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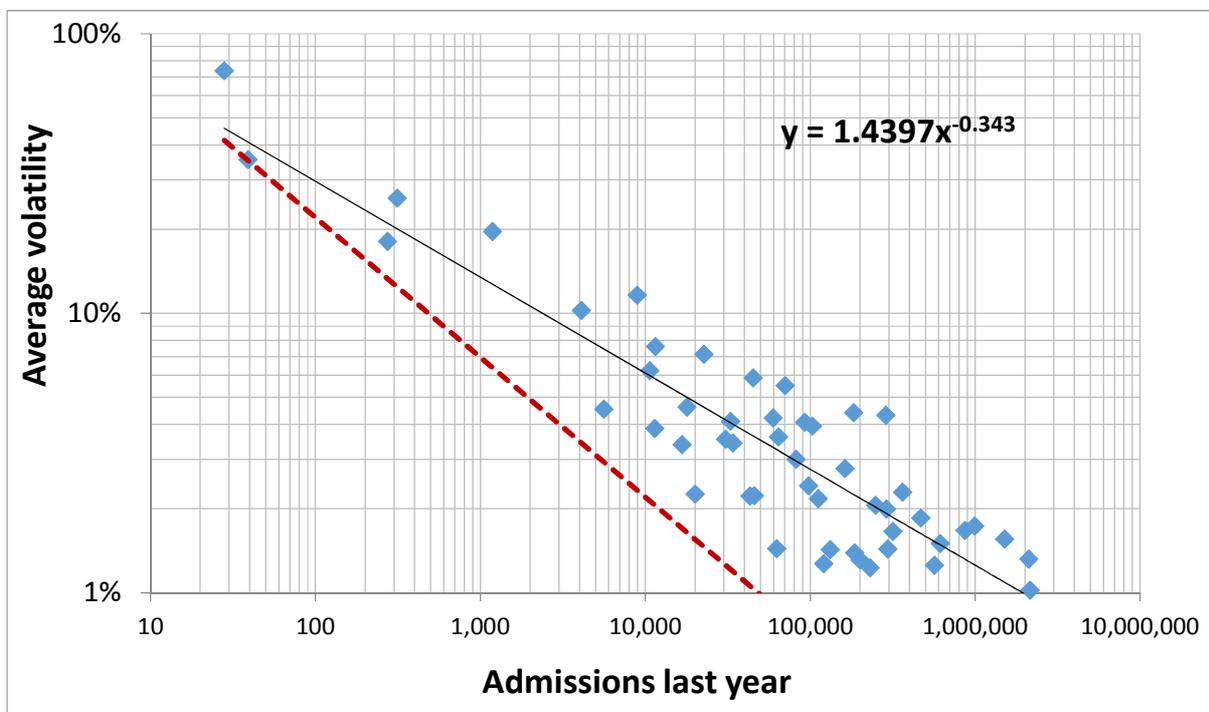
Financial Volatility in NHS Contracts

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

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Each year NHS commissioners calculate the expected activity for a wide range of acute and community events and place contracts with a variety of providers. All this assumes that commissioners actually have the tools to estimate the future. It would appear that no one at NHS England is prepared to point out the obvious, namely, that the inherent volatility in NHS activity is so high it precludes the possibility of any form of accurate contract. Over twenty articles in the 'Money Matters' series have investigated the components of this volatility which arise from the interaction between various medical conditions, age and the environment (weather and infectious outbreaks).

Figure 1: Average year-to-year volatility for age-specialty combinations



Hospital Episode Statistics (HES) (1998/99 to 2012/13) was obtained for England from the Health and Social Care Information Centre website. The dotted line represents 2.2 standard deviation worth of simple statistical-only volatility (Poisson).

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Figure 1 presents an analysis of the average year-to-year volatility in acute admissions for various specialty-age combinations calculated over a fifteen year period (1998/99 to 2012/13) for the whole of England. To simplify the analysis some high level specialty groups have been created covering medicine and surgery. The absolute difference between each year has been calculated and divided by the square root of the first year to convert the difference into a Poisson approximation to standard deviations worth of difference. The average of these has been calculated and turned back into a percentage difference using 2012/13 activity. This adjusts the time series for growth into present day activity.

Age has been included to reflect the fact that different parts of the country have different age distributions. Elective and non-elective has been included to give an overall picture and because in more deprived locations the balance shifts toward non-elective admission. Between 2002/03 and 2010/11 there was additional growth due to 'admissions' into assessment units and HRG tariff driven counting creep as outpatient procedures and tests were re-badged as a 'day case'. The slope of the trend between these years has been calculated, as has the slope either side of these years, and subtracted from the calculation of volatility. To avoid any over-estimation of volatility the highest year-to-year volatility (usually arising when a counting change has occurred), has been deleted from the calculation of the average.

