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Emergency admissions and purchaser financial risk

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Key Words: Financial risk, GP commissioning, Clinical Commissioning Groups (CCG), NHS commissioning

Key Points

- Over 60% of emergency admissions show high levels of special cause variation due to the weather, wider environment and in some instances changes in hospital-based counting and coding
- The variation associated with total emergency admissions is typically 3-times higher than that arising from simple chance variation around the average
- By implication, the financial risk for a capitation funded purchaser associated with payment for emergency hospital admissions is very high
- This level of financial risk appears to be incompatible with some of the aims of PBC
- The volatility in emergency admissions questions the basis behind the HRG tariff which assumes that there is no link between cost and volume.

Abstract

Parts one and two of this series looked at the long term trends and cycles in emergency admissions while part three investigated the implications to acute bed planning. In this part the erratic changes in emergency admission rates due to external conditions such as weather and environment, are discussed in relation to the financial risk experienced by capitation-funded commissioning groups.

Introduction

The purchasing of healthcare on behalf of a defined population be it GP practice, Health Maintenance Organisation (HMO), Primary Care Trust (PCT), Practice Based Commissioning (PBC) group or larger health authority is subject to financial risk arising from chance variation and from the enhanced variability seen in those conditions which are sensitive to meteorological, infectious and other environmental factors (Jones 2004, 2008a,b,c). This is especially true for emergency or unscheduled admissions and this is illustrated by the recent (unexpected) rise in emergency admissions in the UK (Jones 2009a,b).

The UK government is seeking to control healthcare costs by moving the responsibility for healthcare commissioning to primary care general practitioners (GPs) who are organised into practice based commissioning (PBC) groups. These groups form a sub-set of the larger primary care trust (PCT) to which the capitation-funded monies for healthcare costs are distributed.

An earlier study, which looked at the effect of chance variation on the financial risk associated with PBC, demonstrated that the level of simple chance risk was very high and that groups of over 100,000 population were needed to bring this risk to an acceptable level (Jones 2008a, 2009a). It

was pointed out that inclusion of environmental factors would only make the already high risk even higher and that risk sharing arrangements between host PCTs were required (Jones 2008b,c).

A review of the factors leading to the patterns and trends in emergency admissions has suggested that there is higher intrinsic volatility in the number of emergency admissions seen in any single year due to the weather and other environmental factors than has previously been appreciated (Jones 2009b). Roles for long-term cycles and trigger events have also been identified which result in 'unexpected' increases in the number of emergency admissions (Jones 2009c). This paper continues the series by investigating the financial risk specific to various diagnoses. The implications to practice based commissioning (PBC) will then be discussed.

Methods

Emergency hospital admissions covering 30 quarters over the period 2001/02 to 2008/09 for the four million residents of a large strategic health authority in the south of England were extracted using the Doctor Foster 'Performance Manager (PM)' tool at the level of primary diagnosis. Some diagnoses were aggregated into diagnostic groups as defined by the Dr Foster software. Use of a large population is designed to minimise the complicating effects of counting and coding changes which may have occurred at individual hospitals (Jones 2007, 2008d). Admissions were aggregated into a running annual total which simulated 27 years of different quarterly combinations. The running total was adjusted for underlying growth and the resulting growth-adjusted time series was analysed for statistical variation around the average. Linear growth was assumed to apply since both demographic-driven growth and the observed increase in demand for many healthcare categories show near linear growth for periods of time (Jones 1996, Jones 2004, Jones 2009b). Assumed linear growth is also fairly representative of the process for setting annual PCT and PBC budgets for acute services. The measure of variation is based on Poisson statistics and takes the observed standard deviation in the number of admissions divided by the square root of the average number of admissions. By definition the standard deviation for a Poisson distribution is equal to the square root of the average, hence, this ratio measures the actual standard deviation divided by the expected standard deviation for an assumed Poisson distribution (Jones 1996, 2008b). This ratio is called the 'Index of Variation'.

Results

Figure 1 illustrates a common theme for the data and the method of analysis. As can be seen underlying linear growth of around 1.2% per annum has applied for pneumonia over the eight year period, however, the high sensitivity to winter and environmental conditions results in annual totals which can be highly variable especially in those years where admissions are high for two quarters in a row or where there is a single but very high quarterly peak.

