Quality Assurance Through Reimbursement

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Quality assurance and reimbursement programs normally function separately in the health care field. This paper reviews objectives and certain conceptual issues associated with each type of program. Its primary intent is to summarize substantive and operational topics which must be addressed if quality of care is to be enhanced through reimbursement. The focus is on methods for integrating quality assurance and reimbursement. The final section presents topics for future research.

INTRODUCTION

Since many analytic efforts involving the quality of care have focused on definitional and measurement issues, it is not surprising that we know relatively little about how to change provider behavior via the current approaches to quality assurance, i.e., mandatory regulation and voluntary peer review. Regardless of the successes and failures of current methods, it

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appears appropriate to broaden our total approach, build on what has been effective or partially effective, and explore several options for quality assurance. This paper discusses one potentially attractive approach to quality assurance, namely its incorporation into reimbursement. Although incentive reimbursement is conceptually appealing, it has not been tested on a widespread basis and has a number of possible impediments.

Typically, quality assurance and reimbursement programs have different objectives, are administered by separate organizations, and use different types of information for their operation. Because of these differences, issues which are innovative and at the same time characterized by a number of practical problems must be addressed. Our purposes are to: (1) discuss several analytic issues associated with providing quality incentives in the context of a reimbursement system; (2) present operational topics relevant to implementing a reimbursement system incorporating such incentives; and (3) provide suggestions for future research efforts.

To serve these purposes while restricting discussion to areas in which the concepts presented bear practical utility, the focus of the paper is on institutional care, both hospital and nursing home care, but with a greater emphasis on nursing homes due to recent issues and advances in this sector [1–4]. Operational programs appear more likely in the nursing home field in the near future, owing partly to greater variation in the quality of care among nursing homes relative to hospitals [5–10]. It is therefore intended that this paper might assist in facilitating certain operational phases of linking quality assurance and reimbursement for nursing homes. The presentation is restricted to reimbursement and quality assurance programs which pertain to a large number of facilities, such as those covered by a state Medicaid program. These are multifacility programs, not internal programs such as those conducted by peer review groups within individual institutions. Discussion is largely restricted to patient-level quality assurance programs, where data are collected on the quality of care provided to individual patients. Structural and facility-level surrogates for quality are mentioned but are not central to the main theme. A relatively parsimonious presentation of the major issues requires the assumption that basic conceptual, definitional, and measurement issues in reimbursement [11–14] and quality assessment/assurance [15–25] are known.

THE PROBLEM

One of the more common complaints in the institutional provider community is that reimbursement is inadequate to cover the costs of

providing high quality care. Despite the many points of view on this issue, such concerns highlight the natural relationship between quality assurance and reimbursement from the perspective of the cost-effective provision of health care. Given this natural linkage, a need exists to delineate conceptual and operational issues, problems, and approaches in order to assist in the analysis and potential incorporation of quality assurance into reimbursement.

ILLUSTRATIVE WAYS TO INCORPORATE QUALITY INTO REIMBURSEMENT

This section proceeds from a general discussion of methods for incorporating quality into the reimbursement process to more concrete points on certain empirical and measurement impediments. The movement from theoretical to operational is designed to provide a background for the programmatic issues discussed in subsequent sections.

We begin with the assumption that the reimbursement system and quality assurance progam of interest pertain to n facilities (hospitals or nursing homes) and that adequate cost and quality data and measures are available. It is assumed that cost data are available at the cost center and, even more specifically, at the service level. In this case, services refer to discrete treatment categories which may be as general as physical therapy or nursing services (if one is using cost report data) or as specific as ambulatory assistance or blood chemistry analysis (if one has service-specific cost data based on industrial engineering or time and motion studies). Since it will be necessary to discuss quality associated with different cost centers and service categories, we presume that quality of care is measured at the individual patient level. However, the methods require only that adequate quality measures (not necessarily derived from individual patients in all cases) be available at the cost center level or for the service/patient categories under consideration. This could even include structural quality indicators based on licensure and certification data such as those used in Massachusetts [26], although structural indicators are not of primary interest here.

For purposes of this discussion, suppose further that quality of care measures are available for all patients in the facility although, in actuality, a sample of patients is adequate. Assume quality scores for individual patients fall between 0 percent and 100 percent, with higher values indicating better quality and 100 percent regarded as optimal. This can include a variety of different types of indicators, simply measuring each in percentage units [6, 27]. Similarly, quality scores aggregated to the facility level are assumed to fall between 0 percent and 100 percent. The

period of time to which the cost and quality data pertain is the facility's fiscal year. For ease of exposition, assume that the reimbursement and quality assurance systems under consideration pertain to all payers and that reimbursement and quality assurance policies and methods are the same across all payers. This constraining assumption can be lifted by supposing that different policies exist for different payers and then analyzing the different provider and payer incentives separately.

Suppose that the facilities of interest consist of all nursing homes in a given state and that the total number of facilities is about 200 (i.e., $n = 200$). The necessary cost and quality data are available for each facility and the problem is to use the data to develop financial incentives to maintain or improve the quality of care provided by the facilities.

In Table 1, the cost (C_i), quality (Q_i), and reimbursement (R_i) values pertain to the entire facility, for $i = 1, 2, \ldots, n$. That is, C_1 is total cost, Q_1 is an aggregate facility-level quality score calculated using the quality scores of all patients in the facility, and R_1 is total reimbursement or payment for the first facility. For some of the more realistic options, it will be assumed that cost and quality measures are available for specific cost centers or service categories. In these cases, the quality measures pertain to the quality of services provided for each category, aggregated across patients, or more appropriately, across problems requiring the services. Each of the following approaches to the incorporation of quality into reimbursement is depicted in the table. It is important to bear in mind that although quality is presumed to be measured on a continuous scale in the examples, it could, without loss of generality, be characterized by a discrete or polytomous measure which takes on very few distinct values and basically groups facilities into quality categories.

