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Environmental volatility and health care costs

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Since April of 2012 a series of articles in BJHCM has been exploring the 'real world' nature of the volatility in health care attendances, admissions and costs (Jones 2012a-k, 2013a-c). It would appear that no matter which aspect of health you wish to explore from occupied beds to cancer or deaths the same answer comes back – healthcare exhibits intrinsically high volatility. This fundamental truth was ignored by the Department of Health (DH) in the management of the former Primary Care Trusts (PCTs) and is being ignored in the management of the newly formed Clinical Commissioning Groups (CCGs). The repeated message of this series has been that ignorance is not bliss and that an understanding of volatility and its implications to financial management needs to be a key component of successful policy implementation.

It has been claimed that the wider environment (weather, air quality, infectious outbreaks) plays a major role in the expressed volatility. The cynics may well say that such a claim cannot possibly be true. In this respect, the key words 'temperature and hospital admissions' gives 83,000 hits in Google Scholar which indicates that temperature may well be a fundamental environmental variable. An overview of these studies suggests particular effects upon a wide range of dermatological, gastrointestinal, cardiovascular (including blood viscosity) and respiratory conditions affecting not only hospital admissions but also mortality, with special effects against the elderly and interaction with a range of air quality indicators. If temperature is only one of a number of variables (humidity, dew point, barometric pressure, etc) capable of influencing health with possible interactions between the parameters then it should come as no surprise that health care costs exhibit a significant degree of environmental sensitivity which will depend on location.

To illustrate the potential role of temperature Figure 1 shows the trend in average temperature during January from 1772 to 2013 while Figure 2 shows the average day-to-day difference in temperature, i.e. the daily average temperature on the 1st, 2nd and 3rd of January in 1772 was 3.2, 2.0, 2.7 respectively with absolute differences of 1.2 and 0.7, etc. The first thing we learn from Figure 1 is that temperature, even at the monthly average

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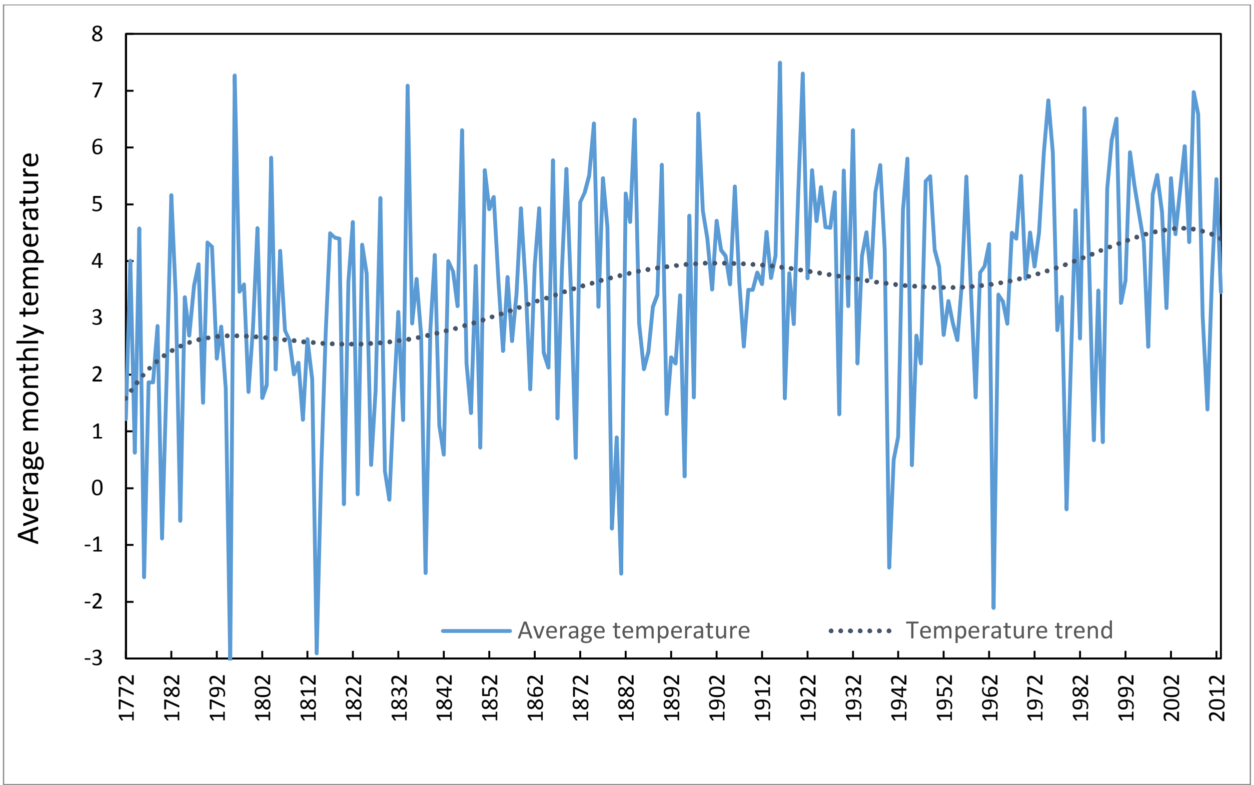
level, is volatile and that the trend in average monthly temperature is following long term cycles of roughly 100 year's between maxima. There are clusters of low years in the mid- to late-1870's and high years in the early- to mid-1920's, while the highest average for January was 7.5°C in 1916. The highest single day average was 11.6°C on 23rd January 1834 while the highest average for 7 consecutive days was 9.4°C also in 1834.

