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Pay for Obesity? Pay-for-Performance Metrics Neglect Increased Complication Rates and Cost for Obese Patients

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Abstract

Background Rates of surgical complications are increasingly being used for pay-for-performance reimbursement structures. We hypothesize that morbid obesity has a significant effect on complication rates and costs following commonly performed general surgical procedures.

Methods We studied 30,502 patients who underwent cholecystectomy for cholecystitis and 6,390 patients who underwent appendectomy for acute appendicitis using administrative claims data from seven Blue Cross and Blue Shield Plans over a 7-year period (2002–2008). We compared 30-day complications as well as total 30-day direct medical costs for obese and non-obese patients. Multivariate regressions were performed to determine the relationship of morbid obesity to complications and cost.

Results Obese patients were more likely to have a complication within 30 days after surgery than non-obese patients (19.2% vs. 15.7% for cholecystectomy, $p<0.0001$; 20.2% vs. 15.2%, $p<0.0001$, for appendectomy). The mean total 30-day postoperative cost for obese patients were $1,109 higher following a cholecystectomy ($p<0.0001$) and $666 higher following an appendectomy ($p=0.09$).

Conclusion Morbid obesity is associated with a higher rate of complications for two commonly performed general surgical procedures and is associated with higher costs for cholecystectomy. Pay-for-performance metrics should account for the increased risk of complications and higher cost in this population.

Keywords Obesity · Appendectomy · Cholecystectomy · Pay for performance · Cost

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Introduction

Pay-for-performance (P4P) initiatives that use surgical complication rates to determine compensation are being widely adopted among federal, state, and private sector health care payers.[1–4] Increasingly, hospitals and health care providers are given financial incentives to optimize processes of care and outcomes. However, there has been growing frustration in the medical and surgical community that such outcome metrics ignore intrinsic differences in complication rates associated with patient comorbidities known to impact outcomes. Obesity is one of the fastest growing and most prevalent major comorbidities that surgeons encounter. Previous studies have suggested its influence on outcomes after general surgery procedures.[5–8]

Since its introduction, providers have been concerned that pay-for-performance compensation plans do not appropriately reimburse for the added work and costs associated with high-risk cases; however, these added risks and costs have not been well-defined. To address this question, we designed a study to measure the risk of complications and cost of obese patients who undergo two commonly performed acute general surgery operations—appendectomy for acute appendicitis and cholecystectomy for acute cholecystitis.

Methods

Our dataset included administrative claims data from 2002 to 2008 for over 3.8 million insured lives from seven Blue Cross and Blue Shield health plans (Blue Cross and Blue Shield Association, Blue Cross and Blue Shield of Tennessee, Blue Cross and Blue Shield of Hawaii, Blue Cross and Blue Shield of Michigan, Blue Cross and Blue Shield of North Carolina, Highmark Inc. of Pennsylvania, Independence Blue Cross of Pennsylvania, Wellmark Blue Cross and Blue Shield of Iowa, and Wellmark Blue Cross and Blue Shield of South Dakota). These data were made available as part of a collaborative effort between Johns Hopkins University and Blue Cross and Blue Shield Plans studying the effects of obesity on health outcomes and cost. The overall composition of the dataset was originally constructed to develop a claims-based risk score to identify obese patients and is described previously.[9]

Within this dataset, we examined all patients between the ages of 18 and 64 who submitted claims for cholecystectomy for acute cholecystitis or appendectomy for acute appendicitis. Patients aged 65 and over were excluded because these patients' costs are confounded by the use of Medicare. Obesity was identified by (1) body mass index (BMI) >35 in those patients who completed a health risk assessment questionnaire or (2) had a claim containing a diagnosis of obesity. Thirty-day postoperative events were identified from the claims data, including length of stay, readmission within 30 days after operation, death, cardiovascular event, venous thromboembolic event, reoperation, GI complications, infectious complications, hemorrhage, respiratory complication, and genitourinary complication. The data used for this study were de-identified in accordance with the Health Insurance Portability and Accountability Act of 1996 definition of a limited dataset and were used in accordance with federal standards for protecting confidentiality of the personal health information of the enrollee.

