

Excess Winter Deaths Atlas: User Guide



The aim of this document is to provide a quick reference on how to use the Excess Winter Deaths Atlas and how to interpret the data available.

There is also a helpful section answering frequently asked questions. If after reading this document you have further questions regarding how the data have been calculated or how to interpret the data, please contact the WMPHO information team at the address at the end of the document.

The Technical Guidance section defines the terms used and the calculations involved in obtaining the Excess Winter Deaths Index (EWDI) and its confidence intervals. There are also worked examples showing how the EWDI is derived for single year and 3 year aggregated period as shown in the EWD Trend atlas and 7 year aggregated period as shown in the EWD by age and underlying cause of death atlas.

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Quick Reference: How to Use the EWD Atlas

How to use the Excess Winter Deaths Trend Atlas

Excess Winter Deaths (EWD) Trend, 1990-2009
Data Selected: All persons all ages 2006-2009

Select Map / Table
Click to toggle between Map or Table.
Table displays data for selected age / condition for all areas. Confidence Intervals and significance are also shown in the table.

Select Age / Condition
Allows user to select age groups or conditions

Adjust map colours
Click on the pencil icon to adjust colours and number of classes.

View EWD by age and underlying cause of death
This opens a new atlas for EWD for age and underlying cause of death

User Guide and Data download
Select this to download user guide including technical specification and spread-sheet with data.

Print
Select for print options

View Bar Chart or Understanding data
Click to toggle between Bar Chart/Understanding data. Understanding data shows brief description of data in atlas.

Use bar chart to select an area
Hover over the graph to see the area name and click to select the area.
Each bar is plotted with 95% confidence intervals shown with I.

View individual years in the bar chart or map
Use the time series animation by clicking on the ► to cycle through all available years of data and watch the map and bar chart change.
To view cycle at your own pace use the <> buttons.

View trend for selected area
Select an area from the map or bar chart to see trend for selected area.

Customising the map
Use the ► to custom filter the map so it shows just the areas of interest or add text, or symbols to the map.
The map can also be printed, saved/ exported as an image.

Zoom in / out of map
Drag the slider to zoom in or out of the map.

Comparison Table

Geography	EWN Index
England	18.1

EWD Legend

- 0-6
- 6-12
- 12-18
- 18-24
- 24-30

EWD for selected time period by region

EWD Trend from 1990 to 2009

Delivered by the West Midlands Public Health Observatory on behalf of the Public Health Observatories in England

How to use the Excess Winter Deaths Trend Atlas: Drilled Down to Local Authorities

Select Age / Condition
Allows user to select age groups or conditions

Drill Up
Allows user to go back to national atlas

Adjust map colours
Click on the pencil icon to adjust colours and number of classes.

View EWD by age and underlying cause of death
This opens a new atlas for EWD for age and underlying cause of death

User Guide and Data download
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Select Map / Table
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Table displays data for selected age / condition for all areas. Confidence Intervals and significance are also shown in the table

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Customising the map
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Use map to see chart for area
Hover or click on map area of interest to see bar chart for the area selected

View trend for selected area
Select an area from the map or bar chart to see trend for selected area.

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Use the time series animation by clicking on the ► to cycle through all available years of data and watch the map and bar chart change.
To view cycle at your own pace use the <> buttons.

Comparison Table

Geography	EWD Index
England	18.1
West Midlands	19.3

EWD Legend

- Local Authorities
- 6-7
- 7-14
- 14-21
- 21-28
- 28-35
- 35-42
- 42-48

EWD for selected time period by Local Authorities

EWD Trend from 1990 to 2009

Delivered by the West Midlands Public Health Observatory on behalf of the Public Health Observatories in England

How to use the Excess Winter Deaths Age and Conditions Atlas

Select Age / Condition
Allows user to select age groups or conditions

Adjust map colours
Click on the pencil icon to adjust colours and number of classes.

View EWD Trend, All ages, 1990-2000
This opens a new atlas for EWD Trend for all ages

User Guide and Data download
Select this to download user guide including technical specification and spread-sheet with data.