The Total Facility Approach. Illustration A in Table 1 states that the total reimbursement amount for a given facility is the average cost for all facilities adjusted by the utilization volume of the facility and the ratio of the facility's aggregate quality score to the average quality score for all facilities participating in the reimbursement/quality assurance system. The quality adjustment is simply this ratio, $Q_i/\bar{Q}$. Obviously, there are other types of adjustments, such as deviations from the mean (measured continuously or in discrete groupings), which could be used instead of a simple ratio.

Similarly, as noted in Illustration B, the standard need not be the quality average for all facilities. It could be statistical in nature, such as the median or the 75th percentile of all quality scores across facilities, or a norm which experts feel is necessary to maintain adequate quality. Analogous cost standards other than average cost for all facilities could

also be used. One such standard could even be the facility's allowable cost for the fiscal year or, for a prospective system, the previous year's allowable cost with an inflation adjustment. In fact, bonuses could be paid on the basis of both cost and quality. Clearly, illustrations A and B are unrealistic in that they do not place a ceiling on reimbursement, do not allow for other factors which influence cost, and incorporate only total facility-level quality.

The Total Facility Approach with Bounds. Illustration C generalizes the prior examples by establishing an upper and lower bound for the quality adjustment factor (the quality ratio in this case). In essence, this illustration addresses the need to "cap" quality from a cost perspective. That is, if a given facility's quality is substantially and perhaps unduly higher than the norm, it might not be appropriate to reimburse for services which increase quality scores while increasing costs disproportionately.

Although somewhat less important and possibly less realistic, it might be appropriate to set minimum values for the quality adjustment factors in order to maintain institutional viability. In other words, if a facility's quality were extremely low relative to a given norm and reimbursement was based on this relationship, revenues inadequate to maintain the fiscal viability of the institution might be the result. While this might be desirable in some cases, other less severe sanctions such as mandatory education programs would warrant consideration. The cap mentioned above could also be applied directly to the reimbursement amount rather than the quality ratio (or any quality adjustment factor such as a deviation from a statistical norm). Nonetheless, this illustration is still inadequate since it does not allow for other factors to influence costs and does not incorporate anything but facility-level cost and quality. It is feasible and possibly more practical to pass to individual cost centers and/or service categories within an institution in order to incorporate quality into the reimbursement process.

The Sub-Facility Bounded Approach. Illustration D in Table 1 deals with a within-facility approach by applying the total institution approach discussed in illustration C to the cost center or service category level within the institution. For a given (set of) cost center(s) or service category(ies), such as nursing services or physical therapy, the reimbursement amount is the volume-adjusted standard cost for that category, further adjusted for the quality of care which pertains to services in that category. Such quality-adjusted costs are summed across all cost centers or service categories to determine total reimbursement.

As with Illustration C, instead of establishing minimum and maxi-

Table 1: Illustrations of Ways to Incorporate Quality (Q_i) Into Reimbursement (R_i)

Notation:

Facility	*Cost*	*Quality*	*Reimbursement*
1	C_1	Q_1	R_1
2	C_2	Q_2	R_2
.	.	.	.
.	.	.	.
.	.	.	.
i	C_i	Q_i	R_i
.	.	.	.
.	.	.	.
.	.	.	.
n	C_n	Q_n	R_n

Illustrations:

A. With $\bar{Q} = \frac{1}{n} \sum_{i=i}^{n} Q_i$ = average quality for all n facilities and $\bar{C}_i$ = expected total cost for the i^{th} facility using the average unit cost across all facilities and adjusting for (multiplying by) the i^{th} facility's volume,

$$R_i = \bar{C}_i \times (Q_i/\bar{Q}). \quad (1)$$

(Assume C_i is the total allowable cost, with inflation adjustments, etc.)

B. For Q_N = an expert-determined norm (or some such statistically determined norm, such as a cut-off level established by patient care experts or set using the 75th percentile instead of $\bar{Q}$),

$$R_i = \bar{C}_i \times (Q_i/Q_N). \quad (2)$$

service with potentially different bounds m_j and M_j for each cost center or service. Again, normative values other than averages could be used for cost and quality.

E. Instead of all facilities, the average ($\bar{Q}$ and $\bar{C}_i$) or normative (Q_N and $\bar{C}_{Ni}$) values could be based on a subset of all facilities or a peer group for the i^{th} facility. Peer groups could be based on case mix similarities, etc.

F. Most generally,

$$R_i = P(C_{ij}, Q_{ij}, X_{ij}), \quad (5)$$

where $F(C_{ij}, Q_{ij}, X_{ij})$ takes its costs, quality, and other characteristics into consideration in the context of these attributes for other facilities and/or established norms for these attributes. Thus, $F(\cdot)$ is based on empirically determined or conceptually conjectured relationships between cost and quality, taking other factors, X, into consideration. Two examples are given below.

Examples

(a) For cost centers or service categories $1, 2, \ldots, k$, there is no relationship between quality and cost. For categories k + i, $k + 2, \ldots, m$, a specified level of quality, Q_{ij}, is

This could also be done for cost, with $\bar{C}_i$ replaced by $\bar{C}_{Ni}$, some normative cost value other than the mean.

C. Somewhat more generally,

$$R_i = \bar{C}_i \times f(Q_i), \tag{3}$$

$$\text{where } f(Q_i) = \begin{cases} Q_i/\bar{Q} & \text{if } m \leq Q_i/\bar{Q} \leq M \\ M & \text{if } Q_i/\bar{Q} > M \\ m & \text{if } Q_i/\bar{Q} < m \end{cases}$$

with m and M as preset normative minimum and maximum values for the quality ratio $Q_i/\bar{Q}$. Note Q_N or C_{Ni} could be used in lieu of $\bar{Q}$ or $\bar{C}_i$ and ceilings could be so established for R_i instead of Q_i/Q.

