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Hospital-acquired conditions after bariatric surgery: we can predict, but can we prevent?

Anne O. Lidor · Erin Moran-Atkin · Miloslawa Stem · Thomas H. Magnuson · Kimberley E. Steele · Richard Feinberg · Michael A. Schweitzer

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Abstract
Background Centers for Medicare and Medicaid Services initiated a non-payment policy for certain hospital-acquired conditions (HACs) in 2008. This study aimed to determine the rate of the three most common HACs (surgical site infection (SSI), urinary tract infection (UTI), and venous thromboembolism (VTE)) among bariatric surgery patients. Additionally, the association of HACs with patient factors and the effect of HACs on post-operative outcomes were investigated.
Methods Patients over 18 years with a body mass index (BMI) $\geq$35 who underwent bariatric surgery were identified using the American College of Surgeons' National Surgical Quality Improvement Program (ACS-NSQIP) database (2005–2012). Patients were grouped into two categories: HAC versus no HAC patients and baseline characteristics and outcomes, including 30-day mortality, reoperation, and mean length of stay (LOS) were compared. Multivariable logistic regression analysis was performed to identify the risk factors for developing a HAC.
Results 98,553 patients were identified, 2,809 (2.9 %) developed at least one HACs. SSI was the most common HAC (1.8 %), followed by UTI (0.7 %) and VTE (0.4 %). The rate of these HACs significantly decreased from 4.6 % in 2005–2006 to 2.5 % in 2012 ($p < 0.001$). Laparoscopic gastric banding was associated with the lowest rates of HAC (1.3 %) and open gastric bypass with the highest (8.0 %). HAC patients had significantly higher rates of in-hospital mortality (0.8 vs. 0.1 %, $p < 0.001$) and LOS (3.9 vs. 2.1 days, $p < 0.001$). On adjusted analysis, open GBP patients had 5.36-fold higher odds of developing a HAC. Interestingly, the presence of a resident surgeon 7–11 years post graduation was associated with significantly increased odds of HACs (1.86, 1.50–2.31, $p < 0.001$).
Conclusion Our data demonstrate a strong correlation between these three HACs following bariatric surgery and factors intrinsic to the bariatric patient population. This calls into question the non-payment policy for inherent patient factors on which they cannot have impact. These findings are important to help inform health care policy decisions regarding access to care for bariatric surgery patients.

Keywords Hospital-acquired conditions · Obesity · Bariatric surgery · Outcomes · Non-reimbursement · Surgical site infection

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A. O. Lidor (✉) · E. Moran-Atkin · M. Stem · T. H. Magnuson · K. E. Steele · R. Feinberg · M. A. Schweitzer
Department of Surgery, Johns Hopkins University School of Medicine, Johns Hopkins Hospital, 600 N. Wolfe Street, Blalock 618, Baltimore, MD 21287, USA
e-mail: alidor1@jhmi.edu

E. Moran-Atkin
e-mail: erinmoranatkin@gmail.com

The Centers for Medicare and Medicaid Services (CMS) has implemented a non-payment policy for certain hospital-acquired conditions (HACs) in an effort to focus on the quality improvement and prevention of medical errors. This new non-reimbursement policy has been in effect since October 1, 2008, and since then, many large health insurers have followed Medicare's lead [1]. As of 2013, 11 HACs have been identified, including foreign object retained after surgery, air embolism, blood incompatibility, pressure ulcer stages III & IV, certain falls and trauma,

urinary tract infection (UTI), vascular catheter-associated infection, manifestation of poor glycemic control, surgical site infection (SSI), and deep vein thrombosis (DVT)/pulmonary embolism [2]. While some of these HAC, such as retained foreign object, should be considered true "never events"; in actuality, most of them represent undesirable outcomes that should be minimized by the routine use of patient safety guidelines and protocols.

Although, this policy was created to promote patient safety and improve patient care, some raise concerns, claiming that it may negatively impact the access to health care for high-risk patients. Bariatric surgery is one of the most commonly performed procedures in the United States, with an estimated 100–20,000 cases perfomed annually [3, 4]. Patients undergoing obesity surgery, are by definition, at high risk for many of these HAC and as such may be particularly vulnerable to the downstream effects of the policy. With increasing numbers of patients undergoing obesity surgery in the United States, we believe this is a timely project and to date, there has been no study addressing this new CMS policy with regard to the bariatric surgery patients.

