

Worse outcomes among uninsured general surgery patients: Does the need for an emergency operation explain these disparities?

Diane A. Schwartz, MD, Xuan Hui, MD, Eric B. Schneider, PhD, Mays T. Ali, BS, Joseph K. Canner, MHS, William R. Leeper, MD, David T. Efron, MD, Elliot R. Haut, MD, Catherine G. Velopulos, MD, Timothy M. Pawlik, MD, MPH, PhD, and Adil H. Haider, MD, MPH, Baltimore, MD

Background. We hypothesize that lack of access to care results in propensity toward emergent operative management and may be an important factor in worse outcomes for the uninsured population. The objective of this study is to investigate a possible link to worse outcomes in patients without insurance who undergo an emergent operation.

Methods. A retrospective cross-sectional analysis was performed using the Nationwide Inpatient Sample (NIS) 2005–2011 dataset. Patients who underwent biliary, hernia, and colorectal operations were evaluated. Multivariate analyses were performed to assess the associations between insurance status, urgency of operation, and outcome. Covariates of age, sex, race, and comorbidities were controlled.

Results. The uninsured group had greatest odds ratios of undergoing emergent operative management in biliary (OR 2.43), colorectal (3.54), and hernia (3.95) operations, $P < .001$. Emergent operation was most likely in the 25- to 34-year age bracket, black and Hispanic patients, men, and patients with at least one comorbidity. Postoperative complications in emergencies, however, were appreciated most frequently in the populations with government coverage.

Conclusion. Although the uninsured more frequently underwent emergent operations, patients with coverage through the government had more complications in most categories investigated. Young patients also carried significant risk of emergent operations with increased complication rates. Patients with government insurance tended toward worse outcomes, suggesting disparity for programs such as Medicaid. Disparity related to payor status implies need for policy revisions for equivalent health care access. (*Surgery* 2014;156:345–51.)

From the Center for Surgical Trials and Outcomes Research, Johns Hopkins School of Medicine, Baltimore, MD

CONSIDERABLE RESEARCH EFFORTS HAVE elucidated that disparities are inherent in surgery.^{1–3} Although health- and patient-related factors have both been implicated in operative inequality, it is likely that the causes are multifactorial and more complex than originally conceived. Mechanisms that

predispose certain populations to decreased health care access, emergent operative management, and unfavorable operative outcomes remain poorly understood but are crucial in elucidating correctable causes of disparity.^{1,4} It is possible that lack of access to elective operative management, which invariably has better outcomes, lesser durations of hospital stay, and decreased mortality rates compared with emergent operation, is a potential link in worse outcomes experienced in large analyses of uninsured patients.⁵

Payor status is associated with access to preventative health care, but the association of payor status and need for emergent operative management is not clearly established. Operative patients who only access the system in times of emergency may be comparable with patients who use emergency department care for basic health management.

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Reprint requests: Diane A. Schwartz, MD, 4940 Eastern Ave Ste A558, Baltimore, MD 21224. E-mail: dschwa37@jhmi.edu

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Preventative medicine and surveillance is not pursued consistently by patients who do not have ready access to health care, placing these patients at increased risk for emergent presentation of preventable illness and emergent admission for otherwise elective surgical problems.⁶ The purpose of our study is to investigate a pathway from payor status to worse outcomes by way of emergent operative management in three of the most common general surgery case types.

METHODS

The 2005–2011 Nationwide Inpatient Sample (NIS) was used to conduct a retrospective analysis of payor status and common surgical procedures. The NIS was investigated for all emergent and elective biliary, colorectal, and hernia procedural *International Classification of Disease*, 9th Edition, Clinical Modification codes, which were chosen based on definitions of Acute Care Surgery (ACS) scope of practice by the American Association for the Surgery of Trauma.⁷ A list of the procedure codes used for this analysis can be found in the online [Supplementary Data](#).

The NIS reports data, including complications, demographics, information on procedures and diagnoses, and variables related to inpatient, pre-, and posthospital care, from approximately 8 million hospital admissions each year. It is the largest, publically accessible all-payor inpatient database in the United States. The NIS includes inpatient discharge data from more than 1,000 hospitals located in 44 states and approximates a 20% stratified sample of US hospitals.