D. Generalizing to different cost centers or service categories would yield

$$R_i = \sum_{j=1}^{m} \bar{C}_{ij} f_j(Q_{ij}). \tag{4}$$

where j indexes a set of m mutually exclusive and exhaustive cost centers (and/or services), $\bar{C}_{ij}$ is (a function of) the expected cost for each category for each facility using average unit cost across the j^{th} category for all facilities and adjusting for the i^{th} facility's volume for the category, Q_{ij} measures the quality of care for each cost center or service category, and $f_j(\cdot)$ is as defined in (3) for each cost center or known to cost $C(Q_{ij})$ dollars. Letting C_{ij} be the allowable cost for $j = 1,2,\ldots,k$ and $C(Q_{ij})$ be the quality-based allowable cost for $j = k+1, k+2,\ldots,m$,

$$R_i = \sum_{j=i}^{k} C_{ij} + \sum_{j=k+i}^{m} C(Q_{ij}).$$

This could be done for facilities grouped according to other characteristics (X) known to influence costs.

(b) Assuming cost is determined partially by quality,

$$R_i = g(C_i, \hat{C}_i)$$

where

$\hat{C}_i$ = predicted or expected cost using quality, Q_i, and possibly other factors, X_i, in an empirically derived prediction function $h(Q_i, X_i)$.

Assuming, for example, $h(\cdot)$ is a regression function with squared coefficient of determination $R^2 = p$, $0 \leq p \leq i$ and p can be interpreted as the percentage of variation in cost attributable to Q and X. The reimbursement would be

$$g(C_i, \hat{C}_i) = (1-p)C_i + p\hat{C}_i,$$

where C_i is actual (allowable) cost and $\hat{C}_i$ is expected cost obtained using Q_i and X_i substituted in $h(\cdot)$ for the i^{th} facility. This approach could be used on a cost center basis.

mum (ceiling) values for quality, such minima and maxima could be established for the actual volume-adjusted reimbursement amount for each cost center or service category, or for the reimbursement amount for the entire facility. This method improves upon the preceding three in that it allows for quality variation across service categories within a facility and incorporates this into reimbursement. However, it remains weak in that an overall quality adjustment such as the quality ratio (i.e., Q_i/Q) fails to take into consideration the fact that quality can differentially influence cost across service categories. It also fails to consider other important determinants of cost, such as facility type and case mix.

Peer Grouping Adjustments. If the average or normative quality and cost values used in Illustrations A through D in Table 1 are calculated for each facility on the basis of a peer grouping procedure, some of the weaknesses associated with Illustration D can be addressed. For example, as pointed out in Illustration E, if facilities are grouped on the basis of case mix, it is more likely that the cost norms would be valid since they would theoretically derive from the cost of treating relatively homogeneous categories of patients. Similarly, quality norms would be more valid since quality measures themselves might have different distributional properties (for example, greater variation) across different types of case mix categories. Such properties could in turn influence quality scores aggregated (across patients, patient problems, or treatment modalities) to the cost center, service category or institutional levels.

Although Illustration E makes explicit reference only to facility-level average and normative values, the peer grouping concept can be employed at the sub-facility level. It would be possible to develop cost center or service category peer groups instead of facility peer groups and apply a quality adjustment to a cost norm to determine reimbursement at the cost center or service category level. Here, both the quality adjustment and cost norm for the cost center of interest for the i^{th} facility would be based on the facility's performance for that cost center relative to the performance of the other facilities whose cost centers were selected as peers for the i^{th} facility. This alternative, however, has certain practical difficulties, such as how to control for general facility-level differences (case mix, indirect costs) at the cost center level. Thus, it is not likely to be a feasible extension of the peer grouping concept.

Illustration E addresses one of the weaknesses of Illustration D because it takes into consideration other determinants of cost such as case mix. The homogeneity of the peer groups for a given facility determines the extent to which this method resolves the problem of dealing with such cost determinants prior to adjusting for quality. However, the other

primary weakness of Illustration D is also inherent in Illustration E. Namely, Illustration E does not compensate for the likelihood that the percentage of variation in cost due to quality fluctuations can vary by cost center or service category, even after peer grouping.

Compensation for the Differential Influences of Quality on Cost. Illustration F in Table 1 contains two examples which incorporate the strengths of the preceding illustrations and address their inability to take into consideration the possibility that quality is not likely to be the sole determinant of cost in a practical setting, even if fairly thorough adjustment and peer grouping procedures are used to compensate for other determinants of cost. Both examples lend themselves to the establishment of reimbursement caps for either the total facility or at the cost center/service category level. Other examples of this general approach could be given, but the intent here is to trace the analytic process necessary to develop methodologically and substantively meaningful approaches to linking quality and reimbursement, not to develop a taxonomy of all approaches to establishing this linkage.

The first example in Illustration F stems from the requirement that cost centers should, in theory, be divided into two categories, those influenced by quality and those not influenced by the quality of care provided in the facility. Any cost center must belong to one of the two categories, but the practical determination of which category a given cost center should be placed in is difficult and requires empirical as well as conceptual investigation. This example presumes that standard reimbursement policy determines reimbursement for those cost centers in the second category, not taking quality of care into consideration. Next, it presumes that by virtue of time and motion studies (or other known or empirically derived relationships), the cost of a given level of quality can be determined for each of the cost centers in the first category. The facility's actual cost is then adjusted for quality according to this relationship in order to determine reimbursement for each cost center in the second category. Total reimbursement is then the sum of the allowable costs across the two different categories of cost centers. This method could incorporate peer grouping on the basis of case mix, facility type, etc., prior to the determination of allowable costs for both categories of cost centers.