We queried the American College of Surgeons' National Surgical Quality Improvement Program (ACS-NSQIP) database (2005–2012) in order to determine the incidence of the three most common HAC among bariatric surgery patients: SSI, UTI, and DVT. Additionally, the association of HAC with patient factors and the effect on postoperative outcomes were investigated. We hypothesized that there exists a strong correlation between HAC following bariatric surgery and factors intrinsic to the bariatric patient population itself and we believe that, this information is important to aid the decision-making process for health care policy makers about the access to care for bariatric surgery patients.

Patients and methods

Data source

This was a retrospective analysis using the American College of Surgeons National Surgical Quality Improvement Program (ASC-NSQIP) database from 2005 through 2012. NSQIP is a large nationally validated, risk-adjusted, outcomes-based program and it is used to measure and improve the quality of surgical care. Nearly 500 hospitals that vary in size and academic affiliation participate in NSQIP [5]. This program employs a prospective systematic data collection on more than 135 preoperative and intraoperative variables, as well as 30 day postoperative morbidity and mortality. The data are collected from clinical records by trained surgical clinical reviewers. Details of ACS-NSQIP are described elsewhere [6]. This study was deemed exempt by the Institutional Review Board of the Johns Hopkins University School of Medicine.

Inclusion criteria

Patients 18 years of age and older with a diagnosis of obesity (defined as International Classification of Diseases, 9th revision (ICD-9) code of 278.01) and body mass index (BMI) $\geq$35 who underwent bariatric surgery (defined as Current Procedural Terminology (CPT) codes of 43770, 43644, 43645, 43846, 43847, 43775, 43842, 43843, and 43845) were included. These procedure codes were categorized into five surgical approaches: laparoscopic adjustable gastric banding (lap band, 43770), laparoscopic gastric bypass (lap GBP, 43644 and 43645), open GBP (43846 and 43847), sleeve (43775), and other bariatric procedures (other, 43842, 43843, and 43845). 165 patients were excluded due to missing age or BMI data. As of 2013, 11 HAC have been identified by the CMS. This study aimed to determine the rate of the three most common HAC: surgical site infection (SSI), urinary tract infection (UTI), and venous thromboembolism (VTE) among bariatric surgery patients. SSI included superficial and/or deep incisional surgical site infection as defined by NSQIP, while VTE was defined as deep venous thrombosis and/or pulmonary embolism. Individuals were divided into two categories for comparison: HAC versus no HAC. Additionally, a sub group analysis stratified by procedure type was performed.

Baseline characteristics of patients

Demographic and clinical characteristics were compared between the HAC and no HAC patients. Demographic characteristics included age, gender, and race (white, black, and other/unknown). Clinical characteristics consisted of American Society of Anesthesiology (ASA) classification of patient physical condition, body mass index (BMI), and preoperative comorbidities such as diabetes mellitus (with oral agents or insulin), current history of smoking (within one year before the operation), dyspnea, history of chronic obstructive pulmonary disease (COPD), hypertension requiring medication, previous cardiac surgery, and steroid use for chronic condition. Additionally we also included the highest level of resident surgeon being present in the operating room (OR) and procedure type. Age and BMI were categorized as: <50, 50–64, and 65 years old, and 35–39, 40–49, and 50, respectively. Categories for the highest level of resident surgeon were determined based on the presence in the OR and post graduation year: no resident scrubbed, 1–3, 4–6, or 7–11 years post graduation, or unknown/not reported. After reviewing the frequency distribution of patients by the ASA class, we combined ASA

class one and two (no or mild disturbance) and ASA class four and five (life threatening and moribund) while leaving ASA class three (serious disturbance) as a standalone variable.

Outcomes

Postoperative outcomes between the HAC and no HAC patients were compared. 30 day mortality was the primary outcome of interest. The secondary outcomes included length of hospital stay (LOS), reoperation and total operative time. In addition, discharge destination and 30 day readmission, added to the ACS-NSQIP database in 2011, were investigated. Analysis of these two additional outcomes was only performed for the 2 year period. A patient was considered to be transferred if they were discharged to rehab, separate acute care, or skilled care (not home).

