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Technical Guide

Fingertips trend markers

Introduction

This guidance document describes the methodology used for the trend markers that are displayed on the Fingertips website. The algorithms set out below are carried out by Fingertips on-the-fly as the page is loading and are only applied to indicators that are proportions or rates (including crude rates and directly standardised rates).

Process for testing for 'recent' statistical trend

These calculations are derived using the most recent N indicator values (x_i) in the time series as shown on the Trends display, their numerators (r_i) and their denominators (n_i) along with the time values (t_i).

If t_i are not straightforward numeric values (eg years) they must be converted into values – the actual values don't matter, but the intervals between time values used must be proportional to the real time intervals between the indicator values.

For the test described below, start with $N = 5$, ie test for trend on the last five points in the time series. If a significant trend is found, a red or green trend marker will be displayed. If no significant trend is identified, repeat the test adding the sixth most recent point in the time series. Keep repeating, adding a further point back in the time series until either a significant trend is identified, or the full time series has been tested. If there is still no significant trend with the full series, an amber trend marker will be displayed.

χ^2 test for trend

The test requires the numerators (r_i) and denominators (n_i) for each of the N values (x_i) in the series and the time values (t_i).

If only indicator values and numerators are present, calculate the denominators as:

$$n_i = \frac{r_i}{x_i}$$

If only indicator values and denominators are present, calculate the numerators as:

$$r_i = n_i x_i$$

For proportions and crude rates, the numerators and denominators are straightforward.

For directly standardised rates, the populations may be present, but the denominators should still be calculated as above and these derived denominators used.

Calculate the test statistic:

$$\chi_1^2 = \frac{\sum n_i \left(\sum n_i \sum r_i t_i - \sum r_i \sum n_i t_i\right)^2}{\sum r_i \left(\sum n_i - \sum r_i\right)\left(\sum n_i \sum n_i t_i^2 - \left(\sum n_i t_i\right)^2\right)}$$

If $\chi_1^2 > 9.5495$ the trend is significant (p < 0.2%) and a red or green trend marker is shown.

Determining the direction of trend

The gradient of the trend, $\hat{\beta}$, is calculated as follows:

For proportions

$$\hat{\beta} = \frac{N \sum \left(\ln \frac{x_i}{1-x_i}\right) t_i - \sum \ln \frac{x_i}{1-x_i} \sum t_i}{N \sum t_i^2 - \left(\sum t_i\right)^2}$$

For all other value types

$$\hat{\beta} = \frac{N \sum (\ln x_i) t_i - \sum \ln x_i \sum t_i}{N \sum t_i^2 - \left(\sum t_i\right)^2}$$

If the test statistic has shown a significant trend, then the sign of $\hat{\beta}$ shows the direction of the trend. If $\hat{\beta} < 0$ then it is a falling trend and downward arrow will be displayed; if $\hat{\beta} > 0$ then it is a rising trend and an upward arrow will be shown. The polarity of the indicator is used to determine the colour of the arrow: eg where 'high is good' an upward arrow will be green and a downward arrow red. For indicators without a clear polarity, a blue marker is used to identify significant trends in either direction.

PHE Technical Guides

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