Patients older than 18 and younger than 65 years of age were included. Pediatric and geriatric patients were excluded purposefully because they have a propensity to be covered by government insurance and could falsely skew results. Race was defined as white (w), black (b), Hispanic (h), or other. Insurance options included were private, Medicare, Medicaid, no insurance, or other, because these insurance types were established previously as standard groupings by Weygandt et al.⁸

The primary analysis of interest was the association of payor type and urgency of operative management. Operations performed emergently were designated as such in the NIS database and this information was extracted to determine which operations were performed electively and which were performed emergently. Elective and emergent operations were stratified by insurance type. Multivariate logistic regression was used to adjust for age, sex, race, and Charlson Comorbidity Index by 0, 1, 2, or 3 comorbidities and to quantify

association between payor status and need for emergent versus elective operation.

Complications related to elective versus emergent operation were defined as secondary outcomes. Complications were defined as major or minor, with major including myocardial infarction, stroke or cerebral vascular accident, acute respiratory distress syndrome, sepsis, renal failure of new onset, organ failure, and pseudomembranous colitis. Minor complications were pulmonary embolus, pneumonia, operative infection, and urinary tract infection. As described previously, multivariate regression was used to adjust for variables and to determine the association between complications of elective versus emergent operation in each payor group. Because results focused on odds between groups in the same datasets, population weights from NIS were not applied.

Missing data comprised less than 10% of the total data evaluated and were dropped from the final analysis. This included entries in which data on outcome, variables of interest, or covariates were missing. Multiple imputation was not performed because missing data were found to be at random. All analyses were performed with Stata/MP statistical software version 12.0 (StataCorp, College Station, TX).

RESULTS

A total of 749,537 patients included in the NIS from 2005 to 2011 met inclusion criteria. The majority of patients, $n = 400,162$ (53.3%) were included in the group of biliary operations. Colorectal procedures were performed in 189,763 (25.4%), and 159,648 patients (21.3%) had hernia operations. [Table I](#) includes demographic data of each of these groups.

Primary analysis. The populations of interest were mostly privately insured, but gross inequalities were notable when analysis was undertaken. Uninsured patients in the biliary group were 2.43 times more likely to undergo emergent operation compared with privately insured patients, a difference that was appreciated in colorectal (odds ratio 3.54; $P < .001$) and hernia (odds ratio 3.95; $P < .001$) operations as well. Medicaid patients underwent emergent operations more frequently than private-pay patients in all categories. Younger patients were more likely to undergo emergent operations than their older counterparts. Black and Hispanic patients demonstrated greater odds of undergoing emergent surgery than whites in each operative category. Men were subjected to emergent management more often than their female counterparts. Patients with substantial comorbidities in the colorectal and

Table I. Demographics by payor in each operative group: biliary, colorectal, and hernia operations

	<i>Biliary category, %</i>					<i>Colorectal category, %</i>					<i>Hernia category, %</i>				
	<i>P</i>	<i>MC</i>	<i>MD</i>	<i>UI</i>	<i>O</i>	<i>P</i>	<i>MC</i>	<i>MD</i>	<i>UI</i>	<i>O</i>	<i>P</i>	<i>MC</i>	<i>MD</i>	<i>UI</i>	<i>O</i>
Age, yr															
18–24	6.8	1.5	21.7	14.8	11.7	2.8	0.1	5.0	7.3	5.7	1.1	0.3	3.3	3.8	2.4
25–34	17.3	7.3	30.1	27.8	22.4	8.4	5.6	17.3	20.0	13.4	6.2	3.6	13.6	14.1	10.3
35–44	23.1	15.0	21.4	23.5	21.0	19.1	13.9	23.9	25.4	20.4	18.7	12.8	24.8	23.5	20.0
45–54	27.2	30.3	15.9	20.9	22.4	34.3	31.1	28.9	30.5	31.6	33.8	32.5	32.2	34.2	34.9
55–64	25.6	45.9	10.9	13.0	22.5	35.4	48.6	21.9	16.9	29.0	40.2	50.9	26.1	24.4	32.5
Race															
W	71.2	66.6	41.9	47.3	50.6	81.1	71.4	53.1	53.7	62.4	79.0	72.9	55.1	53.9	64.7
B	8.2	17.2	15.4	10.1	9.4	6.9	17.4	21.5	21.0	14.9	9.4	15.6	21.3	18.7	13.7
H	14.7	12.1	34.7	35.0	31.5	7.8	8.0	18.4	19.4	16.3	8.0	8.4	18.0	21.5	16.9
Other	5.9	4.1	8.0	7.7	8.5	4.2	3.3	7.0	5.9	6.4	3.5	3.2	5.6	5.8	4.7
Sex															
M	31.9	41.4	17.6	31.0	33.6	55.5	50.5	52.6	68.8	36.7	41.7	43.2	37.2	58.9	58.9
F	68.1	58.6	82.4	69.1	66.4	44.5	49.7	47.4	31.2	36.3	58.3	56.8	62.8	41.1	41.1
Comorb															
0	75.8	41.4	73.1	81.3	76.0	73.8	43.3	61.8	74.8	71.7	67.2	38.7	53.8	72.7	69.7
1	18.2	29.4	18.7	15.1	17.8	17.7	27.5	22.1	18.4	19.4	23.6	32.4	28.9	20.3	22.1
2	3.7	14.4	4.7	2.3	3.8	5.0	14.5	8.7	3.9	5.5	5.8	16.1	10.4	4.1	5.1
≥3	2.3	14.8	3.4	1.4	2.4	3.5	14.7	7.5	2.9	3.5	3.5	12.9	6.9	2.9	3.2
Total, <i>n</i>	217,949	31,117	71,382	59,811	19,903	117,805	16,674	20,127	26,685	8,472	90,669	23,050	22,536	13,694	9,699
Group, total					400,162					189,763					159,648

