Funding to maximise Quality of Care within a budget

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Working Paper 2

Funding to maximise quality of care (QOC) within a budget: bringing net benefit (NB) to case-mix funding

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1 Introduction: from efficiency measurement to funding

The first working paper in this series described and illustrated, in layman terms, how the net benefit correspondence theorem (NBCT) can be applied to compare performance of hospitals in practice allowing for their quality of care (QOC) consistent with maximising net benefit (NB) (Eckermann, Giles and Coelli 2008). Identifying peers and measuring relative efficiency consistent with maximising net benefit creates economic incentives and accountability for providers to move towards evidence based quality of care, to the extent that such performance measures influence what is valued by providers. However, economic incentives are more directly and actively created by funding mechanisms. The question this paper addresses is whether economic incentives, and accountability, for quality of care with performance measures (Eckermann 2004; Eckermann and Coelli 2008; Eckermann, Giles and Coelli 2008; Eckermann, Briggs and Willan 2008) can be extended to funding mechanisms. In particular, can the correspondence theorem be used to modify current hospital case-mix funding in jurisdictions such as South Australia to allow for higher quality of care, while maintaining budget constraint across hospitals and the health system more broadly?

1.1 Incentives for quality and efficiency with current case-mix funding

Current case-mix funding of hospitals in Australian States employs cost weights for individual clinical activities defined by diagnostic related groups (DRGs) to determine hospital recurrent payments. These cost weights are calculated based on the average within admission cost for each DRG derived from a representative retrospective sample of hospitals collected by the National Hospital Cost Data Collection (NHCDC). Such case-mix funding makes hospitals accountable for the in hospital cost per admission of their mix of clinical activities relative to a national average, but not for the effects of care. Proponents of these funding mechanisms describe the lack of accountability for effects of care as ‘clinical neutrality’ of case-mix funding (Brook 2002). However, not including effects implicitly attributes them with a 0 value. Hence, case-mix funding creates active incentives for a cost per admission that minimises quality of care, rather than being ‘clinically neutral’. Figure 1
shows this cost per admission minimising quality of care as the level of standardised effect framed from a disutility perspective \( E^{DU} \) at which cost per admission is minimised, represented by the line starting at point A and extending vertically.

Figure 1 makes clear that current case-mix payments, while creating incentives for a minimum cost per admission quality of care, do not necessarily result in costs per admission at A. This is because case-mix funding makes payments based on average cost per admission across providers for each clinical activity (DRG) rather than relative to the cost minimising provider. Hence, providers at C, which have a quality of care that reflects a policy of minimising cost per admission, can still operate at the industry average cost per admission, effectively hiding technical inefficiency behind lower quality of care. When quality of care is ignored, providers at C and D have the same average cost per admission and, hence, the same measured efficiency, but when quality of care is considered, C is inefficient (both technically
and economically) relative to D or A. Consequently, a funding mechanism that holds providers accountable for average cost, but not quality, creates incentives for minimum cost per admission quality of care but also provides scope for hiding technical inefficiency behind lower quality of care.

Further, a minimum cost per admission quality of care in hospitals at C or A will usually impact on health state and treatment required post separation. These post separation impacts can include increased hospital readmission, treatment in other institutional health care settings, such as aged care, general practice and specialist services, and informal care in non-institutional settings. Therefore, while C and D have the same costs within admission, the lower quality of care with C can lead to higher expected costs over time when considering potential costs post hospital separation.

In general, the expected quantity of health care use over time, as well as expected price of health care use, needs to be considered in determining health system costs over time (Lomas, Fooks, Rice and Labelle 1989; Barer, Lomas and Sanmartin 1996). Hence, even if case-mix funding did minimise cost per admission across hospitals (at A), this does not imply health system costs over time are minimised, given downstream cost and effect implications of quality of care within admission. Consequently, to create appropriate incentives with a given budget, funding mechanisms need to make providers jointly accountable for the value (including effects beyond separation) as well as cost of quality under an appropriate trade-off. The question is, then, is there a funding mechanism that can provide appropriate trade-offs between the cost and value of quality?

2 A funding mechanism consistent with maximising net benefit

Hospitals have control of costs of care (standardised for differences in patients treated) and quality of care (e.g. standardised mortality, morbidity, readmission rates). Hence, funding conditional on differences in quality creates economic incentives for net benefit maximising
quality of care when hospitals are held accountable for their quality of care with the same value for effects as net benefit maximisation. That is, when differences in quality across providers result in payments that differ by the value of differences in effect under net benefit (e.g. $k per unit of effect). In practice, this implies a schedule of payments that differs depending on relative standardised outcomes of care, with relatively lower (higher) payments per admission for lower (higher) quality of care. On the cost-disutility plane this implies relatively lower (higher) payments for hospitals with relatively higher (lower) standardised rates of effects framed from a disutility perspective (e.g. 12 month readmission, morbidity or mortality rates). The lowest feasible payment per admission at which net benefit maximising quality can be achieved is that of the net benefit maximising provider, illustrated as point B in Figure 1. Hence, if providers have the same quality as that for net benefit maximising provider at B, they could feasibly be paid the same amount as the net benefit maximising provider. To create continuous economic incentives for net benefit maximisation, a base or first stage quality payment can be made given the outcomes of care relative to that of the net benefit maximising provider, as shown in Figure 2.