All costs associated with the acute hospitalization and within 30 days post-procedure were calculated from claims data. Physician payments were standardized by current procedural terminology (CPT) code. If a claim had a missing or nonpositive payment amount after the above procedure was followed, then the payment was imputed from the claims with non-missing payments, based on the insurance plan, code (DRG, CPT, or ICD procedure code), and year. For the purposes of this study, cost represents the amount paid by each health insurance plan for a given claim.

For the univariate analysis, the chi-square test was used for the categorical values, and the t test was used for continuous variables. Mean log-transformed costs were used to compare obese and non-obese cohorts within each procedure category. For the multivariate analysis, a logistic regression was used to model the development of any complication, and an ordinary least squares regression on log-transformed costs was used to model the effects on costs.

Results

A total of 6,390 patients (1,082 obese and 5,308 non-obese patients) were identified who underwent appendectomy for acute appendicitis, and 30,502 patients (4,678 obese and 25,824 non-obese patients) underwent cholecystectomy for acute cholecystitis. Patient characteristics are described in Table 1. Obese patients who underwent appendectomy had higher rates of diabetes and sleep apnea (Table 1). Obese patients who underwent cholecystectomy had a higher rate of diabetes, hypertension, and sleep apnea (Table 1). The obese patients in both groups were younger and included more women.

Thirty-day postoperative outcomes are outlined in Table 2 for both the appendectomy and the cholecystectomy groups. The mean length of stay was slightly longer for the obese as compared to non-obese patients undergoing both procedures. The difference was statistically significant for obese patients undergoing appendectomies. The overall complication rate as defined by the occurrence of at least one of the listed categories were higher in obese patients undergoing appendectomy and cholecystectomy (20.2% vs. 15.3%, $p<0.0001$ and 19.2% vs. 15.7%, $p<0.0001$, respectively) as compared to non-obese patients. Obesity did not affect 30-day mortality after either procedure. In examining specific categories of complications, the greatest difference between obese and non-obese patients was seen in the rate of infectious complications (appendectomy, 9.0% [obese patients] vs. 5.0% [non-obese patients] and cholecystectomy, 3.7% [obese patients] vs. 2.1% [non-obese patients]). This likely reflects the higher rate of surgical site infections noted in the obese cohort. Obese patients undergoing either appendectomy or cholecystectomy were also at a significantly increased risk of respiratory complications and reoperation during the hospital stay.

Table 1 Patient characteristics

	Obese, N=1,082	Non-obese, N=5,308	p value
Appendectomy			
Mean age (SE)	43.5 (0.4)	47.3 (0.2)[b]	<0.001
Female (%)	597 (55.2)	2,400 (45.2)[b]	<0.001
Laparoscopic (%)	474 (43.8)	2,441 (46.0)[b]	0.019
Diabetes (%)	223 (20.6)	802 (15.1)[b]	<0.001
Hypertension (%)	404 (37.3)	1,819 (34.3)[b]	0.053
Sleep apnea (%)	113 (10.4)	240 (3.6)[b]	<0.001
Cholecystectomy			
	Obese, N=4,678	Non-obese, N=25,824	p value
Mean age (SE)	44.8 (0.2)	46.1 (0.1)	<0.001
Female (%)	3,502 (74.9)	17,374 (67.3)	<0.001
Laparoscopic (%)	4,398 (94.0)	24,265 (94.0)	0.892
Diabetes (%)	1,032 (22.1)	2,896 (11.2)	<0.001
Hypertension (%)	2,001 (42.8)	7,465 (28.9)	<0.001
Sleep apnea (%)	403 (8.6)	576 (2.2)[d]	<0.001