Statistical analysis

Patients' baseline characteristics and outcomes were compared between the two groups using Pearson's Chi-squared test for categorical variables and Student's t test for continuous variables. Fisher's exact test was used when appropriate. Comparison of mean among five different procedure types was performed using ANOVA. Multivariable logistic regression analysis was performed to identify risk factors for developing a HAC. First, exploratory data analysis was performed using univariate logistic regression. Initially, the model included all covariates with associations in exploratory analysis at the $p < 0.25$ level as recommended by Hosmer and Lemeshow [7]. Additionally, all covariates of clinical importance were included, regardless of statistical significance. Models were then refined based on clinical importance of covariates and their impact on overall fit as assessed by likelihood ratio tests. As a result, the final logistic regression model for developing a HAC was adjusted for age, ASA class, BMI, diabetes, history of COPD, hypertension, steroid use, highest level of the resident surgeon being present in the OR, and procedure type. Lastly, the final model was validated with the goodness of fit test. Statistical significance was indicated by $p < 0.05$. All data analyses and management were performed using Stata/MP version 12 (StataCorp LP, College Station, TX, USA).

Results

Study population

A total of 98,553 patients met the study criteria, including 2,809 (2.9 %) with at least once HAC. SSI was the most common HAC (1.8 %), followed by UTI (0.7 %) and VTE (0.4 %). The rate of developing these three HAC has significantly decreased over the studied years (from 4.6 % in 2005–2006 to 2.5 % in 2012, $p < 0.001$) (Fig. 1). Lap band was associated with the lowest rates of HAC (1.3 %), whereas; open GBP with the highest (8.0 %).

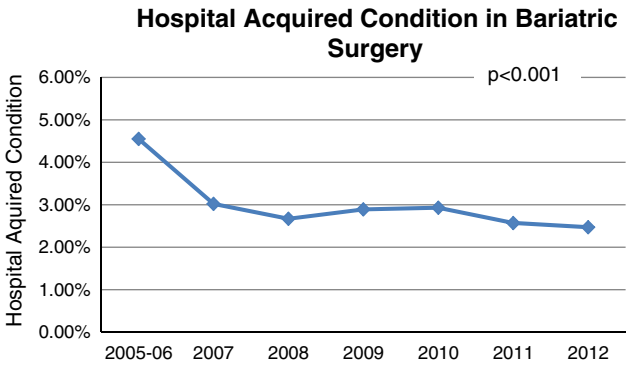

Fig. 1 Trend of hospital-acquired conditions over the studied years

The two patient groups were significantly different at the baseline. The majority of patients were females and white individuals, with a mean age of 45 years and mean BMI of 46.7 (Table 1). Patients who developed HAC were generally older, sicker, had greater BMI and were more likely to have undergone open GBP. With regard to individual comorbidities, the rates of diabetes, dyspnea, history of COPD, hypertension, and steroid use were significantly higher in the HAC population. In addition, HAC were significantly associated with having a higher level of resident surgeon in the OR (4–6 and 7–11 years post graduation).

Unadjusted outcomes

The overall in-hospital mortality rate was 0.14 %, with significantly higher rate among the HAC patients (0.75 % vs. 0.13 %, $p < 0.001$) (Table 2). Patients who developed a HAC-stayed in the hospital longer (3.9 vs. 2.1 days, $p < 0.001$), had longer operative time (144.6 vs. 114.8 min, $p < 0.001$), and were more likely to undergo a reoperation (11.57 % vs. 1.90 %, $p < 0.001$).

The incidence of HAC and studied outcomes varied significantly across the five surgical approaches (lap band, lap GBP, open GBP, sleeve, and other) (Table 3). Open GBP was associated with the highest HAC (8.03 %), reoperation rates (3.94 %), and the longest operative time (mean of 143.5 min) and LOS (mean of 3.9 days). In comparison, bariatric patients who underwent a lap band procedure were the least likely to develop HAC (1.28 %) and to die (0.03 %) or require a reoperation (1.00 %).