Figure 1: Time series of temperature in January (1772 to 2013)



Footnote: Data courtesy of the UK Met Office and is from the Hadley Centre Central England average daily temperature time series. Temperature is in °C.

From Figure 2 we see that the *average* day-to-day difference in temperature for January ranges from 1 to 3°C, although in recent years the volatility has been lower than historic levels. While the average shift from one day to the next appears to be relatively moderate Figure 2 also shows that the maximum shift from one day to the next can be very high and the maximum shift ranges from 2- to 5-times the average daily shift for the month. The highest temperature shift of +10.7°C occurred in 1836 between -2.5°C on the 3rd to 8.2°C on the 4th January. This variability is just for one month of the year, is only for differences in *average* daily temperatures, i.e. difference between daily minimum and maximum temperatures would add additional complexity, and covers just one weather variable. It should therefore come as no surprise that hidden long-term patterns in both bed occupancy and the volatility associated with average occupancy have been noted (Jones 2011, 2012a,c, 2013a) and also in trauma and emergency department attendances (Rusticucci et al 2002, Stomp et al 2009).

It should also be noted that the author's work on financial risk in health care has only focussed *average* year-to-year volatility and as per Figure 2 this implies that the maximum

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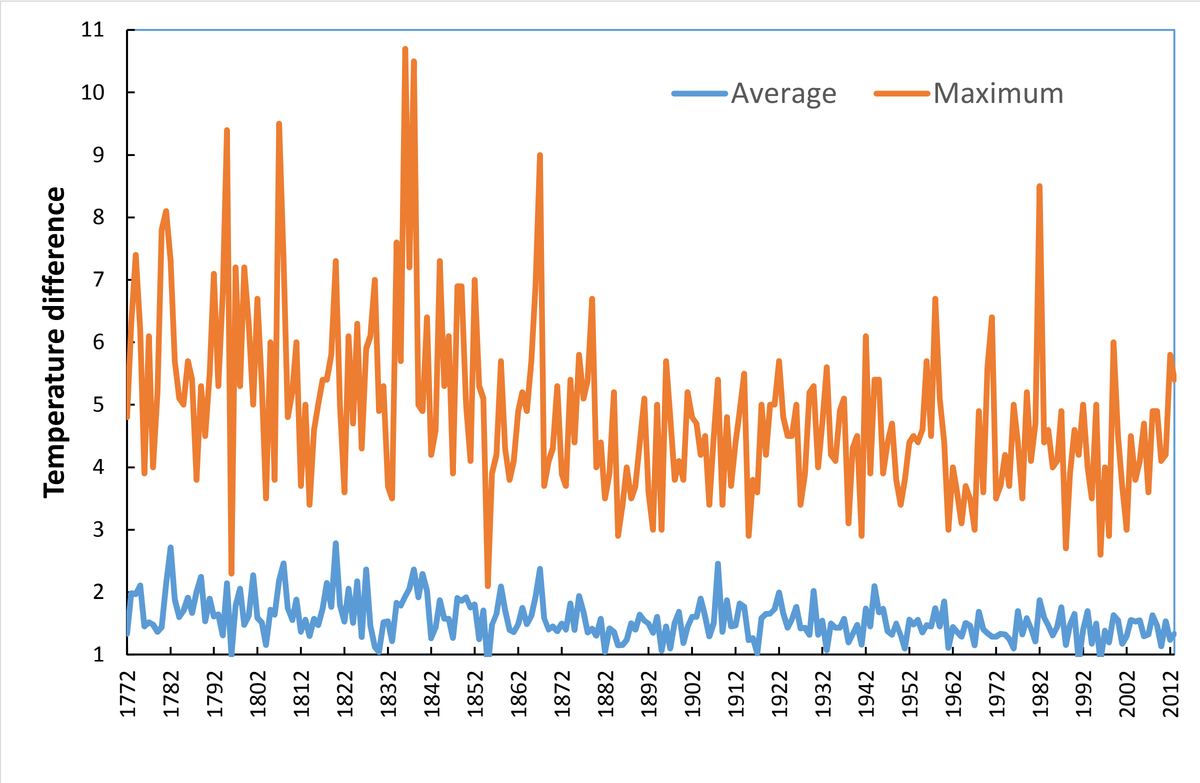
volatility will always be further away from the average than the minimum, i.e. financial risk involves highly skewed risk distributions.

Figure 2: Daily difference in temperature



While it would be lovely to believe that a spreadsheet and a set of demographic forecasts are all that is necessary for financial forecasting and management in the NHS it is patently obvious that this is not the case. It is the author's observation that PCT's had little leverage with the DH and it is contingent upon GP's and their professional representatives to exert greater pressure on politicians and the DH (including the NHS Commissioning Board) to raise awareness to the issues, namely, that the funding formula is flawed due to the omission of environmental factors (Jones 2012a, 2013a), that the extent of risk pooling required for financial stability is far greater than first anticipated (Jones 2012h) and that long term cycles imply the retention of surpluses for adverse years (Jones 2012a,c, 2013a). The 'It's your problem' approach is neither helpful nor indicative of a real desire for CCG's to succeed. Indeed just as the private sector is unable to control the weather so they too are subject to the same constraints. Insurance companies avoid this issue by increasing premiums to maintain a profit margin, which somewhat defeats the whole aim of the current exercise.

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