Print
Select for print options

Select Map / Table
Click to toggle between Map or Table. Table displays data for selected age / condition for all areas. Confidence Intervals and significance are also shown in the table

Zoom in / out of map
Drag the slider to zoom in or out of the map.

Customising the map
Use the ► to custom filter the map so it shows just the areas of interest or add text, or symbols to the map. The map can also be printed, saved/ exported as an image.

Understanding the data
Brief description of selected data – for more information refer to the User Guide.

Use map to see chart for area
Hover or click on map area of interest to see bar chart for the area selected

Use bar chart to select an area
Hover over the graph and click to select an area. Each bar is plotted with 95% confidence intervals shown with I.

Excess Winter Deaths (EWD) by age, 2002-2009
Data Selected: All persons under 65

EWD Legend

English Regions
4.0 - 6.2
6.3 - 7.3
7.4 - 7.9
8.0 - 8.2

Comparison Table

Geography	EWD Index
England	7.1

Understanding the data
Definition: Excess Winter Deaths Index (EWD Index) for all persons under 65 years of age, is the excess of deaths in winter compared with non-winter months from 01.08.2002 to 31.07.2009 expressed as a percentage. The year runs from August to July. Winter months are December to March, Non-Winter months are August to November and April to July.
Rationale behind indicator: Excess winter death increases with age. This indicator measures excess winter deaths expressed as the EWD Index, in order that comparisons can be made easily between different geographies and different age groups. It indicates whether there are higher than expected deaths in the winter compared to the rest of the year.
Time period: 2002-2009
Data Source: PHO Mortality File
Date Extracted: 17.06.2011
Notes: Calculated by WMPHO. Seven years pooled data (2002-2009) due to large variation at Local Authority level. Confidence interval at the 95% level has been calculated. Significance is shown in the data table. Number of excess winter deaths is available in the downloadable data. See "User Guide" for a more detailed methodology.

EWD for selected age/condition by region

Region	EWD Index (%)
North East	~5.5
North West	~6.0
Yorkshire and the Humber	~6.5
East of England	~6.8
West Midlands	7.1
East Midlands	~7.5
London	~8.0
South East	~8.5
South West	~9.0

How to use the Excess Winter Deaths Age and Conditions Atlas: Drilled Down to Local Authorities

Drill Up
Allows user to go back to national atlas

Select Age / Condition
Allows user to select age groups or conditions

Adjust map colours
Click on the pencil icon to adjust colours and number of classes.

View EWD Trend, All ages, 1990-2000
This opens a new atlas for EWD Trend for all ages

User Guide and Data download
Select this to download user guide including technical specification and spread-sheet with data.

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Select Map / Table
Click to toggle between Map or Table. Table displays data for selected age / condition for all areas. Confidence intervals and significance are also shown in the table

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Understanding the data
Brief description of selected data – for more information refer to the User Guide.

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Hover or click on map area of interest to see bar chart for the area selected

Use bar chart to select an area
Hover over the graph to see the area name and click to select the area. Each bar is plotted with 95% confidence intervals shown with I.