Figure 2 NB max QOC within a budget - Step 1 quality payment relative to NB peer
This quality based payment will be less than the current cost for each provider unless they operate at the net benefit maximising point (are both completely technically and economically efficient). That is, the payment schedule line (slope $-k$) is below the frontier representing feasible set of possible quality-cost combinations at every point except the net benefit maximising point. Hence, under this first stage or base payment, hospitals with quality currently below the net benefit maximising level will have an incentive to increase quality, given the cost of increasing quality is less than the additional payment for increasing quality. Conversely, hospitals with quality currently above the net benefit maximising level will have an economic incentive to reduce quality, but not as far as the reduction in quality to cost minimising quality of care with current case-mix funding. That is, there is an economic incentive to reduce quality where the expected cost saving from decreasing quality is greater than the expected loss of payment from decreasing quality, but to an appropriate net benefit maximising level rather than down to a cost minimising level currently.

Additionally, hospitals become jointly accountable for costs and quality of their services and, hence, cannot hide technical inefficiency behind lower quality of care as with current case-mix funding. If total payments across providers with this first stage payment are less than that with current case-mix funding, as is the case in Figure 2, then a second stage buffer payment of a fixed amount per admission for each provider can be made within the current budget per admission. That is, an additional per admission payment can be made to increase the industry average cost per admission across providers up to the current industry average cost per admission with case-mix funding.

3 Can NB maximising QOC be reached within current per admission payments?

The question of whether it is feasible to reach the net benefit maximising quality of care given current case-mix payment per admission is alternatively stated as how far around the frontier
could providers move from the current industry ‘shadow price’? The industry shadow price represents the implicit value for quality in current behaviour across hospitals when calculated as where aggregate industry cost share weighted economic and technical efficiency across hospitals is maximised, following Eckermann (2004) and Eckermann, Giles and Coelli (2008).

How much average industry quality per admission can improve (rate of effect from a disutility perspective reduces) whilst maintaining current average industry funding per admission is an empirical question, dependent on technical versus allocative inefficiency inherent in current performance. The overall budgetary impact will also depend on the impact on expenditure post separation from improving quality of care within admission. Initially, we assume the impact of increasing quality of care on post separation expenditure is neutral. This is a conservative assumption where increased quality within admission is expected to lower health system use and costs beyond point of hospital separation.\(^1\) Under this assumption, Figure 3 presents three distinct scenarios for current average cost per admission (AC1<AC2<AC3), which are associated with increasing levels of inefficiency across hospitals, to determine how far around the frontier providers can feasibly move with current per admission payments to improve the level and value of quality from that implicit in the current shadow price.

\(^1\) The notable exception to this is where lower quality causes low cost deaths. However, in this case, assuming a primary objective is to prevent deaths (a safe assumption in all non palliative settings), increases in budgets to allow higher quality of care are likely to be supported by society in order to reduce such mortality.
The differences in average cost for the same technology (and, hence, position of the frontier) and industry shadow price reflect a different average level of technical inefficiency across providers (industry technical inefficiency) in these scenarios, with AC3 reflecting higher average technical inefficiency across hospitals than AC2 and higher again than AC1. That is, hospitals are, on average, expected to be further away from the frontier where the industry shadow price is the same but the average industry cost is higher (AC3>AC2>AC1). Differences will be driven by technical inefficiency, given allocative inefficiency is the same across providers at the same industry shadow price and technology, as illustrated in these scenarios. Such technical inefficiency is not unexpected with current case-mix payments based on average industry costs, given inefficiency can be hidden behind lower quality of care per admission, as discussed at length in the introduction.

If current average costs are at AC2 or AC3, then a net benefit maximising level of quality, represented at point C with corresponding value of effects of $k$, can feasibly be reached. For AC3, this allows for a surplus over the required costs (and, hence, scope for second stage
buffer payment), while for AC2 the cost of net benefit maximisation matches the current average cost at point C. If average costs are below AC2, then quality of care can still feasibly improve from that implicit with the current shadow price, but not up to the net benefit maximising point. For example, with AC1 the feasible value for effects can only increase from the current shadow price at point A to point B, with a shadow price of \( j \) per unit of effect less than \( k \).

### 3.1 First and second stage payment schedule

In general, to provide economic incentives for a value of effects \( a \), a schedule of quality based payments per admission for any hospital \( i \), conditional on each hospital’s outcomes framed from a disutility perspective \( DU \) e.g. mortality and the cost per admission of the best peer (given scheduled value of quality \( a \)), can be expressed as:

\[
payment_i = C_{peer(a)} + a \times (DU_{peer(a)} - DU_{i})
\]

where:

- \( C_{peer(a)} \) is cost per admission of the best practice peer at the scheduled value of effects;
- \( a \) is the scheduled value of effects;
- \( DU_{peer(a)} \) is the effects framed from a disutility perspective of the peer maximising net benefit at a value of effects \( a \);
- \( DU_{i} \) is the effect framed from a disutility perspective for hospital \( i \).

Beginning with the scheduled value of effects \( a \) set at the current shadow price in the first stage payment ensures payments per admission remain within current case-mix funding. To allow continuity with case-mix funding, a second stage buffer payment representing the residual of case-mix funding per admission once payments conditional on quality of care have been made in the first part payment schedule. Including this buffer payment, the payment made to each hospital \( i \) can be represented as:
\[ \text{payment}_t = C_{\text{peer}(a)} + a \times (D_U_{\text{peer}(a)} - D_U_t) + A \]  \hspace{1cm} (2)

where \( A \) is the second stage residual buffer payment to maintain current average industry case-mix levels of funding per admission.

Under the assumption of no impacts post separation, industry quality of care can feasibly increase within the current industry payment per admission up until a value of effects where a QIC line is tangent to the frontier representing current technology at the current average cost per admission. Consequently, regardless of whether net benefit maximising quality of care can be reached, a funding mechanism conditioning payments on quality is suggested, increasing from the current shadow price to improve quality as far as possible for the current average industry cost per admission.

