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Financial risk in practice based commissioning

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Part 1 of a 3 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.

Key Points:

1. The financial risk associated with healthcare budgets is high and to operate within a financial tolerance of less than ± 3% a PBC group will need to have a population of greater than 50,000 (budget value of £15M).
2. The point of minimum financial risk is reached by placing all admissions costing more than £3,000 into a larger risk pool. This places 27% of the budget into the risk pool.
3. A core group of 47 HRG accounting for 30% of the budget value are the only HRG with sufficient volume for a PBC group to be able to discern if they have made a statistically significant reduction in costs.

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Introduction

Practice Based Commissioning (PBC), is a central part of Government reforms of the National Health Service (NHS) in England. The Department of Health (DH) states that 'PBC is central to world class commissioning and is our most powerful way of reaching in to local communities. It is a crucial method through which PCTs and practices can work together to improve health outcomes and reduce inequalities.' (DH, 2007)

Using their 'fair share' of the total primary care trust (PCT) allocation for healthcare, each PBC group will use innovation to release resources for re-investment into primary care. The Department of Health has published two documents which outlined issues surrounding the allocation of indicative budgets, the use of resources released by practices and the allocation of high cost/high risk activities into a risk pool (DH, 2006, 2007).

A PBC group will effectively become an all-risks capitation-funded health management organisation, somewhat similar to a private health insurance scheme. If there is one thing that the insurance industry knows from many years of experience it is that size confers long term financial stability (Ranger-Moore, 1999). It would therefore be useful to apply actuarial methods similar to those used by the insurance industry.

A computer simulation is not intended to cover all possible sources of financial risk, but focuses on those aspects of risk which are under the control of the PBC group such as the effect of size and allocation of high cost activities into a larger collective risk pool. Hence the outputs from a simulation are an aide to decision making, which attempts to give insight into the practical steps needed to reduce risk. The aim is to learn by foresight rather than the hindsight required after having made a less informed decision which led to a costly or disasterous outcome.

Health Resource Groups

Interest in the financial risk associated with what was then called 'total purchasing' commenced in the mid-1990's. Several papers have exploring the risk associated with high cost conditions and the organisational and policy factors in managing risk (Bachman and Beavan, 1966; Smith 1999; Bojke, 2001). The general consensus was that a total purchasing group needs to be in excess of 100,000 heads to avoid high variation in costs due to random variation, i.e. the actual cost vs. allocated budget.

The vehicle by which a PBC group is billed for inpatient admissions is a health Resource Group (HRG). HRG's cover:

- various body systems
- diseases of childhood
- maternity & neonatal
- mental health
- miscellaneous conditions.

Each HRG covers a range of procedures or diagnoses with the totality of inpatient care condensed into some 600 HRG's (version 3.5). This will be expanded to around

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1,430 in version 4.0 which will be used as a basis for billing in the 2009/10 financial year. Some HRG are reasonably self explanatory, hence H70 'Resurfacing of Hip' with a price of around £4700 makes perfect sense. However, in many cases the HRG carries a generic title and can cover diverse diagnoses, hence D33 'Other Respiratory Diagnoses with age over 69 years or with complications', costing around £1600 contains 62 primary diagnoses covering admissions for tracheotomy malfunction, pulmonary collapse, cough, entopic tissue in lung, etc. For a practice with a list size of 10000 head the national average for D33 is 6 admissions per annum.

HRG are indivisible, hence while a practice may be able to prevent admissions for 'cough' it is the totality of admissions to the HRG upon which cost saving efforts will be rewarded. To the clinician HRG's are a blunt tool within which to operate PBC, however there is no other alternative.

Total cost to the PBC is equal to the number of admissions in each HRG times the price of that HRG. Hence each HRG becomes a cost line in the total budget. Each of the 600 HRG's is further split into elective and emergency care giving rise to a total of 1,200 separate cost lines for v 3.5 rising to 2,860 for v 4.0. (The situation is actually worse than this, because around half of emergency admissions have a separate short stay tariff, all HRG have an upper length of stay above which costs accrue on a daily basis, many HRG have separate paediatric prices and others have prices for specialist services. However, for the sake of simplicity these issues will be ignored as they do not make a material effect on management advice afforded by the computer simulations).

Costs

HRG prices range from around £280 for an elective admission for poisoning (HRG S16) up to in excess of £8,000 for emergency hip replacement (HRG H81); however, around 55% of all admissions cost less than £1,000.

