REVIEW

Practical Strategies for Developing the Business Case for Hospital Glycemic Control Teams

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Many business models may be used to make the business case for support of a multidisciplinary team to implement targeted glucose control in the hospital. Models may be hospital-supported or self-supporting. In the former, the hospital provides financial support based on improved documentation opportunities, reduction in length of stay, and improved resource utilization. In the latter, clinical revenues for diabetes management offsets costs of salary, fringe benefits, and overheads. A combination of these strategies may also be used.

The business plan presented to administration must justify return on investment. It is imperative to involve hospital administration, particularly representatives from coding, billing, and finance, in the development of the business plan.

The business case for hospital support will be based on opportunities related to improving accuracy of documentation and coding for diabetes-related diagnoses, including level of control and complications present, on reduction in length of stay and on optimization of resource utilization through reduction in morbidity and mortality (cost aversion). The case for revenue generation through billing for clinical services will be based on opportunities to increase the provision of glycemic management services in the hospital. Examples from the literature and of analyses to support each of these models are presented. ***Journal of Hospital Medicine* 2008;3 (5 Suppl):76–83.** © *2008 Society of Hospital Medicine.*

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Implementation of targeted inpatient glycemic control by a multidisciplinary team in the hospital is a time-intensive and labor-intensive undertaking. A variety of business models may be applied including those in which the hospital provides financial support and those which will be self-supporting through clinical billing revenues (Table 1). In practice, a combination of these strategies may be used.

In order to make the case to hospital administration for investment of financial support for glycemic control programs, it is necessary to develop a business plan that will justify return on investment. The following discussion is a composite of information from the published literature, personal communication with hospital glycemic control "champions," and the author's experience developing, implementing, and assessing outcomes for a glycemic control task force charged with improving glucose control in the 7 hospital MedStar Health system from which more than 45,000 patients are discharged annually with a diagnosis of diabetes.

The principles for making the business case for support of a glycemic control team are the same as those applied in other

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TABLE 1
Models for Financial Justification of the Hospital Glycemic Control Team

Model	Strategy	Target
A. Hospital-Supported	1. Improve documented patient acuity	Improve accuracy of documentation and coding of: a. uncontrolled diabetes (DM); b. unrecognized DM; c. DM complications
	2. Increase capacity and denied payment for readmissions	Reduction in overall length of stay and readmission rates
	3. Optimize resource utilization	Reduction in morbidity and mortality and reduction in intensive care unit length of stay
B. Self-Supported	1. Allied health professional billings (NP, PA)	Salary offset through income generation
	2. Physician billings	

hospital-based programs. While the clinical argument for a new process, resource, or staff member may be sound, the business plan will also be analyzed from nonclinical perspectives, with attention to its fiscal and operational feasibility. It is therefore important to involve hospital administration, operations, and finance representatives early, in order to obtain their support and address concerns early that would otherwise weaken the request. The information provided in this article is intended to provide practical guidance for developing a plan that is realistic and tailored to the needs of the individual institution.

A. HOSPITAL-SUPPORTED MODELS

The business case for hospital support for the glycemic control team is based on opportunities to improve revenue through accurate documentation and coding, reduction in length of stay, and optimization of resource utilization through reduction in morbidity and mortality (cost aversion).

In order to understand opportunities for improved revenue, it is necessary to understand how hospitals are reimbursed for inpatient care. Medical record documentation is reviewed by hospital coding personnel who apply strict guidelines and ICD-9-CM nomenclature to establish the diagnoses and procedures for each case. The ICD-9-CM is a numerical coding scheme of more than 13,000 diagnoses and 5,000 procedures. The principal and secondary diagnoses and procedures are grouped into a Diagnosis Related Group (DRG) code. In most states, CMS (Medicare) reimburses hospitals a flat rate based on the DRG code assigned to each inpatient case. CMS calculates a specific DRG weight for each DRG code. The DRG weight is a number such as 0.895 or 1.24, which reflects the acuity of the patient assigned to a particular DRG code and expected resource utilization. The greater the weight, the greater the acuity and expected resource utilization. The overall Case Mix Index (CMI) is the simple average of the DRG weight for a population of inpatients. CMI indicates the relative severity of a patient population and is directly proportional to DRG payments. This index is valuable when making comparisons between hospitals or patient groups.