Another variant of this general method is given in the second example of Illustration F. An expected cost is obtained for the entire facility using an empirically derived prediction function which takes quality and other facility factors into consideration. Final reimbursement is based on the actual facility cost and the predicted cost, adjusting for the

fact that the prediction function cannot perfectly specify what facility costs should be. For this example, suppose a facility's actual costs were $1 million and its predicted costs, taking quality and other factors such as case mix into consideration, were $800,000. Then, if the prediction function explained 50 percent of the variation in cost across facilities, its quality (and other) adjusted reimbursement would be $900,000, since (.5) $\times$ 800,000 + (.5) $\times$ 1,000,000 = 900,000. This technique could be applied at the cost center/service category level in the manner discussed in Illustration D.

The practical nature of the approach taken in Illustration F is highlighted by the fact that Ohio has implemented a reimbursement system with quality incentives for nursing homes which falls under the category of the first example. (More discussion on the Ohio system is presented later.) Also, New Jersey's case-mix (DRG) reimbursement system for hospitals uses the type of methodology discussed in the second example to adjust reimbursement for case mix (not quality) using the coefficient of variation of cost (the ratio of standard deviation to the mean cost for each case-mix or DRG category) instead of the coefficient of determination [28]. The New Jersey approach is designed to place greater or lesser emphasis on statewide cost standards for each case-mix category, according to whether the coefficient of variation is small or large. It adjusts for quality indirectly by recognizing that sources of variation other than case mix can influence cost, e.g., quality, and therefore lessens or emphasizes the importance of case mix in accord with the empirically determined importance of other factors.

CASE MIX

Most process and outcome measures of quality are perforce case-mix-specific owing to the need to delineate among patient or patient problem categories in the determination of treatment regimens or assessment of patient progress. As a result, many measures of quality are necessarily defined with a case-mix framework. This points to the need to consider case mix thoroughly in any attempts to link quality and reimbursement. Tables 2 and 3 deal with certain analytic issues relating to this.

Ideal Case Mix Adjustments. In Table 2, it is assumed that p categories of patients encompass the case mix groupings of interest. The example could pertain to p categories of problems instead of patients, where one patient might have several problems and therefore contribute to more than one problem category. For each patient type or category, an

optimal (expert opinion-derived) outcome is specified (process measures could be used analogously). This ideal scheme presumes that the attainment of the optimal outcome for the i^{th} type of patient is known to cost a specific amount, D_i. Since optimal outcomes are known, standards can be specified and used to measure quality for each patient category.

The scheme further presumes it is possible to measure the extent, θ_i, to which the optimal outcome is attained for the i^{th} patient type. It also presumes that the relationship between cost and the extent to which the outcome is attained is known. Thus, this ideal scheme yields a quality-adjusted [using $f_i(\theta_i)$] cost for each type i patient. The functional form of $f_i(.)$ also allows (theoretically) for the possibility that the relationship between quality and cost might not be linear, so that a 72 percent attainment of the optimal outcome might be substantially less than 72 percent of the cost (D_i) for the i^{th} patient type. Variations in provider efficiency could influence the relationship between quality and cost. Consequently, a form of utilization review which examines unnecessary and inefficient service utilization would be necessary in this type of ideal system.

The reimbursement scheme suggested in Table 2 belongs to the category of options illustrated by the first example of Illustration F in Table 1. It highlights the substantive importance of case mix, case mix measurement or categorization, quality measurement, empirical determination of cost as a function of quality, efficiency considerations in establishing the relationship between cost and quality, and the natural association between utilization review and the incorporation of quality into reimbursement.

Practical Case-Mix Adjustments. The steps presented in Table 3 represent an acknowledgment that the ideal approach in Table 2 is not attainable. The points in Table 3 indicate how compromises might be made for the sake of practically incorporating quality into reimbursement through case mix categories. Theoretically, this type of approach attempts to address the issue of cost fluctuations attributable to quality variations within case mix categories. In this respect, it extends current thinking and provides support for empirical studies directed at incorporating case mix into reimbursement [2, 29].

The basic idea in Table 3 is to develop proxy measures for outcomes (very likely process measures of quality), study the adequacy of the relationship between outcomes and the proxy measures, and then incorporate the process measures into the reimbursement scheme. It also demonstrates that it is possible to adjust for the imprecision, if known, of the relationship between the process measures and outcomes. As with

Table 2: Overview of An Ideal Reimbursement Scheme Which Incorporates Patient Outcomes

For a Given Facility

N_1 Type 1 Patients: Optimal Outcome O_1
N_2 Type 2 Patients: Optimal Outcome O_2
. . .
. . .
. . .
N_p Type p Patients: Optimal Outcome O_p

Costs

Case Mix Reimbursement Base:
$\$D_1$ per patient to attain O_1
$\$D_2$ per patient to attain O_2
. . .
. . .
. . .
$\$D_p$ per patient to attain O_p

Reimbursement for Quality

On the average, the specific facility of interest attains some portion $\theta_i (O \leq \theta \leq 1)$ of the ideal outcome for the i^{th} patient type, $i = 1, \ldots, p$.

Since D_i is the cost of treating the i^{th} type in order to attain the ideal outcome, then D_i is incurred, under conditions of optimal efficiency, only when O_i is attained.

Therefore, pay $D_i \times f_i(\theta_i)$ for each Type i patient where $f_i(\theta_i)$ could be θ_i or some more general function of θ_i.

Tables 1 and 2, the technique presented in Table 3 is but an illustration of the methods which could be used to build quality into reimbursement through case mix classifications.

The procedure discussed in Table 3 is dependent on (a) the establishment of empirical relationships between process and outcome measures within case-mix categories; (b) the establishment of empirical relationships between process measures and cost within case-mix categories; and (c) the calculation or estimation of the costs of treating the i^{th} patient type in a given facility. The latter point may be addressed in various ways. For example, an alteration in the formula for reimbursement as given in point 4 of Table 3 (C_{ik} can be partially replaced by $\hat{D}_i$, as shown) could be used. It might also be addressed by incorporating a prediction function approach as in the second example in Illustration F of Table 1. Consideration might even be given to addressing the methodological issue of the simultaneous variation in case mix and quality by using simultaneous equation procedures to determine the separate effects of quality on cost within each case-mix category.

