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Financial risk at the PCT/PBC Interface

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Part 3 of a 5 part series

Jones R (2008) Financial risk in practice based commissioning. ***BJHCM*** 14(5), 199-204.
Jones R (2008) Financial risk in health purchasing Risk pools. ***BJHCM*** 14(6), 240-245.
Jones R (2008) Financial risk at the PCT/PBC Interface. ***BJHCM*** 14(7), 288-293.
Jones R (2009) Emergency admissions and financial risk. ***BJHCM*** 15(7): 344-350.
Jones R (2009) The actuarial basis for financial risk in practice-based commissioning and implications to managing budgets. **Primary Health Care Research & Development** 10(3): 245-253.

Key Points:

1. Very large NHS organisations such as PCTs and acute Trusts can acquire a large cumulative deficit simply due to chance variation.

2. PBC groups will need to make savings equivalent to a minimum of 3.3% of the total annual inpatient budget to offset the cumulate long term effects of adverse financial outcomes arising due to chance.

3. Allocation of budgets on last years costs is guaranteed to create a situation where >75% of practices will receive a fund which is > ± 0.5-standard deviation away from the real (average) budget.

4. The issue of a ‘fair’ PBC budget is problematic.

5. The formation of an inter-PCT financial instrument can be used to limit risk exposure. The cost & any benefit from this instrument will go through the annual accounts under insurance costs & refunds.

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Introduction

Part one of this series looked at the point of minimum financial risk for a PBC group. It concluded that active exclusion of particular HRG from the core PBC budget was vital for financial stability (Jones 2008a). Part two presented a framework for selecting HRG for exclusion and then looked at the risk associated with this pool of excluded HRG. The risk was concluded to be high (Jones 2008b).

The Department of Health (DH) states that 'PBC is …… a crucial <u>method</u> through which PCTs and practices can <u>work together</u> to improve health outcomes and reduce inequalities.' (DH, 2007a).

In the above quote the words 'method' and 'work together' have been highlighted since there are a range of financial risk issues at the PCT/PBC interface which do need to be addressed. Put simply PBC operates within the context of a host PCT. Shifting the risk away from the PBC groups to the PCT will not work since financial pressures effect all parties within the constraints of the overall PCT capitation allocation.

Methods

Methods were presented in part one (Jones 2008a). The data used in the inter-PCT financial risk instrument scenario was obtained from four PCT's and covered the years 2003/04 to 2007/08. Acute capitation weightings and the HRG tariff were obtained from the DH website (DH 2007b, DH 2007c).

Consequences of Poisson Variation

The similations described in part one made use of Poisson statistics. This statistical distribution was said to only have integer outcomes (patients are not divisible), be right skewed and have a standard deviation equal to the square root of the expected average. How this applies in practice is best illustrated by an example.

Figure 1 presents the case for a HRG where the expected annual average is nine. As can be seen the full range of outcomes is between 0 and 22 per annum (as per a standard deviation of ± 3) and the right skew is evident in that an outcome of 6 has a higher frequency of occurance than an outcome of 12 and the fact that the most common values are always the average and the average minus one. This is offset by the tail of outcomes greater than 18 and it is this tail that leads to very high financial risk. The range in outcomes is so wide that the outcome is controlled by the statistical variation. Even if a GP could make a 50% reduction in the real average it would take many years for this reduction to overcome the effects of the inherent high volatility in the activity seen from one year to the next, i.e. it would require something like a three year budget period to reap any benefit and even then the benefit is not guaranteed.

