

Volatility in emergency admissions per death

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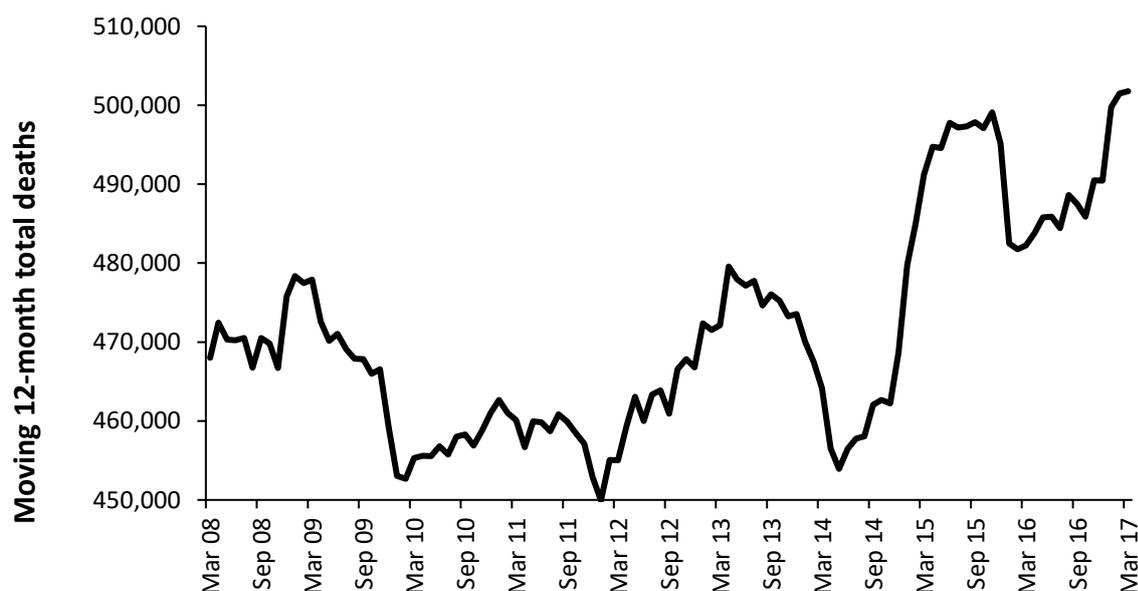
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Deaths and medical demand

For the past 25 years I have been pondering the weighty issue of how to forecast health care demand. Demographic forecasting is a complete failure when attempting to forecast anything of a medical nature. Yes, demography does work for a range of surgical conditions involving 'wear and tear' and injury, however, all surgical specialties together only account for 28% of occupied acute overnight beds, steadily declining from 33% in the early 1990's, and only 41% of all admissions (including day case), declining from 50% in the early 1990's. Nearly 60% of adult admissions (including elective) occur above the age of 60, and 89% of all deaths occur above this age.

Figure 1: Moving 12-month total deaths (all-cause mortality) in England



Footnote: Monthly data on deaths is from the Office for National Statistics, <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/monthlyfiguresondeathsregisteredbyareaofusualresidence>

It is becoming increasingly clear that the approach of end-of-life, especially the last year of life (Kalbarczyk-Steclik & Nicinska 2015, Singer et al 2015), accounts for the majority of a person's lifetime acute utilization of admissions and especially of a hospital bed, especially since length of stay increases with age. This is nothing new and has been known and repeatedly reiterated for many years (Winkel et al 1990, Hanlon et al 1998, Mc Grail et al 2000, Payne et al 2007).

So why is the average NHS manager totally ignorant of this important fact? The suspicion is that the Department of Health and other bodies have been so obsessed with closing acute beds that they have focussed only on those methods which confirm policy (Beeknoo and Jones 2017a,b).

Unprecedented changes in deaths

In recent years, deaths have been showing unprecedented changes and these are demonstrated in Figure 1. Key points are that deaths are not supposed to be showing the wild gyrations seen in Fig. 1, and that since 2012 deaths are supposed to be closer to 450,00 per annum than 500,000. Government agencies seem reluctant to discuss this seemingly inexplicable large gap (Jones 2017d).

Figure 2: Ratio of monthly emergency admissions per death in England, and of the running (moving) 12-month average emergency admissions per death



Footnote: Admissions per death prior to 2013 have been adjusted for growth in zero day stay emergency admissions using a second order polynomial. Hospital Episode Statistics (HES) is from NHS Digital <http://content.digital.nhs.uk/searchcatalogue?q=title%3A%22Provisional+Monthly+Hospital+Episode+Statistics%22&area=&size=10&sort=Relevance> while monthly deaths in England are from the Office of National Statistics <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/monthlyfiguresondeathsregisteredbyareaofusualresidence>

Emergency admissions per death

To illustrate that the approach of end-of-life is so important in defining acute demand, Figure 2 shows the ratio of emergency admissions per death as a moving 12-month average (as in Figure 1). Recall that each year only 5% of the population (the sensitive proportion of the population) is admitted as an emergency admission, and that over half of these are same day stay. Clearly, despite the wild gyrations shown in Fig. 1 the ratio of emergency admissions per death remains remarkably constant at around 11.8 admissions per death. To put this in plain English, deaths are not only a good measure of end-of-life but they are a seemingly excellent measure of the 'sensitive proportion of the population' who are at risk of emergency admission.

January represents the usual peak in deaths but a minimum in the ratio of admissions per death, simply because so many die and can no longer be admitted. In 2016 some 99.3% of all deaths were in adults, hence there is little need to remove childhood deaths from the denominator.