F, Female; *Group, total*, total included in each surgical category; *M*, male; *MC*, Medicare; *MD*, Medicaid; *O*, other; *P*, private; *UI*, uninsured; *total n*, total numbers in each column and in total group.

hernia groups had increased odds of emergent operation compared with patients who had no reported comorbidity. These findings can be seen in [Table II](#).

Secondary analysis. Medicaid and Medicare patients had more major complications compared with privately insured and uninsured patients whether operations were performed emergently or electively. This same trend was seen in minor complications for biliary and hernia cases. Fewer minor complications were seen in Medicaid and Medicare patients for colorectal operations than seen in the other operative categories evaluated. Uninsured patients had fewer complications overall than Medicaid and Medicare patients in every category but still the patients had more complications than seen in privately insured patients except in the category of colorectal. When colorectal was evaluated, uninsured patients experienced the fewest minor complications in emergent colorectal procedures and the fewest major complications in elective colorectal cases than any other payor group evaluated. The complications are shown in [Tables III and IV](#). The findings are not necessarily surprising because nationwide protocols have been instituted to prevent complications in colorectal surgery. Furthermore, the Medicare patients in this analysis had qualifying diseases or chronic conditions, perhaps predisposing them to complications post operatively.

DISCUSSION

Our manuscript describes one possible link between payor status and outcomes for patients undergoing emergent operations. We found risk of emergent operation to be high in patients with government coverage and in patients with no insurance compared with patients with private insurance, but we found that major complications were most apparent in the groups with government coverage. This finding contradicts the intuitive notion that patients without insurance are at the greatest disadvantage to emergent operations and resultantly to complications, and is a similar conclusion found in other large studies.^{9–12} In our study, patients without insurance tended more toward emergent operations, but they were less likely than patients with government coverage plans to suffer from major complications in the operative categories evaluated.

Government coverage programs should narrow the gap of health care access for patients who cannot obtain private insurance. Our work corroborates previous association of worse outcomes to emergent operations and identifies potential targets for policy improvement. We found that

Medicare and Medicaid patients were distinctly disadvantaged when undergoing operative management without a real obvious difference in complications when emergent operative management was compared with elective. This finding emphasizes this patient population with government coverage experiences vastly different outcomes than the private group and is even more at risk than those without any insurance.

Numerous studies have shown that payor status correlates with socioeconomic status and is a significant contributor to health care disparity in the United States.^{8,13} We found that patients with government plans had outcomes seemingly worse than those of uninsured patients, meaning that government plans do not fully equalize access to healthcare and do not substitute at the level of private insurance at this time.