This means that there are far too many HRG cost lines in the budget for a practice to discern what is happening to its endeavours to save costs simply because for a list size of around 10000 persons some 75% of all the 1,200 possible HRG cost lines in v3.5 have a an average expected frequency of less than 1 per annum, i.e. 920 of the 1,200 lines will be a confusing jumble of 0 and 1 (especially so at the far smaller mid-year activity levels). It is in this territory where these low volume events (encompassing 13% of admissions and 23% of inpatient costs) have such a major influence on the financial outcomes of the PBC group. On the positive side the top 280 high volume HRG cover 87% of admissions and 77% of costs, i.e. the core part of the budget is far more manageable.

The recent DH guidance suggests that only 5% of high cost admissions need to be segregated into a risk pool and hence blocked back to the host PCT (DH, 2006). The implications of the risk associated with the 'risk pool' will be discussed in part two of this paper while the implications of PCT risk and PBC cost savings will be covered in part three.

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Methods

Hospital Episode Statistics (HES) data for England covering acute, maternity, community and mental health inpatient admissions over the years 2002/03 to 2004/05 was used to estimate 2007/08 volumes for each HRG. Total admissions come to around 13 million for a population for England of around 51 million persons (The Government Actuary, 2004). The HRG activity for various list sizes was calculated as a proportion of the England total. Hence for 10,000 head this represents 0.0196% of the England total, etc.

Version 3.5 HRG prices for 2006/07 were used to calculate total costs. Prices in 2007/08 were roughly 2.5% higher and in 2008/09 a further 2.3% uplift has been applied (DH, 2008). The tariffs for 48 HRG covering aspects of inpatient mental health, organ transplants, complex admissions, burns, etc which did not have a national price were estimated from a combination of average length of stay and judgement. A conservative estimate was used to avoid unduly skewing any analysis. Examples of high cost and low volume HRG are given in Table One.

Insert Table One near here

A variety of simulations were run using the 'Crystal Ball' software by Decisioneering. All admissions costing more than £3,000; or those with a national volume greater than 100,000 per annum were all modelled individually. All other lower cost and lower volume admissions were grouped into 14 weighted average price bands with a total national annual volume of around 500,000 per price band (equivalent to 100 admissions per annum for 10,000 head of population). Weighted average prices ranged from £276 to £2,511. In any simulation, HRG lines with a volume of less than 1,000 admissions were assigned to a Poisson distribution (see below). The numerical calculation of Poisson distributions for numbers larger than 1000 is too complex and so the Normal approximation to a Poisson distribution is appropriate. Each simulation was run 2,000 times and the standard deviation associated with the cost distribution was calculated using the report generating facility within Crystal Ball. To allow for ease of comparison between different size budgets, the standard deviation was divided by the budget value to give the coefficient of variation which was expressed as a percentage value. The coefficient of variation which is a measure of stability, uncertainty or risk The maximum risk is equal to ± 3.4-times the coefficient of variation; although ± 3-times encompasses 99% of all outcomes. In this study the term budget tolerance uses ± 3-times the coefficient of variation, i.e. the 99% confidence interval.The use of 2,000 itterations in the simulation (the same as running the budget for 2,000 years) gave a coefficient of variation for the mean of 0.04%.

Results

Financial risk arises due to the simultaneous fluctuation in volume and case mix as all HRG cost lines vary due to statistical variation around the expected average value. Poisson statistics is an exceedingly important tool for understanding the statistical variation around the expected average for healthcare events such as GP referrals, A&E attendances and inpatient admissions (Jones, 1996; 2001a; 2001b). A Poisson distribution becomes increasingly right skewed as the average approaches zero, can only have integer outcomes and by definition has a standard deviation associated with

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the true average volume (not cost) which is always equal to the square root of the average volume. Hence in theory the larger the volume of admissions the smaller the inherent financial risk due to fluctuation in the volume. This general rule breaks down if the cost associated with the activity is very high since the high cost acts to magnify the baseline fluctuation in the volume. By implication there is a point of minimum financial risk which occurs when all admissions costing more than a certain value are moved into a larger risk pool. Clinicians within PBC groups will be interested in achieving this point of minimum financial risk.

The point of minimum financial risk was determined by removing HRG's in descending order of price. The allocated budget is assumed to be the national average volume costed at the size of the practice, i.e. the fair share budget. As can be seen in Figure One this point is reached when admissions costing more than £3,000 are removed and placed into a larger risk pool. Admissions costing more than £3,000 or £4,000 account for 9% or 6% of admissions and 35% or 27% respectively of the total budget. Simulation shows that the point of minimum risk is the same irrespective of population size. The financial risk begins to rapidly rise as lower cost admissions are removed due to the effect associated with volume, i.e. the stability afforded by the optimum volume is eroded. Hence for a population of 10,000 a tolerance of ± 8.2% of the total budget value probably represents an unacceptable level of risk and indicates that the minimum size for a PBC group needs to be much greater than 10,000 head.

