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A fatal flaw in national mortality-based disease surveillance

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Over the past six years BJHCM has been instrumental in alerting both the NHS and other government agencies to the highly peculiar behaviour in both deaths and medical admissions, and consequent impact on hospital bed availability, A&E performance, emergency admissions and costs (Jones 2015b-f,l, 2016b).

Epidemiological and infectious concepts have been presented in the context of explaining the NHS activity and cost trends. Agencies such as Public Health England (PHE) have been unable to adjust to the new paradigm, and continue to insist that nothing out of the ordinary is happening (refuted in Jones 2013, 2015a). They point to the fact that the currently accepted disease surveillance methods are more than adequate to detect any new infectious threat, and that mortality-based surveillance is not detecting anything out of the ordinary.

Current mortality surveillance uses the “European monitoring of excess mortality for public health action” (EuroMOMO) methodology (EuroMOMO 2016). This methodology detects periods of excess mortality, and as the name suggests if ‘excess mortality’ is absent, then no public health action is required.

With over 1,400 known species of human pathogens, and with hundreds yet to be discovered (Woolhouse and Gowtage-Sequeria 2005), it would be entirely premature to suggest that novel types of disease outbreaks, i.e. those which contradict currently accepted norms, are not possible or that they cannot evade current surveillance methods.

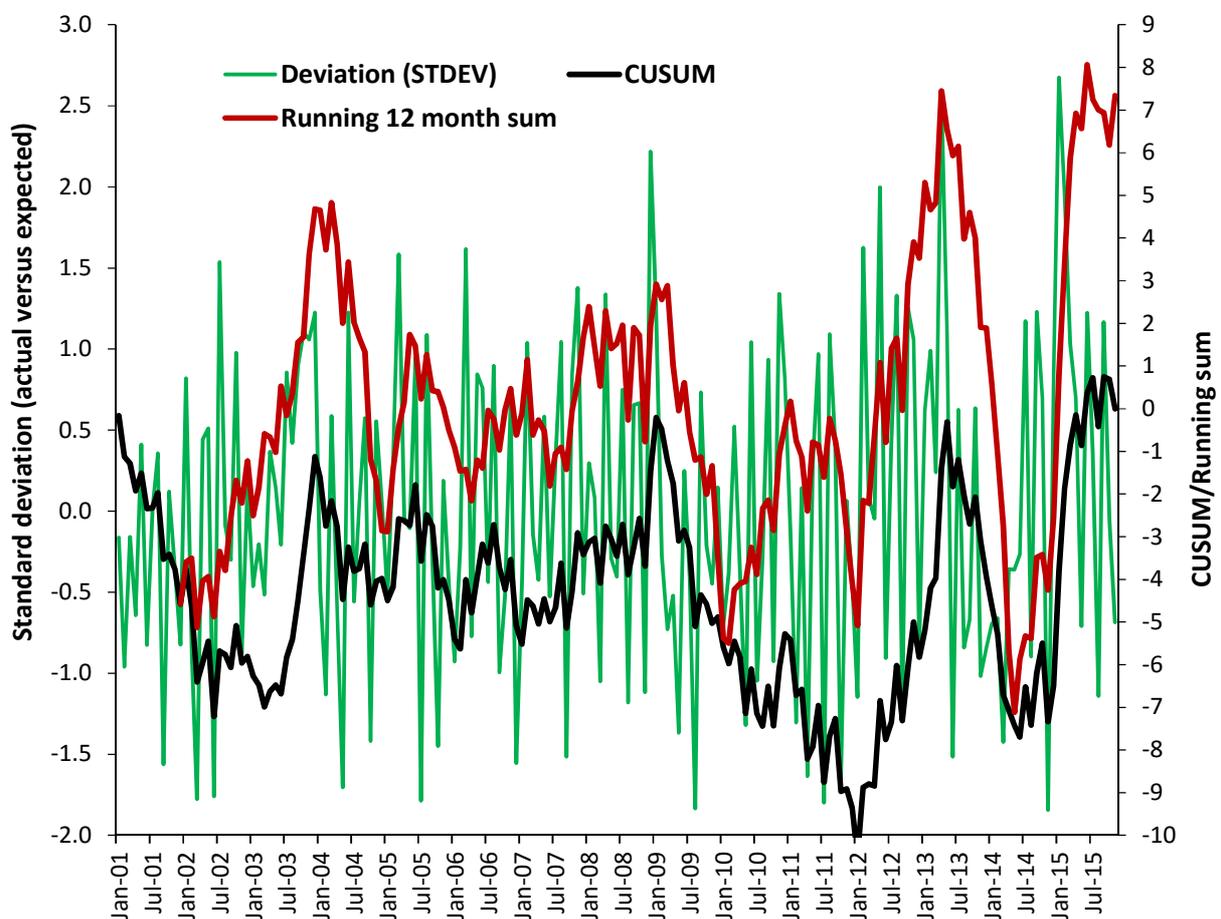
For example, the technology has recently been developed to detect an immune response following exposure to all known 206 species of virus (> 1,000 strains), which infect humans by analysis of a single drop of blood (Xu et al 2015). As part of the validation process for this technology blood from 569 humans from Peru, South Africa, Thailand, and the United States was screened for the extent of viral exposure. Those with HIV/AIDS registered a higher proportion of exposure to 14 common viruses as did the non-US countries. Epstein Barr virus, Rhinovirus A & B, Adenovirus C, Respiratory Syncytial virus and Herpes Simplex 1 being the most commonly detected viruses in non-HIV persons (Xu et al 2015). Most common exposure was 10 viruses per person, and up to 62 viruses in five individuals and 84 in two individuals. This is entirely relevant to the concept called the ‘pathogen burden’ where disease severity

