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Deaths and international health care expenditure

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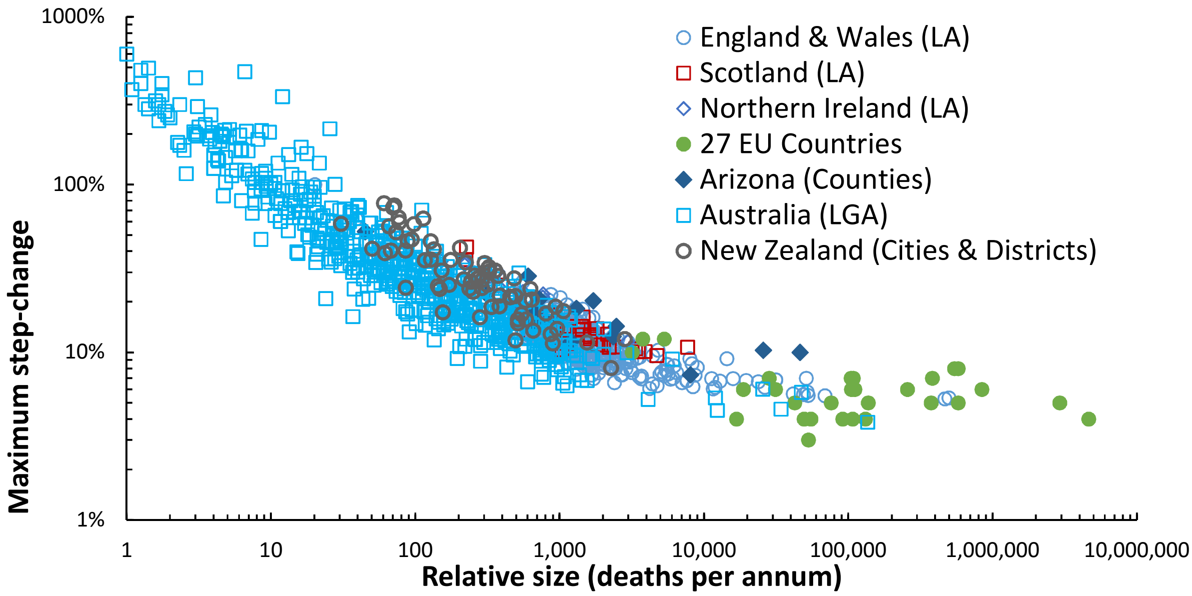
The Money Matters series and other articles in BJHCM and elsewhere have consistently noted that the marginal changes in deaths have a strong influence on the marginal changes in emergency department attendances, GP referral, hospital medical admissions, bed occupancy and health care expenditure (Jones 2015a,b,c). As it were, ignore changes in death at your own peril.

Figure 1: Maximum step-change observed during infectious-like events in various countries



Footnote: Quarterly deaths from January 1991 to December 2014 for district council areas were obtained from the Infoshare database at Statistics New Zealand. Annual deaths for Local Government Areas (LGAs) from 2001 to 2013 were obtained from the Australian Bureau of Statistics (Jones 2015f). Monthly deaths between 1993 and 2013 in the 26 district council areas of Northern Ireland were obtained from the Northern Ireland Statistics and Research Agency (NISRA) website. Monthly deaths for counties in Arizona between 2004 and 2014 were obtained from the Arizona Health Services website (http://www.azdhs.gov/plan/mu/index.php). Monthly deaths in England and Wales were from the Office for National Statistics website (Jones 2015a). Monthly deaths for Scottish local authorities between 1991 and 2014 were obtained from National Records of Scotland. Monthly deaths for 27 European countries were from EuroStat (Jones 2015c). The method is described in the paper by Jones & Beachant (2015).