The Index of Variation is essentially a measure of the observed variation relative to simple chance-based variation. An index value close to 1.0 represents the ideal case when there are no external or special cause forces leading to excess variation around the average. Hence an index of 3.0 indicates that the confidence intervals are three-times wider than would otherwise be expected. Variation associated with admissions to the medical group of specialties are known to be around three-times higher than chance variation while those to the surgical group are around two-times higher (Jones 1996, 2004).

Table 1 presents the results for the analysis of variation associated with emergency admission in maternity, mental health, cardiac and respiratory conditions. As can be seen the Index of Variation associated with many common conditions is intrinsically high. The high variation associated with

maternity would appear to be partly related to a mix of changes in the recording of the primary diagnosis, changes in medical practice, changes in conception rates and to the arrival of large numbers of immigrants from the accession eight countries into the UK from 2004 onward. Whatever the cause(s) the high index of variation implies high financial risk. Emergency admission for mental health (acute and mental health) also appears to be highly variable (and hence high risk) as do admissions to a wide variety of other common conditions (Table 2).

Table 3 summarises the distribution of risk associated with the various diagnoses. As can be seen over 38% of emergency admissions fall within a diagnosis which has an index of variation greater than 3.0 while 61% of emergency admissions have an index greater than 2.0 units. Given 30 data points and Poisson variation an apparent index of variation less than 1.4 can be considered to encompass all diagnoses where there are no major external or special cause forces influencing admissions and these only account for 19% of admissions. Figure 2 shows the position for total emergency admissions (obstetric + mental health + acute) and it is immediately apparent that total emergency admissions are very volatile showing complex growth patterns which suggest high financial risk, i.e. great difficulty in forecasting or controlling a budget.

Discussion

The governments' desire to implement PBC appears to be based on the assumption that GP's can make wide-scale statistically-significant reductions in admission rates. It would appear that the vast literature on variation in primary care has led to the assumption that a significant portion of such variation is largely controllable (Google Scholar 2009). The fallacy of this broad assumption is illustrated by a recent study which showed that intensive case management of frail elderly patients, using a US Evercare-based model, resulted in no statistically-significant effect on rates of emergency admission, bed days or mortality (Gravelle et al 2007). Indeed as methods for correcting for the confounding effects of population characteristics such as deprivation, distance from hospital, etc and hospital admission thresholds are refined it would appear that primary care is increasingly attributed with a smaller proportion of the source of the variation between different districts (Yeung et al 2004, 2005, Jones 2006a,b). A number of influential reviews on the causes for increasing emergency admissions have hinted that a reduction in GP/primary care thresholds may have been implicated (NZHTA 1998, Crossen-White et al 1997, NSW Health 2007). However it is of interest that the majority of the increase has been confined almost exclusively to the medical specialties and recent research shows that the increase occurs in bursts of increase every four to six years (Jones 2009c). It has been proposed that this behaviour has similarities with an infectious agent and as such the increase may have been misattributed to GP/primary care behaviour. Such observations concur with audits of emergency admissions where one study judged that only 6 out of 255 admissions were potentially avoidable (Loudon and Ward 2001). This does not mean that primary care is powerless to make effective change (in targeted areas) but rather it is a question of which agent holds the greater control over the expressed variation in admissions and hence expenditure, namely, primary care or the external environment.

The central issue appears to have become confused due to the different sources of variation. As mentioned above inter-practice variation can often be explained by socio-demographic, distance and other relationships but if proven to be real can be addressed by appropriate process changes, however, it is the variation over time which has an important impact on the annual budget. Indeed while a capitation formula may forecast the likely average cost for a particular group of individuals (based on demographic variables) it is the weather and environment which leads to the ultimate expression of the admissions making up the 'actual' cost rather than the expected 'average' cost.

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The literature on the effect of the environment and meteorological conditions upon emergency admissions for a wide range of conditions is substantial and the implications of these factors appear to have been largely ignored (Makie 2002, Rusticucci 2002, Mangtani 2006, Rising 2006). The health forecasting units from a number of countries are a good example of the degree to which weather and environment influences almost all aspects of health and wellbeing (Coleman 2005, MET Office 2009a, My weather and health forecast 2009). Indeed it has recently been proposed that there are very long-term cycles in emergency admission rates and that medical specialties show a cyclic trigger point every four to six years leading to a new and higher admission rate (Jones 2009b,c). The very high index of variation demonstrated in this study for the majority of emergency admissions implies that the wider environment has a far higher potential to influence total emergency admissions (and cost) than isolated primary care initiatives.