Each hospital is provided a single rate relative to a DRG weight of 1.0 which allows calculation of the expected revenue from CMS per case. The DRG payment for a Medicare patient is determined by multiplying the relative weight for the DRG by the hospital's blended rate: DRG PAYMENT = WEIGHT $\times$ RATE. Each hospital's payment rate is defined by federal regulations and is updated annually to reflect inflation, technical adjustments, and budgetary constraints. There are separate rate calculations for large urban hospitals and other hospitals. There are also technical adjustments for local wage variations, teaching hospitals, and hospitals with a disproportionate share of indigent patients.[1]

Determination of allowable charges for inpatient care varies by location and payor. The State of Maryland, for example regulates hospital inpatient charges for all patients based on the CMI of each hospital. In this reimbursement system, the hospital must ensure that their total average charge per case is on par with their reported CMI, when compared to other hospitals. For non-Medicare payors, reimbursement may also be based on a set DRG payment or a percentage of charges based on contractual stipulations. The business case will be based on the individual hospital's allowed charges.

Empirical studies in this area are lacking, perhaps in part because this is a "sensitive" data area. Publications tend to focus on "potential" rather than actual results. Profiling hospital improvement management performance for documentation, coding and reimbursement does allow hospitals to go beyond focused operational metrics to evaluate themselves in a broad industry context to determine whether they are in alignment with examples from other institutions.[2]

Given this background, specific strategies used to justify hospital support for the glycemic control will now be outlined.

1. Documentation Opportunities

The hospital glycemic control team can help optimize reimbursement through improved accuracy of physician documentation and of coding. Each opportunity should be determined in collaboration with the coding and finance departments. Education for providers and coders must be ongoing, especially in hospitals where staff turnover is common. It should also be made clear that coders cannot specify a diagnosis unless the provider has documented it in the chart. Some initiatives incorporate notifying providers when a documentation deficiency is identified in order to offer an opportunity to provide clarification.

Establishing a definition for each coding designation for diabetes will enable collection of specific data upon which the business case can be built.

a. Accuracy of Designating Diabetes as Controlled or Uncontrolled

The glycemic control team should come to a consensus on a definition of "uncontrolled" diabetes. In the absence of accepted criteria for this designation, the following descriptions are an attempt to provide some guidance. They are derived from the ICD-9-CM Professional 6th edition[3] and the American Diabetes Association (ADA) article on management of diabetes and hyperglycemia in the hospital[4]

- A nonspecific term indicating that the treatment regimen does not keep the blood sugar level of a patient within acceptable limits[3]
- Admission BG over 180(−200) mg/dL or 2 or more BG during the hospital stay over 180(−200) mg/dL
- Lesser persistent hyperglycemia outside guidelines set by AACE and ADA for hospital management, eg, fasting BG over 110 mg/dL and other BGs over 180 mg/dL on non–critical care units, could also be considered consistent with uncontrolled diabetes.

The modifier "uncontrolled" only applies when the patient has a known diagnosis of diabetes. CMS has recently revised reimbursement guidelines for uncontrolled diabetes. This designation no longer provides an incremental increase in reimbursement; however, it is still weighted in the determination of case mix index.

b. Unrecognized Diabetes

The key feature of this designation is that the diabetes is either unrecognized by the treating provider or is not clearly documented as diabetes in the medical record during the hospital stay. Beyond these key features, there are no clearly defined criteria for unrecognized diabetes. It is again contingent on the hospital team, including the coding specialists, to decide on blood glucose thresholds that will be applied to identify those cases which are to be designated unrecognized diabetes. Daily reports of patients with hyperglycemia could be generated in order to alert providers about its presence.