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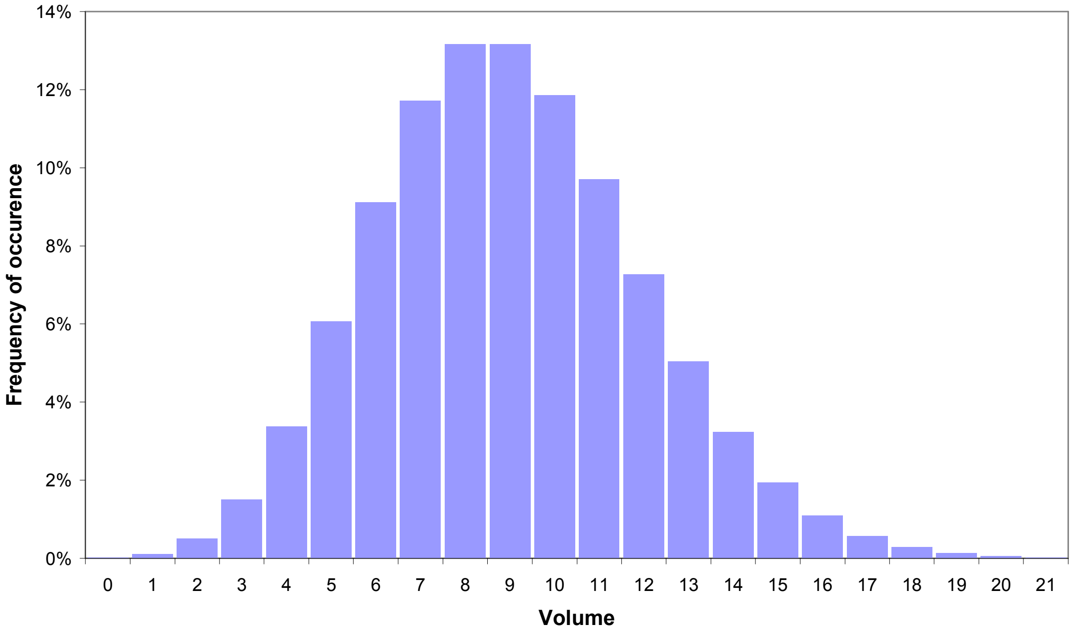
Figure 1: Frequency of outcomes when the expected average is nine per annum



At 100,000 heads and after combining both elective and non-elective activity for each HRG some 236 out of 600 HRG have a frequency of 9 or less per annum. Even at an expected frequency of 100 per annum the full range variation is still ± 30 – an inevitable consequence of the relationship between the average and the standard deviation seen in a Poisson distribution. Some 368 out of 600 HRG have activity between 10 and 100 per annum. Only 2 HRG have an expected activity above 750 per annum and both are to do with pregnancy and childbirth, i.e. they fall into the group of potentially excluded HRG (Jones 2008b). At 750 the full range variation is still high ± 82, i.e. ±11%.

This is the best case scenario! In the real world the actual financial risk includes high cost patients, the effects of weather, pollution levels & infectious diseases and long term cycles in disease rates (Fleming et al 1991, Linn et al 2000, Waller et al 1997). For these reasons real world healthcare variation is typically twice and sometimes up to three-times that of simple Poisson variation (Jones 1996). However, assuming that Poisson variation is the best it gets we can shed light on some difficult PCT/PBC interface issues.

The PBC Budget

DH guidance initially suggested that 2007/08 indicative budgets be based on a 12 months of historic activity (DH 2006). Such a policy will lead to wide scale under- and over- allocation of indicative budgets since the outcome for a single year will, at practice level, be controlled by statistical variation. Simulation shows that the difference in the total cost from one year to the next follows a Beta distribution (coefficients Alpha = 1.21, Beta = 4.82, Scale = 5.68) with the most common difference (the mode) being ± 0.32 standard deviation, the average is a ± 1.14 standard deviation difference while the maximum is higher than ± 5 standard deviation difference, i.e. allocation of budgets on last years costs is guaranteed to create a situation where 75% and 65% of practices will receive a budget which is respectively greater than ± 0.5 and ± 1.0 standard deviation away from the real (average expected) budget. Part one of this series demonstrated that the standard deviation (as a coefficient of variation) is large. For a PBC group with 100,000 heads one standard deviation is around 1.3% of the budget (Fig 2 in part one of this series) and hence the above figures make a material effect on budgets (Jones 2008).

This is a repeat of the winners and losers under the old GP Fund holding scheme which used the same methodology (Jones 1994, Jones 1996) and partly explains why only 70% of indicative budgets calculated in this way fall within ± 10% of a notional fair share (DH 2006). It must be noted that the current version of the capitation formula is entirely unsuited to small area populations such as GP lists and that the formula will itself be contributing to part of this discrepancy. This fundamental discrepancy arises due to a property of geographical data called the Modifiable Areal Unit Problem (MAUP) (Klinkenberg, 2006). Basically the MAUP effect means that healthcare demand correlations based on ward level data must never be used to forecast demand for small areas such as GP lists. The current capitation formula uses ward level data with its inherent danger of missaplication of funds (Sheldon, 1994; Harris & Longley 2002))

More recent DH guidance suggests that PCTs attempt to triangulate the output from the capitation formula, last years costs and index of multiple deprivation (IMD) scores to arrive at a better estimate of the baseline budget for 2008/09 (DH 2007a). Even this compromise presents serious practical difficulties.