Table 3 indicates that around 60% of the budget associated with emergency admission is likely to be controlled to a high degree by external environmental factors. In other words, the amount spent on emergency admissions rises and falls in a manner which is not amenable to direct control, but with the aid of a health forecast some degree of admission avoidance can be implemented (MET Office 2009b).

However well a linear approximation may apply to individual diagnoses it is obvious from Figure 2 that the trend associated with total admissions is highly non-linear. Due to the somewhat erratic nature of the increase in emergency admissions the time series was broken into two parts and highly non-linear polynomial equations with 12 variables was fitted to each part. The variation between the forecast (via the polynomial trend line) and actual admissions had an Index of Variation which varied between ± 8 units. To put this in layman's language – even with the benefit of hindsight and a highly non-linear forecasting method the variation experienced in the real world of emergency financial risk is very high. This is consistent with an observed standard deviation which is around 2.7 times higher than simple chance variation; hence the maximum possible range will be 3-times the observed standard deviation giving the figure of 8 units determined above. The capitation budgets of all PCT's do not show the exceedingly high flexibility implied by a polynomial equation and are constrained within the financial envelope offered to the NHS by government each year. In the years when admissions are lower than expected the resulting 'surplus' is usually spent on any number of worth while projects. However in the years when the deviation is high it will be crippling to any budget and will imply financial austerity both within year and in the years to follow. It would seem that the commissioning of emergency admissions is an exceedingly high risk endeavour and this is partly why private health insurance companies in the UK only cover elective admission and will explain the higher premiums charged for an 'all risks' policy in other countries.

Assessing the impact of changes in counting and coding of emergency admissions on the Index of Variation can be achieved by reference to earlier work in this area which was conducted at specialty level (Jones 1996). This earlier work specifically calculated the Index of Variation over time periods when linear growth applied and observed that for the medical specialties the Index of Variation was around 3 units. Hence specific diagnoses in Tables 1 and 2 with an Index of Variation above 3 units are likely candidates for the effect of additional special cause variation due to counting and coding changes and should only affect a limited number of diagnoses with a more accident and emergency (A&E) department flavour (Jones 2009d).

The implications of the above to PBC are obvious. The financial risk associated with the vast majority of emergency conditions is too high to be realistically held by any PBC group. Indeed such high financial risk should not be the responsibility any PCT and is rather a national issue. What is called a 'bad' year is largely experienced by all (subject to regional variability) and hence the proportion of the fixed capitation budget devoted to emergency admissions rises in all PCT's. In an environment

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where elective admissions are backed by waiting time guarantees the only places left to cut are the primary care budgets covering all manner of initiatives from preventing teenage pregnancy through to preventative care and drug budgets. This is a poor (but probably necessary) way to fund healthcare but it is an even poorer policy which attempts to place this risk on primary care. Indeed the desire of government to give guarantees for all manner of hospital related events (A&E waiting times, inpatient waiting times, etc) all within a fixed capitation budget is leading to massive policy conflicts. Both the way emergency care is funded and the structure of PBC need a radical reappraisal if GP's are to be meaningfully included in the very necessary efforts to contain costs.

The implication of high volatility in emergency admissions to budgeting is that PBC groups must be able to make at the very least a 5 standard deviation reduction in total emergency admissions in order to come close to guaranteeing a surplus against budget in the majority of years. Hence a small PBC group with 1,000 emergency admissions would have to make a 16% reduction in total emergency admissions while a larger group with 10,000 admissions would have to make a 5% reduction to achieve this goal. Reductions in total emergency admissions (including pregnancy and childbirth) of this order of magnitude may be challenging.