There is a paucity of data to guide us in defining a new diagnosis of diabetes in the hospital and multiple variables associated with the stress of illness and hospitalization are known to impact glucose tolerance. However, it seems reasonable to the authors to accept that a patient with a random BG greater than or equal to 200 mg/dL in the hospital has diabetes, particularly when symptoms of hyperglycemia are present, unless there are clearly extenuating circumstances that predispose to hyperglycemia, such as high-dose glucocorticoid therapy. Less clear is the validity of designating a diabetes diagnosis if the fasting BG in the hospital is greater than or equal to 126 mg/dL, the standard cutoff in the outpatient setting. Hemoglobin A1C level may also help clarify underlying glucose tolerance. It is contingent upon the treating physician to confirm a diabetes diagnosis following discharge from the hospital when a lesser degree of hyperglycemia was present or the diabetes diagnosis was in question during the hospital stay.

c. Diabetes Complications

Accurate documentation of diabetes complications also provides opportunities for optimizing reim-

bursement. The ICD-9-CM[1] classifies diabetes complications as follows:

- Renal manifestations, eg, diabetic nephropathy
- Ophthalmic manifestations, eg, diabetic retinopathy
- Neurologic manifestations, eg, diabetic polyneuropathy, gastroparesis
- Peripheral circulatory disorders, eg, peripheral angiopathy, gangrene
- Other specified manifestations, eg, diabetic hypoglycemia; hypoglycemic shock; associated ulceration; diabetic bone changes; drug-induced, eg, secondary to treatment with high-dose glucocorticoids for acute medical condition

Within each of these opportunities, one must collect baseline data to accurately quantify potential for improvement or impact directly attributable to a glycemic control team initiative. Data will be gathered by chart review and/or by extraction from electronic data repositories and then correlated with known financial implications of improved accuracy of documentation for the given criteria, eg, impact on case-mix ratio and or implications for direct billing and reimbursement to the hospital.

The steps necessary to quantify each of these opportunities include:

- Defining the patient population to be assessed, eg, uncontrolled or unrecognized diabetes or diabetes with specific complications, as discussed above
- Delineating the time period to be assessed, eg, baseline, or preimplementation and postimplementation of the intervention
- Obtaining DRG (or other classification system) code and ICD-9 principal and secondary code information
- Review implications of improved coding on reimbursement rates for the hospital for the targeted area of opportunity, ie, if the selected opportunity, eg, uncontrolled diabetes is correctly documented and coded, what is the dollar amount/case that would potentially be recognized by the institution based on the new DRG codes assigned to these cases.
- Extrapolate from the number of cases identified as having potential to be accurately coded, or the increased number of cases that are accurately coded as a result of the team intervention and the dollar amount of value per case to derive a projected total dollar amount that could or has been recognized for the hospital.

EXAMPLE: Potential for Improved Revenue Based on Allowed Charges for Uncontrolled Diabetes.

Assessment of potential for improved revenue based on allowed charges in a MedStar community teaching hospital with 344 beds was conducted using the case mix index (CMI) reimbursement system for the State of Maryland.[5]

Step 1. Define criteria for selection of specific population:

- Hospital × all discharges
- Time period = Baseline FY 2006 Q3
- Age 18 or greater, excluding cases with diabetic ketoacidosis or non-ketotic hyperosmolar state (codes 250.1, 250.2, and 250.3)

Step 2. Obtain APR Diagnostic-related group (DRG) and severity of illness (SOI) information for each case.

Step 3. List reviewed by rates and reimbursement specialist:

- 246 cases reviewed
- Noted that all SOI levels 3 and 4 were not designated as having "uncontrolled" diabetes
- 49 of the 246 cases (19.9%) with potential for changes in allowed charge per case based on designation as uncontrolled diabetes.

Step 4. Calculation of potential for improved revenue

Item	Original (o) CMI	Improved (i) CMI
Case mix index (CMI)	0.9269	0.9750
Allowed charge/case	$8,531	$8,973
× 246 cases (total allowed charge)	$2,098,522 (o)	$2,207,431 (i)
Q3 Potential for improved revenue (i – o)		$108,910
Annualized potential for improved revenue		$435,640

A similar process can be applied to demonstrate potential for improved revenue in systems where reimbursement is based on a combined case rate and percentage of charges based on contractual stipulation.

