An edited version of this article has been published as: Jones R (2013) An unexplained increase in deaths during 2012. ***British Journal of Healthcare Management*** 19(5): 248-253. Please use this to cite.

An unexplained increase in deaths in England and Wales during 2012

Key Points

- In England & Wales between 24,000 to 26,000 unexpected deaths occurred in the 56 weeks subsequent to mid-February 2012
- The 95% confidence interval for total deaths is only ± 1,620 and hence excess deaths are far in excess of simple statistical variation
- Of these 61% were female confirming earlier observations of excess female emergency admissions associated with these outbreaks
- There is high granularity between local authorities suggesting infectious spread of a relatively difficult to transmit agent
- As per earlier observation the increase in deaths is associated with a parallel increase in emergency admissions
- The deaths are only the tip of a much larger morbidity (and cost) pyramid
- Excess deaths are mainly for those aged 85+ however the effect can be discerned above age 65

Abstract

A recurring series of infectious-like outbreaks across all parts of the UK and in other Western countries has been associated with increased deaths, emergency medical admissions, GP referrals and emergency department attendances. Previous outbreaks in 2002 and 2007 suggested that an outbreak may be due again in 2012. As expected, deaths in England & Wales were observed to show a step-like increase of around 430 to 480 extra deaths per week commencing in the sixth week of the 2012 calendar year but increasing to around 1,000 excess deaths per week in early 2013. A parallel increase in emergency admissions also occurs at the same point in time. The impact at local authority level is highly granular and a genuine infectious outbreak is implicated where the method of transmission is probably by person to person contact. The ubiquitous herpes virus, cytomegalovirus, may be the causative agent but this requires validation.

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Introduction

Over the past four years a series of articles in BJHCM has investigated the possibility of major outbreaks of a new type of infectious immune impairment. See Jones (2013b) for references up to September 2012. The last two outbreaks commenced in England in 2002 and 2007, although always slightly earlier in Scotland (Jones 2012e, 2013d). In the UK they can be traced back to the 1980's (lack of data precludes earlier analysis) while in the USA their profound financial impact on total health care costs can be traced back to the early 1960's (Jones 2013b). The next outbreak was due to occur at some point from 2012 to 2015. One of the key features of these outbreaks is a sudden and unexplained increase in deaths along with far wider effects against morbidity and costs (Jones 2011a-c, 2012a-g). For a review see Jones (2013b).

To put deaths into context the Government Actuary expects deaths to continue to decline until around 2015 after which they are to rise, at first gradually and then gaining pace, as the leading edge of the World War II baby boom start to die in appreciable numbers. The WW II peak in births occurred in March of 1947 (Jones 2012g) hence deaths are expected to increase as this cohort reaches 60. There was no demographic reason for deaths to increase in 2012 except due to a *very* extended period of record high or low temperatures (Ekamper et al 2009), neither of which occurred to the extent required, or to major infectious outbreaks, i.e. an influenza pandemic or equivalent. The particular infectious outbreak of interest is proposed to be due to a virus causing a permanent or persistent infection and hence capable of producing a prolonged effect upon morbidity and mortality (Jones 2013b).

Total Deaths

Analysis of the previous outbreaks in 2002/2003 and 2007/2008 suggested a conservative estimate of 20,000 to 30,000 excess deaths across the entire UK during each outbreak with subtle differences in the timing for different regions (Jones 2012c,f). Analysis of the trend in weekly deaths in England & Wales from 2010 to date (data not shown) shows a distinct step-increase in total deaths (all cause, all ages) commencing in week 6 of the 2012 calendar year such that between 24,000 to 26,000 unexpected deaths occurred in the 56 weeks subsequent to mid-February 2012. The lower figure comes from a week by week comparison against actual deaths in 2011 while the higher figure uses a comparison against a weekly average derived from the previous five years with the annual total adjusted to that in 2011. This adjustment is necessary due to the progressive reduction in total deaths over time until the expected minimum point around 2015. Given the fact that each outbreak lasts for around two years the earlier estimates of 20,000 to 30,000 deaths appear to be too low and this outbreak, should it continue as expected, may eventually account for up to 50,000 excess deaths. The outbreak has continued into 2013 and the cumulative deaths during the first 16 weeks of 2013 has been the higher than any of the previous five years and has been 7.3% higher than the average of 2008 to 2012. As this paper goes to press deaths appear to be running at 1,000 excess deaths per week. It should be noted that the 95% confidence interval (Poisson) for annual total deaths is only ± 1,620 and hence excess deaths at an annual level are far in excess of anything that could