Table 3: Practical Problems and Illustrative Alternatives Associated With the Ideal Reimbursement Scheme of Table 2

1. Specification of the p categories of patients, the O_is, and calculation of the D_is are difficult. However, it might be feasible to specify $\hat{O}_i \leq O_i$ on the basis of comparative data across all Type i patients for some specified population, where $\hat{O}_i$ is an average or statistically-established outcome value.

2. With some loss of precision, the point in 1 can be reduced further to computing $\hat{D}_i \leq D_i$ for all Type i patients in the population, where $\hat{D}_i$ is an average or statistically-established cost for the i^{th} category. $\hat{O}_i$ might itself be unknown and left implicit as the average outcome if $\hat{D}_i$ were average cost.

3. Note the $\hat{D}_i$s are dependent on both case mix, i.e., patient type, and level of quality. If the $\hat{D}_i$s were computed and proxies (e.g., process measures) for the $\hat{O}_i$s, were available, call them J_is, then for the specified population which is used as a standard, the pairs $(\hat{D}_1, J_1)$, $(\hat{D}_2, J_2), \ldots (\hat{D}_p, J_p)$ are available.

4. Assume J_i is a proxy for $\hat{O}_i$. If known, the impreciseness of this relation can be taken into consideration. This is illustrated in 5.

   If J_i is a proxy for $\hat{O}_i$, then for a given facility, for the i^{th} type of patient, the reimbursement is determined by some function of $\hat{D}_i$ and adjusted for J_i for the facility. For example, let $\bar{J}_i$ be the mean of the J_is for the population and J_{ik} be the value of J_i for the facility k. Then the reimbursed amount could be $p_i\theta_{ik}\hat{D}_i + (i - p_i)C_{ik}$ where p_i is the proportion of cost which can be empirically explained by variations in J_i (see [b] in illustration F of Table 1), C_{ik} is the cost (or an estimate) of treating the i^{th} patient type in the K^{th} facility, and

   $$\theta_{ik} = J_{ik} / \bar{J}_i$$
   $$= \% \text{ improvement (loss) in (proxy) quality associated with treating the } i^{th} \text{ patient type in facility } k.$$

   The functional form of θ_{ik} could, of course, be different from that presented here.

5. If the correlation between J_i and $\hat{O}_i$ is known or estimated to be r, use r^2 to further deflate p_i in 4. That is, use $r^2 p_i$ instead of p_i in 4.

To render the approach in point 4 of Table 3 more feasible, assume initially that each facility provides average quality care to all patients in each service or case mix category. Next, each facility's total or even cost center-specific costs would be adjusted for case mix differences across facilities (such as a DRG approach for hospitals or a functional status/problem approach for nursing homes) [28, 30]. Then, for a given facility, a process quality score would be calculated for each category by aggregating quality scores across all problems or patients in that category. The percent deviation of the facility's quality score from the average quality score for a given patient category (across all facilities) would be calculated

and used to adjust facility costs in the same way case-mix categories were used.

This is essentially a two-step procedure which involves adjusting costs for case-mix differences with quality constant, then further adjusting case-mix-determined costs for quality variations. As before, this type of adjustment procedure depends on prior empirical knowledge of the relationship between quality and cost within case-mix categories. If this were not possible, an institutional quality score could be calculated by taking a volume-weighted average quality score across case mix categories and adjusting total cost on this basis. In this case, establishment of an empirical relationship between cost and total institutional quality after adjusting for case mix would be feasible. As one pursues this line of reasoning, the need for empirical investigations to stimulate development and provide acceptable procedures for the incorporation of quality into reimbursement is highly evident.

PAYERS

Returning to one of the simplifying assumptions made at the outset of the chapter, it would reduce operational problems if all payers followed the same reimbursement and quality assurance policies. This is not the case now, nor is it likely to be the case in the coming decades. In view of the possibility that payers could incorporate quality into reimbursement systems differently, it is important to be aware of the potential difficulties this brings about, not only from an operational perspective but from the perspective of equitable reimbursement across payers.

This point is related to the reimbursement or quality ceilings discussed earlier in that third party payers might differentially cover the costs of quality up to some preset point, such as average quality within a given case mix category, and then have the facility be reimbursed by the consumer on an out-of-pocket basis for quality above that average value. The logistical difficulties of this approach are many but it has the conceptual appeal of a third-party reimbursement system based largely on case mix and a fixed quality standard. Providers would then be responsible for recovering, from the consumer, costs due to above average quality. This even raises the possibility of third-party insurance to cover the cost of above average quality.

Additional work is needed to determine whether quality variations are substantial enough across provider types to warrant quality-based reimbursement methodologies such as those discussed here. Such work could lead to determinations of whether quality and reimbursement

might appropriately be linked for one particular provider type (e.g., nursing homes) and not another (e.g., hospitals). It might also suggest quality be incorporated into reimbursement only for certain types of patients or procedures.

THE OHIO SYSTEM

Ohio implemented a reimbursement system for nursing homes designed to take both quality and case mix into consideration [30]. This section describes the basic features of the Ohio system in order to illustrate the major operational issues which must be considered in linking quality assurance and reimbursement. The discussion pertains to Medicaid reimbursement and focuses on those aspects of the Ohio approach which are associated with the provision of incentives for quality. This information pertains to the Ohio system as it was planned and existed in late 1980 and early 1981. Due to budget cuts and other complications, some subsequent changes were made in the system. However, during early 1982 it remained essentially the same as described here.