Indeed the high intrinsic variation in the factors leading to emergency admission imply that primary care must be supported by sophisticated tools such as the COPD forecast developed by the MET Office health forecasting unit or by tools which monitor the risk associated with disease progression and detection of individuals who have deviated from their care pathway (MET Office 2009b, Conley et al 2008). Without these tools primary care has no basis upon which to focus scarce resources in order to reduce the level of emergency admissions which implicitly PBC assumes they are able to do. We are in a 'the chicken or the egg' circular argument!

This analysis raises questions regarding what should and should not be covered by PBC. For example, should PBC revert back to the equivalent of GP fund-holding where only elective admissions were covered or be limited to those emergency diagnoses over which primary care has proven ability to leverage change? Indeed just how are commissioners and PBC groups expected to handle financial risk in a capitation funded environment? Should elective guarantees be maintained at all costs? Is the HRG tariff and its assumption that cost and activity are not linked appropriate to something where activity is so evidently very volatile? Serious questions indeed.

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Figure 1: Trend in pneumonia admissions

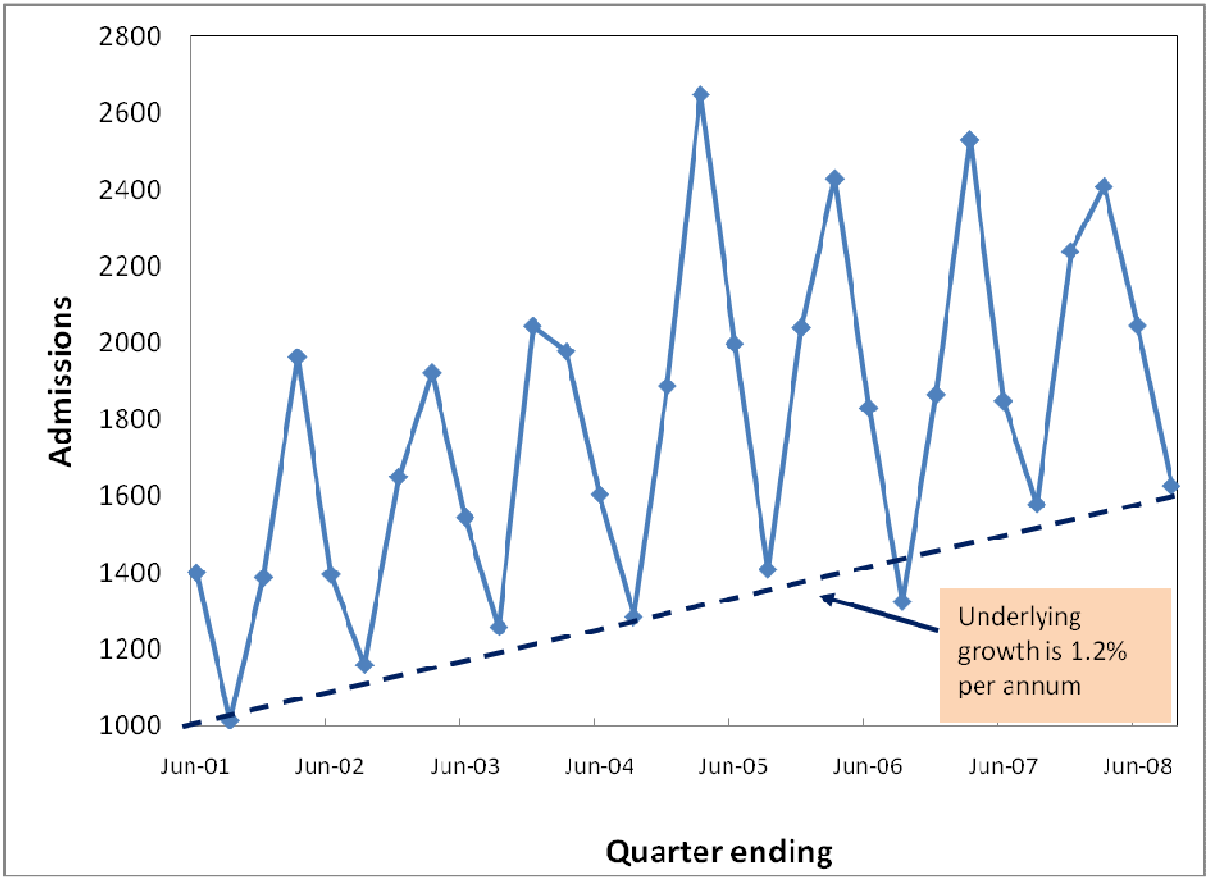

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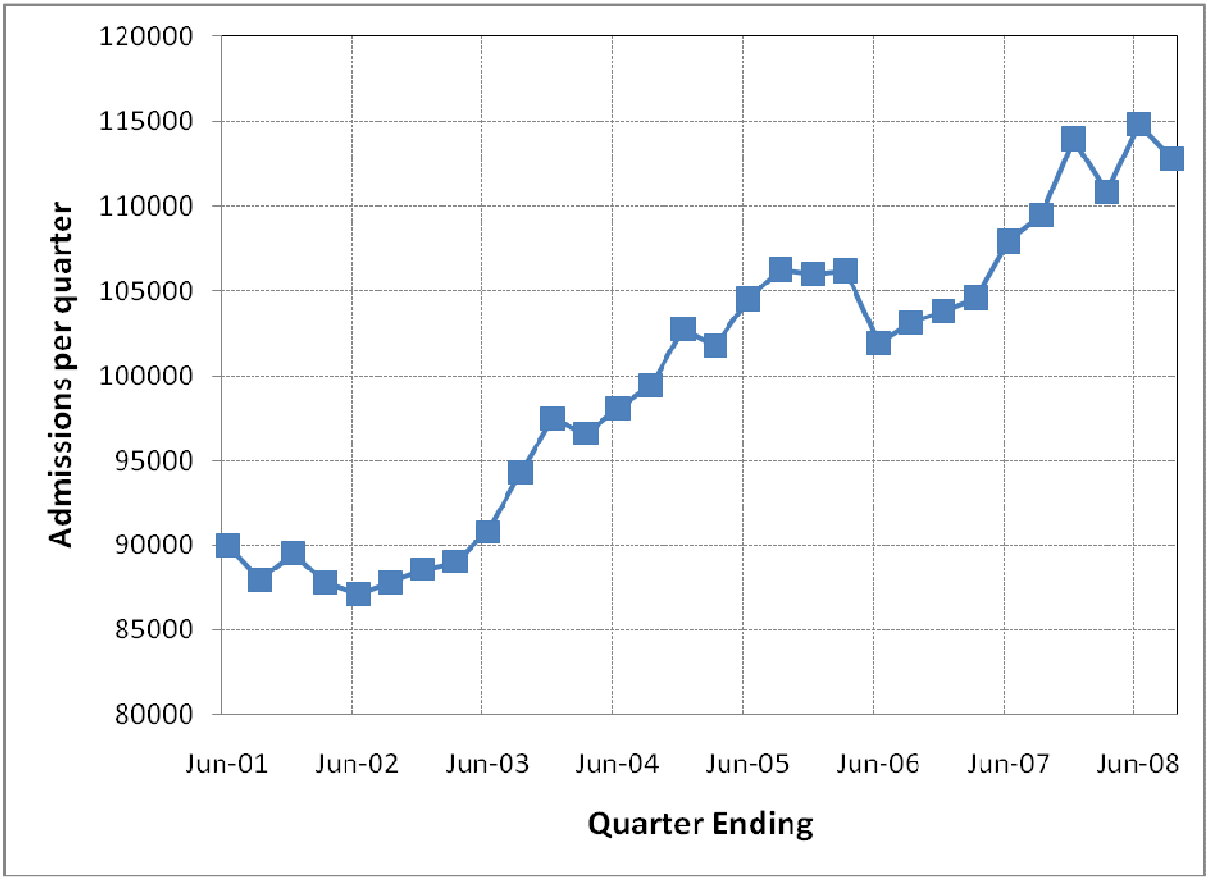
Figure 2: Trend in total emergency admissions



Footnote to Fig 2: Emergency admissions include both zero day stay and overnight stay admissions. For a discussion regarding the component parts of the observed increase refer to Jones (2009b,c). Total excludes 'liveborn'.