As has already been pointed out last years costs are an entirely unsuitable starting point. The only statistically valid basis for this type of calculation is to take four to five years of historic data and do a trend over time. Such an approach removes much of the single year statistical volatility. The key feature of such an approach is the recognition that healthcare activity data often exhibits step changes, i.e. the local hospital decides to re-badge certain outpatient procedures as an inpatient ‘day case’ and so a step increase in inpatient activity (and cost) will effect all PBC groups using this hospital. In the years between the step changes, experience shows that the trend lines are remarkably linear. Yes, there are low level errors in the data but these are orders of magnitude less than the statistical-based variation. The errors tend to cancel out leaving the base trend.

The use of IMD data is a good suggestion as this measure of deprivation does have good predictive power in a wide variety of both primary and secondary care situations (Hoare 2003, Woods 2005, Jordan 2004, Saxena 2006, Stratton & Elia 2006). However there is a distinct lack of readily available correlations for a wide variety of secondary care admissions necessary to inform a discussion about budgets for hospital admissions or outpatient attendances. Correlations should be conducted using the smallest available geographical unit to avoid the MAUP issue (Harris & Longley 2002).

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A PBC Capitation Formula

The DH is promising a version of the capitation formula applicable to small population groups such as GP practices at some time beyond 2009/10 and we must wait to see how effective this will be in addressing the formula side of the allocation problem.

However, all capitation formula have an inherent coefficient of variation associated with the allocated funds which is a reflection of the imprecision in the formula arising from the use of demographic and other variables as a proxy for healthcare need. This coefficient of variation is usually large (Stone & Gilbraith 2006, Smith et al 2001, Walker et al 1997, Rice et al 2000). Hence formula based funding always leads to over- and under-funding relative to other recipient groups. The degree of over- or under-funding will increase as the population size decreases due to the effect of size on the standard error of the mean. Hence not only does the risk due to statistical variation in demand increase as population size decreases but so also does the propensity of the capitation funding formula to over- or under-fund relative to other recipients. On both counts there is great benefit in belonging to a larger group. The relatively under-funded practices therefore have to make greater savings to offset both the risk arising from statistical variation and any inherent under-funding relative to other practices.

Complicating Factors

In the real world of NHS finances there are two additional complicating factors that point to a compromise solution rather than a formula driven solution.

Firstly, there is the practical observation that the counting and coding of events by different acute sites (even sites within the same Trust umbrella) does lead to different cost implications (Jones 2007). Hence different PBC groups within a PCT will experience cost pressures simply due to the balance of acute sites their patients attend.

The second complication is to do with the fundamental basis of the NHS tariff. The tariff for each HRG is a weighted average of prices submitted by acute trusts and by implication implies some form of 'average' population characteristics. Hence, each HRG has a set of hidden assumptions around the average age profile, ethnic mix and deprivation score. By implication PBC groups which deviate the most from this 'average' will experience differential financial pressures for each HRG relative to other PBC groups. These cost pressures follow a different trajectory to the capitation formula.

In conclusion, even with a perfect capitation formula there will still be real world cost pressures which may be beyond the scope of influence of a PBC group or even a PCT. The whole emphasis of part one and two of this series is around active selection of a set of HRG to form the core PBC budget. This core budget is one over which the PBC group is able to exert active and statistically significant influence. The capitation formula is not designed to forecast the cost of individual HRGs and hence cannot be used to estimate this core budget. The solution is to revert to a trend based on past activity as suggested above. Some would argue that this approach favours practices which over-use acute services, but then it is these very practices who need the encouragement to change.

PBC Cost Savings

An additional issue to which the simulation can shed light is that of the retention of 70% of resources released by the practice allowable by the DH (DH 2006). The conclusions from part one show that depending on size there is opportunity to achieve below budget outcomes due chance fluctuation in total cost. In essence some practices will have access to 'savings' which are nothing to do with their direct efforts to innovatively release resources by curtailing admissions.

Indeed the top 48 high volume lines of HRG activity which accounts for 42% of total admissions but only 29% of total costs are probably the only lines with high enough activity for a PBC group to prove that its endeavours have had a statistically significant effect.

