IDENTIFYING VARIATION IN CANCER MORTALITY IN THE ELDERLY: NOT AS EASY AS IT SOUNDS

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Background

Age adjusted cancer mortality rates have fallen by 11% over the last decade. This improvement is focused on those under 75; 15% reduction in those under 75, 5% reduction for those 75 and over.

It is widely observed that this trend is not uniform across the UK. We aimed to uncover the extent to which mortality rates vary in those 75 and over and how to identify which areas warrant further investigation.

Method

UK registry data was extracted from the UK Cancer Information Service.[1] We extracted age-adjusted cancer (ICD-10 C00-C97) mortality rates and numbers of deaths, for people under 75 and 75 and over, cross tabulated with higher tier local authorities or equivalents[2] (LAs) for two decades up to 2011. We explored the data using a range of methods from basic techniques such as ranking to more complex tools such as the Association of Public Health Observatories' funnel plot tool[3].

Results

Figure 1 shows there is variation in the age-adjusted mortality rate of those age 75 and above; the area with the highest rate (2,309 deaths per 100,000) has more than double the rate of the area with the lowest rate (1,076 deaths per 100,000). These areas are different enough to the UK as a whole and have populations large enough to identify them as significantly different to the UK. This variation could be due to many factors including socio-economic deprivation, case mix and data quality and cause of death coding. However, much of the variation in other geographies was found to be variation due to chance.

Figure 1: Cancer mortality rates in patients 75 and older

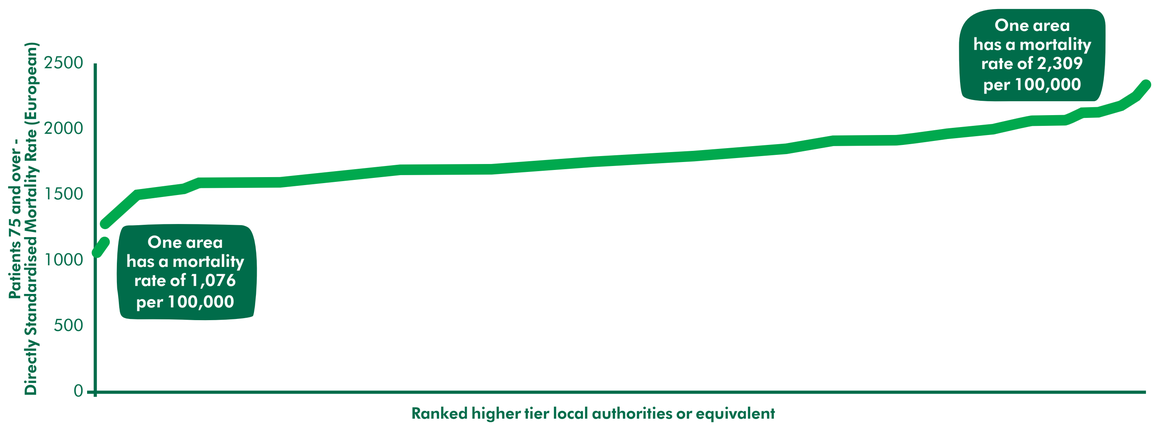
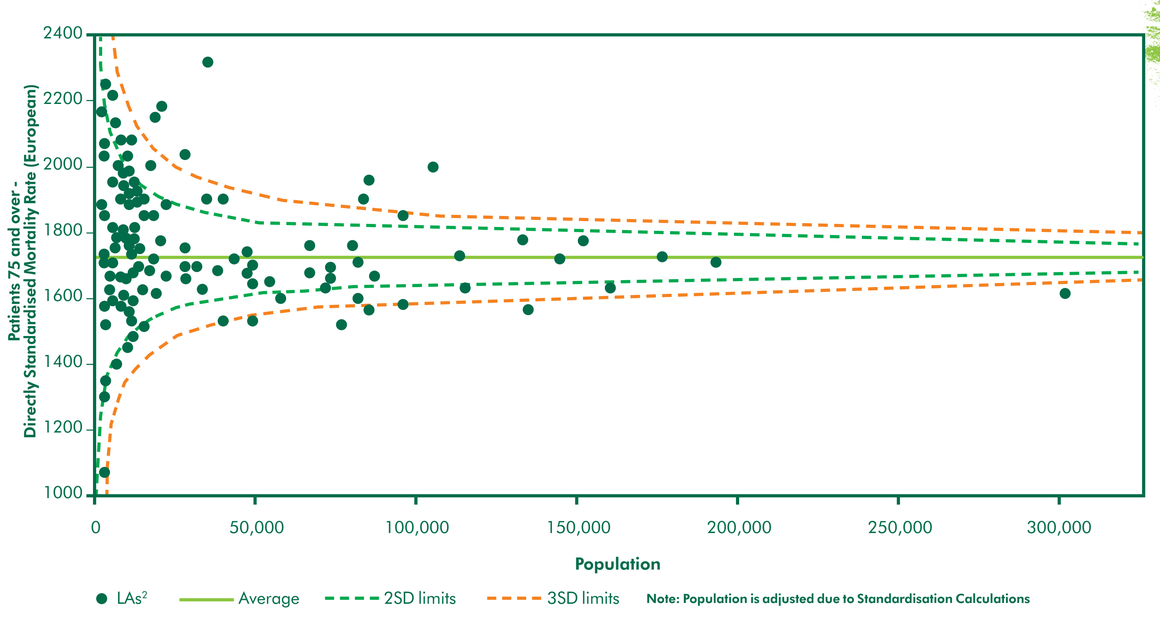


Figure 2 shows 16 data points outside of the 3 standard deviations control limits indicating that there are 16 LAs with significant variation from the UK average. In these LAs the variation is not due to noise in the data so there is likely to be something additional impacting the mortality rate. This variation is known as special cause variation and often points to the need for investigation.