[a] N = 1,082
[b] N = 5,308
[c] N = 4,678
[d] N = 25,824

Table 2 Thirty-day postoperative outcomes following procedures

	Obese, N=1,082	Non-obese, N=5,308	p value
Appendectomy			
Any complication, n (%)	219 (20.2)	813 (15.3)	<0.001
Readmission within 30 days	72 (6.7)	278 (5.2)	0.062
Death	1 (0.1)	1 (0.02)	0.310
Cardiovascular	44 (4.1)	207 (3.9)	0.797
Thromboembolic event	12 (1.1)	36 (0.7)	0.135
Reoperation	22 (2.0)	46 (0.9)	0.001
GI complication	67 (6.2)	240 (4.5)	0.019
Infectious complication	97 (9.0)	268 (5.0)	< 0.001
Hemorrhage	20 (1.8)	38 (0.7)	<0.001
Respiratory complication	42 (3.9)	143 (2.7)	0.034
Genitourinary complication	35 (3.2)	152 (2.9)	0.509
Mean length of stay (SE)[a]	4.3 (0.2)	4.0 (0.05)[b]	0.040
Cholecystectomy			
Outcome	Obese, N=4,678	Non-obese, N=25,824	p value
Any complication, n (%)	900 (19.2)	4,064 (15.7)	<0.001
Readmission within 30 days	305 (6.5)	1,528 (5.9)	0.110
Death	8 (0.2)	49 (0.2)	0.785
Cardiovascular event	255 (5.5)	1,136 (4.4)	0.002
Thromboembolic event	53 (1.1)	219 (0.8)	0.056
Reoperation	52 (1.1)	149 (0.6)	<0.001
GI complication	306 (6.5)	1,519 (5.9)	0.080
Infectious complication	173 (3.7)	537 (2.1)	<0.001
Hemorrhage	58 (1.2)	276 (1.1)	0.301
Respiratory complication	180 (3.8)	798 (3.1)	0.007
Genitourinary complication	143 (3.1)	685 (2.7)	0.117
Mean length of stay (SE)[a]	4.8 (0.1)	4.6 (0.04)	0.059

[a] A t test was used for the means; a chi-square test was used for all other comparisons

Inpatient costs were calculated for the hospitalization associated with the index operation. Additional claims, excluding pharmacy, submitted within a 30-day period after the operation were also identified and included in the total cost calculations. The mean costs are tabulated in Table 3. On a univariate analysis, the obese patients incurred significantly higher costs than non-obese patients for cholecystectomy ($p<0.001$). In the appendectomy group, there was a trend towards higher overall costs in the obese group, but not statistically significant ($p=0.091$). Payments were $666 higher in obese patients following appendectomy and were $1,109 higher in obese patients following cholecystectomy.

A multivariate logistic regression was performed to model the odds of experiencing a complication. These results are summarized in Table 4. On a multivariate analysis, the obese patients had a relative risk of 1.43 (confidence interval (CI), 1.21–1.70) for developing a complication after appendectomy and 1.19 (CI, 1.09–1.29) for developing a complication after cholecystectomy. Obesity was associated with a statistically significant increased cost in the cholecystectomy group on the multivariate analysis, after controlling for the comorbidities that were unequally distributed between the obese and non-obese groups (diabetes, hypertension, sleep apnea), as well as age ($p<0.001$).

Discussion

P4P initiatives have been heralded as a success in introducing financial performance incentives into medicine with the goal of improving quality of care and reducing health care expenditures. With rapidly exploding popularity, they have been adopted at the federal, state, and hospital level to financially reward good provider outcomes and punish poor performance.[1–4] However, despite the conceptual appeal of P4P policies, those that are based on outcome measures require risk adjustment, otherwise, providers who care for higher risk patients would be unfairly penalized.[10,11] We believe that obesity is an important comorbidity that must be included when defining high-risk populations because of its effect on perioperative outcomes, its rapidly increasing prevalence in the United States, and its unequal distribution geographically, racially, and socioeconomically.[12] The goal of this study was to identify if a diagnosis of morbid obesity correlated with higher rates of postoperative morbidity, mortality, and cost after two acute general surgery procedures: appendectomy and cholecystectomy. We focused on these procedures because they are commonly performed with a standard approach to management and the majority of costs stemming from the procedure occur within 30 days of the procedure.