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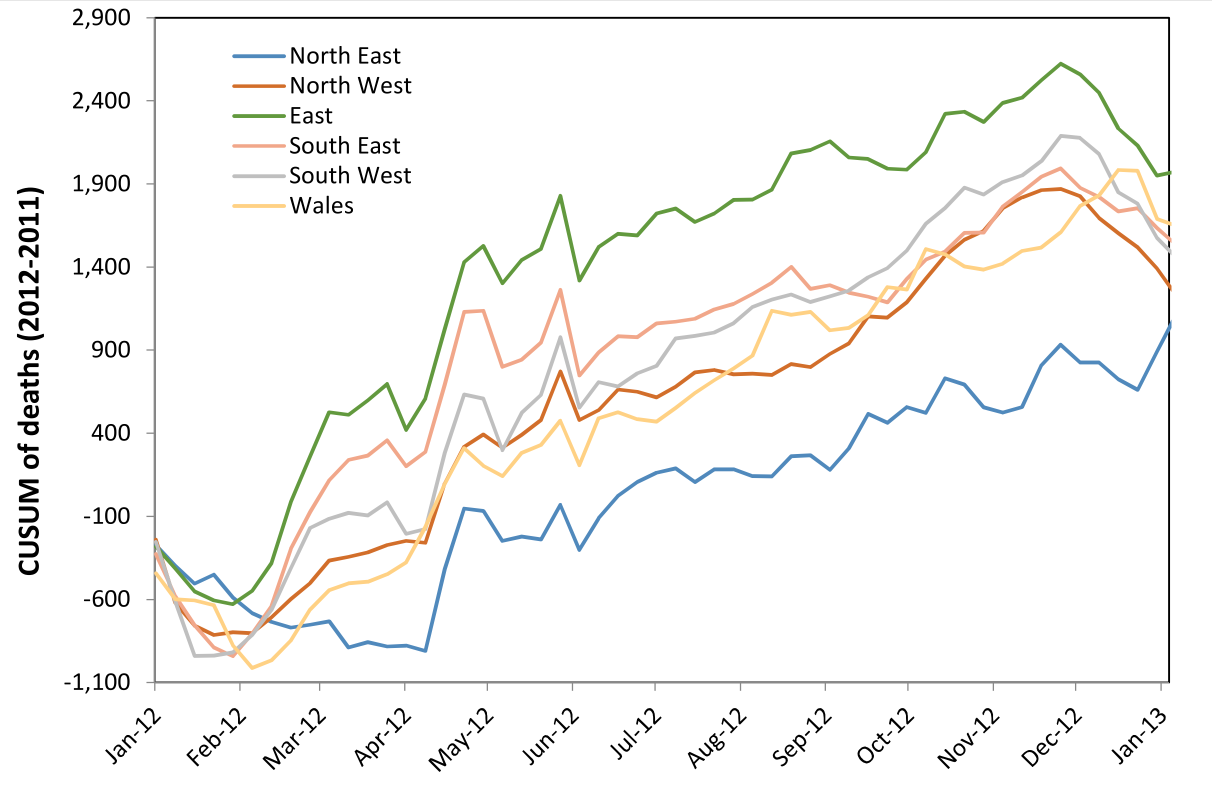
arise from simple statistical variation. Having surveyed the overall position the question of geographic spread will now be addressed.