4 A sequential funding mechanism to improve quality with a budget constraint

A sequential two stage funding mechanism is suggested in transition from case-mix funding with an implicit 0 value for quality towards a funding mechanism with incentives for net benefit maximising quality of care while remaining within case-mix budgets. To ensure average payments remain at current levels while beginning to make providers accountable for their quality of care, the first stage funding mechanisms can start with a schedule of relative payments reflecting the current shadow price for effects.\(^2\) Starting from this initial industry shadow price for quality, the following three steps can then be sequentially undertaken until a net benefit value of quality \((k)\) is reached or the second stage buffer payment is exhausted:

1. First stage fund according to scheduled price for quality (effects) across providers, the current shadow price in period 1;

\(^2\) Starting this first stage schedule at the current shadow price allows a buffer for a second stage funding mechanism, the extent of which will depend on technical inefficiency.
2. Second stage apportion remainder of case-mix funding budget pro-rata/admission (buffer payment); and

3. Subsequent period increase scheduled price (value) for quality (effects).

This two-stage sequential payment mechanism is illustrated in Figure 4.

![Image of Figure 4: Sequential 2-stage funding mechanism](Image)

**Figure 4 Sequential 2-stage funding mechanism**

5 Illustrating quality funding: PTCA in South Australia

Previously we have illustrated application of the NBCT to performance measurement by comparing efficiency across three hospitals for PTCA DRGs F10Z and F15Z, based on their standardised mortality rate and costs over 12 months (Eckermann, Giles and Coelli 2008).

Here, we extend this example to illustrate funding mechanisms that modify case-mix funding to create more appropriate incentives for quality of care while maintaining current case-mix payments per admission.
5.1 Quality payments given standardised measures of effect

The industry shadow price of quality across the three hospitals for combined F10Z and F15Z DRGs was estimated at $13,818 per mortality avoided with standardised 12 month mortality rates of 0.66%, 3.74% and 2.66% for Hospitals A, B and C, respectively. Hence, if providers were paid per admission for an industry standardised patient population based on their current 12 month standardised mortality rates alone, then Hospital A would be paid $425 ($13,818 × 0.038) per admission more than Hospital B and $278 per patient more than Hospital C ($13,818 × 0.020), given a scheduled value of quality at the current industry shadow price of $13,138 per mortality avoided. Following equations (1) and (2), such differential payments would be made relative to the cost of economic efficient provider/s at the scheduled value for quality.

The current shadow price is the same as the threshold value at which Hospital A and Hospital C have equal net benefit and, hence, both A and C are economic efficient providers at this shadow price. This implies the schedule could be expressed relative to C or A. However, given an intention to increase the scheduled value for quality above the shadow price, a payment schedule for combined activities relative to the current performance of Hospital A with higher quality of care (lower standardised mortality rate) is suggested as the benchmark.

The cost within admission for Hospital A differs across these two activities ($9,731 for F10Z and $7,772 for F15Z) and hospitals can have different proportions of these two activities. Hence, if we consider F10Z and F15Z separately, a quality based payment schedule for hospital \( (i) \) can be set for F10Z as:

\[
payment_{F10Z} = 9731 + 13138 \times (0.0136 - M_{10z}^i*)
\]

where \( M_{10z}^i* \) is the standardised mortality rate for hospital \( (i) \) for F10Z.

Similarly, the payment schedule for hospital \( (i) \) can be set for F15Z as:
\[ \text{payment}_{F15Z} = \$7,772 + \$13,138 \times (0 - M_{15Z}^i) \]  

(4)

where \(M_{15Z}^i\) is the standardised mortality rate for hospital \((i)\) for F15Z.

If we consider the average payment per admission for F10Z and F15Z combined, then a quality based payment schedule for hospital \((i)\), given a proportion \(p_i\) of F10Z admissions \([\{1 - p_i\}]\) of F15Z admissions] for hospital \((i)\), can be set as:

\[ \text{payment}_{F10Z+F15Z}^i = p_i \times \text{payment}_{F10Z}^i + (1 - p_i) \times \text{payment}_{F15Z}^i \]  

(5)

Equation (5) makes clear that the average payment per admission, like current case-mix payments, will depend on the proportion of activities in each DRG.

In our PTCA example with DRGs combined in performance measurement, expanding out equation (5) simplifies, with a single estimate of the industry shadow price across activities, to:

\[ \text{payment}_{F10Z+F15Z}^i = p_i \times \$9,731 + (1 - p_i) \times \$7,772 + \$13,138 \times [p_i \times (0.0136 - M_{10Z}^i) + (1 - p_i) \times (0 - M_{15Z}^i)] \]

5.2 Adjusting for costs beyond hospital separation and patient mix

The payment schedules in equations (3) to (5) allow for standardised effects beyond point of separation and, hence, provide incentives for more appropriate quality of care while preventing incentives for effect shifting. However, like case-mix payments, they are still based on within admission costs and, hence, implicitly assume that there are no differences in costs beyond the index hospital admission. Further, they assume that the expected cost of treating patients does not differ within DRG.

Incentives for cost-shifting arise where cost impacts beyond point of hospital separation are not adjusted. Hence, if linked costs are available beyond point of hospital separation, then
cost-shifting incentives can be prevented by including them in performance measurement and adjusted in funding mechanisms admission (Eckermann 2004, Eckermann 2006, Eckermann and Coelli 2008). Similarly, cream-skimming incentives arise with case-mix funding where providers can select patients on observed factors within DRG to lower expected costs. Hence, payments, like performance measures, should also be adjusted for differences in expected costs arising from patient risk factors within admission.