Figure 2: Funnnel plot showing variation in cancer mortality rates 2011



To investigate we need to understand if the rate is stable over time. Figure 3 and 4 show two example LAs with particularly high mortality rates. One example demonstrates a stable system and one is an example of an unstable system. In each of these examples a different next stage is recommended.

Figure 3: Control chart showing variation over time in a LA with a high mortality rate (in 2011) in an stable system

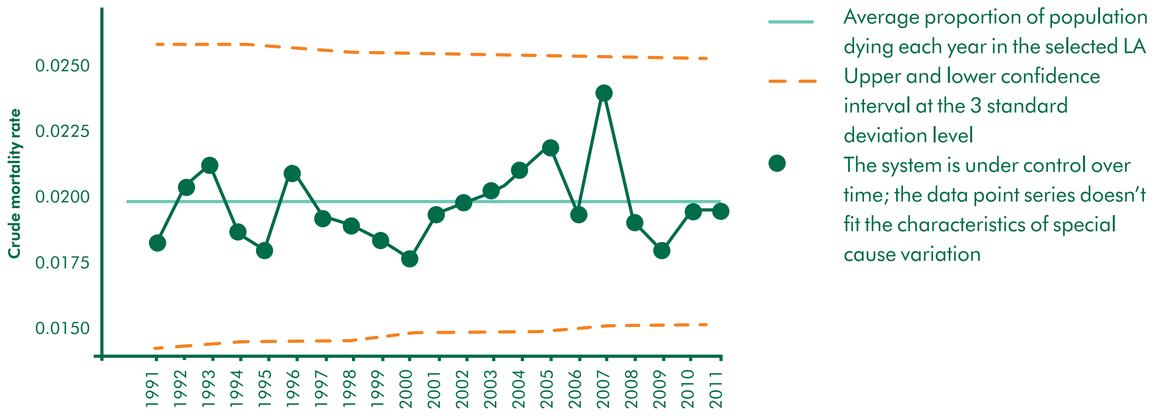


Figure 3 shows the high mortality rate in this area is part of a stable and predictable system (common cause variation). The high rate is unlikely to change without intervention so if a lower mortality rate is realistic to achieve a systematic change of the whole system is probably needed[4].

Figure 4: Control chart showing variation over time in a LA with a high mortality rate (in 2011) in an unstable system

Figure 4 indicates that in this LA there is special cause variation. This variation is likely to be due to a changing factor external to the system. The reason for the recent high rate may need to be investigated to learn more about the factors influencing mortality in this area. The best way to do this is often by disaggregating the data for example for specific cancer types to create control charts to identify where the process is stable and where there is special cause variation[4].

Identifying special cause variation

Many tests have been suggested to detect the presence of special cause in control charts[4]. The tests used here:

- Points above or below 3 standard deviations
- 2 out of 3 consecutive points above or below 2 standard deviations
- 4 out of 5 consecutive points above or below 1 standard deviations
- 8 points on the same side of the mean line
- 14 points in a row alternating

Conclusions

It is important to be able to accurately identify areas with genuinely higher mortality rates so that we can focus rationed efforts to improve cancer outcomes taking into account local context and differences in data quality. One way to do this is through a funnel plot that identifies areas with special case variation.

The next stage is to unpick why variation may be present and so work out the sort of change that could improve performance; this can be partially achieved through studying how mortality rates vary over time. Given the random nature of death some variation is expected. If the mortality rate needs improvement in a stable system (i.e. the mortality is still poor over time) a systematic change of the whole system is probably needed. Alternatively the variation over time may indicate that something unpredictable is happening for example the unstable system (Figure 4). These unpredictable changes are likely to be caused by an altering external factor. We need to identify this altering external factor as a first step to bring improvement to these unstable systems.

References

1. UK Cancer Information Service contains data from a number of organisations including the Welsh Cancer Intelligence and Surveillance Unit, Scottish Cancer Registry and Northern Ireland Cancer Registry.
2. The geographies include Unitary Authorities, Metropolitan Boroughs, Inner and Outer London and Northern Ireland Districts.
3. Public Health England. (2008). *Analytical Tools for Public Health: Funnel plot for rates (including directly standardised rates)*. Available: http://www.apho.org.uk/resource/item.aspx?RID=47240. Last accessed 16th Sept 2013.
4. Raymond G. Carey (2003). *Improving Healthcare with Control Charts: Basic and Advanced SPC Methods and Case Studies*. USA: ASQ Quality Press.