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## Comparing Outcomes of Cholecystectomies in White vs. Minority Patients

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### Abstract

**Background:** This study aims to investigate the influence of socioeconomic status on healthcare disparities between minority and/or uninsured and white and/or insured individuals undergoing cholecystectomies.

**Methods:** This was an IRB approved retrospective review of all cholecystectomies at an academic medical center from 2013 to 2018. Data collected include demographics, insurance type, charge of admission, and clinical outcomes.

**Results:** 1554 patients underwent cholecystectomies. Of those, 23.8% were white and 76.2% non-white. Minority patients were more likely to be younger than white patients at time of admission (44.6 vs 53.3,  $p<0.01$ ), require emergent admission (77.6% vs 66.1%,  $p<0.01$ ), undergo open or laparoscopic-converted-to-open cholecystectomies ( $p<0.01$ ), and have intraoperative and postoperative complications ( $p<0.01$ , 0.03 respectively).

Minority patients more commonly had MediCal (53.5%) or were self-pay (5.3%). For self-pay, overall charge was higher compared to that of emergency MediCal (by 11.9 per 1000 dollars).

**Conclusion:** Minority/uninsured patients have poorer outcomes and higher charges after cholecystectomy.

### Keywords

cholecystectomy; socioeconomic status; insurance; charge

## INTRODUCTION

Gallbladder disorders are common and costly for industrialized countries. Approximately 700,000 cholecystectomies are performed annually, and 20 million people in the United States have gallstones.<sup>1</sup> Over the last three decades, expenditures involving gallstone complications have cost the United States \$6.2 billion annually.<sup>2,3</sup> The financial burden from gallbladder disease is attributed to environmental factors associated with socioeconomic

status (SES), which result in longer length of hospital stays and an increase of post-operative complications.<sup>4,5</sup> Furthermore, uninsured minority individuals may forgo seeking treatment until later stages of the disease.<sup>6</sup> Therefore, it is crucial to investigate whether socioeconomic status imposes a barrier on seeking treatment for gallbladder disease.

Cholecystectomies performed to treat a diseased gallbladder comprise a class of laparoscopic and open procedures. Due to the high incidence rate of complications arising from the gallbladder, patients are advised to seek treatment before their symptoms become worse and subsequently lose their opportunity to undergo a laparoscopic procedure.<sup>6,7</sup> However, this specialized treatment option may not be available for uninsured patients or patients of minority background as socioeconomic limitations and health insurance status may restrict their access to necessary primary healthcare.<sup>4</sup> As a result, minority/uninsured patients are often at a far greater disadvantage compared to non-minority and insured individuals when measuring outcomes of healthcare.<sup>5</sup> This disparity may also lead to higher risks of intra-operative and post-operative complications for patients seeking treatment.<sup>8</sup>

Besides the apparent increased risk of complications for minority/uninsured patients, we suspect the presence of additional discrepancies between groups to primary healthcare access at US academic medical centers, such as this one. These differences in access to healthcare and overall outcomes of medical treatment may be due to gender, race/ethnicity, health insurance status, location of residence, the severity of illness upon admission, and age. Numerous studies have also associated an increase of complications to socioeconomic inequalities. For example, Lu et al reports patients with disadvantaged backgrounds to be more susceptible to risks involving cholecystectomy procedures.<sup>4</sup> Andrew et al suggests that environmental factors like education, income and insurance status play a role in gallbladder pathogenesis.<sup>5</sup> This study intends to investigate the possible influence of insurance status on healthcare disparities in our greater analysis of minority/uninsured versus white/insured individuals who undergo a cholecystectomy procedure.

The objective of this study is to evaluate healthcare outcomes between minority and/or uninsured individuals versus white and/or insured individuals to see whether the socioeconomic status of a patient will lead to further complications in the minority/uninsured group. Health care access was evaluated under the assumption that it correlates to insurance status.

Cholecystectomies are a suitable study between minority and/or uninsured individuals versus white and/or insured individuals because patients of any ethnicity with limited primary health care access are more prone to health conditions that increase the need for gallbladder removal, particularly acute procedures.<sup>6</sup> Moreover, whether a surgical procedure is emergent or routine influences patient well-being, as emergent cholecystectomies have a significant correlation with morbidities and even mortality.<sup>9</sup> Ethnicity and insurance do play a significant role in the original presentation and the aftermath of gallstone disease, necessitating a gallbladder removal.<sup>10,11</sup> Both minority and uninsured patients have higher disease complexities and require more frequent interventions during and after the surgical procedure.<sup>5,12</sup> There are limited studies evaluating the correlation between routine primary care treatment, decreased emergent cholecystectomies, and lower rates of post-operative

morbidities and mortality. Due to the disparity of healthcare access, we hypothesize that minority patients are typically uninsured and have a higher rate of emergent admission for cholecystectomy operations and subsequently, worse post-operative outcomes.