We now demonstrate how payment schedules in equations (3) to (5) can be adjusted for costs beyond separation and differences in patient risk factors within admission using analysis from the comparison of performance of PTCA (Eckermann, Giles and Coelli 2008). In the PTCA example, costs of readmission up to 12 months from index admission were included in performance measures as shown in Table 1.

Table 1 Cost of admissions standardising for age and Charlson Co-morbidity index

<table>
<thead>
<tr>
<th></th>
<th>LOS index admission</th>
<th>Cost index admission</th>
<th>Cost of readmission</th>
<th>Total cost Unadjusted</th>
<th>Age, Charlson standardised cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F10Z</td>
<td>F15Z</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital A</td>
<td>5.00</td>
<td>$9,731</td>
<td>$2,710</td>
<td>$12,441</td>
<td>$12,337</td>
</tr>
<tr>
<td>Hospital B</td>
<td>3.80</td>
<td>$8,935</td>
<td>$2,313</td>
<td>$11,248</td>
<td>$11,034</td>
</tr>
<tr>
<td>Hospital C</td>
<td>4.98</td>
<td>$9,713</td>
<td>$2,690</td>
<td>$12,403</td>
<td>$12,430</td>
</tr>
<tr>
<td>Hospital A</td>
<td>3.05</td>
<td>$7,772</td>
<td>$1,976</td>
<td>$9,748</td>
<td>$9,739</td>
</tr>
<tr>
<td>Hospital B</td>
<td>2.15</td>
<td>$7,165</td>
<td>$2,823</td>
<td>$9,988</td>
<td>$10,132</td>
</tr>
<tr>
<td>Hospital C</td>
<td>2.67</td>
<td>$7,513</td>
<td>$3,660</td>
<td>$11,173</td>
<td>$11,009</td>
</tr>
</tbody>
</table>

1 Costs adjusting for length of stay were calculated based on difference from mean NHCDC length of stay for F10Z as $9,279 + (LOS - 4.31) × $662.88 and for F15Z as $7,347 + (LOS - 2.42) × $667.36.

In funding schedules, costs of readmission and differences in expected costs due to patient mix should also be used to adjust the payment formulae relative to Hospital A as the appropriate peer at the current industry shadow price. Hence, adjusting for readmissions and patient mix, the funding formulae in equations (3), (4) and (5) for hospital (i) respectively become (6), (7) and (8):
\[ Payment_{F10Z}^i = 9,731 + (2,710 - C_{r10Z}^i) + Z_{aF10Z}^i \times 13,138 \times (0.0136 - M_{10Z}^i) \] (6)

\[ Payment_{F15Z}^i = 7,772 + (1,976 - C_{r15Z}^i) + Z_{aF15Z}^i \times 13,138 \times (0 - M_{15Z}^i) \] (7)

\[ Payment_{F10Z+F15Z}^i = p_i \times Payment_{F10Z}^i + (1 - p_i) \times Payment_{F15Z}^i \] (8)

where:

\[ C_{rF10Z}^i \] and \[ C_{rF15Z}^i \] represent the actual cost of readmission for hospital \( i \) for F10Z and F15Z, respectively, up to 12 months; and

\[ Z_{aF10Z}^i \] and \[ Z_{aF15Z}^i \] represent the difference in total standardised cost to 12 months between the patient population treated in hospital \( i \) and the patient population in the peer hospital, A, for F10Z and F15Z, respectively.

Table 2 illustrates quality payments and adjustment for readmission and expected differences in costs, given patient risk factor standardisation of costs for the PTCA example and assuming provider quality and readmission rates were the same as the performance measurement period. The quality payment in the fourth column reflects the payment schedule in equations (3), (4) and (5) adjusting for quality with standardised rates of effects, while that in the last (seventh) column reflects the payment schedules in equations (6), (7) and (8).
Table 2: First stage payment schedule adjusting for quality, readmission and within DRG cost

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>F10Z</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital A</td>
<td>$9,731</td>
<td>$0</td>
<td>$9,731</td>
<td>$0</td>
<td>$0</td>
<td>$9,731</td>
</tr>
<tr>
<td>Hospital B</td>
<td>$9,731</td>
<td>-$487</td>
<td>$9,244</td>
<td>$397</td>
<td>-$110</td>
<td>$9,521</td>
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<tr>
<td>Hospital C</td>
<td>$9,731</td>
<td>-$172</td>
<td>$9,559</td>
<td>$20</td>
<td>$131</td>
<td>$9,710</td>
</tr>
<tr>
<td><strong>F15Z</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital A</td>
<td>$7,772</td>
<td>$0</td>
<td>$7,772</td>
<td>$0</td>
<td>$0</td>
<td>$7,772</td>
</tr>
<tr>
<td>Hospital B</td>
<td>$7,772</td>
<td>-$327</td>
<td>$7,445</td>
<td>-$847</td>
<td>$154</td>
<td>$6,752</td>
</tr>
<tr>
<td>Hospital C</td>
<td>$7,772</td>
<td>-$351</td>
<td>$7,421</td>
<td>-$1,684</td>
<td>-$155</td>
<td>$5,582</td>
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<tr>
<td><strong>F10Z and F15Z Combined</strong></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Hospital A</td>
<td>$8,718</td>
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<td>Hospital B</td>
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<td>-$246</td>
<td>$27</td>
<td>$8,094</td>
</tr>
<tr>
<td>Hospital C</td>
<td>$8,718</td>
<td>-$264</td>
<td>$8,454</td>
<td>-$861</td>
<td></td>
<td>$7,576</td>
</tr>
</tbody>
</table>

1 Combining of activities is undertaken based on industry level activity with 48.3% of PTCA admissions F10Z and 51.7% F15Z.

