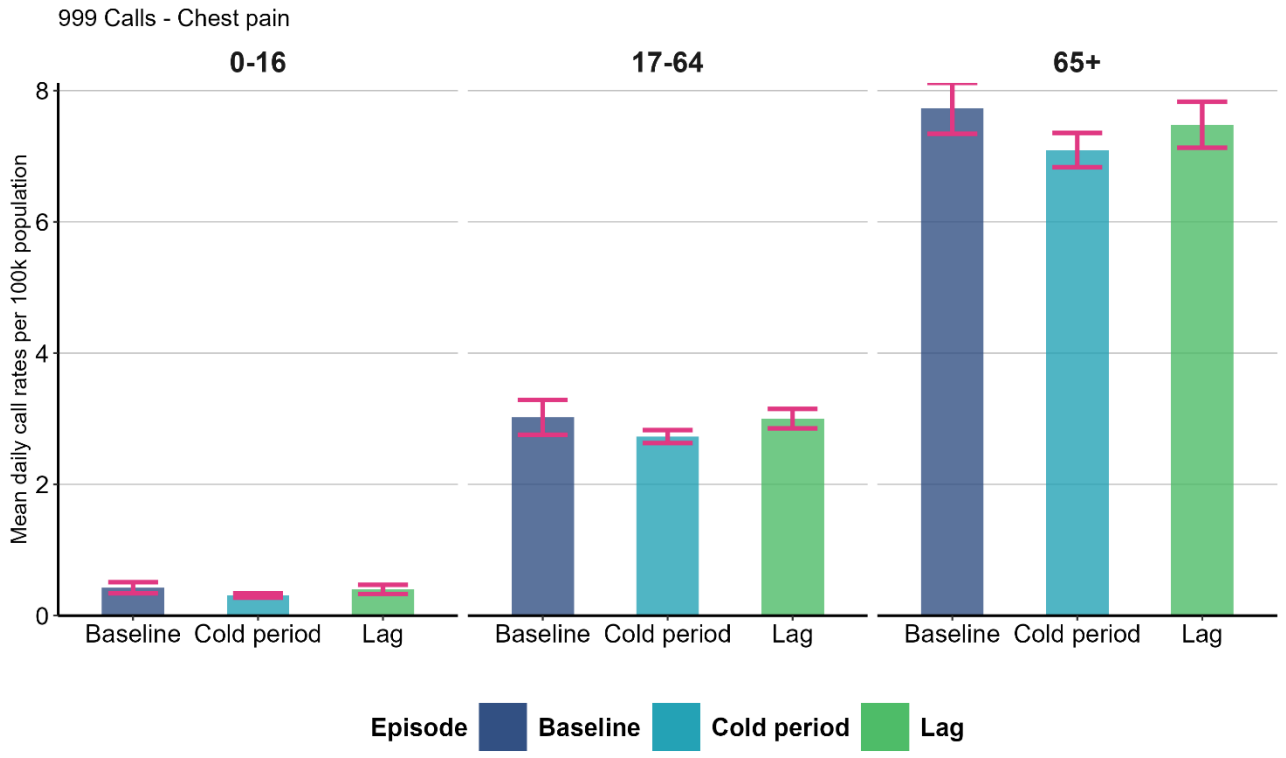
3. Continue and strengthen cold-weather morbidity surveillance by:
    a. Incorporating Distributed Lag Non-Linear Models (DLNMs) to better capture both immediate and delayed health effects of cold exposure, and to model the non-linear relationship between temperature and health outcomes. This will allow for more accurate estimation of risk ratios and attributable fractions.
    b. Where possible, adjusting for potential confounders such as influenza activity and ethnicity.