It is always advisable to use conservative, realistic assumptions when making such projections. Finally, one should note that in a hospital where successful efforts to optimize documentation and coding have been implemented such that the CMI, for example, has been maximized, it is less likely that financial benefit from incre-

mental improvement in documentation will be recognized.

2. Reduction in Length of Stay and Readmissions

Financial benefit linked to reduction in length of stay (LOS) may be assessed in one of two ways. If reimbursement is predetermined based on DRG, shorter LOS means that fewer resources are spent caring for the patient. This model is known as cost aversion. It optimizes revenue recognized per case for the hospital. The second model focuses on throughput for hospital beds. If LOS is shortened there is increased availability of beds for additional billable patients to be admitted to the hospital. Newton and colleagues have applied the throughput model to successfully obtain hospital support for a nurse-case manager diabetes management team, as shown in the example below.[6] This model's success is contingent on high occupancy rates.

The concept that intervention by a glycemic control team can have a positive impact on LOS is not new. In a small study (N = 70) by Levetan and colleagues in 1995, the average LOS of patients cared for by a diabetes team was 3.6 $\pm$ 1.7 days, which was 56% shorter than in diabetes patients who did not (8.2 $\pm$ 6.2 days), $P < .001$, and 35% shorter than that for patients who received a traditional individual Endocrine consult (5.5 $\pm$ 3.4 days), $P < .05$. Of note, LOS correlated significantly ($P < .0001$) with time from admission to consultation, such that each 1-day delay in consultation resulted in a 1-day increase in length of stay.[7] Admittedly, the magnitude of reduction in LOS that is currently feasible through implementation of glycemic control teams is likely less than was possible a decade ago.

EXAMPLE: Reduction in length of stay and resultant increase in patient throughput.

Newton and colleagues applied the throughput model to the results of an inpatient diabetes management program in Greenville, North Carolina, to calculate the return on investment for a multidisciplinary glycemic control team that uses endocrinologist supervised nurse case managers. A 0.26-day reduction in LOS among 6,876 discharges for patients with diabetes was equated to 1,788 days saved per year, allowing an incremental annual inpatient volume of 350 patients with an average LOS of 5.11 days. Multiplying this incremental inpatient volume by the hospital's $6,357 revenue margin per patient is translated into a throughput value of $2,224,029 for the year. Based on salaries, consultant fees, data management and product services expended to implement their inpatient diabetes management program, these authors suggest that the throughput value allowed a 467% return on investment.[6] The return would be even greater if averted expenditures were factored in.

3. Resource Utilization

Opportunities for cost savings through improved glycemic management may be assessed by analysis of geometric mean cost, expected cost for the selected practice and comparative cost deviation between patients with and without hyperglycemia. Many companies offer risk-adjustment analysis software for hospitals. The Care Science software utilized by MedStar Health calculates a geometric mean cost for a given population of inpatient cases and compares this to the expected cost based on the population's clinical and demographic information. The cost of a specific inpatient case is calculated using the hospital's overall cost to charge ratio. The average cost for a given population is calculated using a geometric mean of these specific costs. Geometric mean is used to dampen any outlier effect of extremely high-cost cases. A statistical model provided by the software company utilizes clinical and demographic information to calculate expected cost for an individual case or a population. In addition, analysis of the impact of glycemic control on morbidity and mortality will allow demonstration of cost savings attributable to the inpatient glycemic control initiative.

Relative to impact of glycemic control on morbidity, mortality and cost savings Furnary and colleagues have demonstrated the impact of targeted blood glucose control in diabetes patients undergoing open heart surgery (N = 4864) in an ongoing prospective, nonrandomized, interventional study. Continuous intravenous insulin infusion therapy (IIT) targeting BG < 150 mg/dL was found to be associated independently with reduction in mortality risk and deep sternal wound infection by 57% and 66% respectively ($P < .0001$ for both). Coronary artery bypass graft (CABG) surgery-related mortality (2.5%) and deep sternal wound infection (DSWI) rates (0.8%) were normal-

ized to that of the population without diabetes through implementation of targeted BG control using IIT for 3 days following cardiac surgery. Taking into account both direct and indirect costs of insulin therapy, additional costs and LOS attributable to DSWI this group estimates that intensive BG control realizes an overall cost savings of $680 per patient. The estimated cost saving was calculated based upon assumptions that the Portland protocol [reduced the incidence of DSWI by 1 case for every 83 patients in whom it was applied, off-setting the cost of a single DSWI] + [reduction in LOS by 1 day accounted for by a 50 mg/dL reduction in BG] − [the increased cost of implementing the protocol per patient]. The majority of savings are attributed to decreased costs for treatment of wound infections and to shorter length of hospital stay.[8]