The illustrated payment schedule has been derived from performance measures where the major PTCA DRGs F10Z and F15Z were combined in estimating the current shadow price and peers across industry activity for three hospitals. In performance measurement, this combining of activities was undertaken to increase robustness of analysis in aggregating events as quality indicators. Such combining of similar activities also has some theoretical and practical advantages in informing payment schedules. First and foremost, in estimating a common shadow price, it allows the same value for effects in the first and subsequent quality payments. This is desirable, given that, in order to maximise efficiency of the hospital and health system, we would want shadow prices to be equalised across activities as well as for hospitals within activities following principles of program budgeting and marginal analysis and maximisation of net benefit following Graham (Graham 1992), a point to which we return in detail in the discussion.
However, there are also limitations that arise from aggregating, particularly where the peers for individual activities are different from the peers that arise from combined analysis. The same framework and methods are simply applied to individual activities to identify peers and estimate industry shadow prices in forming separate payments by activity. In general, the level of aggregation at which the methods are applied can be chosen to suit the decision context. DRGs F10Z and F15Z were combined in constructing the technology, identifying peers and estimating shadow prices in the current analysis, but analysis could have been undertaken at an individual DRG or a more aggregated level (e.g. all PTCA or major disease classification (MDC) level). The reader interested in choosing level of analysis is referred to the relevant chapter and policy sections in Eckermann (Eckermann 2004: 33-41, 191, 195, 259).

5.3 Second stage buffer payment – residual of average cost case-mix funding

To maintain the current level of case-mix funding per admission, a second stage buffer payment per admission can be made as the residual of current case-mix funding reflecting average industry cost per admission. Table 3 calculates case-mix payments per admission for F10Z, F15Z and the industry combination F10Z and F15Z based on the observed industry average cost of hospitals, as well as case-mix payments adjusted for cost of readmission and patient differences, to allow comparison between all relevant quality based and current case-mix based payments. Table 4 then calculates the second stage buffer payment (constant across hospitals) as the residual of industry case-mix funding and readmission, patient mix and first stage quality based funding for each hospital (last column of table 2). Adding this second stage buffer payment to first stage quality the total quality, readmission and patient mix adjusted quality based payments for each hospital are derived in the third column of table 4. Columns 4 and 5 compare this total quality adjusted payment with average cost and readmission.
Table 3: Average cost casemix payments, adjusted for readmission & patient mix but not quality

<table>
<thead>
<tr>
<th>Casemix payment</th>
<th>Readmission Adjustment</th>
<th>Patient mix Adjustment</th>
<th>Adjusted case-mix payment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>F10Z</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital A</td>
<td>$9,731</td>
<td>-$127</td>
<td>-$22</td>
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<tr>
<td>Hospital B</td>
<td>$8,935</td>
<td>$270</td>
<td>-$131</td>
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<td>Hospital C</td>
<td>$9,713</td>
<td>-$107</td>
<td>$109</td>
</tr>
<tr>
<td>Industry¹</td>
<td>$9,485</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td><strong>F15Z</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital A</td>
<td>$7,772</td>
<td>$1,171</td>
<td>$48</td>
</tr>
<tr>
<td>Hospital B</td>
<td>$7,165</td>
<td>$324</td>
<td>$202</td>
</tr>
<tr>
<td>Hospital C</td>
<td>$7,513</td>
<td>-$513</td>
<td>-$106</td>
</tr>
<tr>
<td>Industry¹</td>
<td>$7,470</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td><strong>F10Z and F15Z Combined¹</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital A</td>
<td>$8,943</td>
<td>$544</td>
<td>$14</td>
</tr>
<tr>
<td>Hospital B</td>
<td>$8,090</td>
<td>$298</td>
<td>$41</td>
</tr>
<tr>
<td>Hospital C</td>
<td>$8,410</td>
<td>-$317</td>
<td>-$2</td>
</tr>
<tr>
<td>Industry*</td>
<td>$8,443</td>
<td>$0</td>
<td>$0</td>
</tr>
</tbody>
</table>

¹ Industry figures have been taken as the weighted average of hospitals to reflect average cost case-mix funding. Standardisation has also been undertaken based on industry activity.

Table 4: Casemix payments adjusted for quality with a second stage residual buffer payment

<table>
<thead>
<tr>
<th>Stage 1 Quality payment</th>
<th>Stage2 Buffer payment</th>
<th>Total quality payment</th>
<th>Case-mix payment Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>F10Z and F15Z Combined²</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital A</td>
<td>$8,718</td>
<td>$521</td>
<td>$9,239</td>
</tr>
<tr>
<td>Hospital B</td>
<td>$8,094</td>
<td>$521</td>
<td>$8,615</td>
</tr>
<tr>
<td>Hospital C</td>
<td>$7,576</td>
<td>$521</td>
<td>$8,097</td>
</tr>
<tr>
<td>Industry²</td>
<td>$7,922</td>
<td>$521</td>
<td>$8,443</td>
</tr>
</tbody>
</table>

¹ The second stage buffer payment of $521 represents the difference between the average standardised industry cost per admission with average cost case-mix funding of $8,443 (table 3) and the average industry first stage quality payment of $7,922 (column 1).

