An edited version of this article has been published as: Jones R (2013) Population density and health care costs. ***British Journal of Healthcare Management*** 19(1): 44-45. Please use this to cite.

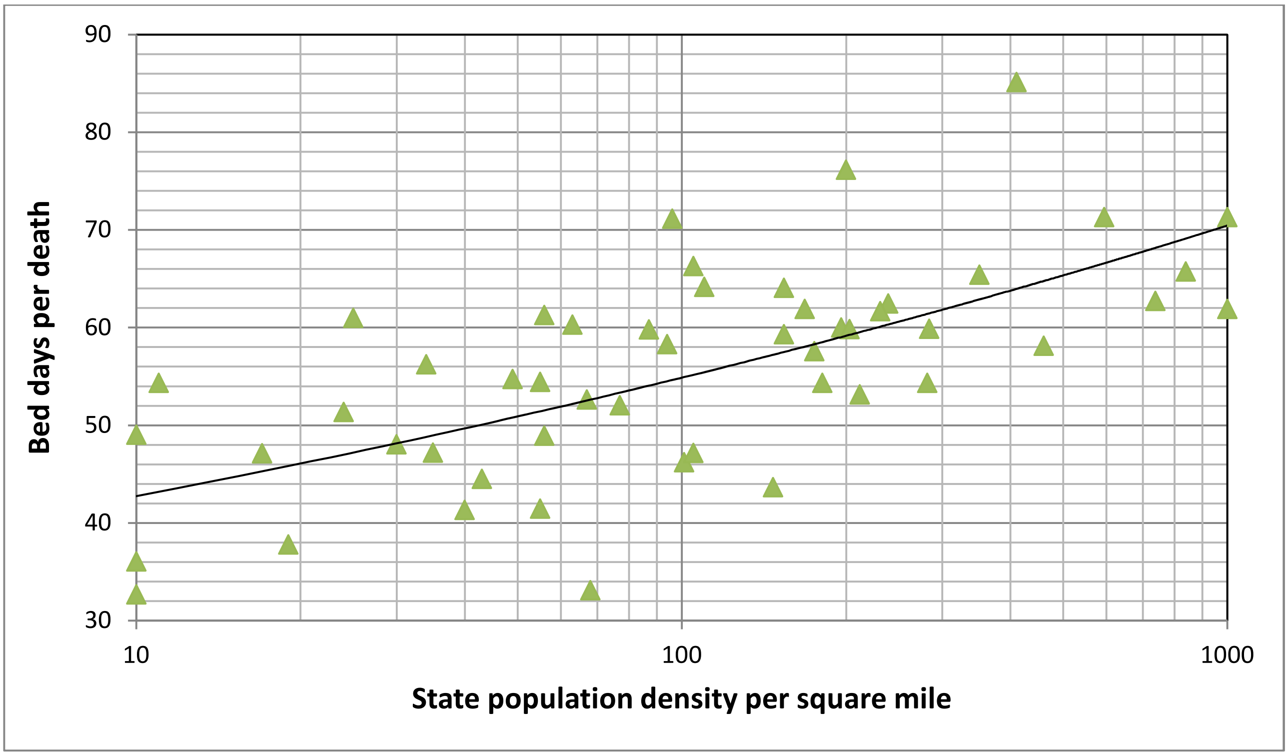
Population density and health care costs

Dr Rod Jones (ACMA, CGMA)
Statistical Advisor, Healthcare Analysis & Forecasting
hcaf_rod@yahoo.co.uk

For further articles in this series please go to: www.hcaf.biz
The edited version is available at www.bjhcm.co.uk or via Athens.

A recent series of articles in ***BJHCM*** has investigated the possibility that recurring outbreaks of a persistent infectious immune impairment may be having a profound effect upon medical admissions, GP referral, A&E attendance, ambulance journeys, incidence of particular cancers and deaths (Jones 2001d,2012a-i).