The step reduction in the coefficient of variation occurring near £5,400 is due to HRG H04 (Primary Knee Replacement), which occurs with a sufficient volume (around 12 per 10,000 head) to give a measurable reduction in overall risk. All other step changes increase the coefficient of variation and are associated with particular HRG having a very low incidence.

Insert Figure One near here.

PBC groups are not obliged to operate at the point of minimum risk, but must simply reduce it to a level which they feel is compatible with their level of risk aversion. An alternative strategy is to reduce risk by increasing the size of the PBC group. Figure Two investigates this option by moving 2.3% of the total budget (highest cost HRG) into the risk pool and then investigating the effect of size on the risk associated with the core budget. This option suggests that the group would need to cover a population of between 100,000 and 200,000 head in order to have a tolerance of ± 3% on the core budget, i.e. the part of the budget excluding the risk pool. The DH (2006) indicates that some 70% of practices are forming into PBC groups and Figure Two suggests that this is a necessity. A figure of around 100,000 head was concluded to be around the optimum size in an earlier study which also considered organisational factors including the motivation to control costs (Ranger-Moore, 1999).

Insert Figure Two near here.

Using a combination of the two strategies of size and excluding HRG above a certain cost will allow a PBC group to find the point of absolute minimum risk. This is achieved by only excluding HRG costing more than various amounts on the condition that they fall below various volume thresholds. This is illustrated for a practice with 10,000 head of population in Table Two.

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Insert Table Two near here.

Table Two demonstrates that for 10,000 head of population the point of absolute minimum risk is achieved by excluding all admissions with a HRG cost more than £4,000 where annual volume is less than ten. The dash in the table represents the point where there are no admissions with a higher annual volume. At this combination of price and volume some 27% of the budget will be placed into the risk pool. There is no intrinsic method to locate this point other than using computer simulation.

Discussion

When dealing with financial risk size does confer great benefits and PBC groups are not exempt from such considerations. This explains why most private health insurance organisations have more than one million members. Indeed the statutory duty to break even and the governments' desire that every NHS organisation should make a surplus should lead to an even more cautious risk strategy than pursued by private health insurers since they have the option to achieve break even over much longer time frames, to increase premiums as required and to refuse insurance to high risk individuals.

The exact average volume associated with each HRG does vary with the age distribution, deprivation, ethnicity, etc of the population, however, the use of national average figures are sufficiently real world to provide a useful source of management advice to those formulating the BPC risk policy. Hence a figure of 100,000 head for a PBC group is hard to avoid since below this point the risk rises to such an unacceptable level as to outweigh potential gains even if aggressive cost savings were immediately available. Indeed it become exceedingly difficult for smaller groups to prove that their efforts have made a statistically significant effect in the face of up to a five standard deviation difference in the cost of two successive years based on statistical variation alone.

Given the hitherto unexplored issues addressed in this work it is hard to envision how the risk policy can be formulated in the absence of supporting computer simulation of the various risk strategies available and of the different mix of HRG to go into the risk pool. Based upon the results of Figure One PBC groups are strongly advised to scrutinise all HRG costing more than £4,000 for potential inclusion into the risk pool. If the PBC group feels that it can exert no practical control over the volume for that HRG then it should be added to the risk pool. For example, can we or do we as a PBC group wish to exert any control over the volume of L01 (Kidney Transplant) costing around £4,400 with a national volume of just 1,115 per annum? If not then it should be added to the risk pool. It is highly likely that many PBC groups will find that this process will generate a group of HRG with a share of the total budget far greater than 5%. Issues regarding the risk pool will be discussed in part two of this paper.

One final comment is required regarding those HRG to which Poisson randomness does not strictly apply. These will be HRG where a single patient can make multiple admissions over a space of time such as cancer treatments, renal dialysis, etc. In such cases a modification of Poisson randomness called the Negative Binomial

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Distribution will apply (Glynn 1996). Some 60 HRG v3.5 lines fall into this group and PBC groups are strongly recommended to block these HRG back to the host PCT since a single patient can have up to ten or more admissions in a year. The aim is to target those HRG where genuine change can be exerted in order to re-invest savings. It is not helpful or desirable to have such savings eroded by the chance costs associated with such high cost patients.