² Industry figures have been taken as the weighted average of hospitals to reflect average cost case-mix funding. Standardisation has also been undertaken based on industry activity.
The total quality payment with adjustment for readmissions and patient severity (table 4, column 3) is higher than that of unadjusted case-mix funding (Table 4, column 4) for Hospitals A and B and lower than that of case-mix funding for Hospital C. If case-mix funding were also adjusted for readmissions and expected cost of patient mix (Table 4, column 5), then comparing column 3 with 5. Hospital B with the highest standardised 12-month mortality rate would have a reduction in payments from quality adjustment relative to case-mix funding of $153 per admission, hospital C a reduction of $13 per admission and hospital A an increase of $251 per admission.

In considering any argument that hospitals such as B, which currently has relatively lower quality of care, will be ‘disadvantaged’, it should be noted that for technically efficient providers the quality plus buffer payments will be closer to actual costs of providers than average case-mix payments. Providers who have lower quality of care have lower expected costs when technically efficient (on the frontier) for any level of quality above cost minimising quality of care. Hence, under payment systems based on average cost per admission, it is the providers with relatively higher quality of care, including the peer at the current shadow price, that are currently disadvantaged, effectively subsidising providers with lower quality of care. In practice, this will be reflected in lower cost and/or lower technical efficiency of relatively lower quality providers. Rather than penalising providers with higher quality of care per admission and encouraging them to reduce their quality of care (with an implicit 0 value for quality), providers with lower quality of care per admission should be encouraged to increase their quality of care and technical efficiency, at least up to that of the peer at the current industry shadow price.

6 Advantages of the sequential two-stage payment schedule

The proposed sequential payment schedule provides achievable and more appropriate incentives at each stage, while maintaining budget control. Hence, inefficient hospitals can change behaviour over time, with clinicians and administrators within hospitals given time to
adapt to economic accountability in valuing quality of care. The sequential first stage payment is conducive to planning of administrators, while second stage payments allow a buffer for actual performance and budget control. This allows an ordered improvement towards net benefit maximising quality of care from current average cost case-mix funding, which currently implicitly gives a 0 value for quality while allowing technical inefficiency to be hidden behind lower quality of care.

Analysis thus far suggests NB maximising quality of care can be reached where current average cost per admission is above that of the NB maximising producer (technically and allocatively efficient). However, increased hospital QOC/admission has been conservatively assumed to have a neutral impact on health care costs post-separation. Improved QOC within admission can be expected to reduce health system use and costs post separation. Consequently, QOC may increase further than average cost per admission suggests, while remaining within the health system budget.

6.1 *Improving hospital communication and internal organisation*

Case-mix funding creates economic incentives for a quality of care minimising cost per admission and, across hospitals, allows hiding of technical inefficiency behind lower quality of care by ignoring quality and being based on average costs. The proposed two-stage funding mechanism creates accountability for quality as well as the cost of care relative to a peer with an appropriate quality and cost of care. Consequently, the proposed funding mechanism removes current incentives for technical as well as allocative inefficiency. The sequential two-stage mechanism starting at the current industry shadow price for quality allows a process of managed transition and budget control in moving from case-mix funding towards net benefit maximising quality of care. This moves quality as far towards NB maximisation as possible within a case-mix or health system budget.
The joint accountability for quality and costs of care with these proposed funding mechanisms is also expected to have an impact on the level of internal communication between clinicians and administrators within hospitals. Harris (Harris 1977) described the internal organisation of the hospital as split between administrators, with an objective of cost minimisation, and clinicians, with an objective of quality maximisation. The ground on which they met is where clinicians within any given specialty attempt to cordon off resources (beds, equipment, labour etc.) to support (defend) quality of care with uncertain spot levels of patient demand, while administrators attempt to minimise excess resource capacity to in turn minimise costs for given activity. The level of quality within any given specialty for any given hospital under this split is then effectively a battle of control between administrators and clinicians with opposing objectives.

However, as Harris later suggests, this splitting of the organisation results in many inefficiencies:

“The failure to recognise that doctors and hospitals are linked by a strong bond of joint production is the basis of many of the hospitals’ inefficiencies.”

(Harris 1977, p. 475)

These inefficiencies include breakdown in allocation mechanisms for inputs and hoarding practices of clinicians as well as those related to a lack of information flows and knowledge in trade-offs between cost and quality of care resulting from this split in internal organisation.

Inefficiencies related to the lack of recognition of joint production in decision making under organisational separation are the basis for the ultimate conclusion Harris reaches that:

“ultimately a rational public policy towards hospitals requires a change in the internal organisation of the hospital itself.” Harris (1977, p. 467).
Harris also suggests that the primary objective of health maximisation and quality, or doctor part of the ‘hospital firm’, needs to be included alongside the objective of cost minimisation where currently:

“policy towards hospitals is almost exclusively directed at the supply side of the organisation…this policy is doomed to failure”. (Harris 1977, p467)

Including health effects consistent with the economic objective of net benefit maximisation under the correspondence theorem, means this primary policy concern of Harris (1977), for inclusion of health maximisation in the objective function, can be directly addressed in performance measurement and funding.

Use of the proposed performance measures and funding mechanisms allows policy makers to create a structural framework for a shift in hospital organisation. Clinicians and administrators are provided with guidance in valuing quality as well as a common objective, which trades off the cost and value of quality of care. This structural framework allows hospitals to be organised such that clinicians and administrators can have a dialogue in relation to the common goal of net benefit maximising quality of care under funding constraints.