Excess Winter Deaths (EWD) by age, 2002-2009
Data Selected: All persons under 65

West Midlands - Local Authorities

EWD Legend

- Local Authorities
- 4.8 - 5.5
- 5.6 - 6.2
- 6.3 - 6.9
- 7.0 - 7.6
- 7.7 - 8.3
- 8.4 - 9.0
- 9.1 - 9.7
- 9.8 - 10.4
- 10.5 - 11.1
- 11.2 - 11.8
- 11.9 - 12.5
- 12.6 - 13.2
- 13.3 - 13.9
- 14.0 - 14.6
- 14.7 - 15.3
- 15.4 - 16.0
- 16.1 - 16.7
- 16.8 - 17.4
- 17.5 - 18.1
- 18.2 - 18.8
- 18.9 - 19.5
- 19.6 - 20.2
- 20.3 - 20.9
- 21.0 - 21.6
- 21.7 - 22.3
- 22.4 - 23.0
- 23.1 - 23.7
- 23.8 - 24.4
- 24.5 - 25.1
- 25.2 - 25.8
- 25.9 - 26.5
- 26.6 - 27.2
- 27.3 - 27.9
- 28.0 - 28.6
- 28.7 - 29.3
- 29.4 - 30.0
- 30.1 - 30.7
- 30.8 - 31.4
- 31.5 - 32.1
- 32.2 - 32.8
- 32.9 - 33.5
- 33.6 - 34.2
- 34.3 - 34.9
- 35.0 - 35.6
- 35.7 - 36.3
- 36.4 - 37.0
- 37.1 - 37.7
- 37.8 - 38.4
- 38.5 - 39.1
- 39.2 - 39.8
- 39.9 - 40.5
- 40.6 - 41.2
- 41.3 - 41.9
- 42.0 - 42.6
- 42.7 - 43.3
- 43.4 - 44.0
- 44.1 - 44.7
- 44.8 - 45.4
- 45.5 - 46.1
- 46.2 - 46.8
- 46.9 - 47.5
- 47.6 - 48.2
- 48.3 - 48.9
- 49.0 - 49.6
- 49.7 - 50.3
- 50.4 - 51.0
- 51.1 - 51.7
- 51.8 - 52.4
- 52.5 - 53.1
- 53.2 - 53.8
- 53.9 - 54.5
- 54.6 - 55.2
- 55.3 - 55.9
- 56.0 - 56.6
- 56.7 - 57.3
- 57.4 - 58.0
- 58.1 - 58.7
- 58.8 - 59.4
- 59.5 - 60.1
- 60.2 - 60.8
- 60.9 - 61.5
- 61.6 - 62.2
- 62.3 - 62.9
- 63.0 - 63.6
- 63.7 - 64.3
- 64.4 - 65.0

Comparison Table

Geography	EWD Index
England	7.1
West Midlands	7.9

Understanding the data

Definition: Excess Winter Deaths Index (EWD Index) for all persons under 65 years of age, is the excess of deaths in winter compared with non-winter months from 01.08.2002 to 31.07.2009 expressed as a percentage. The year runs from August to July. Winter months are December to March, Non-Winter months are August to November and April to July.

Rational behind indicator: Excess winter death increases with age. This indicator measures excess winter deaths expressed as the EWD Index, in order that comparisons can be made easily between different geographies and different age groups. It indicates whether there are higher than expected deaths in the winter compared to the rest of the year.

Time period: 2002-2009

Data Source: PHO Mortality File

Date Extracted: 17.06.2011

Notes: Calculated by WMPHO. Seven years pooled data (2002-2009) due to large variation at Local Authority level. Confidence Interval at the 95% level has been calculated. Significance is shown in the data table. Number of excess winter deaths is available in the downloadable data. See "User Guide" for a more detailed methodology.

EWD for selected age/condition by local authorities

Bar chart showing EWD Index (%) for various Local Authorities. Each bar includes a 95% confidence interval (I).

Interpreting Excess Winter Deaths

The Excess Winter Deaths Index (EWD Index) indicates whether there are higher than expected deaths in the winter compared to the rest of the year. The EWDI is the excess of deaths in winter (*December to March*) compared with non-winter months from the preceding *August to November* and the following *April to July* expressed as a percentage.

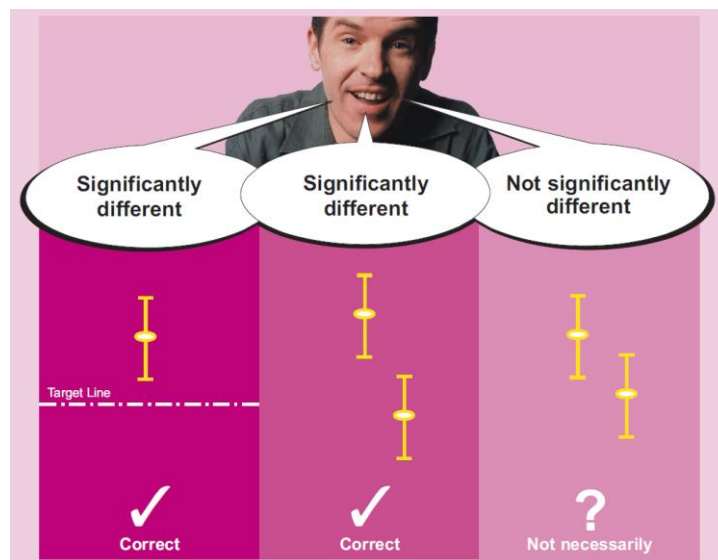
As an example, consider that local authority A had an EWD Index of 26.8% for 2006-2009 with an average of 247.5 excess winter deaths. This means that:

- Local authority A had an average of 248 additional deaths each winter than would be expected from the rate of death in the non-winter months.