Figure 1: CUSUM of total (all-age) deaths for 2012 compared to 2011.



Data kindly supplied by Dr T Hennell, Senior Public Health Analyst, North West Public Health Team. All regions have been adjusted to have the same number of deaths by minimizing the sum of the weekly standard deviations across the regions using the Solver function in Microsoft Excel. Hence the South East (largest region) is the reference point at 1.0 and weekly deaths in the North East are all multiplied by 2.85, Wales by 2.39, East Midlands by 1.81, etc with smallest regions having the highest multiplication factor.

Regional Spread

The spread of the proposed infectious agent is demonstrated in Figure 1 which shows the cumulative sum of the difference in weekly deaths between 2012 and 2011. All regions were first adjusted to the same number of total deaths to facilitate like-for-like comparison. In a CUSUM plot a change in the slope of the trend indicates a shift from one rate of death to another. If we approach this chart from the point of view of an infectious spread several things can be discerned. Firstly, the infectious outbreak in England & Wales appears to first emerge in the East of England at around February while in the North East the point of initiation is delayed until around April, but earlier in the adjacent North West. There is probably no particular reason for the variable timing between locations other than random person-to-person contacts sufficient to create a mass effect.

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Table 1: Change in number of deaths (age 65+) in 2012 compared to 2011

Locality	Ratio	Locality	Ratio	Locality	Ratio
E. Cambridgeshire	86%	Elmbridge	108%	Derby	110%
Barrow-in-Furness	90%	Doncaster	108%	Stevenage	110%
Hammersmith & Fulham	90%	Maidstone	108%	Test Valley	110%
Central Bedfordshire	91%	Wigan	108%	Fylde	110%
Uttlesford	91%	Sutton	108%	E. Hampshire	110%
Suffolk Coastal	94%	Harrogate	108%	Harborough	110%
E. Riding of Yorkshire	104%	Sunderland	108%	Exeter	110%
Manchester	104%	Forest of Dean	108%	Burnley	110%
Wiltshire	104%	Hillingdon	108%	Charnwood	110%
Kirklees	104%	New Forest	108%	Hertsmere	111%
St. Helens	105%	South Holland	108%	Solihull	111%
Cornwall	105%	Pendle	108%	Wokingham	111%
Birmingham	105%	Waltham Forest	108%	Bracknell Forest	111%
Wales	105%	Erewash	108%	Staffordshire Moorlands	111%
Croydon	105%	Preston	108%	North Dorset	111%
Stockport	105%	Eastleigh	108%	Cheshire E.	112%
Calderdale	105%	Northumberland	108%	Luton	112%
County Durham	106%	Horsham	109%	E. Devon	112%
Salford	106%	Crawley	109%	Carlisle	112%
E. Lindsey	106%	N.W. Leicestershire	109%	Gosport	112%
Poole	106%	Merton	109%	Chelmsford	112%
Cheshire W. & Chester	106%	Stroud	109%	Hinckley & Bosworth	112%
Telford & Wrekin	106%	Dacorum	109%	Isle of Wight	112%
Havering	106%	Plymouth	109%	West Devon	113%
Shropshire	106%	Teignbridge	109%	S. Cambridgeshire	113%
Wyre	107%	Rugby	109%	Reading	113%
Peterborough	107%	Cheltenham	109%	Cherwell	114%
Havant	107%	Southampton	109%	S. Oxfordshire	114%
Lambeth	107%	Eastbourne	109%	Huntingdonshire	114%
Newark & Sherwood	107%	North Norfolk	109%	E. Hertfordshire	114%
Mendip	107%	Daventry	109%	Gedling	114%
West Oxfordshire	107%	Milton Keynes	110%	Selby	115%
Rushcliffe	107%	Tandridge	110%	Braintree	115%
Northampton	107%	Halton	110%	Cannock Chase	116%
Worthing	107%	Hart	110%	South Staffordshire	116%
Rother	107%	Newham	110%	Darlington	116%
Middlesbrough	107%	Broxbourne	110%	Brent	117%
Epping Forest	107%	Ashfield	110%	South Bucks	117%
Wirral	107%	Worcester	110%	Watford	119%
Medway	108%	Warrington	110%	Cambridge	119%
Windsor & Maidenhead	108%	N.E. Lincolnshire	110%	St Edmundsbury	119%
Stoke-on-Trent	108%	Ashford	110%	Bromsgrove	121%