## METHODS

A retrospective analysis was done for all cholecystectomies performed at the University of California, Irvine Medical Center between July 2013 and October 2018. All patients age 17 who underwent cholecystectomies were identified using all International Classification of Diseases version-9 (ICD-9) procedure codes pertaining to cholecystectomies. In order to focus our investigation on the outcomes of patients with primary gallbladder disease, patients who received cholecystectomies as part of a larger procedure, such as pancreaticoduodenectomies, were then excluded. Data collected include demographics, insurance type, emergent versus non-emergent admission, charge of admission, complications, and length of stay (LOS) and intensive care unit (ICU) LOS. Non-whites included Hispanic, Asian, Black/African-American, and Native Hawaiian or other Pacific Islander. Insurance status was categorized as MediCal/Managed MediCal, Commercial/Contracts/Private, MediCare/Managed MediCare/County, and None/Self-Pay. Commercial, Contracts, and Private insurance were combined into a single group due to the low number of subjects in each individual category.

The primary outcomes were morbidity, mortality, and charge of admission. Morbidity was defined by intra-operative and post-operative complications. Due to the low number of subjects who expired, a statistical analysis of mortality could not be performed. A comparison was then made for patients who had a disposition other than home, including skilled nursing facility (SNF), acute care facility, short-term inpatient care, and expired. Other measured outcomes included charge of admission, LOS, ICU LOS, transfer from a different facility, and number of previous visits for the same chief complaint. Intraoperative complications were determined via individual chart review and included unexpected bleeding, injury to nearby structure, failed stone removal, and delayed wound closure. Postoperative complications were determined via chart review and included bleeding, surgical site infection, sepsis, pneumonia, ulcer, ileus, urinary retention, bile leak, and organ failure.

Charge of admission was capped at \$1M due to some outliers that were influential on the models (10 changes were made). Similarly, LOS was capped at 60 days (5 changes were made).

Chi square and t-tests, as well as linear and logistic regression models, were utilized for analysis. Qualitative variables were coded as absent or present. Regression models were used to model total cost, LOS, post-operative mortality, as well as pre- and post-operative complications. Logistic regression models were used to model the dichotomous outcomes postoperative complications and morbidity/mortality. Linear regression models were used to model continuous hospitalization outcomes, total charge, and LOS. The main predictors of interest were race/ethnicity and insurance status. We adjusted for potential confounders including age, gender, admission type, and conversion procedure.

Predictors of outcome were reported with an odds ratio (OR) with 95% confidence intervals (CI). Differences of  $p < 0.05$  were considered statistically significant. All statistical analyses were conducted using Stata/IC 16.1 (StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC).

## RESULTS

### Demographics

Of the 1554 patients who underwent cholecystectomies for primary gallbladder disease, 23.8% were white and 76.2% were non-white. In both groups, the majority of patients were female (59.8% and 68.2% respectively, Table 1). Non-white patients were younger than white patients at the time of admission for surgical intervention (44.6 vs 53.5,  $p < 0.01$ , Table 1).

### Type of Admission and Procedure

Emergent admission was significantly higher in non-white than white patients (77.6% vs 66.1%,  $p < 0.01$ , Table 1). Non-white patients were more likely to have been transferred from another facility prior to receiving surgical intervention (80 vs 49,  $p = 0.04$ , Table 1). Non-white patients were also more likely to undergo open or laparoscopic-converted-to-open cholecystectomies than their white counterparts (mean 65 vs 53,  $p < 0.01$  and mean 35 vs 25,  $p < 0.01$ , respectively, Table 1).

### Morbidity/Mortality

No significant difference was found between whites versus non-whites in hospital length of stay (4.8 vs 4.4,  $p = 0.87$ , Table 1) or ICU LOS (0.2 vs 0.1,  $p = 0.61$ , Table 1). Non-white patients had significantly greater number of intraoperative ( $p < 0.01$ ) and postoperative ( $p = 0.03$ ) complications. No significant difference was found between disposition to home versus disposition to care facility or expiration (OR 0.75, CI 0.38–1.50,  $p = 0.47$ , Table 2).

### Insurance and Charge

The most common insurance type in white patients was private/contract/commercial insurance (49%) while the majority of non-white patients had MediCal (53.5%). A greater number of non-white patients had no insurance or were self-pay compared to whites (5.6% vs 1.4%, Table 1). The charge for patients who had no insurance or self-pay was higher than that of patients with emergency MediCal insurance (by 11.9 per 1000 dollars, Table 3). The charge for patients who had no insurance/self-pay was lower than that of patients with commercial/contract/private insurance and Medicare (by 4.6 per 1000 dollars, 13.9 per 1000 dollars respectively, Table 3).