Table 1 Baseline demographic and clinical characteristics

Characteristic	Total $n = 98,553$	No HAC $n = 95,744$ (97.15 %)	HAC $n = 2,809$ (2.85 %)	p
Age group				<0.001
<50	62,699 (63.62 %)	61,115 (63.83 %)	1,584 (56.39 %)	
50–64	31,589 (32.05 %)	30,520 (31.88 %)	1,069 (38.06 %)	
≥65	4,265 (4.33 %)	4,109 (4.29 %)	156 (5.55 %)	
Female	77,274 (78.64 %)	75,069 (78.64 %)	2,205 (78.72 %)	0.918
Race				0.003
White	72,992 (74.06 %)	70,846 (74.00 %)	2,146 (76.40 %)	
Black	14,321 (14.53 %)	13,975 (14.60 %)	346 (12.32 %)	
Other/unknown	11,240 (11.41 %)	10,923 (11.41 %)	317 (11.28 %)	
ASA classification				<0.001
I–II	32,676 (33.19 %)	32,026 (33.48 %)	650 (23.16 %)	
III	63,434 (64.43 %)	61,418 (64.21 %)	2,016 (71.82 %)	
IV–V	2,348 (2.38 %)	2,207 (2.31 %)	141 (5.02 %)	
BMI				<0.001
35–39	18,231 (18.50 %)	17,884 (18.68 %)	347 (12.35 %)	
40–49	53,956 (54.75 %)	52,630 (54.97 %)	1,326 (47.21 %)	
≥50	26,366 (26.75 %)	25,230 (26.35 %)	1,136 (40.44 %)	
Diabetes	27,366 (27.77 %)	26,292 (27.46 %)	1,074 (38.23 %)	<0.001
Current smoker	11,389 (11.56 %)	11,068 (11.56 %)	321 (11.43 %)	0.829
Dyspnea	22,737 (23.07 %)	21,888 (22.86 %)	849 (30.22 %)	<0.001
History of COPD	1,719 (1.74 %)	1,617 (1.69 %)	102 (3.63 %)	<0.001
Hypertension	52,433 (53.20 %)	50,648 (52.90 %)	1,785 (63.55 %)	<0.001
Previous cardiac surgery	976 (1.25 %)	939 (1.24 %)	37 (1.58 %)	0.146
Steroid use	962 (0.98 %)	911 (0.95 %)	51 (1.82 %)	<0.001
Highest level of the resident surgeon				<0.001
No resident scrubbed	36,664 (37.20 %)	35,666 (37.25 %)	998 (35.53 %)	
1–3 years post graduation	10,095 (10.24 %)	9,798 (10.23 %)	297 (10.57 %)	
4–6 years post graduation	24,108 (24.46 %)	23,288 (24.32 %)	820 (29.19 %)	
7–11 years post graduation	2,034 (2.06 %)	1,935 (2.02 %)	99 (3.52 %)	
Unknown/not reported	25,652 (26.03 %)	25,057 (26.17 %)	595 (21.18 %)	
Procedure type				<0.001
Lap band	24,435 (24.79 %)	24,123 (25.20 %)	312 (11.11 %)	
Lap GBP	55,370 (56.18 %)	53,629 (56.01 %)	1,741 (61.98 %)	
Open GBP	5,282 (5.36 %)	4,858 (5.07 %)	424 (15.09 %)	
Sleeve	10,504 (10.66 %)	10,296 (10.75 %)	208 (7.40 %)	
Other	2,962 (3.01 %)	2,838 (2.96 %)	124 (4.41 %)	

HAC hospital-acquired condition, *ASA* American Society of Anesthesiology, *BMI* body mass index, *COPD* chronic obstructive pulmonary disease, *GBP* gastric bypass, *VBG* vertical banded gastroplasty

ASA I–II (No/Mild Disturb), III (Severe Disturb), IV–V (Life Threat/Moribund). Different denominators due to missing data: gender (TOTAL $n = 98,259$; no HAC $n = 95,458$; HAC $n = 2,205$), ASA ($n = 98,458$; 95,651; 2,807)

These lap band patients had the shortest operative time (mean of 69.4 min) and LOS (mean of 1 day).