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appears to increase with higher numbers of pathogens, i.e. combinations of pathogens may be more detrimental to health than the single pathogen studies currently indicate (see reviews Jones). In this respect Cytomegalovirus (CMV), via its huge repertoire of immune evasive and modulating genes, may be acting as an agent provocateur to other pathogens (see Jones 2016a) – despite being widely regarded as largely innocuous.

Having briefly established that disease surveillance may be more complex than a few big name pathogens such as Influenza - with surprisingly low levels of exposure in the study of Xu et al (2015), confirming a suspicion that influenza *alone* may not be the feared pathogen that Public Health agencies appear to believe (see wider discussion in Jones 2016c).

Figure 1: Monthly deaths in England (2001 to 2015), and CUSUM and running 12 month total analysis for hidden patterns



However, returning to the issue of disease surveillance, Figure 1 presents a EuroMOMO type of analysis of a series of monthly deaths in England between Jan-01 and Nov-15, which was obtained from the Office for National Statistics. The raw monthly data was first corrected for the long-term trend in deaths using a second order polynomial, where all monthly deaths were corrected to the Dec-15 position. This

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effectively linearizes the time trend. Average deaths for each adjusted month were then determined (an average of 15 years), and the standard deviation for that month also calculated. The difference between the actual and expected deaths in each month was then calculated, and this difference was turned into a standard deviation difference by dividing by the standard deviation for each month.

Anything greater than a ± 2 standard deviations difference (STDEV) can be considered to be potentially statistically significant, i.e. an example of a public health actionable event. As can be seen only four months in the entire time series (Dec-08, May-12, Apr-13, Jan-15, all of which occur in the typical 'winter' season) 'flag' as being 'actionable', which would tend to support the PHE view that nothing out of the ordinary is happening.

However Figure 1 goes deeper than this superficial conclusion by employing two methods used to detect hidden patterns in a time series. In the first, a cumulative sum of deviations from the mean (CUSUM), indicates fundamental changes in otherwise hidden behaviour every time the slope of the CUSUM undergoes a major change. In the second method, a running 12 month total is used to remove underlying seasonal behaviour and detect hidden step-like changes in the death rate. Both methods indicate that the trend contains deeper messages than PHE may care to publically admit. The running 12 month total in particular appears to be detecting a regular series of step-like increases in death at two year intervals.