Conclusions

How then should a PBC group resolve these apparent conflicts? You have been handed the entire budget along with its high level of inherent risk. You can take reasonable steps to minimise the risk arising from random variation, however, the aim of the policy decision to give you the money is for you to release resources. Some release of resources is required simply to cover the inherent risk in acting as a capitation-funded healthcare maintenance organisation. If you concentrate on the top 50 highest volume HRG you will find ample scope for cost savings such as HRG S22 'Planned Procedures Not Carried Out' costing £420, N12 'Antenatal Admissions not Related to Delivery Event' costing £460 (which some hospitals treat as an outpatient and now subject to DH guidance) (DH, 2008), and the exceeding high variation in Orthopaedic intervention rates for joint replacements and arthroscopies, etc. The issue of acute hospital counting practice is exceedingly important given that the boundary between outpatient and day case is exceedingly blurred (ISD, 2007). This aside there are specific clinical procedures where excess intervention does occur, i.e. CABG, PTCA, etc (Rand, 1998).

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. These 48 high volume lines include the major admissions which are sensitive to ambulatory care based interventions and the major elective interventions where there is significant national variation in intervention rates. Hence there is some sense in the suggestion that PBC groups should initially concentrate on these 48 high volume lines and shift the rest of their budget into a larger PCT risk pool. Such a smaller core budget would require around 100,000 head of population with a total budget of £2.7M in the PBC group to be financially stable.

It will be interesting to see how PBC groups fare given the different risk strategies available and their potential impact on cost savings. PBC groups are strongly advised to test various risk strategies using computer simulation as there is no other way of assessing the risk and hence the contingency fund to be associated with these decisions.

Conflict of interest: None

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Table 1: Low volume HRG (v3.5) costing more than £4,000.

HRG Code (v3.5)	Description	Expected admissions for 1,000,000 head
E01	Heart and Lung Transplant	0.3
J17	Major Burn with Significant Graft Procedure, age over 49	0.3
R07	Spinal Cord Injury with Fusion or Decompression	0.3
J23	Other Burn with Multiple Significant Graft Procedures, age over 49	0.8
J24	Other Burn with Multiple Significant Graft Procedures, age 18 to 49	1
J20	Other Burn with 1 Significant Graft Procedure, age over 49	2
D01	Lung Transplant	3
E02	Heart Transplant	3
T15	Childhood Non-Psychotic Disorders	6
E03	Cardiac Valve Procedures	8
C60	Cochlea Implants	10
G01	Liver Transplant	10
T17	Specific Learning Disabilities	11
T13	Eating Disorders or Obsessive Compulsive Disorders	35
T06	Depression with Section	37
T08	Presenile Dementia	38
T04	Mania with Section	40
Q15	Amputations	110
T05	Mania without Section	123
T02	Schizophreniform Psychoses with Section	141
T01	Senile Dementia	329
T03	Schizophreniform Psychoses without Section	503

A rate per million head (not age or deprivation standardised) based on the average estimated activity for England in 2007/08 is given as an indicative value.

HRG = health resource group

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Table 2: Financial risk (as ± %) associated with the inpatient budget for a PBC group covering 10,000 head with exclusion of admissions into a risk pool under price and volume combinations.

Exclude when average volume is less than:	Exclude admissions costing more than:						
	£3,000	£4,000	£5,000	£6,000	£7,000	£8,000	£9,000
1	9.90%	9.75%	9.66%	9.63%	9.63%	9.66%	9.69%
2	9.48%	9.21%	9.15%	9.15%	9.18%	9.36%	9.45%
3	9.30%	9.06%	8.97%	9.00%	9.03%	9.21%	9.24%
4	9.00%	8.76%	8.55%	8.52%	8.55%	8.91%	9.00%
5	8.67%	8.46%	8.46%	8.52%	8.55%	8.76%	8.82%
6	8.40%	8.19%	8.28%	8.40%	8.43%	8.67%	8.70%
7	8.25%	7.95%	8.13%	8.34%	-	-	-
8	8.10%	-	-	-	-	-	-
9	8.07%	-	-	-	-	-	-
10	8.01%	-	-	-	-	-	-

Note: Minimum possible risk exposure is 7.95%

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Figure One: Potential financial risk associated with the core inpatient budget of a practice with a list size of 10,000 after removal of admissions costing more than certain amounts into a risk pool.