7. Appendix

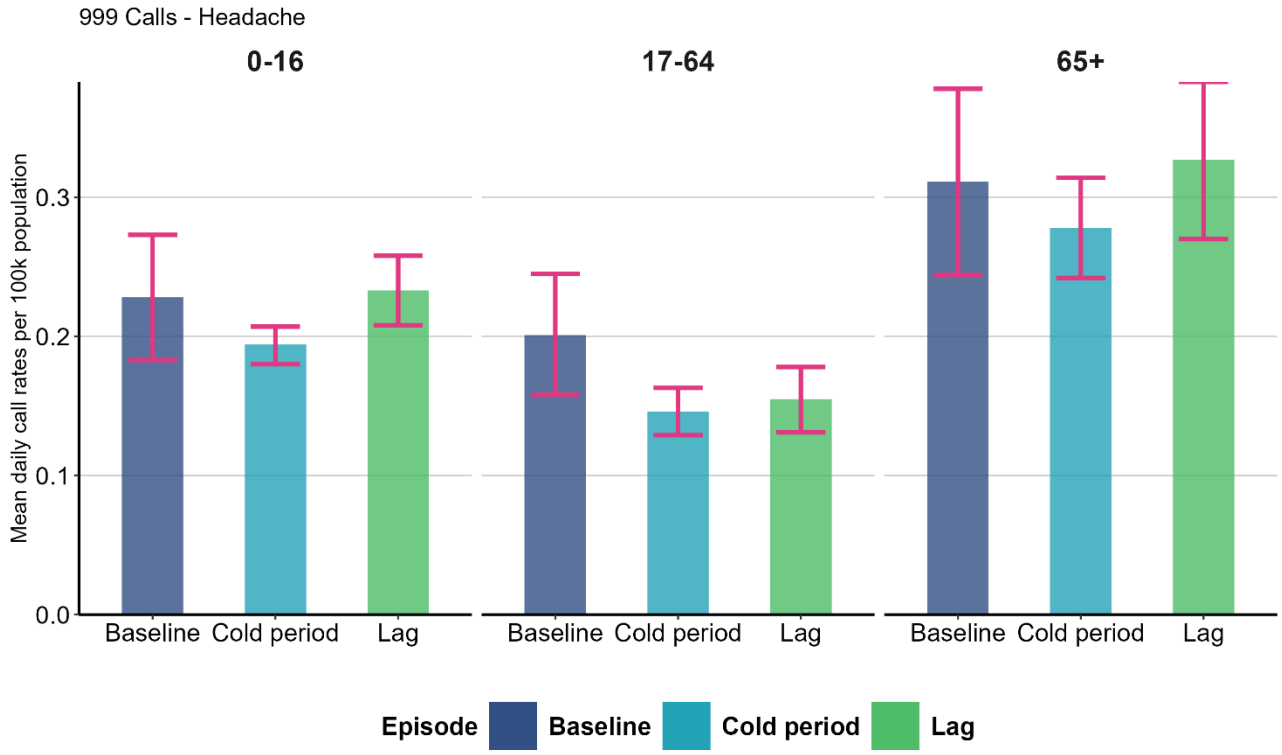
Appendix 1 - Age-stratified daily 999 call rates (per 100,000 population) categorised as 'Cardiac or respiratory arrest' during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).



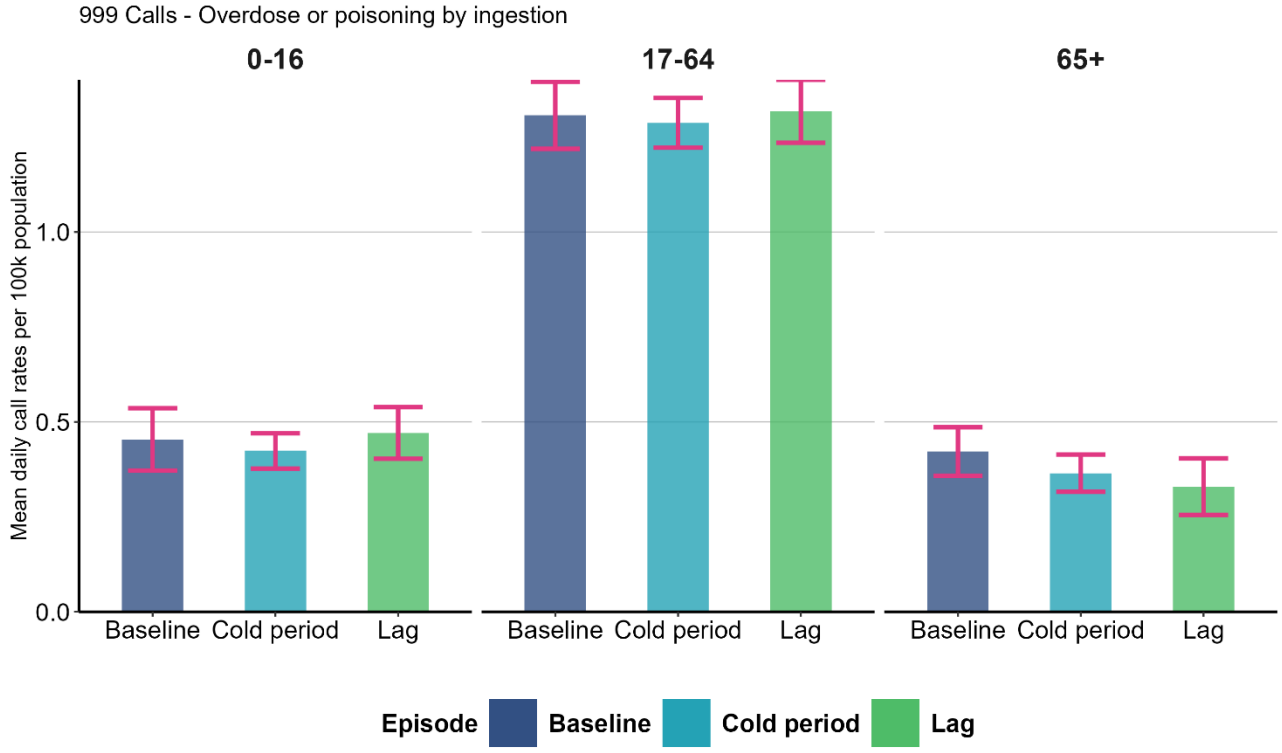
Appendix 2 - Age-stratified daily 999 call rates (per 100,000 population) categorised as 'Chest pain' during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).