Our findings suggest that morbidly obese patients have increased complication rates following appendectomy for acute appendicitis and cholecystectomy for acute cholecystitis. Much of the excess morbidity observed in the obese patients was infectious in nature, predominantly surgical site infections. Previous data regarding morbidity and mortality following general surgical procedures in the obese are mixed.[5–8,13,14] Many groups have reported that obese patients have an increased rate of surgical site infection, especially in patients with very high BMI (>40). Mortality and other complication rates have not been clearly shown to be higher in obese patients, and in fact an "obesity paradox" has been suggested by some studies,[8] indicating improved outcomes in obese patients. However, our study is not necessarily incongruous with these previous findings. First, we selected only acutely ill patients, namely those with acute appendicitis or acute cholecystitis who required urgent or emergent operations. Thus, the acute nature of the procedures we studied may be amplifying the effect of obesity on perioperative complications. Obese patients may have delayed presentations for acute appendicitis and cholecystitis and thus have more severe disease at the time of operation. Second, since we only selected acute procedures, the treating physician's ability to optimize comorbidities preoperatively is limited. Both of these aspects of acute care surgery may influence the effect of obesity on postoperative outcomes.

Our study also demonstrates a statistically significant increased cost of care for obese patients undergoing cholecystectomy and a trend towards increased cost for obese patients undergoing appendectomy. On average,

Table 3 Unadjusted costs for surgical admission and 30-day follow-up

	Obese	Non-obese	*p* value[a]
Appendectomy			
Inpatient cost	$13,995 (12,604–15,387)	$13,872 (12,847–14,898)	0.142
Post-discharge	$2,371 (1,410–3,331)	$1,828 (1,468–2,188)	<0.001
Total 30-day cost	$16,366 (14,607–18,125)	$15,700 (14,589–16,811)	0.091
Cholecystectomy			
Inpatient cost	$17,296 (15,770–18,822)	$15,942 (15,427–16,456)	<0.001
Post-discharge	$2,440 (1,933–2,948)	$2,685 (2,404–2,966)	<0.001
Total 30-day cost	$19,736 (18,101–21,372)	$18,627 (18,006–19,247)	<0.001

[a] *t* test of log-transformed costs in dollars

Table 4 Multivariate regression for development of any complication and overall cost

	Any complication			Cost				
	Likelihood ratio	95% confidence interval	*p* value	Cost: regression coefficient	95% conf interval	Cost (percent change)	95% confidence interval	*p* value
Appendectomy								
Obesity	1.43	1.21–1.70	<0.001	1,334.1	−12.6–2,793.9	8.4	−0.1–17.6	0.052
Laparoscopic (vs. open)	0.90	0.79–1.03	0.142	2,132.3	1,078.8–3,251.5	13.4	6.8–20.5	<0.001
Age								
35–44	1.14	0.90–1.46	0.278	1,987.6	317.8–3,828.2	12.5	2.0–24.2	0.018
45–54	1.34	1.07–1.68	0.012	2,318.1	703.0–4,089.2	14.6	4.5–25.9	0.004
55–64	1.82	1.45–2.28	<0.001	5,579.3	3,613.3–7,741.8	35.2	22.9–48.9	<0.001
Male	1.05	0.91–1.20	0.498	206.9	−738.1–1,209.4	1.3	−4.6–7.6	0.676
Diabetes	1.25	1.05–1.49	0.014	3,458.6	1,891.7–5,164.1	21.8	12.0–32.7	<0.001
Hypertension	1.21	1.04–1.40	0.013	1,109.3	0.00–2,296.4	7.0	0.00–14.5	0.050
Sleep apnea	1.48	1.14–1.93	0.003	3,506.8	1,109.3–6,244.1	22.1	7.0–39.5	0.003
Cholecystectomy								
Obesity	1.19	1.09–1.29	<0.001	1,598.15	946.0–2,269.8	8.5	5.0–12.1	<0.001
Laparoscopic (vs. open)	0.52	0.46–0.58	<0.001	−8,036.34	−8,542.7 to −7,505.0	−42.8	−45.5 to −39.9	<0.001
Age								
35–44	1.12	1.01–1.25	0.038	632.59	−43.2–1,332.7	3.4	−0.2–7.1	0.067
45–54	1.30	1.17–1.44	<0.001	1,029.06	362.5–1,720.9	5.5	1.9–9.2	0.002
55–64	1.79	1.61–1.98	<0.001	3,164.64	2,402.9–3,956.0	16.8	12.8–21.1	<0.001
Male sex	1.28	1.20–1.36	<0.001	2,375.38	1,846.4–2,915.7	12.6	9.8–15.5	<0.001
Diabetes	1.50	1.38–1.63	<0.001	3,876.51	3,070.4–4,712.3	20.6	16.3–25.1	<0.001
Hypertension	1.39	1.29–1.49	<0.001	2,549.70	1,974.8–3,138.3	13.6	10.5–16.7	<0.001
Sleep apnea	1.51	1.30–1.75	<0.001	1,342.79	60.3–2,712.6	7.1	0.3–14.4	0.040