Explanation: The number of winter deaths does not translate directly to being x more than in non-winter as the non-winter period is based on 8 months of data and therefore we expect half this number to take place in the 4 months of winter (December-March).

- The EWD Index for local authority A is 26.8%. This means that an additional 1 in 4 deaths occurred in winter compared to non-winter months.
- The EWD Index for local authority A is significantly higher than the England average of 18.1%.

Explanation: The 95% confidence interval range for the EWD Index for local authority A was 21.6 to 32.3%. As the England EWD Index is below this range, local authority A's EWD Index is considered to be significantly higher. However, whilst it is safe to assume that non-overlapping confidence intervals indicate a statistically significant difference, it is not always the case that overlapping confidence intervals do not and further testing may be required.



Source: APHO Technical Briefing 3: Commonly Used Public Health Statistics and their Confidence Intervals, <http://www.apho.org.uk/resource/item.aspx?RID=48457>

Frequently Asked Questions

Why the interest in excess winter deaths?

There is some evidence to suggest that excess winter deaths (EWD) are preventable. Mortality in winter increases more in England compared to other European countries with colder climates, suggesting that it is more than just lower temperatures that are responsible for the excess mortality in winter^{i,ii}. Recently, the Public Health White Paper published in 2010, “Healthy Lives, Healthy People” proposed a Public Health Outcomes Framework for consultationⁱⁱⁱ. Reducing excess winter mortality is one of the outlined outcomes for the “Healthy Life Expectancy and Preventable Mortality” domain.

Why does the excess winter deaths (EWD) year run from August to July?

The EWD Index is calculated based on the “Office for National Statistics (ONS) Method” which defines the winter period as December to March, and the non-winter period as August to November of that same year and April to July of the following year to incorporate an expected figure based on deaths either side of the winter of interest. The winter period was selected as these are the months which over the last 50 years have displayed above average monthly deaths^{iv}. However, if deaths starts to increase prior to this, for example in November, the number of deaths in the non-winter period will increase, which in turn will decrease the estimate of excess winter deaths.

Why express excess winter deaths as index (EWDI)?

Excess winter deaths are expressed as the EWD Index (EWDI), in order that comparisons can be made easily between different geographies. The EWDI indicates whether there are higher than expected deaths in the winter compared to the rest of the year. It also gives an idea where interventions need to be improved or instigated to cope with the change of seasonal temperature.

Why calculate excess winter deaths by age group?

Excess winter deaths affect all ages; however the EWDI is known to increase with age with the elderly the most susceptible group to higher death rates in winter^v. In addition, as EWD and the EWDI are not age standardised, given the age profile of excess winter deaths, it is reasonable to assume that areas with a greater older population will have higher excess winter deaths. Looking at the EWDI by age group provides a solution to this problem.

Why calculate excess winter deaths by selected underlying cause of death?

Excess winter deaths can be attributed to nearly all the main causes of death. However certain conditions are known to be exacerbated during winter months. Previous studies have shown that circulatory and respiratory diseases contribute to most (70%) of the excess winter deaths in Englandⁱ.

Why have 3 year rolling averages instead of single years?

The nature of excess winter deaths leads to high variation year on year^{vi}. Using 3 year rolling averages, some of the variation is smoothed out making it easier to see a trend and to make comparisons between areas.

Why have data for seven years been used for age and underlying cause of death?

The nature of excess winter deaths leads to high variation year on year. Looking at EWD by age or selected condition for a single year makes numbers even smaller and increases the variation seen^{vii}. Using data for seven years increases the sample size and provides stability in deriving the confidence intervals.

Are there any other data quality issues?