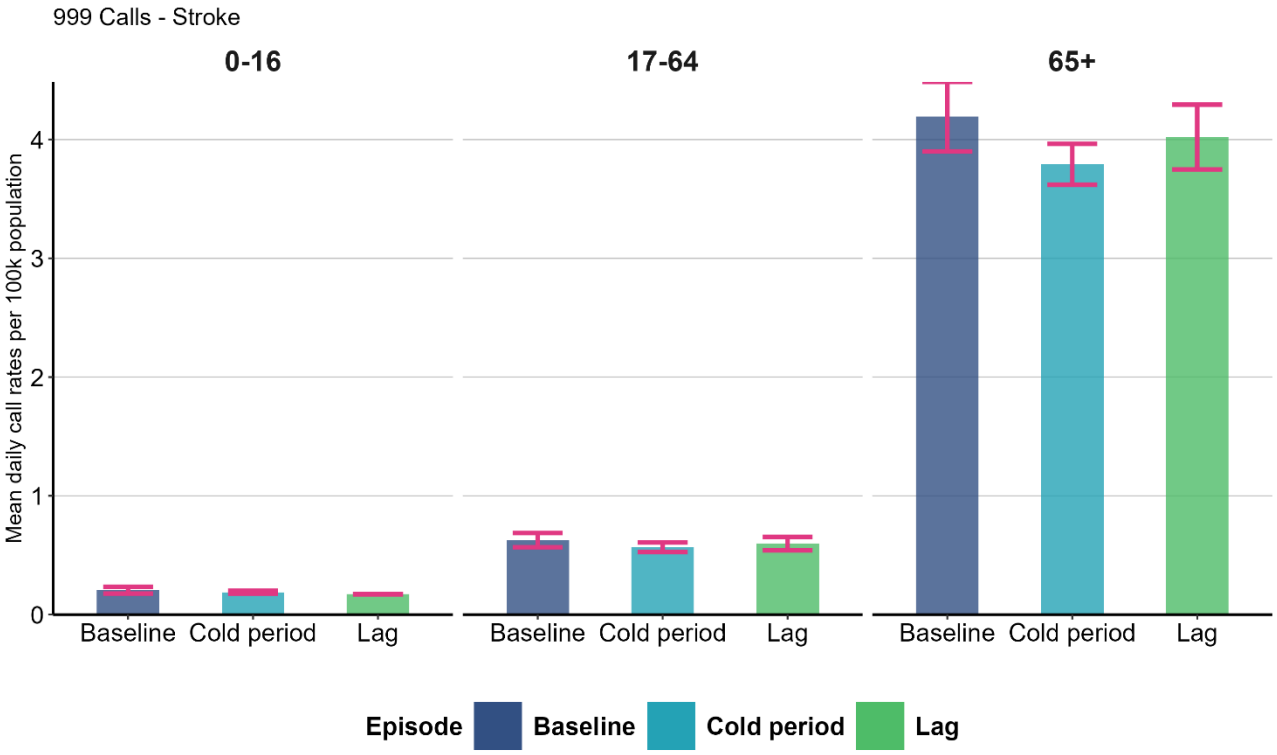
Appendix 3 - Age-stratified daily 999 call rates (per 100,000 population) categorised as 'Headache' during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).