Other groups have found that patients with government plans, specifically Medicaid, experienced inequality in access to advanced health care technology. This consideration is an important one in the context of emergent and elective cases, because uninsured and government insured patients are more likely to undergo emergent operative management where specific technology may not be an option. For example, it has been shown that compared with privately covered patients, those patients with Medicaid do not have ready access to laparoscopic complex procedures for colorectal disease.¹⁴ In thoracic surgery, it is evident that lack of insurance or poor coverage predisposes to greater recurrence rates of lung cancer or more advanced stage at diagnosis, thereby portending worse outcome.¹⁵ Groups have attempted to decrease the gap between those receiving standard of care and those who do not have access to it.¹⁶

We find that there is a possible link of payor status to health care access and treatment type, and government coverage represents an area of focus as these plans are expanded to the nation's uninsured population. The Patient Protection and Affordable Care Act has attempted to equalize health care access even to previously un-insurable patients by extending coverage for single adults under the age of 26 on their parents' insurance plans and by covering pre-existing conditions for patients with chronic disease. The Act also increases obligation of businesses to offer plans to employees. The government-funded plans, including established Medicare and Medicaid, were created to provide broad coverage to large populations. Although the outcomes remain worse than those seen with private insurances, the intention of policy makers

Table II. Adjusted odds for patients requiring emergent versus elective operations in each surgical category by demographics and payor status

	<i>Biliary</i>		<i>Colorectal</i>		<i>Hernia</i>	
	<i>OR</i>	<i>95% CI</i>	<i>OR</i>	<i>95% CI</i>	<i>OR</i>	<i>95% CI</i>
Payor						
Private	Ref.		Ref.		Ref.	
Medicare	0.84	[0.82–0.87]	1.42	[1.37–1.47]	1.00	[0.97–1.03]
Medicaid	1.42	[1.38–1.46]	1.65	[1.59–1.70]	1.43	[1.39–1.47]
Uninsured	2.43	[2.36–2.51]	3.54	[3.41–3.67]	3.95	[3.79–4.12]
Other	1.22	[1.17–1.27]	1.47	[1.41–1.54]	1.30	[1.24–1.36]
Age, yr						
18–24	Ref.		Ref.		Ref.	
25–34	0.86	[0.82–0.89]	0.91	[0.86–0.97]	0.77	[0.70–0.85]
35–44	0.72	[0.69–0.75]	0.75	[0.71–0.79]	0.65	[0.60–0.71]
45–54	0.62	[0.59–0.64]	0.62	[0.58–0.65]	0.61	[0.56–0.67]
55–64	0.57	[0.55–0.59]	0.52	[0.49–0.54]	0.58	[0.53–0.63]
Race						
White	Ref.		Ref.		Ref.	
Black	1.11	[1.07–1.14]	1.84	[1.78–1.90]	1.67	[1.62–1.73]
Hispanic	1.25	[1.22–1.28]	1.51	[1.46–1.56]	1.51	[1.46–1.56]
Other	0.98	[0.94–1.01]	1.57	[1.50–1.64]	1.39	[1.32–1.47]
Sex						
Male	Ref.		Ref.		Ref.	
Female	0.82	[0.81–0.84]	0.75	[0.73–0.76]	0.78	[0.77–0.80]
Comorbid						
0	Ref.		Ref.		Ref.	
1	0.91	[0.89–0.93]	1.35	[1.31–1.38]	1.00	[0.97–1.02]
2	0.83	[0.80–0.86]	1.34	[1.28–1.39]	1.06	[1.02–1.10]
≥3	0.83	[0.80–0.86]	1.87	[1.78–1.95]	1.54	[1.47–1.61]

CI, Confidence interval; *OR*, odds ratio.

is to expand the coverage in ways to provide comprehensive care to previously uninsurable patients. Our focus in presenting the data on payor status is to highlight that there are disparities when comparing government funded insurance plans to privately funded insurance. We have further identified specific targets for improvement, such as complication rate and likelihood of emergent operation.

Limitations in our study are notable for having a larger emergent group than elective population. This finding is grossly different than other large national datasets, where emergent operations are the minority. Because NIS is representative of a 20% stratified sample across US hospitals for inpatient admissions, it is likely that the common, elective procedures in biliary and hernia are being performed more frequently on an outpatient or short-stay visit status and are not representative of a true admission. Medicare coverage eligibility includes age older than 64 years and history of durable employment, or as exception for chronic disease. Because our study does not include patients older

than 64 years of age, Medicare patients are not universally included. Only those who have coverage for chronic disease and were younger than 65, the standard Medicare age, are included for analysis. Elderly populations have shown decreased disparate treatment secondary to increased coverage with Medicare, which is an advantage our study did not evaluate.¹⁷ Our group also did not analyze cost of hospital care when government-funded patients are compared with insured ones; however, if these patients are being admitted with more advanced disease, and tending toward operative management with more postoperative complications and possibly greater durations of hospital stay, then it is possible that the cost of the government-funded patients will continue to be an excessive burden on our health care system.