Previous studies have indicated large infectious-like outbreaks in 2002, 2008, 2013 and 2014 (Jones 2015b-d), while re-analysis of data reveals a further event in 2010 which is concealed by slower small area spread than the other events (Jones 2015e,h,j). My own further analysis also suggests emerging evidence for smaller events in 2004 and 2006, i.e. every two years (Jones 2016b). These smaller events can be seen in Figure 1. Note that the sharpness of the inverted 'V' in the running 12 month total chart is indicative of the degree of spatial synchrony in these infectious-like events. High spatial synchrony occurs when transmission between persons is more rapid. On this occasion the national picture is a composite of small area spread across the whole of England (Jones 2015c,e,h,j).

In conclusion, there is a series of infectious-like events which evades current EuroMOMO-type disease surveillance. During these events death are consistently high for a 12 month period before they return back to the expected base line. These events occur with variable spatial synchrony which implies that the magnitude of the effect against human health (deaths and medical admissions) may be considerably underestimated. There is indeed a 'fatal' flaw in current disease surveillance methods, such that outbreaks of a pathogen of considerable public health importance have been totally missed by the very agencies who are supposed to protect the health of the public. Sadly, it is currently politically expedient for the government to blame the NHS for the cost and performance consequences of these events.

References

EuroMOMO (2016) European monitoring of excess mortality for public health action.

<http://www.euromomo.eu/>

Jones R (2013) Analysing excess winter mortality: 2012/13. *BJHCM* 19(12): 601-605.

Jones R (2015a) Recent trends in life expectancy at older ages.

http://www.hcaf.biz/2015/PHE_Life_Expectancy.pdf

An edited version of this article has been published as: Jones R (2016) A fatal flaw in mortality based disease surveillance. *British Journal of Healthcare Management* 22(3): 143-145. Please use this to cite.

Jones R (2015b) Recurring Outbreaks of an Infection Apparently Targeting Immune Function, and Consequent Unprecedented Growth in Medical Admission and Costs in the United Kingdom: A Review. *Brit J Med Medical Res* 6(8): 735-770. doi: 10.9734/BJMMR/2015/14845

Jones R (2015c) Are emergency admissions contagious? *BJHCM* 21(5): 227-235.

Jones R (2015d) Unexpected Increase in Deaths from Alzheimer's, Dementia and Other Neurological Disorders in England and Wales during 2012 and 2013. *J Neuroinfectious Dis* 6:172. doi: 10.4172/2314-7326.1000172

Jones R (2015e) Small area spread and step-like changes in emergency medical admissions in response to an apparently new type of infectious event. *FGNAMB* 1(2): 42-54. doi: 10.15761/FGNAMB.1000110

Jones R (2015f) Deaths and international health care expenditure. *BJHCM* 21(10): 491-493.

Jones R (2015g) Links between bed occupancy, deaths and costs. *BJHCM* 21(11): 544-545.

Jones R (2015h) Simulated rectangular wave infectious-like events replicate the diversity of time-profiles observed in real-world running 12 month totals of admissions or deaths. *FGNAMB* 1(3): 78-79.

Jones R (2015i) A 'fatal' flaw in hospital mortality models: How spatiotemporal variation in all-cause mortality invalidates hidden assumptions in the models. *FGNAMB* 1(3): 82-96.

Jones R (2015j) Infectious-like spread of an agent leading to increased medical hospital admission in the North East Essex area of the East of England. *FGNAMB* 1(3): 98-111.

Jones R (2015k) Influenza-like-illness, deaths and health care costs. *BJHCM* 21(12): 587-589.

Jones R (2016a) Is cytomegalovirus involved in recurring periods of higher than expected death and medical admissions, occurring as clustered outbreaks in the northern and southern hemispheres? *Brit J Med Medical Res* 11(2): 1-31. doi: 10.9734/BJMMR/2016/20062

Jones R (2016b) The real reason for the huge NHS overspend? *BJHCM* 22(1): 40-42.

Jones R (2016c) The unprecedented growth in medical admissions in the UK: the ageing population or a possible infectious/immune aetiology? *Epidemiology: Open access* 6(1): 1000219

Woolhouse M, Gowtage-Sequeria S. (2005) Host range and emerging and reemerging pathogens. *Emerg Infect Dis* 11(12): 1842-1847.

Xu G, Kula T, Xu Q, Li M, et al (2015) Comprehensive serological profiling of human populations using a synthetic human virome. *Science* 348(6239): aaa0698.