COSTS AND REIMBURSEMENT

The Ohio system treats three general types of costs separately. The first two, property costs and general/administrative costs, form the categories which constitute the basis for the prospective portion of the reimbursement system. For example, the per diem rate for general/administrative costs is uniformly set for all facilities at the statewide median plus four-fifths of the statewide standard deviation. This rate is uniform for all facilities and is intended to provide incentives which promote (short-run) efficiency for the majority of facilities, since nursing homes with administrative costs below this rate can keep the difference. Property costs are not reimbursed at a uniform rate for all facilities, but guidelines regarding interest, depreciation, and return on equity are uniform. The third category consists of patient care costs, which are reimbursed on the basis of the facility's actual cost, Medicaid case mix, quality of care provided to Medicaid patients, and reimbursement ceilings. This is the cost category of primary interest here; it comprises more than 60 percent of nursing home costs in Ohio.

The Ohio approach is predicated on patient-level data which are collected on a quarterly basis for all Medicaid nursing home patients in the state. Data include information on the specific service needs of each patient and the extent to which services are provided to meet such needs.

Service needs aggregated across all Medicaid patients in a given nursing home determine the Medicaid case mix for the nursing home, which in turn determines the reimbursement ceiling for the facility. In essence, the reimbursement system incorporates an approach which translates individual patient service needs into costs and, through aggregation of individual service needs to the facility level, permits the translation of total service needs into facility costs. This translation of needs into cost is the basis for case mix measurement and case-mix-determined reimbursement ceilings. It also permits the system to consider the dollar amount associated with the discrepancy between patient needs and services provided—which is the way quality is measured, i.e., using process measures.

Operational definitions are used to ascertain whether a specific patient requires each of the following 20 services:

1. Behavioral/mental
2. Personal hygiene
3. Eating
4. Mobility
5. Appliances
6. Oral Medications
7. Injections
8. Dressings
9. Incontinence/catheter
10. Enema/douches
11. Suctioning/tracheotomy
12. Oxygen/aerosol therapy
13. Colostomy, ileostomy/ureterostomy
14. Intravenous/subcutaneous fluid
15. General habilitation
16. Specialized services
17. Physical therapy
18. Occupational therapy
19. Speech and audiology
20. Psychosocial service

Each service is defined and has various levels of intensity. For example, the four levels of mobility are: (a) no service needs; (b) limited assistance required; (c) partial dependence; and (d) total dependence. All such levels are operationally defined. The intensity of some of the service needs is measured by the degree of dependence (as with mobility). Intensity for others is measured by frequency of need. For example, the different levels of the suctioning/tracheotomy service are: (a) no service; (b) self-care or staff assistance; (c) more than 30 times a month; and (d) comatose patient.

Services 1 through 14 are considered routine maintenance services which must be available for all patients—although not all patients would utilize each of the services. Only those services actually needed by the patient are included in the determination of case mix. Services 15 through 20 fall into a different category since they are specialized rehabilitation services more typically provided by individuals not on the regular nursing staff of the facility. Service 15 determines whether Services 16 through 20

are included and constitutes the planning and evaluation component of rehabilitation. The frequency and mix of Services 16 through 20 are determined by the nursing home interdisciplinary team using criteria established by the state.

These 20 services were selected by the Department of Public Welfare using an approach which convened nurses, occupational therapists, physical therapists, psychiatrists, physicians, records technicians, social workers, speech pathologists, pharmacists, and administrators. Since the intent of this paper is to discuss the basic issues associated with incorporating quality into reimbursement, a detailed evaluation of the appropriateness of service selection, the levels of intensity associated with each, and case mix and quality measurement specifics using this approach will not be discussed. However, the mechanics of how to use this approach in reimbursement are important.

REIMBURSEMENT METHODS

To associate a dollar amount with each service need for a given patient, three factors are considered: (a) the *direct patient care time* required to provide the needed service by the appropriate provider, (b) the *indirect time* required to provide the specified service (which is time often not spent in the presence of the patient), and (c) the *wage rate* for the appropriate provider. The dollar value associated with a given level of intensity for a service is the sum of the direct time and indirect time multiplied by the wage rate. For each service category, the dollar value increases as the service intensity level increases since greater time is required to provide the service and/or a higher cost provider is required. The direct time, indirect time, wage rate, and dollar value for each of the four levels of service provided to patients with need for assistance in ambulation (i.e., mobility) are given below.

Service Level	*Direct Time (mins/day)*	*Indirect Time (mins/day)*	*Hourly Wage Rate*	*Dollar Value*
a	-	-	-	-
b	7	20	$4.05	$1.82
c	40	21	$4.05	$4.12
d	45	45	$6.25	$6.67

The wage rates are for nurses aides for levels b and c, and for LPNs for level d. The wage rates are based on 115 percent of the statewide nursing home average, and the times are based on time studies conducted

in Ohio nursing homes. The dollar value is obtained by dividing the sum of both times (expressed in minutes) by 60 in order to multiply it by the appropriate hourly wage rate. This represents a maximum resource consumption measure expressed in terms of dollars. Further, the time and wage factors are deliberately set at levels designed to reflect optimal care ("optimal" in terms of the care which the Ohio Medicaid program can afford to finance). Consequently, the dollar value represents expected resource consumption if optimal (affordable) care is provided. Incentives for quality are incorporated into the routine services by varying the amount of indirect time recognized in each of the levels of the first 14 services. Those levels which represent more independent functional status receive a greater indirect allowance than levels which reflect increased dependence upon institutional services. For example, in the area of mobility, Ohio incorporated an allowance in the "limited assistance required" level for the services of a physical therapist aide to prevent contractures.

For each Medicaid patient, data are collected on patient needs relative to the above 20 services. Patient needs are aggregated across service categories and translated into a dollar value at the facility level, thereby reflecting optimal resource consumption needs. Let this value be called the "case-mix-determined maximum cost." For each Medicaid patient and for each of the 20 services, dollar values are also determined for services delivered in excess of what was needed and those not delivered but needed. Therefore, by aggregating patient-specific data to the facility level across all Medicaid patients, it is possible to obtain a dollar amount which reflects the resource consumption needs or case mix of Medicaid patients in the facility (the case-mix-determined maximum cost) and two other dollar amounts which reflect the costs of inappropriate services provided and needed services not provided, respectively. These amounts which, taken together, reflect case mix, quality, and, in some sense, efficiency, are then used in the process of determining the reimbursement amount to be paid the nursing home for patient care (i.e., not for property or general/administrative) costs.