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Table 1: Index of variation associated with a range of conditions

Diagnosis	Proportion of admissions (2008/09)	Index of Variation
Pregnancy & childbirth		
Normal pregnancy and/or delivery	10.3%	6.4
Hypertension complicating pregnancy	3.8%	4.8
Liveborn	34.4%	4.6
Other complications of pregnancy	20.2%	4.5
Polyhydramnios and other problems of amniotic cavity	5.6%	4.3
Haemorrhage during pregnancy, abruptio placenta, etc	5.4%	4.0
Other complications of birth affecting management of mother	14.1%	3.7
Intrauterine hypoxia and birth asphyxia	1.6%	3.6
Other perinatal conditions	5.2%	3.6
Prolonged pregnancy	1.3%	3.3
Short gestation, low birth weight, etc	3.5%	2.9
Birth trauma	0.5%	2.7
Early or threatened labour	5.6%	2.5
Spontaneous abortion	2.6%	2.3
Malposition, malpresentation	2.7%	2.2
Haemolytic jaundice and perinatal jaundice	1.6%	2.0
Induced abortion	0.7%	1.8
Fetopelvic disproportion, obstruction	0.6%	1.8
Diabetes or abnormal glucose tolerance in pregnancy	0.5%	1.8
Foetal distress and abnormal forces of labour	12.6%	1.8
Ectopic pregnancy	0.7%	1.1
Mental health		
Affective disorders	15%	4.9
Schizophrenia and related disorders	6%	3.9
Other mental conditions	4%	3.9
Anxiety, somatoform, dissociative, and personality disorders	7%	3.3
Alcohol-related mental disorders	12%	2.9
Other psychoses	10%	2.8
Senility and organic mental disorders	23%	2.6
Substance-related mental disorders	1%	2.1
Poisoning by psychotropic agents	20%	1.9
Personal history of mental and behavioral disorder	1%	1.8
Respiratory conditions		
Asthma	0.5%	4.4
COPD and bronchiectasis	0.8%	4.3
Other upper respiratory infections	0.6%	4.1
Other upper respiratory disease	0.7%	3.8
Pneumonia	1.0%	3.3
Acute bronchitis	0.9%	3.2
Other lower respiratory disease	0.2%	2.9
Pleurisy, pneumothorax, pulmonary collapse	0.2%	1.9
Respiratory failure, insufficiency, arrest (adult)	0.1%	1.7
Respiratory distress syndrome	0.0%	1.1
Cardiac conditions		
Coronary atherosclerosis	0.7%	4.3
Cardiac dysrhythmias	0.7%	3.0
Congestive heart failure	0.4%	2.8
Acute myocardial infarction	0.6%	2.3
Non-specific chest pain	1.8%	2.2
Heart valve disorders	0.1%	1.2
Other and ill-defined heart disease	0.0%	1.2
Pulmonary heart disease	0.2%	1.0
Cardiac arrest and ventricular fibrillation	0.0%	1.0
Cardiac and circulatory congenital anomalies	0.0%	1.0

Proportion of admissions is relative to the groups defined by maternity and mental health while all other diagnoses are relative to total acute admissions – excluding maternity & mental health. The total for maternity is greater than 100% due to 'liveborn' which is included as a reference point.

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Table 2: Index of variation associated with other diagnoses

Diagnosis	Proportion of acute admissions (2008/09)	Index of Variation
Other screening for suspected conditions	0.5%	3.9
Syncope	0.6%	3.5
Viral infection	0.5%	3.4
Spondylosis and other back problems	0.4%	3.1
Superficial injury & contusion	0.7%	3.0
Complications of surgical or medical care	0.5%	3.0
Skin and subcutaneous tissue infections	0.8%	2.9
Other skin disorders	0.3%	2.7
Genitourinary symptoms	0.3%	2.7
Intestinal infection	0.4%	2.5
Calculus of urinary tract	0.3%	2.4
Other non-traumatic joint disorders	0.3%	2.4
Headache including migraine	0.5%	2.4
Open wounds of head, neck, and trunk	0.4%	2.4
Nausea and vomiting	0.3%	2.3
Noninfectious gastroenteritis	0.6%	2.1
Abdominal pain	1.7%	2.1
Gastrointestinal haemorrhage	0.5%	2.1
Fever of unknown origin	0.2%	2.0

Table 3: Risk associated with emergency admissions

Index of Variation	Proportion of total emergency admissions
> 3	40%
2 to 3	23%
1.4 to 2	19%
< 1.4	19%