The Annual Mortality File provided by ONS to the Public Health Observatories (PHOs) is based on registered deaths and the EWD and EWDI calculations are based on the date of death occurrences. It is possible that a small number of deaths might not have been registered when the data were released.

Technical Guidance

Definition: Winter Deaths

The number of deaths in the winter months is the number of deaths that occurred between 1st December and 31st March. The number of deaths was extracted from the ONS Annual Mortality Files.

For aggregated years the deaths in each winter period were summed. Using the 1990 – 1993 mortality data for all ages and all causes of deaths as an example, the winter deaths were the total number of deaths which occurred between 1st December 1990 to 31st March 1991, 1st December 1991 to 31st March 1992 and 1st December 1992 to 31st March 1993. This was repeated for the next three years rolling up until 2006 to 2009 to get the trend data. Values published in the downloadable Excel files are the average (yearly) excess winter deaths, so for the three year period, it is the total excess winter deaths divided by 3.

Definition: Non-Winter Deaths

This is the number of deaths in the following 1st April to 31st July and the preceding 1st August to 31st November of the winter of interest. The year runs from 1st August to 31st July to incorporate an expected figure based on deaths either side of the winter of interest. The number of non-winter deaths was also extracted from the ONS Annual Mortality Files.

The 3 year figures used in the EWD atlas is calculated based on aggregates of the non-winter months from the August prior to the winter of the first year to the July following the winter of the 3rd year. Using the 1990 – 1993 mortality data for all ages and all causes of deaths as an example, the total non-winter deaths is the sum of the deaths for the periods; 1st August to 31st November 1990, 1st April to 31st July 1991, 1st August to 31st November 1991, 1st April to 31st July 1992, 1st August to 31st November 1992 and 1st April to 31st July 1993. This was repeated for the next three years rolling up until 2006 to 2009 to get the trend data.

Definition: Expected Winter Deaths (Denominator)

The expected number of deaths is based on the non-winter deaths x 0.5 i.e. it is the number of deaths that occurred during the preceding four months (August to November) and subsequent four months (April to July) of the winter months. As there are 8 non-winter months compared to 4 winter months this is multiplied by 0.5 to get an average for a 4 month period.

The expected number of non-winter deaths in a 4 month period was derived as:

$$\text{Expected Winter Deaths} = \frac{1}{2} (\text{Non} - \text{Winter deaths}(\text{Aug} - \text{Nov}, \text{Apr} - \text{Jul}))$$

Values published are average non-winter deaths so for the three year period, the non-winter deaths are divided by 6 (because 3 x 0.5 = 6).

Definition: Excess Winter Deaths (EWD) (Numerator)

The calculation of excess winter deaths (EWD) in this profile uses the ONS definition[‡] which compares deaths in the winter months (December to March) with the expected number of deaths (average non-winter months). The calculation can be obtained from formula 1 below:

$$EWD = (\text{winter deaths}(Dec - Mar)) - \frac{1}{2(\text{Non - Winter deaths}(Aug - Nov, Apr - Jul))}$$

Formula 1:

$$EWD = a - \frac{b}{2}$$

Where **a**= number of winter deaths and **b**= number non-winter deaths

(It is possible to have negative excess winter deaths when there are fewer deaths in winter than expected, i.e. greater rate of death in non-winter months than winter. However in this country this is rare and usually due to small numbers)

Definition: Excess Winter Deaths Index (EWDI)

The Excess Winter Deaths Index (EWDI) is the excess winter deaths expressed as a percentage of the average number of deaths in the autumn and summer months i.e. non-winter months. The calculation can be obtained from formula 2 below:

$$EWDI = \left(\frac{EWD}{(\text{Average of Non-Winter Deaths})} \right) * 100$$

This can be rearranged to give Formula 2:

Formula 2:

$$EWDI = \frac{a - \frac{b}{2}}{\frac{b}{2}} = \left(2 \frac{a}{b} - 1 \right) * 100$$

Where **a**= number of winter deaths and **b**= number non-winter deaths

Definition: EWDI Confidence Intervals

A confidence interval is a range associated with a parameter estimate, where the estimate is obtained from a random sample. Due to the random nature of the sample the parameter estimate also has random variability associated with it. A 95% confidence interval can essentially be thought of as a range which will contain the true underlying parameter variable (which we are trying to estimate) in 95% of repeated sampling experiments.

