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Age and volatility in health care costs

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A series of articles in BJHCM has been investigating the 'real world' volatility associated with health care costs in order to explain why commissioners find it so difficult to manage budgets over extended periods of time. The components of cost have been show to exhibit high spatio-temporal granularity, i.e. time and place are vitally important in understanding this volatility or instability in costs. Table 1 presents the results of an analysis of year-to-year volatility associated with various diagnoses assigned to inpatient admissions over a thirteen year period. The year-to-year volatility was calculated after adjustment for assumed linear growth (which would arise if demographic change was to apply) and was then averaged. The expected volatility which would arise from simple statistical randomness was then subtracted from the 'real world' figure. For example, the diagnosis 'Pain in throat and chest' is associated with 1,900 FCE for age 0-14, actual volatility is 4.9% less expected volatility of 2.3% ($\sqrt{1900}/1900$) giving the 2.6 percentage point difference shown in Table 1. This allows a degree of adjustment for the variety of admission volumes associated with the different groups in Table 1.

For each diagnosis the category with the highest percentage value is the one which is most sensitive to changes in the external environment. Hence disorders of urinary tract (mainly urinary tract infections), pneumonia, syncope & collapse and fracture of femur show the greatest year-to-year volatility in admissions for 60-74 year olds. As expected children show high volatility for particular conditions. The effect of age, year and location is a well recognised source of volatility in respiratory illnesses (Fleming et al 2005) as is the weather in fractures in the elderly (Mirchandani et al 2005) and this is reflected in Table 1. Hence as a general comment it should be readily apparent that the differences in age and gender alone which are evident in each local area are sufficient to establish a spectrum of environment-dependant volatility in costs. Ethnicity and other factors are also likely to add further increments in volatility experienced in different locations. The capitation formula allocates funding for the 'average' and does not encompass all the necessary explanatory variables to describe volatility around this average which will arise from local fluctuation in environmental parameters, i.e. does not explain why it may be more difficult to deliver a balanced budget in one location compared to another.

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The diagnosis for unknown and unspecified causes of morbidity (i.e. you are sick but we don't exactly know what is wrong with you) exhibits the highest level of environment-induced volatility. This non-specific diagnosis has been noted to be a particular feature of a cycle in emergency admissions which appear to be associated with periodic outbreaks of a new type of infectious immune impairment (Jones 2012). For the elderly (age 65+) some 22% of emergency admissions are given an ill-defined (ICD R code) diagnosis. While these admissions are generally half the length of stay of patients with a more specific diagnosis the patients are just as likely to experience re-admission indicating some form of genuine ongoing illness (Walsh 2011).

Table 1: Relative volatility (actual – expected, percentage point difference) for high volume inpatient diagnoses.

ICD Description (3 digit)	Male	Female	0-14	15-59	60-74	75+	All
All diagnoses	1.3%	1.4%	1.4%	1.3%	2.0%	**5.0%**	1.4%
Pain in throat and chest	2.2%	2.5%	2.6%	3.0%	2.3%	**8.5%**	2.3%
Abdominal and pelvic pain	3.0%	3.0%	2.1%	3.3%	2.7%	**3.6%**	3.0%
Pneumonia organism unspecified	5.3%	6.5%	7.0%	5.7%	**21.7%**	11.2%	5.9%
Other disorders of urinary system	5.3%	4.2%	2.8%	3.7%	**28.4%**	12.8%	4.6%
Other cataract	3.1%	3.3%	1.5%	2.0%	3.9%	**5.4%**	3.3%
Other chronic obstructive pulmonary disease	3.7%	4.9%	**15.4%**	4.4%	5.3%	5.3%	4.4%
Chronic ischaemic heart disease	1.5%	1.8%	**19.9%**	1.7%	2.1%	8.4%	1.6%
Other noninfective gastroenteritis and colitis	4.1%	3.7%	5.4%	3.4%	5.6%	**9.3%**	3.9%
Dorsalgia	2.9%	3.9%	4.3%	3.2%	3.3%	**7.2%**	3.6%
Cholelithiasis	1.8%	1.2%	3.1%	1.1%	1.2%	**5.7%**	1.2%
Atrial fibrillation and flutter	1.1%	0.9%	3.7%	1.4%	2.0%	**5.3%**	0.9%
Unspecified acute lower respiratory infection	5.4%	6.4%	**8.3%**	3.2%	7.0%	7.9%	6.1%
Syncope and collapse	3.0%	3.2%	4.1%	4.6%	**11.1%**	6.8%	3.2%
Heart failure	1.9%	2.8%	**6.1%**	2.1%	4.3%	2.6%	2.5%
Senile cataract	5.4%	6.3%	-0.2%	**6.7%**	5.8%	**6.7%**	6.1%
Cerebral infarction	3.2%	3.9%	12.4%	4.3%	**13.5%**	10.9%	3.7%
Dental caries	3.9%	3.9%	2.1%	**9.1%**	7.9%	8.3%	3.9%
Gonarthrosis [arthrosis of knee]	3.0%	3.0%	**24.7%**	2.7%	3.5%	5.7%	3.1%
Follow-up after treatment for neoplasm	1.8%	1.6%	**17.3%**	1.5%	2.3%	4.7%	1.9%
Fracture of femur	2.3%	1.9%	2.1%	1.5%	**16.7%**	3.3%	2.0%
Gastritis and duodenitis	4.1%	3.2%	**5.0%**	4.4%	3.7%	2.7%	3.6%
Diverticular disease of intestine	3.6%	2.6%	**58.5%**	3.0%	3.9%	5.5%	3.0%
Other diseases of digestive system	2.8%	3.8%	5.0%	4.2%	**5.6%**	5.3%	3.3%
Other malignant neoplasms of skin	5.7%	4.8%	**15.2%**	2.9%	7.1%	8.1%	5.4%
Angina pectoris	1.4%	1.6%	**27.9%**	1.5%	2.9%	2.5%	1.6%
Unknown/unspecified causes of morbidity	19.0%	20.4%	**34.9%**	16.4%	21.0%	18.6%	19.5%
Malignant neoplasm of bronchus and lung	2.8%	3.1%	**116.3%**	3.0%	2.9%	3.5%	2.8%
Other diseases of anus and rectum	4.8%	4.8%	3.2%	5.4%	5.5%	**6.0%**	4.9%

Footnote: Data for England was extracted from the Hospital Episodes Statistics website (http://www.hesonline.nhs.uk/Ease/servlet/ContentServer?siteID=1937&categoryID=203) and is for total finished consultant episodes including day case over the period 1998/99 to 2010/11. Data analysis including adjustment for growth is described in previous articles. Expected volatility for each category is assumed to be described by Poisson statistics and is therefore equal to $\sqrt{FCE}/FCE$. Diagnoses with the highest number of admissions are at the top of the table.

It would appear that the whole issue of the management of financial risk in health care has suffered from widespread ignorance regarding the real issues. Changing commissioners will not solve these problems and this whole area requires far more fundamental research if we are ever going to

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genuinely manage risk pools on behalf of commissioners, especially those where year-to-year volatility (and perhaps even growth) in costs is higher due to factors which are outside of their control.

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