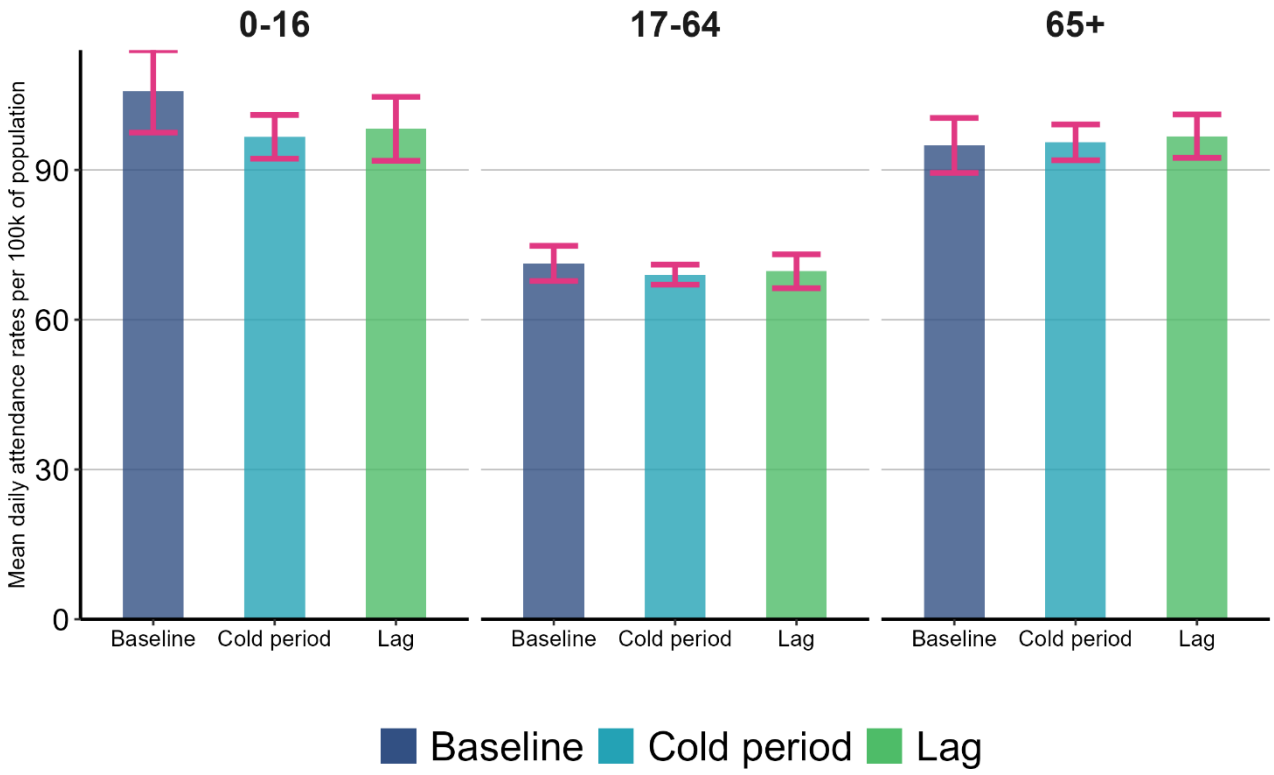
Appendix 4 - Age-stratified daily 999 call rates (per 100,000 population) categorised as 'Overdose or poisoning by ingestion' during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).