PCT Risk

At this point the important issue of cumulative surplus/overspend needs to be addressed. It is the host PCT which holds the responsibility for any 'overspend' while PBC groups are allowed to keep 70% of the 'surpluses'. The probability of four bad years in a row is surprisingly high at 1 in 16 (6%) while nine bad years in a row is 1 in 512 (0.2%). The maximum cumulative surplus/overspend due to Poisson-based variation in demand is three-times the annual coefficient of variation multiplied by the square root of the number of years the scheme has been operating. This surplus/overspend is always set against a single year's budget. Hence in four years of running as a PCT or PBC group the cumulative maximum surplus/overspend will be six-times the annual coefficient of variation while after nine years of operation it will be nine-times, etc. In other words the host PCT needs to make a minimum cost saving of 1- to 1.5-times the annual coefficient of variation of the budget in order to guarantee a result better than financial break-even in 4 to 9 years time. In this case the minimum cost saving is needed to offset potential cumulative losses arising from statistical randomness in costs.

This cumulative effect also partly explains why, in the past, large NHS acute Trusts and PCTs have apparently 'mysteriously' slipped into deeper and deeper financial chaos. Poor management can indeed play a part but the unavoidable cumulative effect of statistical variation in demand (and cost) is commonly overlooked. Obviously some one else will be experiencing a counterbalancing surplus, a fact which is of little consolation. Once again there is a clear message - minimise the coefficient of variation associated with the total budget via a suitable large collective risk pool and make simultaneous appropriate cost savings using all possible means (some of which will be required to counteract the adverse effects of random variation in the total budget).

For a host PCT with 300,000 heads a value of one coefficient of variation (from Fig 2 in part one) is 1% of a total inpatient budget of around £105,355,000. Hence by implication the PBC groups need to make total saving of £3,512,000 (3.3%) in order to pass on £1,054,000 (1%) to the host PCT which will be used to cover losses arising in those PBC groups where statistical variation in costs or other factors prevent the release of savings. A genuine 3.3% saving against the entire inpatient budget seems to be unlikely, hence there is a very high likelihood of insufficient savings to cover unexpected higher costs due to statistical variation, i.e. host PCT's could make a loss.

The DH figure of 30% of savings to be returned to the host PCT may be reasonable if savings due to chance are excluded. This is best achieved if the PBC group states ahead of time the specific HRG where their efforts will release cost savings and their performance in these lines only will be the basis for retaining 70% of savings. This whole area is high risk and the 70% figure may well need to be adjusted to a lower value and the DH needs to clarify the guidance to exclude fortuitous 'savings'.

From a risk perspective the current DH proposal of 70% retained savings is somewhat similar to the output of a statistical analysis where we are 70% confident that the observed cost saving is <u>not</u> due to chance and that the remaining 30% could be due to chance. Rephrasing the issue of retained saving in the context of a 70% confidence interval would then mean that actual proportion of retained savings would vary according to the specific conditions applicable to each situation. This is the basis for a 'fair' distribution of savings.

In conclusion, the current basis for operating PBC is subject to considerable financial uncertainty due to the relatively small size of both PBC groups and their host PCT's. The next section will look at how an inter-PCT financial risk instrument could be developed to deliver the financial stability necessary for PBC to thrive.

Financial Risk Instruments

A financial risk instrument is similar to an insurance policy. PCTs from any location can join together to develop a mutually acceptable financial risk instrument. This risk instrument can be developed on any basis using a set of mutually acceptable principles backed by suitable analysis. This will be illustrated by the development of a hypothetical risk instrument covering four PCT's. Actual data was analysed from the four PCTs and the key conclusions from this process will be chronicled in the form of a case study.

The finance directors of three smaller PCTs meet by chance at a conference. Their discussion turns to the volatile nature of PCT financial management and the concept of a financial risk instrument. One of them knows a FD at a larger PCT who could be approached in order to increase the size of the group population to over 1,500,000 weighted head. This would significantly reduce the individual risk of the smaller PCT's.

They agree to initially analyse the previous four years of activity data with a view to testing a relatively simple and low-key financial instrument in the present year. Past activity would all be costed using the current year tariff and the effect of specialist and childrens uplifts would be ignored, i.e. the financial instrument can be constructed using any mutually agreeable set of principles. Their proposal was to select HRG simply on the basis of annual activity and any HRG with combined activity of 100 or less across the four PCTs would be considered for inclusion into the 'risk pool' and that risk sharing would be on the basis of weighted capitation. The figure of 100 was chosen since full range variation around the average below this level of activity is > ± 30%, i.e. all HRG are very high risk. The fact that some of the selected HRG are covered by Specialist Commissioning does not matter since in essence this is roughly equivalent to double insurance on the same item.

Analysis of the data was completed and a meeting convened to discuss next steps. The outcomes from this meeting were as follows.