payments associated with the inpatient hospitalization and 30 days postoperatively averaged $1,109 higher in obese patients undergoing cholecystectomy and $666 higher when undergoing appendectomy. This effect of obesity on costs was significant in the multivariate analysis for the cholecystectomy group. Although many factors likely explain why costs were higher in the obese group, we believe that this effect is driven by the higher rate of postoperative complications intrinsic to this population. Other possibilities to explain this difference include differences in severities of illness, ASA classification, and the presence of other diagnoses not captured in the claims dataset we used. Furthermore, one could hypothesize that obese patients consume more inpatient health care resources even without the presence of a significant complication; for example, more radiographic studies or laboratory tests may be required in obese patients. Our dataset is unable to distinguish among these different possibilities, but there does appear to be a significant independent impact of obesity on the amounts paid by the health care plans included in the dataset. If non-risk-adjusted P4P incentives were to be implemented in this patient population (for example, based on surgical site infection rates), the reimbursement rates would reverse, penalizing those who care for higher numbers of obese patients. Providers would not only be paid the same standard reimbursement for obese patients as they are paid for lower-risk non-obese patients, but they would actually be penalized by pay-for-performance policies for the occurrence of complications in obese patients. Furthermore, as obesity has a higher prevalence in the minority and the lower income populations, many hospitals that disproportionately care for these high-risk patients are being penalized by unadjusted P4P policies.

This study has several important limitations because it was conducted using an insurance claims database. First, the identification of a postoperative complication is dependent on a claim being accurately recorded in the dataset using the correct diagnosis and code. Although this method of identifying surgical complications is not as sensitive as the review of each patient's medical record or prospective data collection, the rates of complications that we identified are comparable to prior studies. Further, the method of detecting events based on codes was the same in each comparison group. Second, our ability to determine a patient's obesity status was similarly limited. We defined obese and non-obese patients based on the presence of an obesity diagnosis code or body mass index information through health risk assessment questionnaires. This likely underestimates the number of obese patients in the dataset, as some patients who do not carry a diagnosis of obesity or have BMI information available may still be obese, whereas those who do carry a diagnosis of obesity are unlikely to be non-obese.

Because of the way in which the dataset was originally constructed,[9] the appendectomy cohort did not include all patients who underwent appendectomy operations, but instead only patients who underwent an appendectomy and had one of the original dataset inclusion criteria (a diagnosis of obesity, an obesity-related comorbidity, or completion of a health risk assessment). Therefore, the appendectomy group overall is enriched with obese patients compared to the population at large. Consequently, our results probably underestimate the true impact of obesity on outcomes and cost (type II error) since our non-obese cohort is likely contaminated with many obese patients. This did not apply to the cholecystectomy group as all patients who underwent cholecystectomy were included in the original dataset. Another limitation is our definition of cost as payments made by the various health insurance plans included in the dataset. This definition does not include costs that are shouldered by the hospital, the provider, or the patient. Although paid reimbursements represent one measurement of cost, an overall societal perspective would provide a broader view of the costs of surgical care but would be beyond the scope of this paper.