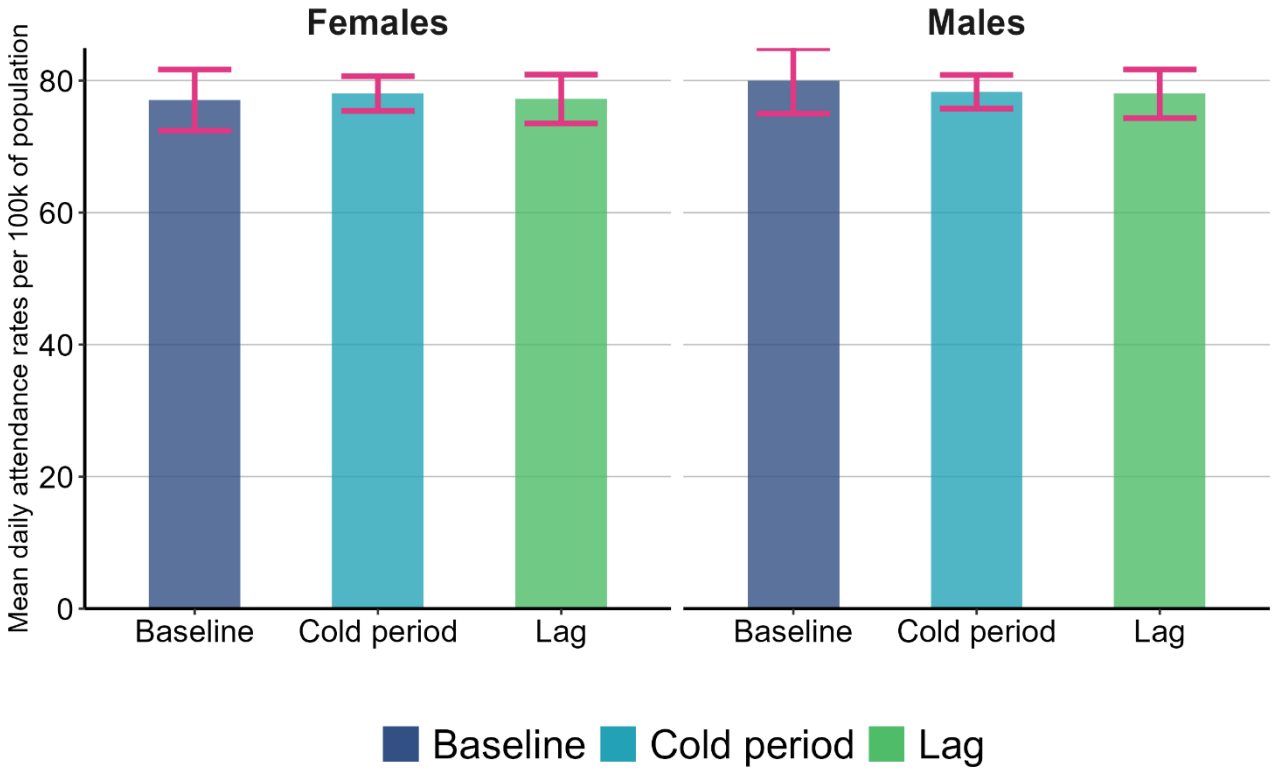
Appendix 5 - Age-stratified daily 999 call rates (per 100,000 population) categorised as 'Stroke' during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).



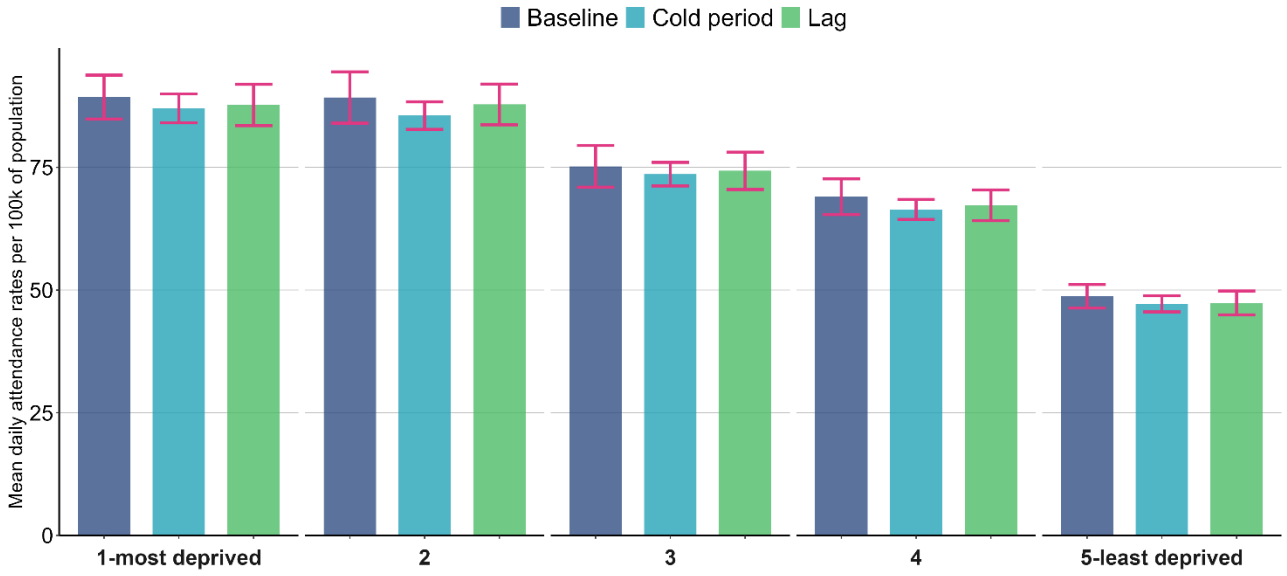
Appendix 6 - Age-stratified mean daily A&E (all cause) attendance rates (per 100k of population) during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).