Some 52 age-specialty combinations are shown in Fig. 1 and all roughly cluster around a power-law (or log-log) relationship which is described by the equation shown in Fig. 1. Note the rapidly escalating average volatility as the activity diminishes. This is driven by two components. Firstly simple statistical scatter around an average, shown in the dotted line, which represents 2.2 standard deviations worth of scatter (Poisson). In explanation, chance-based volatility can be estimated using Poisson statistics which describes the variation around the average for whole number 'arrival' events. The real world volatility is far higher due to the additional contribution from the environment (weather and infectious events). The reason the two lines converge as the activity gets smaller is that statistical- or chance-based volatility increases as size reduces. The closer a data point is to the dotted line that particular age-specialty combination is less sensitive to the external environment. Hence paediatric admissions for children aged 15 and over is the least sensitive to the environment simply due to the fact that immunity to multiple agents has been acquired by this age and for the next decade this group generally experiences optimum health. The exception for this age group will be trauma (weather related) and tonsils (the Head & Neck group) which lie further away from the dotted line.

While Fig. 1 is for inpatient activity, my own studies show that it is fairly representative of many different types of activity such as outpatients, diagnostics or community. The names on the labels may change but the general principles do not.

CCG commissioners are far smaller than the whole of England and Table 1 uses the equation in Fig. 1 to adjust all age-specialty combinations to the equivalent volatility for a contract with activity of 1,000 per annum. Given that the year-to-year volatility contains a wide spread in values the median (sometimes called the robust mean) has also been shown. As can be seen the minimum possible volatility is less than $\pm 10\%$ for orthopaedics, plastic surgery and children older than 14 in paediatrics. Hence if we had 1,000 admissions last year the average expected outcome for next year (in the absence of growth) will be 900 to 1,100. Since this is only a 14 year average, on 20% to 50% of occasions the actual activity will be outside these limits – and there is nothing you can do about this because it is driven by fluctuation in the external environment. Indeed you can reduce the expected activity for next year via various admission

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avoidance schemes but you cannot change the volatility, hence your anticipated 10% reduction in admissions can be diminished or amplified, leading to incorrect conclusions regarding the success or otherwise of particular schemes. Obviously use the equation in Fig. 1 to modify the figures in Table 1 to suit local activity. High volatility is seen in admissions to A&E (the specialty code used for assessment units, although medicine and surgery are sometimes also used, is generally covered by the short stay tariff), and several other age-specialty combinations.

Table 1: Year-to-year volatility adjusted to 1,000 admissions

Age	Group	Average	Median	Age	Group	Average	Median
>14	Paediatrics	6%	6%	60-74	Head & Neck	14%	13%
60-74	Mental Illness	6%	8%	15-59	Rehabilitation & Palliative	14%	14%
15-59	Plastic Surgery	7%	6%	15-59	Medicine	14%	12%
75+	Haematology	8%	7%	75+	Medicine	14%	14%
75+	Orthopaedic	8%	7%	<15	Orthopaedic	15%	10%
60-74	Haematology	8%	4%	15-59	Head & Neck	15%	13%
75+	Plastic Surgery	8%	7%	<15	Head & Neck	16%	14%
60-74	Plastic Surgery	8%	7%	<15	Learning Disability	17%	17%
15-59	Haematology	8%	7%	60-74	Surgical	17%	20%
75+	Mental Illness	9%	7%	60-74	Pain	17%	7%
60-74	Rehab/Palliative	9%	10%	<15	Mental Illness	17%	15%
60-74	Oncology	10%	7%	75+	Head & Neck	17%	16%
60-74	Medicine	10%	9%	15-59	Learning Disability	18%	20%
15-59	Mental Illness	11%	9%	15-59	Surgical	18%	13%
15-59	Orthopaedic	11%	8%	15-59	Obstetrics	19%	17%
<15	A&E	11%	9%	<15	Paediatrics	19%	20%
<15	Plastic Surgery	12%	11%	60-74	A&E	19%	19%
60-74	Learning Disability	12%	11%	15-59	Pain	19%	11%
75+	Oncology	12%	9%	<15	Pain	21%	15%
0-14	Rehab/Palliative	12%	12%	75+	Rehab/Palliative	21%	9%
60-74	Orthopaedic	12%	9%	75+	Learning Disability	22%	18%
<15	Haematology	12%	9%	<15	Medicine	22%	24%
75+	Surgical	14%	10%	<15	Obstetrics	24%	20%
75+	Pain	14%	11%	<15	Oncology	25%	30%
<15	Surgical	14%	10%	75+	A&E	26%	27%
15-59	Oncology	14%	15%	15-59	A&E	30%	24%
				All	All	16%	14%

National figures contain counting changes occurring over time in different hospitals. Use local data to obtain a better estimate for use in local contracts or use the lower of the average or the median as an estimate.

While the all age, all specialty figure in Table 1 appears high, the volatility rapidly diminishes with size to 8.2% at 10,000 admissions and 4.1% at 100,000 admissions. A theoretical 100 equally sized CCGs in England would give around 3.5% volatility. The message here is to try and monitor the contract at the highest possible level of aggregation, such as all inpatient, all outpatient, etc.

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In conclusion, the long-term volatility in all lines of an NHS contract will be unacceptably high and this is amplified by the fee-for-service HRG tariff. The 70% discount on emergency activity above 2009/10 out-turn is a crude method of risk sharing which at 70% probably transfers an undue burden of risk to the acute sector. However, do have the common sense to recognize the intrinsic importance of volatility and include estimates for volatility against each contract line to avoid unnecessary arguments about activity (and cost) variances which are beyond anyone's control. While every effort should be made to reduce future activity do not expect to immediately see a favorable reduction and it may take three or four years for the real trend to emerge.

For background references please go to <http://www.hcaf.biz/financialrisk.html>