Schmeltz and colleagues recently have reported reduction of surgical morbidity and mortality in diabetes patients undergoing cardiac surgery using IIT in the ICU followed by subcutaneous insulin outside the ICU. The authors hypothesize that the combination of IV and SQ insulin might be less costly and less nursing intensive than the 3 days of IV insulin therapy recommended by Furnary.[9]

EXAMPLE: Opportunity for cost savings through improved glycemic management.

Exploratory cost analysis for identification of potential resource utilization opportunities was carried out for a 33% sample of discharges from a 344-bed community teaching hospital in the MedStar Health System for FY 2006, Quarter 3. Data were obtained from COMPAS (Clinical Outcomes Management and Process Analysis System), a database and software managed and licensed by Quovadx's CareScience division. The database warehouses patient characteristics, resource utilization, and most laboratory data for all inpatients. Analysis compared costs for cases with two or more BG > 180 mg/dL at some point during the hospital stay to those cases in which hyperglycemia was not present during the stay,[3] as shown in Table 2. The data suggest a financial opportunity as evidenced by the delta in comparative cost deviation.

Such analyses can serve as the basis for discussion with finance and operations to obtain an estimate of potential value of the glycemic control team to the hospital.

TABLE 2
Opportunity for Savings Based on Comparison of Costs Between Patients with and Without Hyperglycemia

Outcome	Cases with 2 or More BG at Some Point During Stay > 180 mg/dL	Cases with Controlled BG
Cases	465	1,228
Geometric mean cost	$10,312	$5,272
Expected cost (select practice)	$9,639	$5,595
Comparative cost deviation	$ 673	($ 323)
Comparative cost sig level	90% sig	90% sig

B. REVENUE GENERATION THROUGH BILLING FOR CLINICAL SERVICES

Implementation of targeted BG control in the hospital provides opportunities for an increase in the provision of clinical consultative services for diabetes management. Physicians and allied healthcare providers can bill when they provide such care, and the revenues offset costs of salary, fringe benefits and other expenses.

1. Nurse Practitioner (NP) Support Model

Northwestern University has successfully implemented a Glycemic Management Service (GMS) with the use of easy-to-follow insulin protocols guided by a formal management service. This model, implemented on inpatient surgical services utilizing Advanced NPs in conjunction with supervision by a board-certified endocrinologist, has proven to be effective and financially viable. Revenue generated by GMS consultation has been able to provide salary support for the NPs and 25% of a supervising physician's salary.[10]

EXAMPLE: Justification of NP support through offset by billings for consultative diabetes management services.

Nurse Practitioners on the Northwestern glycemic management service did between 35 and 45 new patient plus follow-up consults each per month in the first 7 months of 2006. Total monthly billings for each NP for new patient consults averaged $13,000 and for follow-up consults averaged $12,600. This annualizes to billings of about $310,000 for each NP. If one assumes an annual salary of $80,000 for an NP plus 30% fringe benefits ($24,000), the total salary expenses incurred to support each NP is $104,000 (Mark Molitch, personal communication, 2008). Additional operating costs and contractual allowances

TABLE 3
Example of Justification of Endocrinologist Support Through Offset by Billings for Consultative Diabetes Management Services