Footnote: This list excludes all local authorities where the difference could have arisen due to chance, i.e. is within two standard deviations of the 2011 number of deaths, as calculated from Poisson statistics.

If we examine the trend for the East of England there is spread across the whole of the region between February to May of 2012 such that between May and December deaths are constantly

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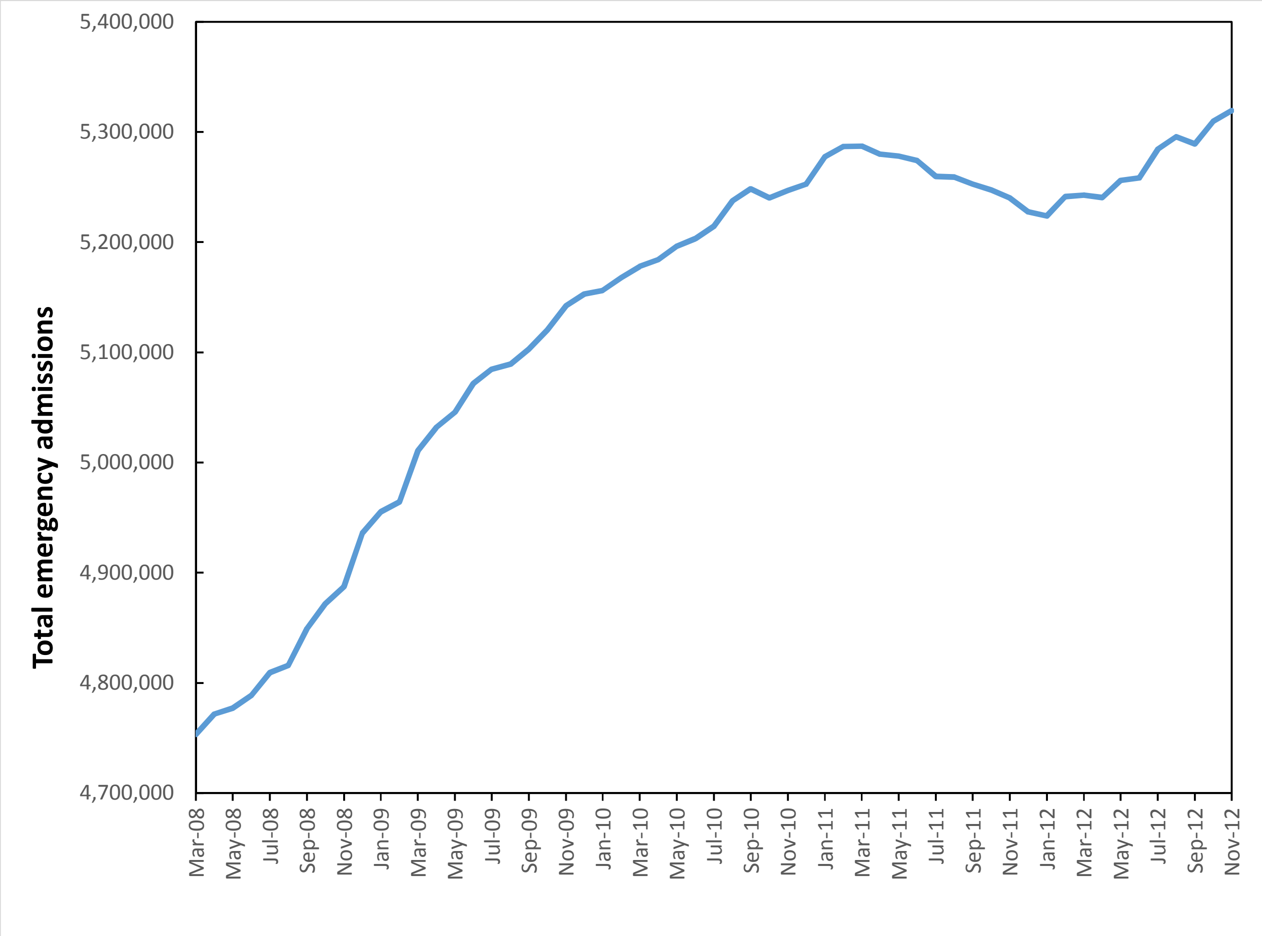
higher than 2011 and the slope of the line is roughly constant. East of England suffers a higher degree of fatalities than the North East by virtue that it is higher up the Y-axis. Since deaths are the tip of a much larger morbidity pyramid then we can assume that total health care costs will be disproportionately higher in the East of England compared to the North East. The author's previous estimate using PCT programme budgeting expenditure was that each outbreak adds around £6billion of additional costs for England and that this is subject to regional and local differences (Jones 2012a). This would confirm the assertion that the capitation formula, which distributes funds at a local level, is fundamentally flawed in that it ignores the potential costs of non-person based factors such as the local environment, i.e. weather, air quality and infectious outbreaks (Jones 2011a, 2013a).