The EWDI is treated as odds $\left(\frac{a}{b} \right)$

i.e. $\left(2 \times \frac{a}{b} - 1 \right)$ is treated as odds

Where **a** = number of winter deaths and **b** = number of non-winter deaths.

[‡] Although data on EWDI published by the ONS are based on single years while WMPHO published data are based on pooled years as well as single years, both organisations used the same definition of EWD and EWDI.

2 is a constant and therefore does not need to be included in the confidence interval calculation as a constant has no variance, and -1 is also a constant and can be subtracted at the end.

The formula for a calculation of 95% confidence intervals was taken from Kirkwood and Stern^{viii} and the method for estimating the standard error when numbers for excess winter deaths or non-winter deaths are small i.e. less than 5 was suggested by Edmondson-Jones^{ix}.

Hence the 95% confidence interval is given by formula 3:

Formula 3:

$$\text{Lower Confidence Limit (LCL)} = \left| \frac{2 \times \frac{a}{b}}{e^{1.96 \times \sigma}} - 1 \right| = 2e^{(\text{LN}(\frac{a}{b}) - 1.96\sigma)} - 1$$

$$\text{Upper Confidence Limit (UCL)} = \left| \left(2 \times \frac{a}{b} \right) \times e^{1.96 \times \sigma} - 1 \right| = 2e^{(\text{LN}(\frac{a}{b}) + 1.96\sigma)} - 1$$

σ is the standard error for (log odds), EWDI in this case and is derived from formula 4a

Formula 4a

$$\sigma = \sqrt{\frac{1}{a} + \frac{1}{b}} \quad \text{When the numbers of excess winter and non-winter deaths are large (>20).}$$

When numbers for excess winter deaths or non-winter deaths are small i.e. less than 5, σ is derived from formula 4b below. This improves stability (wide variations seen with small numbers) in the confidence interval calculations.

Formula 4b

$$\sigma = \sqrt{\left(\frac{1}{a} + \frac{1}{b} \right) - \frac{1}{2} \left(\frac{1}{a^2} + \frac{1}{b^2} \right) + \frac{1}{4} \left(\frac{1}{a^3} + \frac{1}{b^3} \right)}$$

The method used in this Atlas is similar to that used in APHO health profiles, where the EWD Index is treated as odds. This is different from the method used by the ONS in deriving confidence intervals where the EWDI is considered as a ratio. Using the ONS method at local authority level where the number of deaths can be quite small will produce relatively inaccurate and wide confidence intervals.

Worked Examples

Worked Example 1: EWD, EWDI and Confidence Intervals Calculations for Single Year Data

In 2002/2003 there were 250 winter deaths and 492 non-winter deaths in a local authority in England.

Winter Deaths <i>(Sum of all deaths in the period)</i>	Non-Winter Deaths <i>(Sum of all deaths in the period)</i>
December 2002, January to March 2003	August to November 2002, April to July 2003

- 1) From formula 1 above, the excess winter deaths (EWD) for 2002/2003 are:

$$EWD = (250 - \frac{492}{2}) = 4$$

There were 4 excess winter deaths in this year.

- 2) From formula 2 above, the excess winter deaths index (EWDI) for 2002/2003 is:

$$EWDI = (2 \times \frac{250}{492} - 1) * 100 = 1.63\%$$

- 3) Since excess winter deaths is less than 5, σ the standard error for (log odds) EWDI uses formula 4b above :

$$\sigma = \sqrt{\left(\frac{1}{250} + \frac{1}{492}\right) - \frac{1}{2}\left(\frac{1}{250^2} + \frac{1}{492^2}\right) + \frac{1}{4}\left(\frac{1}{250^3} + \frac{1}{492^3}\right)} = 0.077605$$

- 4) From formula 3 above, the lower (LCL) and upper (UCL) confidence limits for EWDI are:

$$LCL = (2e^{(\ln(\frac{250}{492}) - 1.96 \times 0.077605)} - 1) * 100 = -12.7\%$$

$$UCL = (2e^{(\ln(\frac{250}{492}) + 1.96 \times 0.077605)} - 1) * 100 = 18.3\%$$

Worked Example 2: EWD, EWDI and Confidence Intervals Calculations for 3 Years Pooled Data

Between 1990 and 1993 (pooled), there were 588,660 winter deaths and 990,972 non-winter deaths in England.