Our work shows a possible link in payor status and the risk of emergent operation. It is apparent that patients with government coverage are more likely to suffer complications in every category investigated. Our intention in presenting these data is to show that despite national efforts to

Table III. Odds for major complications in each operative category, by payer type, elective, or emergent operations

Payor	Elective operation		Emergent operation	
	OR	95% CI	OR	95% CI
Biliary				
Private	Ref.		Ref.	
Medicare	1.27	[1.14–1.40]	1.45	[1.38–1.53]
Medicaid	1.32	[1.17–1.49]	1.35	[1.29–1.42]
Uninsured	1.20	[1.01–1.42]	1.10	[1.04–1.16]
Other	1.05	[0.86–1.28]	1.11	[1.02–1.21]
Colorectal				
Private	Ref.		Ref.	
Medicare	1.63	[1.51–1.76]	1.51	[1.40–1.62]
Medicaid	1.38	[1.26–1.51]	1.28	[1.19–1.38]
Uninsured	0.99	[0.86–1.14]	1.05	[0.97–1.14]
Other	1.31	[1.16–1.49]	1.10	[0.98–1.24]
Hernia				
Private	Ref.		Ref.	
Medicare	1.33	[1.23–1.43]	1.45	[1.34–1.56]
Medicaid	1.37	[1.25–1.50]	1.41	[1.31–1.52]
Uninsured	1.11	[0.94–1.31]	1.17	[1.07–1.28]
Other	1.03	[0.90–1.19]	1.09	[0.97–1.23]

CI, Confidence interval; OR, odds ratio.

Table IV. Odds for minor complications in each operative category, by payer type, elective, or emergent operations

Payor	Elective operation		Emergent operation	
	OR	95% CI	OR	95% CI
Biliary				
Private	Ref.		Ref.	
Medicare	1.36	[1.22–1.52]	1.66	[1.58–1.74]
Medicaid	1.50	[1.34–1.68]	1.40	[1.35–1.45]
Uninsured	1.27	[1.08–1.48]	1.29	[1.23–1.34]
Other	1.20	[1.00–1.45]	1.11	[1.04–1.19]
CR				
Private	Ref.		Ref.	
Medicare	1.11	[1.05–1.18]	0.91	[0.86–0.96]
Medicaid	1.04	[0.98–1.10]	1.00	[0.95–1.05]
Uninsured	1.01	[0.93–1.09]	0.91	[0.87–0.96]
Other	1.02	[0.94–1.11]	0.93	[0.86–1.00]
Hernia				
Private	Ref.		Ref.	
Medicare	1.50	[1.40–1.62]	1.52	[1.42–1.62]
Medicaid	1.43	[1.31–1.56]	1.41	[1.32–1.51]
Uninsured	1.33	[1.15–1.54]	1.11	[1.03–1.20]
Other	1.10	[0.97–1.26]	1.07	[0.97–1.19]

CI, Confidence interval; OR, odds ratio.

create equality and ready access to medical care and insurance, there are still tremendous gaps in our ability to provide equal care to all patients.

Although we are not the first group to demonstrate a disadvantage to health care resources for government coverage, we are presenting a unique view of payor status in the context of emergent versus elective cases. Our data also suggest that in the context of postoperative complications, uninsured patients actually fare slightly better than patients with government coverage. Private payors consistently had less risk of emergent operation and the fewest complications of all groups compared. To better equalize access to health care entities, including operative management for emergencies, ACS teams have developed. Emergency admissions are on the increase, and emergency operations have worse outcomes compared with elective operations of the same case type.^{18–20} Emergent procedures have increased duration of hospital stay and complications leading to greater mortality rates.²¹ In that we have now shown government and noninsured patients to be at greatest risk of emergent operations, and that ACS developed to better target emergent patients who have inherently more complications, we recognize the risk of overwhelming the system created to improve surgical access. The findings shown in our study demonstrate differences that may be magnified with comprehensive care packages. At this time, patients who obtain health care coverage on the free market are at an advantage of faster diagnosis, elective management, and improved outcomes.

SUPPLEMENTARY DATA

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.surg.2014.04.039>.

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