Figure 2: Emergency admissions in England



Footnote: Data is for England and is from http://www.hscic.gov.uk/searchcatalogue?productid=11281&q=title%3a%22hospital+episode+statistics%22&sort=Relevance&size=10&page=1#top. The overall shape of this trend is the result of infectious spread subsequent to the 2007 outbreak followed by a decline in admissions as the most sensitive members of the population eventually succumb and die. This decline continues until the point that the infectious outbreak enters England.

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Gender

Previous outbreaks have been observed to create higher female medical admissions (Jones 2013b). During 2011 female deaths accounted for 51.6% of total deaths but since the step-up in deaths in mid-February of 2012 this has shifted to 61% of the excess deaths (data not shown). This gender specificity also appears to concur with the observation that each outbreak is accompanied by a small shift to higher male births (2013c) which then dissipates with time.

Granularity

Granularity or spatial clustering in infectious outbreaks is a well-recognized phenomena (Ruiz-Moreno et al 2010). The extreme granularity in the infectious spread, which has been characterized for the 2007 outbreak (Jones 2011a, 2012e), is further explored in Table 1 where the relative deaths for those aged 65+ in 2012 against 2011 are compared at Local Authority level. Note that East Cambridgeshire (East of England) has 14% *fewer* deaths although Cambridge and St Edmundsbury are badly affected with +19% more deaths, through to Bromsgrove (Midlands) with 21% more deaths. The actual proportion of deaths will depend on the timing of the outbreak, i.e. more deaths across the whole of 2012 for an earlier outbreak, and the extent of penetration into the elderly population, i.e. locations with higher proportions of females, the elderly or nursing homes. If mortality is an indicator of additional morbidity the CCGs servicing Bromsgrove and similar should be experiencing unanticipated financial difficulties. This granularity will also have a profound influence on attempts to measure hospital mortality rates (Jones 2012c).

Emergency Admissions

During previous outbreaks it has been observed that emergency medical admissions increase in parallel with the increase in deaths (Jones 2013b). This crucial linkage is illustrated in Figure 2 where a running 12 month total of emergency admissions since 2008 demonstrates a change in the trajectory at the same point that deaths increase in Figure 1. Indeed in the absence of the increase in deaths emergency admissions, in particular medical admissions, would be expected to continue to decline. It is anticipated that such a decline would continue until the trend intersected that which would arise from simple demographic-based growth. This decline has been previously documented (Jones 2010) and was initially proposed to be due to some form of collective switch to a dormant infection. On consideration, the downward trend probably arises from the eventual death of susceptible members of the population which then leaves a 'healthier' than average residual population.