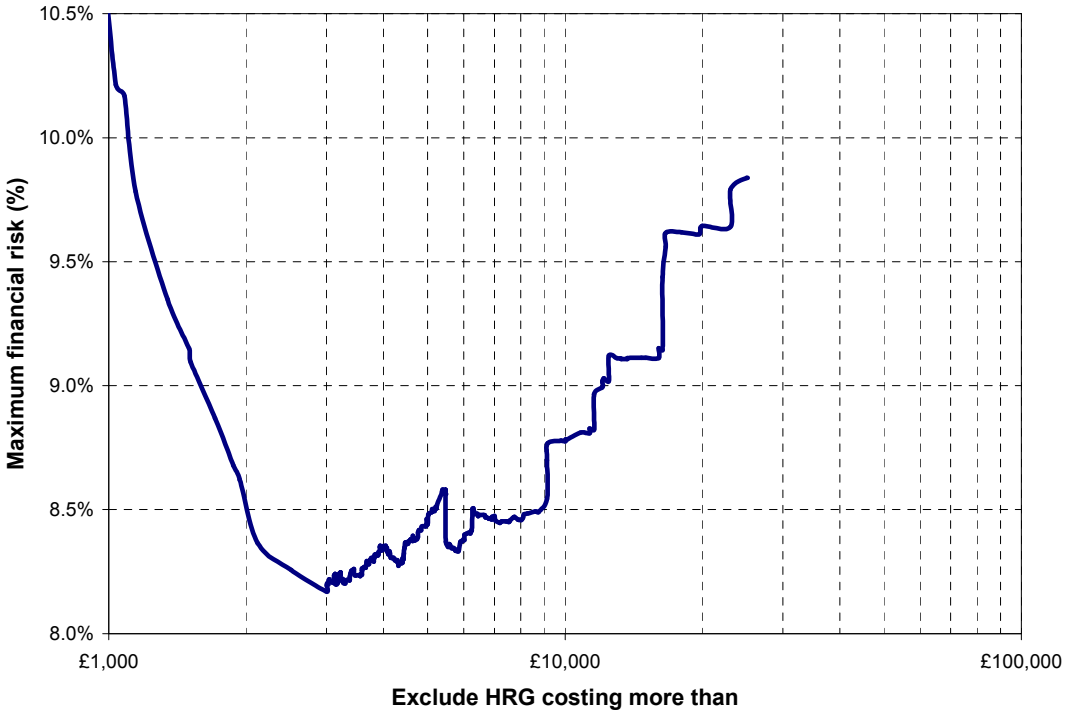

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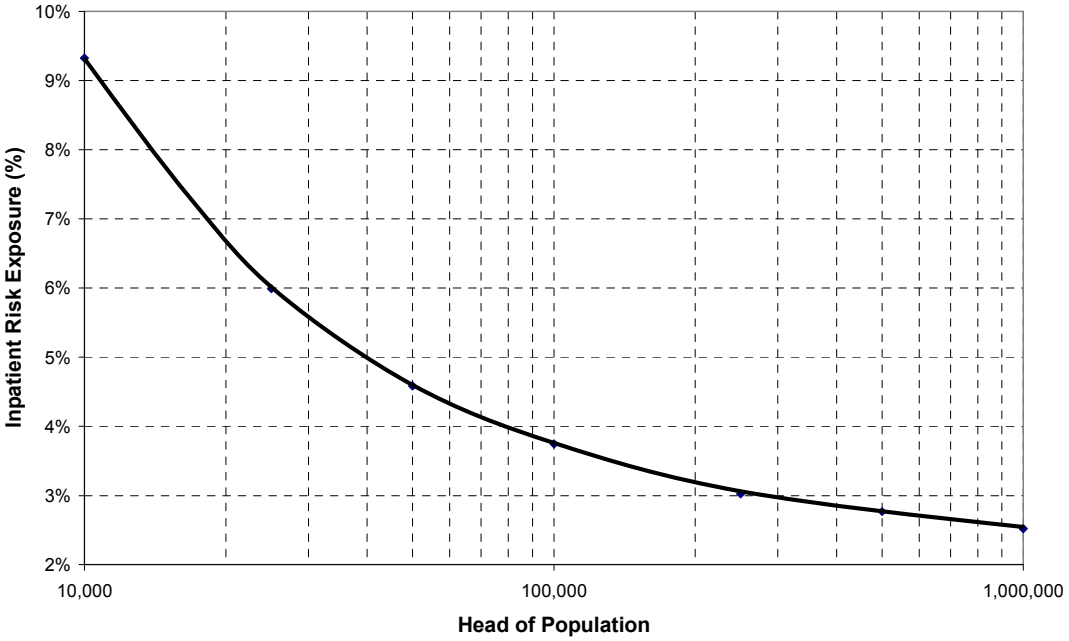
Figure Two: Effect of size on the exposure to financial risk on the inpatient budget. This simulation is for the total budget less highest cost HRGs given in Table 1.



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