The funding mechanism acts as a structure for the relationship between administrators and clinical decision makers, in influencing both the value of and accountability for quality in the negotiation framework. While Harris (1977) characterises administrators as cost minimising, the objective function that underlies the funding mechanism determines the primary argument in the administrator’s objective function.
Under case-mix funding, the administrator’s underlying objective is to minimise cost per admission and, hence, administrators effectively become accountants. The objective function implicit in the funding mechanism also affects clinicians’ negotiation position in demanding resources, to the extent it reflects, and is informed by, clinical effects. Under case-mix funding, clinicians do not have their quality of care valued and, hence, are not economically accountable for their outcomes of care. However, this will not necessarily lead to costs minimising resource use per admission at a clinical level, given the inefficiencies created by the internal split between clinicians and administrators that this system requires. Additionally, at a hospital or industry level, cost minimising resource use per admission is unlikely to occur, given the scope for hiding technical inefficiency behind lower quality of care where payments do not hold hospitals accountable for quality of care.

Under the proposed funding mechanism, providers have their quality of care valued while becoming accountable for quality of care. Administrators are no longer encouraged to act as accountants minimising cost per admission, but rather to consider trade-offs between the value and cost of quality of care. Hence, the proposed performance and funding mechanisms actively encourage meaningful dialogue between administrators and clinicians trading off cost and value of quality within hospital.

The proposed funding mechanism allows a more appropriate trade-off between the value of quality of care (currently implicitly valued at 0 by case-mix funding) and cost of quality of care. As payments are relative to best practice, this creates economic accountability for quality of care. Under correspondence conditions, this funding mechanism creates a structure for the internal hospital relationships between manager and physician to support quality of care that maximises net-benefit in practice. The mechanism in allowing for the value as well as the cost of quality supports evidence based medicine in terms of both how, as well as
which, strategies or technologies are adopted in treating patients for any given clinical activity (DRG).

The proposed method of continuous quality based payments has distinct advantages over alternatively performance based payment systems, which set a fixed reward for reaching a target level of performance (Lindenauer et al 2007). Fixed target performance based payments do not provide a theoretical basis (economic or otherwise) for the level of payment or target level and can only provide localised incentives around a target level, rather than the continuous incentives with the proposed mechanism.

Nevertheless, the proposed method, like other quality based performance based payments, requires processes of clinical audit and peer review to ensure measurement is not finessed by providers over time (Eckermann 2004, p.207-210) and data to support robust approaches in preventing cream-skimming and cost shifting incentives.

7 Policy implications

For policy makers, the correspondence theorem provides an evidence based framework to systematically replace perverse economic incentives for cost minimising quality of care, with accountability for effects and cost of quality of care under an appropriate trade-off. This framework, while allowing comprehensive and flexible identification of what is required at a DRG level and providing a linear and flexible method for synthesis, is not, however, a panacea by itself. As discussed at length in Working Paper 1, satisfying correspondence assumptions focuses existing policy agendas on risk adjustment to avoid cream-skimming and data linkage to avoid cost, and event (effect), shifting.

To satisfy the common comparator assumption and overcome incentives for cream-skimming, challenges remain for policy makers in adjusting costs and rates of effects for patient risk factors. To curtail incentives for cost and event shifting and satisfy the coverage of effect
assumption requires either linkage to costs and effects beyond separation or modelling these effects conditional on health status at point of hospital separation.

However, adjustment for patient risk factors and allowing for effects beyond hospital separation are required to be systematically addressed by any performance measure and funding mechanism to avoid incentives for cream-skimming and cost and effect shifting. Hence, the explicit nature of coverage and comparability conditions in the net benefit correspondence theorem provides an appropriate framework to qualify and improve performance measurement and funding mechanisms.

7.1  Appropriate use of data linkage and risk modelling

Policy makers generally recognise the importance of adjusting for risk factors at admission and effects beyond separation, but have not had a theoretical framework to appropriately synthesise these effects alongside costs in economic performance measurement and funding. In Australia, various initiatives in data linkage have been, and continue to be, undertaken in modelling effects of hospital admissions beyond point of separation and interactions between hospitals and other health care providers. These initiatives include:

(1) linkage of hospitalisation to residential aged care by the Australian Institute of Health and Welfare;
(2) linkage of Medicare data, for patient level prescription drug use under the Pharmaceutical Benefits Scheme (PBS) and general practitioner and other Medicare services under the Medical Benefits Schedule (MBS), by the Health Insurance Commission (HIC);
(3) the health-connect electronic health record used clinically (matching with unique identifiers);
(4) Western Australian data linkage (using probabilistic modelling) of individual patient hospitalisation morbidity (readmission by principal diagnosis) death, cancer and mental health registry data back to 1971 (Holman, Bass, Rouse and
Despite these data linkage initiatives, quality (effects) of care measures continue to be excluded from hospital inpatient performance measures and funding mechanisms. Perverse incentives for quality of care will remain in the absence of a framework, and method, that systematically synthesises evidence of the effects and costs of quality of care in performance measures and funding mechanisms consistent with an appropriate objective function. The correspondence theorem provides the systematic evidence based framework to synthesise these data. Where correspondence conditions are satisfied, appropriate economic incentives for quality of care are created, with an underlying objective of net benefit maximisation, and perverse incentives for cost shifting and cream-skimming are avoided.

8 Future Research

8.1 Aggregation across time

In the illustrated application of performance and funding mechanisms for PTCA, the choice to combine DRGs F10Z and F15Z was, in large part, made to reduce the impact of chance on observed relative performance and technology. Similar benefits in stability can be achieved by aggregating costs and effects over time. Hence, in informing relative performance measures or funding schedules, the frontier (technology), peers and their cost and quality could be initially assessed with two or more years of data and then reassessed either as a rolling average every year or kept for a similar period before being reassessed. Alternatively, the construction of technology frontiers and identification of peers could be assessed using methods that explicitly allow for uncertainty, such as stochastic frontier analysis (Coelli et al 1998; Eckermann 2004, 259-266; Eckermann and Coelli 2008).
8.2  *Maximising quality of care with any given budget*

Application of the net benefit correspondence theorem to funding has been illustrated with the budget notionally fixed at current case-mix funding levels per admission to demonstrate the ability to improve quality while maintaining budgetary control. However, the methods presented in this paper could be modified to consider funding mechanisms that allow movement towards maximum quality for any given budget.