Figure 1: Bed utilisation and population density in the USA



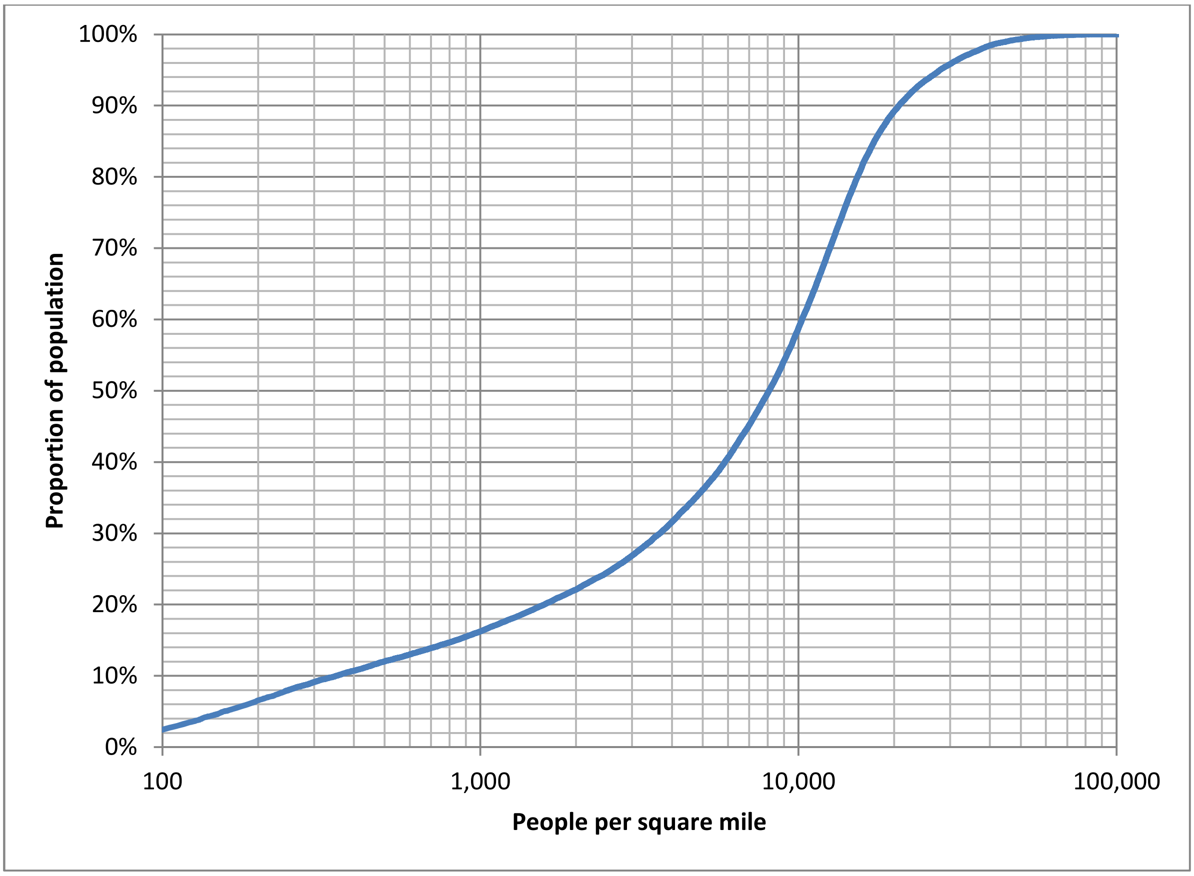
Footnote: Data on occupied beds by state is from http://www.ahd.com/state_statistics.html while deaths are from http://www.cdc.gov/nchs/data/nvsr/nvsr59/nvsr59_04.pdf Note that relative wealth is a major contributing factor to the scatter around the trend line and wealthy (higher levels of private insurance) states tend to lie above the trend line. Contrary to popular belief, bed days per death in the US are approximately the same as the UK once adjustment is made for population density and gradients in wealth across the USA (author's calculations).

An edited version of this article has been published as: Jones R (2013) Population density and health care costs. ***British Journal of Healthcare Management*** 19(1): 44-45. Please use this to cite.

An accompanying article in this edition investigates potential implications to the funding formula, which assumes that all costs are largely person-related, i.e. sex, age, deprivation, personal disease history, etc. If infectious spread is involved in some £6 billion of costs associated with each outbreak of the proposed infection then factors relating to infectious spread may need to be incorporated into the funding formula. In this respect population density is an obvious factor which would be relevant.

In the USA there is a reasonable log-linear correlation between population density (at state level) and the utilisation of hospital beds (Figure 1), expressed as bed days per death, to reflect the important contribution of end of life to bed utilisation (Jones 2011b-e). This is consistent with the fact that population density and related household crowding are known to increase admissions for mental health, alcohol and drug abuse and respiratory conditions (Schweitzer & Su 1977, Morris & Munasinghe 1994, Sundquist & Frank 2004). High population density is usually associated with higher levels of noise and air pollution which are both related to increases in emergency admission (Tobias et al 2001, Sauerzopf et al 2009). Regarding the mental health aspects of population density it should be of no surprise that London (rightly) has a higher proportion of these beds than in other parts of England (author's calculations).

Figure 2: Population density in England



Footnote: Population density has been calculated using lower super output areas (LSOA) which contain around 1,500 head of population (see http://www.data4nr.net/resources/population/). Calculated density will include any 'green space' contained in the LSOA. For a wider discussion of the calculation of population density see Dorling & Atkins (1995).

An edited version of this article has been published as: Jones R (2013) Population density and health care costs. ***British Journal of Healthcare Management*** 19(1): 44-45. Please use this to cite.