The overall 30 day readmission rate in 2011–2012 was 5.40 % and significantly varied between the two groups (no HAC 4.75 %; HAC 30.77 %, $p < 0.001$) (Table 4). Furthermore, HAC patients were significantly associated with discharge rate to rehab, acute care, or skilled care facility (HAC 2.86 %; no HAC 0.44 %, $p < 0.001$). In addition, patients who underwent an open GBP were more likely to be transferred (2.58 %) and to be readmitted (10.13 %).

Table 2 Observed unadjusted rates of postoperative outcomes

Outcome	Total $n = 98,553$	No HAC $n = 95,744$ (97.15 %)	HAC $n = 2,809$ (2.85 %)	p
30 day mortality	141 (0.14 %)	120 (0.13 %)	21 (0.75 %)	<0.001
LOS (days)	2.2 ± 5.9	2.1 ± 5.9	3.9 ± 6.3	<0.001
Operation time (min)	115.7 ± 60.4	114.8 ± 59.6	144.6 ± 76.5	<0.001
Reoperation	2,142 (2.17 %)	1,817 (1.90 %)	325 (11.57 %)	<0.001

HAC hospital-acquired condition, *LOS* length of stay

Adjusted outcomes

A number of factors intrinsic to the bariatric patient population (i.e., higher ASA classification, greater BMI, diabetes, hypertension) were significantly associated with increased odds of developing a HAC with nearly 75 % increased odds in patients over 50-year old (Table 4). Additionally, the more technically challenging operations were associated with increased odds of developing a HAC. Specifically, open gastric bypass patients had 5.36-fold higher odds of developing a HAC in comparison to lap band patients (OR 5.36, 95 % CI 4.60–6.24, $p < 0.001$). Interestingly, the presence of a resident surgeon 7–11 years post graduation in the OR was associated with significantly increased odds of acquiring a hospital condition (1.86, 1.50–2.31, $p < 0.001$) compared to the presence of no resident. Not surprisingly, the likelihood of HAC for patients on steroids was 1.60 times of those not taking the steroids. Table 5.

Discussion

This retrospective analysis using the ACS-NSQIP database shows that HACs are an infrequent event in the bariatric population, with only 2.85 % of patients developing HAC.

Table 3 Observed unadjusted rates of postoperative outcomes stratified by procedure type

Outcome	Lap band 24,435 (24.79 %)	Lap GBP 55,370 (56.18 %)	Open GBP 5,282 (5.36 %)	Sleeve 10,504 (10.66 %)	Other 2,962 (3.01 %)	p
Total HAC	312 (1.28 %)	1741 (3.14 %)	424 (8.03 %)	208 (1.98 %)	124 (4.19 %)	<0.001
HAC						<0.001
UTI	69 (0.28 %)	470 (0.85 %)	56 (1.06 %)	61 (0.58 %)	26 (0.87 %)	
SSI	215 (0.88 %)	1036 (1.87 %)	316 (5.98 %)	89 (0.85 %)	64 (2.16 %)	
VTE	28 (0.11 %)	235 (0.42 %)	52 (0.98 %)	58 (0.55 %)	35 (1.22 %)	
30 day mortality	8 (0.03 %)	81 (0.15 %)	35 (0.66 %)	9 (0.09 %)	9 (0.27 %)	<0.001
LOS (day)	1.0 ± 6.4	2.5 ± 5.4	3.9 ± 5.3	2.2 ± 7.5	3.1 ± 4.6	<0.001
Operative time (min)	69.4 ± 32.3	135.2 ± 56.3	143.5 ± 76.3	99.0 ± 48.4	142.3 ± 81.9	<0.001
30 day reoperation	245 (1.00 %)	1,454 (2.63 %)	208 (3.94 %)	160 (1.52 %)	75 (2.53 %)	<0.001

GBP gastric bypass, *HAC* hospital-acquired condition, *UTI* urinary tract infection, *SSI* surgical site infection, *VTE* venous thromboembolism, *LOS* length of stay

Table 4 Observed unadjusted rates of discharge destination and readmission stratified by HAC and procedure type (2011–2012)