Although the process of determining the final reimbursement amount entails various types of allowances and exceptions, it is reasonably straightforward in concept. First, only the costs actually incurred for patient care are subject to reimbursement. Second, costs above the case-mix-determined maximum costs are disallowed because unreasonable. Third, no credit or allowance is given for excessive quantities of services. That is, the value of services given in excess of need is *not* added to the case-mix-determined maximum to determine the facility's ceiling for nursing and rehabilitation costs. Finally, the value associated with short

fall (i.e., underdelivered) services is deducted from otherwise allowable costs. For example, if the facility percentage of undelivered services (the percentage is determined by dividing the value of undelivered services by the case mix-determined value and allowing a 5 percent tolerance factor) is 3 percent, 3 percent of the facility's actual nursing and habilitation costs are disallowed.

The case mix-determined maximum cost represents a reimbursement ceiling based on the care needed and on time studies conducted in nursing homes which are regarded as exemplary. The reimbursement ceiling is therefore premised on the cost of high quality care. If a facility does not provide such care, then it not only receives a lesser amount than the reimbursement ceiling, but experiences an actual fiscal loss—i.e., a disallowance of costs otherwise reimbursable. In another respect, this ceiling represents a quality of care ceiling in that it is based on the costs of those services which the state has found to be adequate in facilities judged to be exemplary in terms of care provided.

INCENTIVES, OPERATIONAL FEATURES

The incentives associated with this reimbursement scheme should be reasonably clear. It uses a relatively stringent approach to establishing a reimbursement ceiling since actual costs are lowered to the case-mix-determined amount if they exceed it. Further, actual reimbursement is lessened even more if the quality of care is less than that on which the case mix-determined amount is based. Finally, the policy of not sharing the difference between the facility's actual cost and the case-mix-determined ceiling, (when actual cost is less than the ceiling) may be an incentive for quality but a potential disincentive for efficiency. The disincentive might exist since, for a given level of quality, a nursing home would be reimbursed more if its actual costs were equal to the case-mix-determined maximum than if they were less than this amount.

The disallowances and exceptions render the reimbursement process more complex than just discussed. In fact, they alter it slightly in terms of this overall description, but the primary components of the reimbursement systems are as described. The following points summarize several operational features of the Ohio approach which appear relevant to any reimbursement system which incorporates quality.

Administration. The administering organization for the total reimbursement system in Ohio is the Ohio Department of Public Welfare. The agency staff administers the Medicaid program, is responsible for collecting the necessary data, and coordinates the total program with nursing homes and other involved agencies. The Department has overall respon-

sibility for the determination of reimbursement policy, allowable costs, and the details of the reimbursement methodology—in keeping with federal and state guidelines.

Appeals by the nursing home are permitted through the Department of Public Welfare's regular hearing process or, in those cases where PSROs were granted long-term care review responsibility, by the PSROs' hearing process. There are two levels of appeal. The first focuses on whether a patient should be institutionalized and is therefore based on the recipient's need for institutional service. The second addresses the facility's disagreement with the type and mix of services needed by a patient and the facility's delivery mechanism. The PSRO hearing process deals only with first level.

The system apparently received a reasonable degree of government and industry support in Ohio. Although this paper is not intended to discuss the political and operational aspects of securing and implementing state legislation for the system, this was a significant factor in implementing the Ohio system. It should be regarded as critical to implementing any multi-provider reimbursement system which incorporates quality, especially a system which penalizes a facility for not rendering needed services.

Utilization Review. Utilization review is conducted in conjunction with the patient assessment activities needed for reimbursement purposes. Data collected for each patient also yield a point value associated with the service needs of each patient. This point value does not directly affect payments. It is an internal management tool to assure that the decisions of the patient assessment staff are internally consistent and to indicate whether the patient is appropriately placed [30]. In addition to calculating this point scale for each patient for purposes of utilization review, information is collected to assist in a determination of how the total needs of the individual patient might best be met, taking the complexity and comprehensiveness of the range of services needed by the individual patient into consideration. Using such information, the needs of individual patients in a given facility can be compared with the facility's capacity to provide the necessary services. Where appropriate, recommendations can be made for placement of patients in other facilities, home care settings, etc. Disincentives for maintaining inappropriately placed patients are also incorporated into the reimbursement system.

Data. The data used to measure case mix and quality must be based on documented evidence in the patient record. If the nursing home does not have adequate documentation, information which is present might not adequately reflect either patient needs or services being provided. The

disincentive for facilities' overstating either services provided or patient needs is a provision in Ohio law which allows for prosecution in the event of fraudulent alteration of patient records. The disincentive for inadequate documentation in the reverse direction (i.e., less intense patient needs or lower quality than is actually the case) is lower reimbursement. Even after a brief operational period, it appeared that proper documentation was stimulating a systematic and more timely approach for planning service delivery. Documentation has apparently improved substantially in as many as 80 percent of the facilities.

Patient-level data are collected on forms which can be scanned and computerized without keypunching. Editing, data management, and report generation programs check the data for accuracy and produce the facility-specific and state-level reports necessary to maintain the system and set reimbursement rates for nursing homes. Patient-specific data are also verified on site by direct patient observation. If the observation indicates a discrepancy between patient records and actual patient needs or services provided, a follow-up team is sent to the facility. Forms are relatively brief compared with standard patient assessment forms in the long-term care field [31, 32, 33]. Data collection requires approximately 40 full-time equivalent trained nurses, one clerical person responsible for initial editing and computerization, and one programmer to maintain and monitor data processing.