Cytomegalovirus

Based on the author's extensive background research there is no natural phenomena capable of causing such an extended period of deaths other than a persistent infectious outbreak. The ubiquitous herpes virus, cytomegalovirus (CMV), has been proposed to be the infectious agent based on the range of conditions specifically affected and the pattern of admission prior to decease (Jones 2012f, 2013b). Indeed just as every infectious disease with acquired immunity has a typical pattern of incidence over time (Grassly et al 2005) so CMV should be no exception (Jones 2013b). This will require confirmation.

Present Context

The outcome of this infectious spread has been numerous press reports of Emergency department overcrowding, ambulance delays, overflowing inpatient beds and inability of Social Services to cope (Health Service Journal 2013). Confirmation for Bromsgrove which had the highest increase in deaths during 2012 is a near crisis position in the nearby hospitals (Bromsgrove Standard 2013). However while the position nationally seems clear researchers may need some guidance as they attempt to link cause and effect.

Firstly, deaths are merely the tip of the wider effects against morbidity and hence unscheduled attendances and admissions. However, from a statistical perspective the smaller number of deaths at local authority level is subject to high statistical scatter (Jones 2012c) and clear trends may be difficult to detect. It is for this reason that Figure 1 uses much larger regional totals to detect the overall picture. The timing of onset at smaller local levels can be approximated using events with larger numbers such as emergency department attendances, emergency admissions or even GP referrals (Jones 2012a,e). Interpreting results obtained from acute hospitals is more problematic since attendances/admissions at an acute site are the concentrated composite of any person with a serious infection from the whole hospital catchment area. If the infection is difficult to transmit the hospital catchment will consist of locations and persons ranging from isolated infections through to mini-epidemics. Overlaid on this will be the balance between capacity in primary care, acute care and social services which is unique to each location and this will lead to different aspects of the unscheduled care pathway coming to greater prominence in some areas than others. Hence cause and effect is far easier to demonstrate using larger regional totals, however, the exact balance between local deaths and unscheduled events will create a patchwork effect behind the composite regional picture.

Implications

In the past, the consequences of these outbreaks were treated within a blame culture, i.e. local management is incompetent and has failed to manage demand – no other explanation is accepted. How did such a view gain a foothold? Subsequent to the 1993 and 1996 outbreaks, one of the rare occasions with only a short interval between outbreaks, everyone panicked and thought health care demand was escalating at an unprecedented rate. Numerous groups conducted research and concluded that the processes of health care were broken and needed fixing (Jones 2013b). The problem is that such a statement, was and will always be, partly true. Western health policy is now predicated on this assumption and only heretics would dare to question this fundamental truth. What everyone failed to notice was that emergency medical

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admissions only ever increased at the points that deaths increased and this explains why the ratio of hospital bed days per total deaths remains roughly constant over long periods of time (Jones 2011b,c). It could even be postulated that if the Department of Health had recognized these anomalies as an infectious outbreak then the market reforms implemented by Andrew Lansley may have been deflected for a more measured view of the factors required for a successful health service, i.e. higher levels of integration rather than supposed free market 'efficiency'. It would appear that a period of intensive research is required to confirm if the deaths are due to an infectious source or some other unexplained phenomena, although the link with increased emergency admissions remains undisputed. This will then inform more weighty issues surrounding the funding formula, pricing of HRGs, risk sharing between CCGs and the direction of health care policy.

The author has estimated that the last two outbreaks each added £6billion of incremental costs into the NHS, i.e. the increased deaths is merely the tip of the cost pyramid. Even the most ardent free market exponents would draw the line at claiming that competition and other market-based measures could remedy the fundamental consequences of an unacknowledged infectious outbreak.

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