In the 34 largest urban areas in the US the weighted population density per square mile ranges from 2,360 in Atlanta to 33,030 in New York and only five cities have a weighted density above 10,000 per square mile (http://austinzoning.typepad.com/austincontrarian/2008/03/weighted-densit.html). This implies that around 14% of the US population lives at a density above 10,000 compared to 40% in England (Figure 2). In this respect the raw average for London is slightly above 12,000 while the weighted average is around 22,000 per square mile. Four small areas with a density greater than 100,000 per square mile are all in London.

It should therefore come as no surprise that London appears to bear the financial and operational brunt of each outbreak (Jones 2011a, 2012a,i) and may partly explain why bed utilisation in London appears to be disproportionately high (Jones 2011c,e). The use of bed days per death as a measure of bed utilisation is not infallible and in London this measure is skewed by the high outward migration for those who have retired. The wealthy and healthy leave London for more desirable retirement locations leaving the elderly chronically sick behind. This acts to increase the number of occupied bed days while at the same time reduces the number of deaths which occur in London giving high apparent bed days per death (author's calculations). This is supported by a study of mortality and migration in the UK which showed that migration alone was sufficient to account for the observed differences in the standardised mortality rate at local and regional levels (Brimblecombe et al 1999).

Could it possibly be the case that the allegations that London is 'inefficient' and needs to radically cut bed numbers, etc in order to live within its means are simply an artefact of a flawed resource allocation formula in which two of the more important parameters are simply missing? Is this a back to the drawing board moment?

References

Brimblecombe N, Dorling D, Shaw M (1999) Mortality and migration in Britain, first results from British household panel survey. Social Science & Medicine 49: 981-988.

Dorling D, Atkins D (1995) Population density, change and concentration in Great Britain 1971, 1981 and 1991. Department of Geography, Newcastle University, Studies on Medical and Population Subjects No.58, London: HMSO http://www.dannydorling.org/wp-content/files/dannydorling_publication_id1449.pdf

Jones R (2011a) Infectious outbreaks and the capitation formula. BJHCM 17(1): 36-38.

Jones R (2011b) Does hospital bed demand depend more on death than demography? BJHCM 17(5): 190-197.

Jones R (2011c) Bed days per death: a new performance measure. BJHCM 17(5): 213

Jones R (2011d) Bed occupancy – the impact on hospital planning. BJHCM 17(7): 307-313

Jones R (2011e) Factors influencing demand for hospital beds in English Primary Care Organisations. BJHCM 17(8): 360-367.

Jones R (2012a) Volatile inpatient costs: implications to CCG financial stability. BJHCM 18(5): 251-258.

Jones R (2012b) Are there cycles in outpatient costs? BJHCM 18(5): 276-277.

Jones R (2012c) Financial risk in commissioning: cancer costs. BJHCM 18(6): 315-324.

Jones R (2012d) End of life and financial risk in GP commissioning. BJHCM 18(7): 374-381.

Jones R (2012e) Diagnoses, deaths and infectious outbreaks. BJHCM 18(10): 539-548.

Jones R (2012f) Increasing GP referrals: collective jump or infectious push? BJHCM 18(9): 487-495.

An edited version of this article has been published as: Jones R (2013) Population density and health care costs. ***British Journal of Healthcare Management*** 19(1): 44-45. Please use this to cite.

Jones R (2012g) Age-related changes in A&E attendance. BJHCM 18(9): 502-503.
Jones R (2012h) GP referral to dermatology: which conditions? BJHCM 18(11): 594-596.
Jones R (2012i) Could cytomegalovirus be causing widespread outbreaks of chronic poor health. Hypotheses in Clinical Medicine, Chapter 4; Eds M. Shoja et al. New York: Nova Science Publishers Inc.
Morris R, Munasinghe R (1994) Geographic variability in hospital admission rates for respiratory disease among elderly in the United States. Chest 106(4): 1172-1181.
Sauerzopf V, Jones A, Cross J (2009) Environmental factors and hospitalisation for chronic obstructive pulmonary disease in a rural county of England. J Epidemiol Community Health 63(4): 324-328.
Schweitzer L, Su W-H (1977) Population density and the rate of mental illness. Am J Public Health 67: 1165-1172.
Sundquist K, Frank G (2004) Urbanisation and hospital admission rates for alcohol and drug abuse: a follow-up study of 4.5 million women and men in Sweden. Addiction 99(10): 1298-1305.
Tobias A, Diaz J, Saez M, Alberdi J (2001) Use of Poisson regression and Box-Jenkins models to evaluate short-term effects of environmental noise levels on daily emergency admissions in Madrid, Spain. Eur J Epidemiol 17(8): 765-771.