	Physician-Supported Model for Business Case	
Item	**Amount $**	**Comments**
A. Operating Revenue		
- Gross Patient Service Revenue		
Professional Fees	328,320	Based on 4-5 new level 4 consults/day generating $24,000/month and 2 level 2 follow-up consults/day generating $5,760/month billings on average; balance in level 3 outpatient visits.
- Deductions from Revenue		
Contractual Allowances	(123,504)	
- Net Patient Service Revenue	204,816	= 62%
Total operating revenue	**204,816**	
B. Operating Expenses		
- Personnel (salary)	(150,000)	1.0 FTE endocrinologist
- Benefits	(15,000)	
- Purchased services	(18,443)	9% billing fees
- Risk Management	(11,000)	
- Other operating expenses	(5,000)	Pager/phone/printed materials/CME
Total operating expenses	**(199,433)**	
C. Earnings from Operations		
Net earnings	**5,383**	

must also be offset in the return on investment equation, as illustrated in the physician support model example below.

2. Physician Support Model

The case for return on investment (ROI) for physician consultation may be made in a similar fashion (Table 3). This model's success is contingent upon meeting the projected number of new consults and follow-up visits.

One should also note that reductions in length of stay attributed to the diabetes case management provided by the physician or NP/PA can potentially be factored in the resultant financial benefit equation.

Other: Diabetes Education in the Inpatient Setting

Finally, at this time, financial justification for direct support for inpatient diabetes education services is challenging as there is no mechanism whereby inpatient education services can be billed. The case is therefore supported by incorporating the role of the educator into the business plan for the diabetes case management team as a whole. Financial support is then justified indirectly via 1 or more mechanisms. Net positive collections for clinical services by the team physicians and/or allied healthcare providers who are NPs or PAs may be applied to defray the cost of educator salary. Reduction in length of stay and/or costs resulting from the team initiative may also be used in support of diabetes educator positions. The diabetes educator may also be incorporated as a member of the hospital education program in order to help meet the requirement that basic diabetes education be provided to enable safe discharge of the patient from the hospital into the primary care setting.

CONCLUSION

Financial justification for support of a hospital based glycemic control team is challenging but possible, as has been shown by Newton[5] and by DeSantis and Molitch.[10] Various models may be used individually or in combination to make the case to hospital administration for salary support for team members. The models that may be helpful in this regard include: improved documentation opportunities; reduction in length of stay; reimbursement for direct clinical diabetes case management consultative services by physicians and NPs or PAs, and demonstration of improved resource utilization for the hyperglycemic patient managed by the hospital glycemic control team.

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REFERENCES

1. American Hospital Directory. Medicare Prospective Payment System. http://www.ahd.com/pps.html. Accessed September 5, 2008.
2. Price K, Farley D. How does your coding measure up?: analyzing performance data gives HIM a boost in managing revenue. *J AHIMA*. 2005;76(7):26–31.
3. Hart AC, Hopkins CA, Ford B, eds. ICD-9-CM Professional for Physicians. 6th ed. Salt Lake City, UT: Ingenix; 2006.
4. Clement S, Braithwaite SS, Magee MF, et al. on behalf of the American Diabetes Association Writing Group. Management of diabetes and hyperglycemia in hospitals. *Diabetes Care*. 2004;27:553–591.
5. Analysis provided by MedStar Health Outcomes Department.
6. Newton CA, Young S. Financial implications of glycemic control: results of an inpatient diabetes management program. *Endocr Pract*. 2006;12(Suppl 3):43–48.
7. Levetan CS, Salas JR, Wilets IF, Zumoff B. Impact of endocrine and diabetes team consultation on hospital length of stay for patients with diabetes. *Am J Med*. 1995;99:22–28.
8. Furnary AP, Wu Y, Bookin S. Effect of hyperglycemia and continuous intravenous insulin infusions on outcomes of cardiac surgical procedures: the Portland diabetes project. *Endocr Pract*. 2004;10:21–33.
9. Schmeltz LR, DeSantis AJ, Thiyagarajan V, et al. Reduction of surgical mortality and morbidity in diabetic patients undergoing cardiac surgery with a combined intravenous and subcutaneous insulin glucose management strategy. *Diabetes Care*. 2007;30:823–828.
10. DeSantis AJ, Schmeltz LR, Schmidt K, et al. Inpatient management of hyperglycemia: the Northwestern experience. *Endocr Pract*. 2006;12:491–505.