1. HRG meeting the criteria covered 376 elective and 317 non-elective HRG with a total value across the four PCT of around £52M. Of these 20 elective and 10 non-elective had no activity in any of the four years.
2. HRG covering Mental Health (HRG Chapter T) were found to show very different trends in activity and gross levels of inpatient activity between the PCTs. The decision was made to exclude these HRG pending a joint investigation of different admission criteria between the respective Mental Health and Learning Disability Trusts and why several acute Trusts appeared to have a high number of HRG in this chapter; 12 elective and 10 non-elective HRG were excluded
3. Weighted capitation was shown to differ by up to 13% from actual average costs. Weighted capitation is a total allocation and is not intended to model individual HRG. The basis of the financial instrument was therefore decided to be on the basis of average costs over the past four years. However the FD's noted that they would have expected a random sample consisting from over 60% of all HRG to be closer to the capitation allocations. They agreed to investigate if the effects of age, sex, deprivation and ethnicity could explain the observed differences or if there were fundamental issues around how acute trusts in the different locations were counting and coding activity in these low volume HRGs.
4. Working at the 95% confidence interval a notional risk fund of £1.9M was earmarked as insurance costs. No money changes hand at this point other that to note that this sum of money is earmarked as an insurance cost. The share of this total fund for each PCT was based on average cost over the past four years. Had each PCT 'self insured' against this risk the total risk fund would have been £3M. Had the smallest PCT 'self insured' a fund of £390,000 would have been set aside to cover the risk exposure but by virtue of the larger group size this was reduced to just £145,000.

The financial year sped by and out-turn activity was available to determine the risk adjustments. A meeting was duly convened to discuss results prior to sharing the risk fund. Analysis was presented and the following were noted.

1. Of the 20 elective and 10 non-elective HRG with zero previous activity two elective involving transplants showed 1 admission each (HRG D01 lung & G01 liver) and two non-elective also had activity (M04 complex major upper genital tract and R98 spinal chemotherapy). The acute Trust responsible for the non-elective R98 was asked to explain the nature of the admission.
2. Over 70 and 35 HRG showed a very large step increase or decrease respectively in activity at the 100% confidence interval of statistical significance. The FD's agreed that this was part of the nature of the financial

risk they were seeking to cover but agreed that each would investigat the reasons for this unprecedented change with the responsible acute Trusts. Clinical audit of selected HRGs and even a wider review of counting & coding would be required, i.e. point #3 above. Failure to address issues may incur adjustments in future rounds of the risk fund.

3. Total cost of activity across the four PCTs was £500,000 higher than the average of the previous four years, however, at individual PCT level there were swings in cost of between -42% and +18%, i.e. the chosen set of HRG is indeed a source of very high financial risk. The net cost (share of actual cost less share of the risk fund) to the largest PCT was a refund of £210,000 to offset against 18% higher costs. One of the smaller PCTs had the highest net cost of £138,000; however, this 'insurance' cost was more than offset by the massive 42% lower cost in their part of the activity pool.
4. The FD's concluded that the process had been valuable. They would repeat the process in the following year and would invite other PCT's to participate and gain the benefits of greater size.
5. Given the large swings on the risk fund at PCT level they also decided to investigate how to weight the re-distribution of funds toward those with the greatest cost pressure.
6. A decision was made to investigate more complex criteria for inclusion of HRG into the risk pool as per part two and to incorporate actual costs where specialist and paediatric uplifts are applicable (Jones 2008b).

Case study ends here

The above scenario is based on real figures. It illustrates the process of establishing a risk instrument and the likely secondary benefits arising from the analysis behind such an instrument. The key benefit is that PCT-level financial stability is greater as a result of the risk instrument with knock-on benefits to the PBC groups within each of the PCT's. What may otherwise be crisis overspends are moderated to enable PBC groups can get on with the business of making and retaining cost savings.

Above all PCT autonomy has been maintained and a control loop has been established to manage the gross activity changes for which there is no apparent reason and which all PCTs would probably have overlooked as background 'noise' in the small volume parts of their respective budgets.

Conclusions

For PBC to work in the real world the issue of financial risk management is central to the whole operation of the scheme. PBC groups hosted by the largest PCTs will by virtue of the size of the host PCT experience the least issues from overall financial volatility.

The issue of PBC group cost savings must operate within a core budgetwhere high risk HRG are placed into the wider PCT risk pool; otherwise the risk is that savings will arise simply due to chance variation in the larger budget. Indeed it is difficult to assess which proportion of reported of Total Purchasing savings were real and sustained over a longer time frame and what proportion was due to chance.

Hopefully this series has made a useful contribution to the deliberations of both policy makers and practitioners alike.

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