There are several important policy implications from our study. First, structure and process measures may be incentivized, but outcome measures should only be used in P4P models when they are risk-adjusted. The American College of Surgeons National Surgical Quality Improvement Program (NSQIP) is one such validated risk-adjusted means of benchmarking outcomes at a hospital level. We warn that failure to risk-adjust could lead to the discrimination against high-risk populations and penalize doctors and hospitals who disproportionately care for these patients. Many doctors have already raised the issue of P4P policies to highlight disparities of care.[15,16] Our study suggests that obese patients are at increased risk of complications following two acute general surgery procedures, appendectomy and cholecystectomy, and incur higher costs for these procedures. Payers should consider reimbursing operations on obese patients with a cost adjustment that accounts for the additional complications that obese patients experience after surgery. Our results also begin to frame the financial impact of obesity on the health care system. We propose that obesity be included in any risk-adjustment strategy for appropriate P4P compensation.

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References

1. Rosenthal MB, Landon BE, Normand SL, Frank RG, Epstein AM. Pay for performance in commercial HMOs. N Engl J Med 2006;355:1895–902.
2. Ryan AM. Effects of the Premier Hospital Quality Incentive Demonstration on Medicare patient mortality and cost. Health Serv Res 2009;44:821–42.
3. Kuhmerker K, Hartman T. Pay-for-Performance in State Medicaid Programs: A Survey of State Medicaid Directors and Programs. 2007.
4. CMS. Centers for Medicare and Medicaid Services: Hospital Quality Initiatives. 2010;2010.
5. Merkow RP, Bilimoria KY, McCarter MD, Bentrem DJ. Effect of body mass index on short-term outcomes after colectomy for cancer. J Am Coll Surg 2009;208:53–61.
6. Dindo D, Muller MK, Weber M, Clavien PA. Obesity in general elective surgery. Lancet 2003;361:2032–5.
7. Thomas EJ, Goldman L, Mangione CM, Marcantonio ER, Cook EF, Ludwig L, Sugarbaker D, Poss R, Donaldson M, Lee TH. Body mass index as a correlate of postoperative complications and resource utilization. Am J Med 1997;102:277–83.
8. Mullen JT, Moorman DW, Davenport DL. The obesity paradox: body mass index and outcomes in patients undergoing non-bariatric general surgery. Ann Surg 2009;250:166–72.
9. Clark JM, Chang HY, Bolen SD, Shore AD, Goodwin SM, Weiner JP. Development of a Claims-Based Risk Score to Identify Obese Individuals. Popul Health Manag 2010.
10. Mehta RH, Liang L, Karve AM, Hernandez AF, Rumsfeld JS, Fonarow GC, Peterson ED. Association of patient case-mix adjustment, hospital process performance rankings, and eligibility for financial incentives. JAMA 2008;300:1897–903.
11. Fiscella K, Franks P, Gold MR, Clancy CM. Inequality in quality: addressing socioeconomic, racial, and ethnic disparities in health care. JAMA 2000;283:2579–84.
12. Centers for Disease Control and Prevention (CDC). Differences in prevalence of obesity among black, white, and Hispanic adults - United States, 2006–2008. MMWR Morb Mortal Wkly Rep 2009;58:740–4.
13. Davenport DL, Xenos ES, Hosokawa P, Radford J, Henderson WG, Endean ED. The influence of body mass index obesity status on vascular surgery 30-day morbidity and mortality. J Vasc Surg 2009;49:140,7, 147.e1; discussion 147.
14. Benoist S, Panis Y, Alves A, Valleur P. Impact of obesity on surgical outcomes after colorectal resection. Am J Surg 2000;179:275–81.
15. Ryan AM. Has Pay-for-Performance Decreased Access for Minority Patients? Health Serv Res 2009.
16. Werner RM, Goldman LE, Dudley RA. Comparison of change in quality of care between safety-net and non-safety-net hospitals. JAMA 2008;299:2180–7.