Winter Deaths (Sum of all deaths in the period)	Non-Winter Deaths (Sum of all deaths in the period)
December 1990, January to March 1991	August to November 1990, April to July 1991
December 1991, January to March 1992	August to November 1991, April to July 1992
December 1992, January to March 1993	August to November 1992, April to July 1993

- 1) From formula 1 above, the excess winter deaths (EWD) for 1990-1993 are:

$$EWD_{3 \text{ years}} = (588660 - \frac{990972}{2}) = 93174$$

There were 93,174 excess winter deaths in 3 years.

The average excess winter deaths per year are:

$$EWD_{\text{per year}} = \frac{93174}{3} = 31058$$

- 2) From formula 2 above, the excess winter deaths index (EWDI) for 1990-1993 is:

$$EWDI = \left(2 \times \left(\frac{588660}{990972} \right) - 1 \right) * 100 = 18.80\%$$

- 3) Since excess winter and non-winter deaths are more than 5, σ the standard error for (log odds) EWDI uses formula 4a:

$$\sigma = \sqrt{\frac{1}{588660} + \frac{1}{990972}} = 0.001645565$$

- 4) From formula 3 above, the lower (LCL) and upper (UCL) confidence limits for the EWDI are:

$$LCL = \left(2e^{\left(\ln\left(\frac{588660}{990972}\right) - 1.96 \times 0.0016456 \right)} - 1 \right) * 100 = 18.4\%$$

$$UCL = \left(2e^{\left(\ln\left(\frac{588660}{990972}\right) + 1.96 \times 0.0016456 \right)} - 1 \right) * 100 = 19.2\%$$

Worked Example 3: EWD, EWDI and Confidence Intervals Calculations for the EWD Index by Age and Underlying Cause of Death

Between 2002 and 2009 (pooled), there were 372,596 winter deaths and 199,571 non-winter deaths in the 0-64 age group in England.

Winter Deaths <i>(Sum of all deaths in the period)</i>	Non-Winter Deaths <i>(Sum of all deaths in the period)</i>
December 2002, January to March 2003	August to November 2002, April to July 2003
December 2003, January to March 2004	August to November 2003, April to July 2004
December 2004, January to March 2005	August to November 2004, April to July 2005
December 2005, January to March 2006	August to November 2005, April to July 2006
December 2006, January to March 2007	August to November 2006, April to July 2007
December 2007, January to March 2008	August to November 2007, April to July 2008
December 2008, January to March 2009	August to November 2008, April to July 2009

- 1) From formula 1 above, excess winter deaths (EWD) for 2002-2009 is:

$$EWD_{7\text{ years}} = (372596 - \frac{199571}{2}) = 13273$$

and average excess winter deaths per year is:

$$EWD_{\text{per year}} = \frac{13273}{7} = 1896.14$$

- 2) From formula 2 above, excess winter deaths index (EWDI) for 2002-2009 is:

$$EWDI = \left(2 \times \left(\frac{372596}{199571} \right) - 1 \right) * 100 = 7.12\%$$

- 3) Since excess winter and non-winter deaths are more than 5, σ the standard error for (log odds) EWDI uses formula 4a:

$$\sigma = \sqrt{\frac{1}{372596} + \frac{1}{199571}} = 0.002773918$$

- 4) From formula 3 above, the lower (LCL) and upper(UCL) confidence limit for EWDI are:

$$LCL = \left(2e^{\left(\ln\left(\frac{372596}{199571}\right) - 1.96 \times 0.002773918 \right)} - 1 \right) * 100 = 6.5\%$$

$$UCL = \left(2e^{\left(\ln\left(\frac{372596}{199571}\right) + 1.96 \times 0.002773918 \right)} - 1 \right) * 100 = 7.7\%$$

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