Costs. The administrative costs of the system are estimated to be $2.9 million, compared with a total cost of $320 million for nursing home reimbursement by the Medicaid program in Ohio. Although this triples the previous administrative costs for the Medicaid nursing home reimbursement system in Ohio, it is less than 1 percent of the total cost. Furthermore, the system appeared to have a favorable impact on nursing home quality of care even in its initial few months. It was reported that several facilities which were visited a second time appeared to provide care more in keeping with the norms established by the standards of care than was the case at the first visit.

Incentives. In establishing this system, an important feature consisted of the perceived behavioral incentives for providers. At this date it is too early to determine whether the apparent quality and appropriate placement incentives will bring about behavior which is in keeping with high quality care and, in general, a cost-effective approach to the provision of nursing home care in Ohio.

Other Payers. The difference in charges for public and private patients in Ohio nursing homes is about $5.00 per day, with private

patients charged more. Medicare does not participate in this system, but Medicaid covers approximately 50 to 60 percent of nursing home utilization in Ohio. Although Medicaid is the dominant payer for nursing home care (as is the case for most states), it remains to be seen whether the different reimbursement procedures for the three main payers will affect provider behavior, quality of care, costs, or public understanding and support.

Development. The evolution of the Ohio system was based in part on the West Virginia system which reimburses nursing homes on the basis of case mix [34]. Some of the West Virginia and Ohio concepts date back even further to the case-mix approach to reimbursement for nursing homes in Illinois [1]. The developmental work in Ohio took place in about one year, although two prior years were spent documenting problems with the previous system and securing legislative support for reform.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions represent a synopsis of research which is needed to investigate further ways to unify quality assurance and reimbursement. They stem from the methodological points raised earlier and from current policy issues as well, especially those in the long-term care field.

RESEARCH ISSUES

The Incremental Nature of Research. Several approaches to quality assurance, including PSRO and voluntary peer review, accreditation, certification, etc., have been attempted during the past decade. An analogous statement holds true for approaches to reimbursement. All programs have been imperfect; several have been relatively unsuccessful. Yet, the temptation to discard these approaches because of their imperfections should be resisted. Each program has its strengths and weaknesses; thorough analysis of existing approaches can reveal the features upon which to build, as well as those which should be discarded.

Quality Measurement in General. The actual development, assessment, and validation of quality measures which are parsimonious and sufficiently precise for reimbursement purposes is an area which needs intensified effort. Because of cost limitations as well as the breadth of possible approaches to quality assurance, priorities should be developed

which indicate those areas of patient care in strongest need of increased attention. This requires the development of expert opinion-based lists of patient care services, settings, or provider types where quality problems are thought to be most serious.

Refined Process and Outcome Measures of Quality of Care. The refinement of the specificity, sensitivity, and relevance of process and outcome (and even structural) measures of care is important. If these types of measures are to be incorporated into reimbursement systems, the data upon which they are based need to be relatively easy to collect. To validate acceptable process measures, evaluation of process-outcome relationships must be undertaken in various care settings; for different problems, diagnoses, and procedures; and under varying conditions with respect to provider types, duration of care, etc. It is imperative to attempt to determine the existence of points at which increases in the numbers of types of services provided produce diminishing marginal returns in patient status.

Quality Norms. Norms for the quality of care must be realistic and appropriate for the purpose at hand. Over time, such standards could be refined through analysis of data collected for the purposes of administering a quality-based reimbursement system.

Cost Categories and Measurement. Departmental costs can be differentially influenced by the quality of care provided. Research is needed to specify which cost centers are sensitive to quality variations, and practical unit cost measures should be developed as potential bases for reimbursement rates and associated policies.

Cost Norms. Similar to quality, acceptable limits for reimbursable costs should be analyzed through research. Regardless of the approach taken to the establishment of such norms, they must be based, in part, on the relationship between cost and quality if quality assurance is to be linked with reimbursement.

Relationship Between Cost and Quality. To base reimbursement on quality, the extent to which quality influences cost should be incorporated into the reimbursement scheme. This requires empirically determined or agreed upon conceptual relationships between quality and cost. These relationships should comprise one of the driving forces in a reimbursement system dealing with quality and thus should form the focus of future empirical studies.

Case Mix Measurement. Conceptually, the consideration of case mix is an intermediate step between straightforward cost reimbursement and a

more complex quality-based reimbursement system. Case mix measures must be taken into consideration in any reimbursement scheme which addresses quality of care. Although several advances have been made, ranging from DRGs for acute care to functional status indices for nursing home care [1, 18, 29, 35], further case mix refinement is necessary in the quality of care context.

Assessment Levels. This paper has dealt chiefly with patient-level assessment. It is only reasonable, however, to expect that the assessment level be only as detailed as is necessary to attain a given degree of effectiveness. Additional empirical investigations should evaluate the efficacy of facility vs. patient level assessment.

Incentives to Change Provider Behavior. A fundamental purpose of quality assurance is to provide a mechanism for remediating deficiencies in the quality of care. This emphasizes the need for continued research into ways of changing provider behavior through increased knowledge, incentives, and, where appropriate, disincentives.

The Potential for Integration. The extent to which quality assurance and reimbursement can be unified needs considerable study. It is doubtful that a complete unification of the two objectives can be attained by a single program. Further, the possibility of subjecting only portions of institutions (cost centers, specific patient categories, etc.) or types of institutions to a unified quality assurance/reimbursement approach needs to be evaluated.

Conceptual Merits Versus Actual Benefits. The conceptual merits of a reimbursement approach which pays for quality care have been discussed throughout this paper. Yet, we do not pretend that these merits necessarily outweigh the costs and impediments of implementing such a system. Further study is needed to examine such trade-offs.

In conclusion, the integration of quality assurance and reimbursement is an appropriate goal to consider from the perspective of the efficient and effective provision of health care. Whether the goal can be attained in view of the several practical and methodological problems which confront us remains to be seen.

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