For example, consider where the process of increasing quality from the shadow price in current activity was undertaken for all clinical activities within the budget currently allocated by hospital case-mix funding and sub-budget for individual activities (DRGs). Further, assume the measures of effects representing quality of care were generically measured across activities in linking to or modelling long term health outcomes (e.g. QALYs). Then, for the current global case-mix budget, information on the technology (frontier) and value of this generic effect across activities where technical efficiency was eliminated with sub-budgets for each activity provides a rational basis for redistributing current sub-budgets across activities to maximise health within any given budget.

Following the principles of program budgeting and marginal analysis (PBMA), health is maximised for a given budget and population treated when resources are shifted, such that the value of effects from quality of care are equalised across activities (and providers are technically efficient), as illustrated in Figure 5.
Figure 5: Maximising NB across activities

This result follows from diminishing marginal returns as, where all providers are on the frontier (technically efficient) across all activities for a given budget, then improving quality in one activity has a higher expected cost per unit effect than the loss in quality from taking budget from another activity to support this. Hence, any shift in budget from where the value of effects has been equalised results in a lower net level of health. This value of effects equalised across activities with technically efficient providers will also represent the true value of effects in net benefit from that budget, following Graham (1992).

Consequently, following Graham (1992) and PBMA principles, the information provided by the proposed performance measurement and funding mechanism allows a rational basis for determining the optimal quality of care for any given global budget and given population in allocation of budgets across activities, whether:

(i) redistributing current sub-budgets across activities;
(ii) allocating new expenditure to where there is greatest expected gain; and/or
(iii) removing expenditure where there is lowest expected loss.
Quality payment schedules can be made relative to that for the net benefit maximising hospital at the scheduled value of effect on the basis of the cost per admission or a cost over the 12 month follow-up period. Given that case-mix payments are currently made to hospitals on a per admission basis, adjustment of this payment system for quality has been illustrated per admission in this paper. However, if providers were paid across a continuum of care (e.g. capitation based payments for GPs), adjustment for quality payments could similarly be made relative to that of a net benefit maximising peer across this continuum of services over time, rather than the cost of the peer for a single service.

9 Conclusion

This paper has provided a working model for extending accountability for the value of quality of care in performance measurement consistent with maximising net benefit to funding mechanisms that create active economic incentives for improving quality within current health budgets. Specifically, a payment schedule starting with a value of quality increasing from the current industry shadow price, with payments made relative to that of net benefit maximising peer at any given value, enables quality to increase as much as possible while maintaining current case-mix budget levels per admission.

Continuous accountability for cost and quality relative to the net benefit maximising peer with this payment mechanism prevents the hiding of technical inefficiency behind lower quality of care. Gradually increasing the value of effects from the current industry shadow price provides increasingly appropriate economic incentives for a positive value to quality of care for economic (net benefit) efficiency (combining allocative and technical efficiency), while maintaining budgetary control and enabling hospitals and their internal organisation to adapt.

Price signals for the positive value of quality from this funding mechanism create meaningful economic incentives for improving internal organisation, accountability and communication
between administrators and clinicians within hospitals. Clinicians become accountable for quality while having their value recognised. Administrators are encouraged to consider trade-offs between the cost and value of quality to the health system rather than minimising costs under incentives from funding arrangements, which implicitly attribute a 0 value to quality of care.

Consequently, the combined approach to funding as well as measuring performance consistent with principles of maximising net benefit creates active incentives for ‘evidence based medicine in practice’ by hospitals and providers in choice of which technologies are used and the way they are used, within current budgets. This has been shown to improve on current case-mix funding and performance mechanisms, which, while creating active incentives to minimise cost per admission, implicitly ascribe a 0 value to quality of care and, in practice, allow hiding of technical efficiency behind lower quality of care. Further, the implicit 0 value of quality of care within admission with current case-mix funding also has expected impacts on requirements for treatment beyond hospital separation. Hence, even if the objective were purely minimising health expenditure (implicitly with a 0 value for effects) in considering budgetary impacts over time, a minimum cost per admission needs to be traded off against post separation impacts.

For the full advantages of the proposed funding mechanisms and performance measurement to the health system to be realised, coverage and comparability conditions of the net benefit correspondence theorem should be explicitly addressed and analysis appropriately qualified where they are not met. These robustness conditions have previously been shown as necessary and sufficient to prevent incentives for cost and effect shifting and cream-skimming and, hence, are an important consideration regardless of what performance measurement and funding methods or mechanisms are employed (Eckermann 2004; Eckermann 2006; Eckermann and Coelli 2008). In practice, satisfying these conditions supports current policy initiatives to link data to outcomes and costs of associated resource beyond separation and
standardise measures of effect and cost for differences in patient risk factors. The illustrated example from South Australian hospitals demonstrates application of such robust methods to satisfy correspondence conditions in linking to 12 month outcomes (readmissions, mortality, costs) and standardising these rates and costs for patient risk factors. Where coverage and comparability conditions are satisfied in applying the net benefit correspondence theorem to performance measurement and funding, perverse incentives for cost shifting and cream skimming are avoided while creating active economic incentives for appropriate quality of care.

References