The ratio of emergency admissions per death includes paediatric admissions and 11% of admissions can be removed from the numerator, however this only reduces the ratio by around 1 emergency admission per death.

To repeat, there has been considerable growth in both deaths and admissions since 2010, however, as can be seen in Figure 2 the ratio has remained roughly steady. However, despite this the moving 12-month average which shows extended periods of low/high admissions per death. Specifically, that the ratio of emergency admissions per death switches to high when deaths appear to switch to 'low'. Recall that in a moving 12-month average or total it is the change in slope that defines the point of high/low switching. The horrendous winter of 2016/17 fell in a period of high emergency admissions per death, i.e. high deaths multiplied by high admissions per death led to a bed crisis. The period of high admissions per death back in 2014 did not precipitate a bed crisis simply because there were 2,500 more acute beds at that time (NHS England 2017), and fewer delayed discharges than those in recent times due to reductions in local authority social care funding.

The two periods of higher admissions per death in 2014 and 2016 are generally 5.1% to 6.5% higher than the baseline. Seemingly similar events occurring prior to 2014, with the 2010 event showing a 6.0% increase, i.e. there is a degree of event specificity (Jones 2015, 2016, 2017a-e).

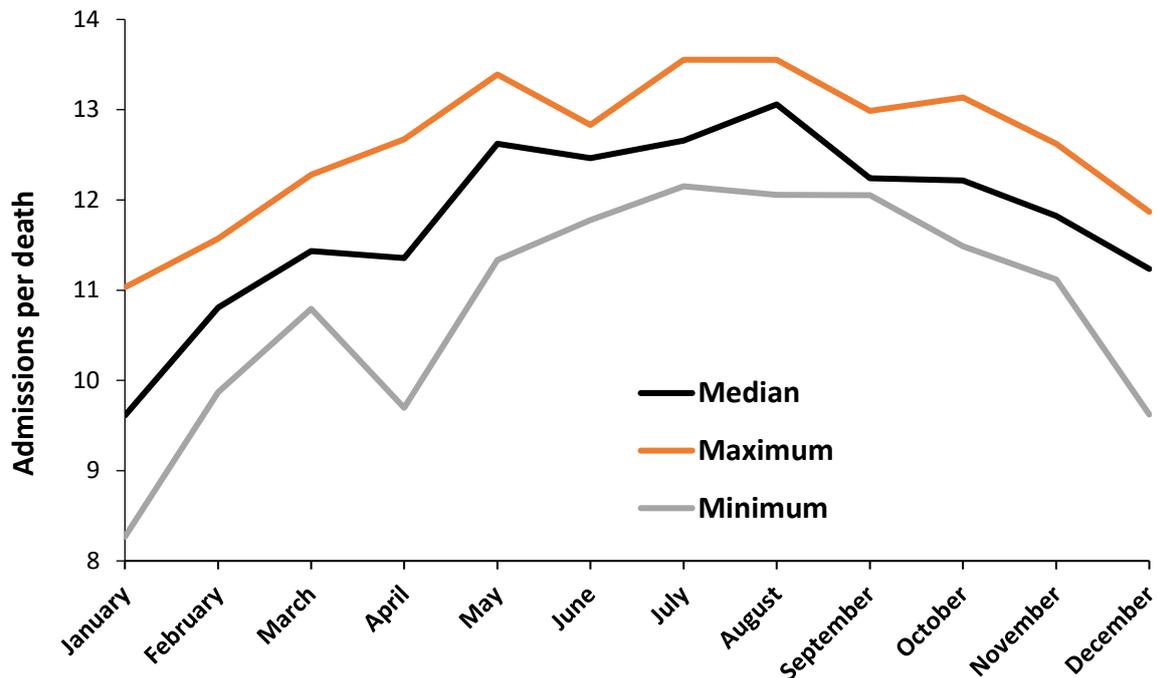
Seasonal variation

Almost all health care shows seasonal variation. Figure 3 takes the monthly data used to construct Fig. 2, and compares the range in the monthly average of emergency admissions per death.

Emergency admissions per death are lowest in winter and highest in summer. The range between maximum and minimum relative to the median over a 10-year period varies between 29% in January and 26% in April through to a more manageable 8% to 11% between June and September. This wide range in emergency admissions per death indicates fundamental shifts in case-mix and complexity due to temperature, other metrological parameters and the prevailing mix of infectious pathogens.

Emergency admissions per death are lowest in December and January simply because these are the months in which most people die, and can therefore no longer be admitted or re-admitted. During the summer months, the external environment is more benign and hence admissions per death are higher.

Figure 3: Range in admissions per death over a 10-year period, after adjusting earlier years for growth



I am not suggesting that all health care demand be forecast using deaths, paediatrics and obstetrics being obvious exceptions. However, future models are likely to be a mix of demographics and deaths with the balance between the two depending on the specialty. Medical demand will clearly have a very small demographic component.

It is at this point that the Sustainability and Transformation Plans (STPs) have totally ignored reality. All STPs will have dutifully applied demographic forecasts giving totally unrealistic pictures of the huge variation and growth in future admissions, especially in view of the fact that deaths are set to rise for the next 20 years as the World War II baby boomers come to the end of their life. STP forecasts signalling huge reductions in acute beds are nothing more than an example of gross ignorance of the fundamental mechanisms behind admissions and bed demand.

Clearly something of profound public health importance is occurring, with no one seemingly allowed to state the obvious. This is a sad indictment of the strangle hold which policy-based evidence has had on the NHS.

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Provenance

Dr Rodney Jones has over 25-years' experience in health care demand forecasting and capacity planning. He has published over 200 papers in this area including bed planning and the financial risk in health care commissioning.