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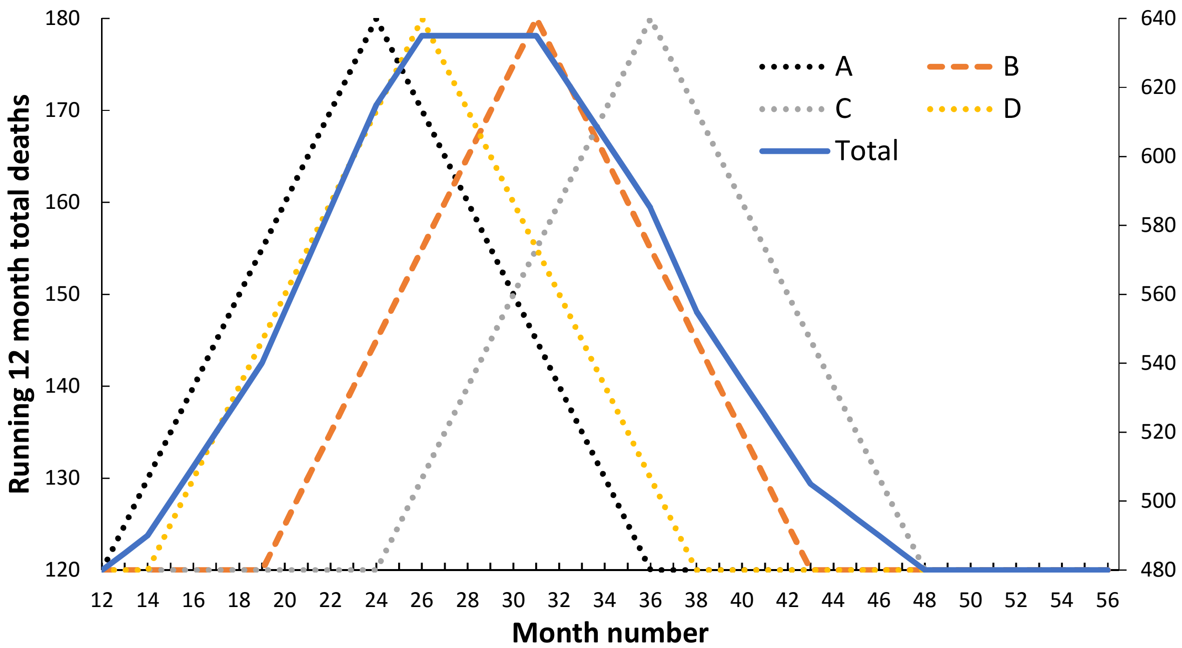
It has also been suggested that a new type of infectious-like event is leading to step-like increases in deaths which endure for around 12 months before abating, i.e. the event behaves like a rectangular wave with very small area transmission (Jones 2013a,b, 2014, 2015a,b,g, Jones & Beauchant 2015). Each 'event' involves a particular set of medical conditions sensitive to immune function (Jones 2013a,b, 2015b,d,e,h). These events usually only occur around twice per decade, however, a four-in-a-row series at two year intervals (2008, 2010, 2012, 2014) has led to huge operational and cost pressures (Jones 2015b). Figure 1 presents data for these step-increases from around the world (Australia, New Zealand, Arizona (USA), all parts of the UK and 27 European countries), where it can be seen that the maximum step-change, i.e. rectangular wave, within all countries behaves in the same way, and at roughly the same time. One would normally hope that Public Health Departments may show some degree of interest in such a profound phenomenon, although sadly such interest has been lacking up to the present.

It is important to explain how the relationship with size arises as a result of a particular type of apparent slow infectious-like spread. It is known that infectious events usually progress within social networks where contact or proximity allows passage of the agent between members of the network (Eubank et al 2004, Cauchemez et al 2011). Figure 2 illustrates how the magnitude of the event diminishes in a larger area made up from four smaller areas (hypothetical social networks). As can be seen the event moves between areas over a 24 month period (which is a common time period for these outbreaks). Each area has 10 deaths per month which jumps to 15 deaths (+50%) during the 12 month duration of the outbreak. In this illustration two areas initiate early in the outbreak, while the other two initiate later.

Figure 2: Running 12 month total deaths in 4 small social networks and that observed in the composite total.



In a running 12 month total, the step-change occurs at the start of the inverted 'V' and ends at the apex. The value at the apex reveals the magnitude of the step-change. As can be seen, deaths within the

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larger area only show an apparent jump (in the running total) from 480 to 635 (+32%). Hence, as the size of the spatial unit increases, the apparent percentage increase diminishes in roughly a power law function as seen in Fig. 1. As can also be seen in Fig. 1 the effect of size reaches saturation point at around 1,000 deaths per annum, and beyond this size the observed 'apparent' effect reaches an asymptote of around a 4% to 6% increase in deaths. This explains why the percentage increase observed at whole country level is so much smaller than the maximum potential increase seen within a single social network.

Fig. 2 also elegantly demonstrates how the disposition of initiation dates within an area can lead to different estimates for the value of the step-up or step-down associated with these events, and in the overall shape of the running total for the larger area, and this disparity is commonly observed in real-world health care data (see Jones 2015g).

It must be pointed out that disease surveillance tools employing deaths usually only run at national or regional level, hence, the massive potential for increased deaths of +500% in a social network containing an average of only 1 death per annum, is totally lost at national level, and the resulting 4% to 6% increase (spread over the duration of the event) is dismissed as being of insignificant importance.

Hence we have a disease-like event exerting vast potential impact not only on deaths but medical admissions and other sources of health care costs which has lain hidden due to its unique kinetic patterns of spread within the population. In the UK the NHS has been 'blamed' for the consequences of these outbreaks, which have led to unexplained increases in medical admissions and GP referral (Jones 2015c).

While the can be no objection to implementing the host of worthy schemes designed to reduce health care costs, it must be categorically stated that the contribution of these worthy schemes will continue to be overwhelmed by these vastly important outbreak-like events, the next of which is due around 2019.

On a practical note, analysis of areas containing fewer than 10 deaths per annum involves a higher contribution from Poisson-based uncertainty; however, stable estimates of the step change can be obtained using areas containing 100 to 1,000 deaths. In this particular range the log-log relationship is relatively linear which allows extrapolation backwards to reveal the maximum impact in a single social network.

Hopefully Public Health Departments around the world will begin to take appropriate interest…… even if only to investigate the impact on costs.

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