	HAC			Procedure type					
Outcome	No HAC $n = 32,442$ (97.48 %)	HAC $n = 839$ (2.52 %)	p	Lap band 4,724 (14.19 %)	Lap GBP 18,239 (54.80 %)	Open GBP 658 (1.98 %)	Sleeve 8.931 (26.84 %)	Other 729 (2.19 %)	p
Discharge Destination									<0.001
Transfer[1]	142/32,366 (0.44 %)	24/839 (2.86 %)	<0.001	9/4,706 (0.19 %)	88/18,195 (0.48 %)	17/658 (2.58 %)	34/8,921 (0.38 %)	18/725 (2.48 %)	
30 day Readmission	1,476/31,103 (4.75 %)	248/806 (30.77 %)	<0.001	104/4,485 (2.32 %)	1,150/17,586 (6.54 %)	63/622 (10.13 %)	349/8,589 (4.06 %)	58/627 (9.25 %)	<0.001

GBP gastric bypass, *HAC* hospital-acquired condition

[1] Transfer is discharge to rahab, separate acute care, or skilled care (not home)

Table 5 Multivariable logistic regression analysis of variables associated with developing a hospital-acquired condition (HAC)

Variable	OR	*p*	95 % CI
Age group			
<50	Reference	Reference	Reference
50–64	1.16	0.001	(1.07–1.27)
≥65	1.31	0.002	(1.10–1.56)
ASA classification			
I–II	Reference	Reference	Reference
III	1.20	<0.001	(1.09–1.32)
IV–V	1.71	<0.001	(1.40–2.09)
BMI			
35–39	Reference	Reference	Reference
40–49	1.20	0.003	(1.06–1.35)
≥ 50	1.77	<0.001	(1.56–2.00)
Diabetes	1.26	<0.001	(1.16–1.37)
History of COPD	1.43	0.001	(1.15–1.76)
Hypertension	1.19	<0.001	(1.09–1.30)
Steroid use	1.64	0.001	(1.23–2.19)
Highest level of the resident surgeon			
No resident scrubbed	Reference	Reference	Reference
1–3 years post graduation	1.10	0.142	(0.97–1.26)
4–6 years post graduation	1.31	<0.001	(1.19–1.44)
7–11 years post graduation	1.86	<0.001	(1.50–2.31)
Unknown/not reported	0.96	0.439	(0.86–1.07)
Procedure type			
Lap band	Reference	Reference	Reference
Lap GBP	2.27	<0.001	(2.01–2.57)
Open GBP	5.36	<0.001	(4.60–6.24)
Sleeve	1.59	<0.001	(1.32–1.91)
VBG	3.01	<0.001	(2.43–3.73)

ASA American Society of Anesthesiology, *BMI* body mass index, *COPD* chronic obstructive pulmonary disease, *GBP* gastric bypass, *VBG* vertical banded gastroplasty

ASA I–II (No/Mild Disturb), III (Severe Disturb), IV–V (Life Threat/Moribund)

Hospital-acquired conditions developed more frequently in patients with comorbidities, higher BMI and elevated ASA stratification. Not surprisingly, patients undergoing an open RYGB had a higher likelihood of developing HAC. In other words, the patients most likely to develop a HAC after bariatric surgery are precisely those who stand to benefit the most from undergoing these procedures.

Notwithstanding the very low overall rate of HAC in this study, the one most frequently observed was SSI. Patients most likely to experience a SSI included diabetics, patients undergoing open gastric bypass, and those with the highest BMIs. The incidence of SSI has been reported to range from 1–7 % depending on the surgical procedure performed. Haridas reported an overall SSI rate of 3.1 % in a 6 year institutional review of all vascular and general surgery procedures [6], while Podnos and colleagues reported wound infection rates of 6.63 and 2.98 % for open RYGB and laparoscopic RYGB, respectively [8], findings very similar to our own. And, while certain types of procedures (e.g., colorectal) are inherently more prone to infectious complications than others, it seems to us that, even among relatively "clean" surgical procedures such as bariatric surgery, the elimination of all SSI—while a laudable goal in theory—is not likely to be attainable in actuality.