Discussion

Dr. David McFadden (Burlington, VT): Primary discussants have been given 1 min, so congratulations on a very important topic, a great manuscript, and an outstanding presentation.

I'll just ask a couple of questions because I know there are a lot of people in the audience who want to comment on this very provocative paper.

As you mentioned, there is a cost–charge payment continuum. Your findings of increased payments intuitively represents increased charges and increased costs. Do you think the incremental payment offsets the incremental real cost to the health care providers? If not, and given the already narrow margins on these two conditions, care may indeed become a losing proposition for these obese patients, especially those without commercial insurance.

Secondly, although the length of stay did not differ between the groups, it does appear a little excessive, especially in a Blue Cross population. You had a 5-day length of stay for cholecystectomy and a 4-day length of stay for appendectomy. I am just interested in your thoughts or comments about this.

Closing Discussant

Dr. Kenzo Hirose: Cost obviously is a very difficult topic to analyze, and certainly it depends on one's perspective. The perspective of this paper is from the health care payer. And in some sense, the motivation is to reduce costs as much as possible. And that means basically reducing the amount that is reimbursed to either the provider or the hospital.

And again, in terms of the burden to the provider and the hospital of caring for these patients, certainly this doesn't address any of those costs inherent in caring for these patients. And doing so would take a different analytic approach.

The way we looked at it, it certainly has a number of caveats and depends on various reimbursement modes, fee-for-service versus others, and certain contracts that each of the healthcare payers has with their associated hospitals and providers. So with those caveats, this is how we looked at costs because we had access to these numbers. It certainly doesn't address a lot of the other questions regarding whether it's a losing proposition to take charge of these patients or not. It's certainly an important question to ask.

In terms of the length-of-stay numbers, for I believe, in terms of cholecystectomy, our mean hospital stay was 4 or 5 days. We did notice that this was fairly long. I believe we selected for patients that had somewhat more severe disease. These were patients who underwent urgent or emergent operations with acute inpatient hospitalization. It is not necessarily postoperative length of stay either, and it would include any stay prior to their surgery. So we believe that we have selected for a group of patients that may have a little bit more severe disease.

Discussant

Dr. Henry Pitt (Indianapolis, IN): Very nice work. We've been looking at pancreatectomy, a high-risk operation, in conjunction with the statisticians at the American College of Surgeons National Surgical Quality Improvement Program. We and found, like you did, that obesity is a risk factor for mortality, serious morbidity, and overall morbidity for this high-risk operation. In the NSQIP database, they have five categories of obesity, and somewhat to my surprise, only BMI greater than 40 was the factor that increased the risk for pancreatectomy.

You had just two categories, less than and more than BMI of 35. Do you think the cutoff, if you had better data, would be higher than 35?

Closing Discussant

Dr. Kenzo Hirose: Part of our data is based on the BMI, but also a large portion of patients were ones that carried a diagnosis of obesity. So this is one of the sorts of the risks of using administrative claims data to look at these patients. Some of these patients needed to carry a diagnosis of obesity, so this probably skewed the population to patients who had more severe forms of obesity. So someone who has a BMI of greater than 35, who doesn't have comorbidities, probably would not be carrying the diagnosis of obesity. There's a bit of a coding bias that is inherent in the way we looked at our patients. We recognized this, although we felt that in terms of the bias, that this would probably bias patients in the obese group to be of higher BMIs and have higher comorbidities and potentially have contaminated our non-obese group with a certain number of obese patients. But we felt that this type of bias would have, if anything, reduced the effect that we were looking for. Thus, we feel that the effect that we see is legitimate one.