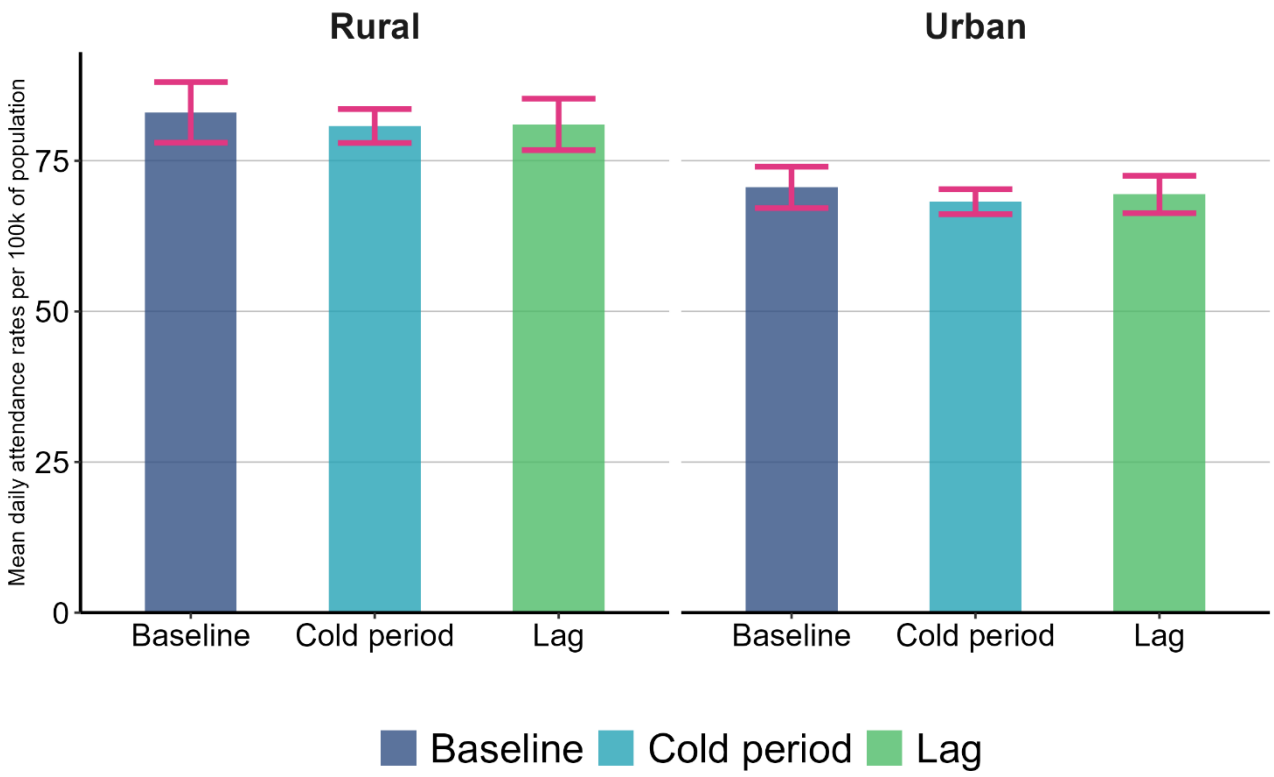
Appendix 7 - Sex-stratified mean daily A&E (all cause) attendance rates (per 100,000 of population) during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).



Appendix 8 - Mean daily A&E attendance (all cause) rates by WIMD (per 100,000 of population) during baseline (royal blue bar), cold (teal bar) and lag (green bar) periods (± 95% confidence intervals (pink line)).



Appendix 9 - Average daily A&E attendance (all cause) rates by rural urban classification (per 100,000 of population during baseline, cold and lag periods (± 95% confidence intervals (pink lines)).



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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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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 routinely collected 999 calls from Welsh Ambulance Services NHS Trust (WAST), Emergency Department Dataset for Wales and meteorological data, analysed using standard epidemiological techniques.

Value: Provides evidence on the impact of cold weather on health and emergency service utilisation in Wales, supporting public health policy, emergency planning, and climate adaptation efforts.

We welcome feedback to support continuous improvement of future outputs