The presence of a surgical resident in the operating suite has previously been reported as a risk factor for worse outcomes after vascular and general surgical procedures. [9]. In this study, we noted an increase in risk for developing HAC of 30 and 80 %, respectively, when mid-level and senior residents were involved in the surgical procedure. Raval et al. [10] noted that resident involvement was associated with slightly worse surgical outcomes, although risk of mortality decreased in the same patients. Similarly, Krell et al. [11] demonstrated that resident involvement in laparoscopic gastric bypass is independently associated with the development of both wound infections and venous thromboembolism. It has been hypothesized that longer operative times of cases when residents are involved may account for the higher rates of SSI and VTE events [12–14]. Alternative explanations which have been advanced include: a greater chance of tissue injury when operative procedures are performed by less experienced surgeons; and a component of selection bias, to the degree that the presence of residents in the OR might correlate with a higher level of case complexity [10, 11]. We did note that patients with HAC in our study had significantly higher operative times (approximately 30 min longer), while the presence of the most junior residents (PGY 1–3) was not associated with increased odds of HAC—an apparent contradiction which might be explained by more junior residents' not having as much direct input in these procedures.

The implementation of the CMS non-reimbursement policy in 2008 is known to have had an impact in reducing the incidence of HAC and reducing healthcare costs. Nguyen and colleagues demonstrated a significant decrease in overall bariatric surgery complications from 14.6 to 10.4 % after CMS expanded reimbursement to include laparoscopic bariatric procedures in 2006 [15]. This decrease in bariatric complication rates likely reflects the accompanying shift from open to laparoscopic procedures which followed that decision. We also noted a decline in the incidence of HAC in the bariatric surgery population from 2005 to 2008 followed by a plateau in HAC from 2008 to 2012. This trend, too, correlates closely with the decline in the open procedures being performed. The

minimal further reduction in the incidence of HACs in the bariatric surgery population since the implementation of the CMS non-reimbursement policy may simply reflect the reality that these complications may already have been lowered to a level beyond which further reductions will be very hard-won, given the risks inherent in this population.

The data presented in our study serve as a reminder that there are certain demographic and disease-specific variables—such as high BMI, diabetes, and open surgery—which increase the risk of developing a HAC. Given that high BMI and the presence of obesity-related comorbidities are the very indications for bariatric surgery, the expectation by CMS that these adverse surgical outcomes be entirely eliminated (lest reimbursement be withheld) seems unrealistic. An unintended consequence of the implementation of this non-reimbursement policy may be to lead physicians to deny surgery to higher risk patients for fear of being penalized financially in the event of HACs, thereby reducing access to care for this population., Karve et al. [16] demonstrated that the CMS Pay-for-performance program resulted in worsened racial health care disparities and potential financial penalties for hospitals with large minority populations. Similarly, other groups have shown deceased access to care and reduced quality of care for high-risk patients after implementation of public CABG report cards in New York [17].

The principal limitations of our study are related to the chosen database. While the NSQIP allowed us to gather information from a large population-based database, hospital participation in NSQIP is voluntary and self-funded, so it is not known whether the data reported by these hospitals can properly be extrapolated to all hospitals and the general population. Participating hospitals in the NSQIP are kept anonymous, precluding any ability to adjust for hospital characteristics such as size, patient volume, teaching status, or individual surgeon experience. The focus of NSQIP is patient safety and quality of care, so we were able to collect data on a large number of potential complications. However, the database does not provide information on the technical aspects of each operation or clinical details associated with each adverse outcome as defined by CMS.

In conclusion, we found that a variety of hospital-acquired conditions now being employed by CMS to alter reimbursement rates after bariatric surgery are, in large part, related to intrinsic patient factors inherent in this population. As such, the ability of surgeons to impact the incidence of these index conditions may, in fact, be minimal. While the non-payment policy implemented by CMS may provide a window into the future of health care policy in this country, it also provides some pause for thought. Instead of achieving the stated desire of decreasing the rate of surgical complications, such policies might instead have the unintended consequence of reducing access to care for higher risk patients—patients who are, by definition, the very ones most in need of, and likeliest to benefit from, these surgical procedures.

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