## DISCUSSION

In this retrospective analysis of patients who underwent cholecystectomies in a five year period, minority patients were significantly younger at presentation, more likely to present as an emergent admission, and more likely to necessitate an open or laparoscopic-converted-

open procedure. While there was no significant difference in the length of stay or ICU length of stay, minority patients had more intraoperative and postoperative complications.

In support of our hypothesis, minority patients were more likely to be uninsured or require emergency MediCal compared to their white counterparts. Although not statistically significant, uninsured/self-pay patients had a trend of higher charge than that of patients who required emergency MediCal. Compared to no insurance at all, emergency insurance provides relief for the patient's financial burden.

On the other hand, patients with no insurance/self-pay had a trend of lower charge than that of patients with private insurance and Medicare. However, this should be interpreted in the context of charge as opposed to cost. This analysis used charge for comparison of financial impact of treatment, hence requiring consideration of components that contribute to total charge. Patients with private/commercial/contract insurance are likely to have a higher total charge of admission based on the premise that private insurers will pay only a proportion of the total bill. However, these patients are only required to pay the deductible before the rest of the charge is covered by insurance, further decreasing the financial burden on the patient. On the other hand, patients who qualify for Medicare must meet eligibility requirements, including age over 65, disability, or kidney dialysis and transplant. As such, patients with Medicare have a greater number of health conditions and comorbidities at baseline, requiring additional care during admission that adds to total charge. Moreover, as Medicare covers approximately 80% of hospital bills, patients with Medicare insurance are only responsible for 20% of the total charge while no insurance/self-pay patients need to pay for 100% of their bills. To this effect, the burden of the hospital bill is substantially heavier for the uninsured.

The impact of insurance status on healthcare outcomes is an ongoing topic of research. Studies have consistently shown that minority and uninsured patients are disadvantaged when receiving care for gallbladder disease. Greenstein et al found that acute cholecystitis patients with Medicaid were less likely to receive cholecystectomies on admission than those with private insurance and were more likely to have open or laparoscopic-converted-open cholecystectomies<sup>13</sup>. Similarly, Ambur et al evaluated the outcomes of cholecystectomies based on income quartile and found that patients of the lowest quartile were more likely to have Medicaid insurance and higher rates of mortality and postoperative complications<sup>9</sup>. Additionally, similar to our findings, those of the lowest quartile were more likely to be of minority descent and younger at age of presentation. However, contrary to the results of our present study, those in the lowest quartile had lower total charge of admission. Additional studies agree that uninsured patients are more likely to undergo an emergent procedure and have a longer LOS and more complications<sup>6,8,14</sup>.

Furthermore, in the discussion of the postoperative outcomes, it is vital to consider the underlying disparities of health that fuel these results. Gallbladder disease is a common ailment that can result from a number of factors. Although there are nonmodifiable factors such as age and gender, there are also modifiable factors such as diet. This, combined with the finding that minority patients present at younger ages, raises the need to investigate ingrained disparities that start earlier in a patient's lifetime. For instance,

studies show that lowest-income highest-minority neighborhoods had the most significant declines in convenience stores over time, hence limiting the availability and access of these communities to healthy foods<sup>15</sup>. Similarly, health literacy is key to preventative health but often limited in minority populations. This may be due to many reasons including education, resources, and language barriers<sup>16, 17</sup>. In order to address the health and insurance disparities faced by minority populations, a comprehensive evaluation is necessary to account for the social determinants of health in this multifactorial problem.

There are a few limitations to address in this study. Our investigation included 1554 cholecystectomies performed at an academic medical center over the course of five years. When determining the categories of insurance, several types were combined due to the low number of individuals in each group. Private insurance was combined with commercial/contract insurance despite the former being associated with personal insurance and the latter associated with employment. However, given that they are both managed by a private insurance company, they were treated as one category. County insurance was grouped with Medicare and managed Medicare as they are all state-sanctioned insurance. Similarly, a total of 3 patients expired post-operatively, which is insufficient data to perform meaningful analysis and prevented us from comparing the mortality rates between minority and white patients. A larger multicenter study with an extended timespan may provide a greater number of subjects and better insight to the relationship between race, insurance status, and outcomes. Another limitation is the utilization of charge to compare financial impact of insured versus uninsured admissions. Charge may fluctuate depending on the patient's overall health condition. A patient with multiple comorbidities requires more healthcare services during an admission than an otherwise healthy patient presenting solely with a gallbladder complaint. Future studies may consider the cost of admission, which quantifies the actual amount of money collected for each admission. Finally, as patients were identified via ICD-9 procedure codes and complications identified via chart review, reporting and coding error may be present.

## CONCLUSION

Socioeconomic status plays a significant role in the clinical outcome and financial burden of healthcare in patients who identify as minority. Minority patients are more likely to require emergent admission for cholecystectomies, transfer to a different facility for higher level of care, undergo open or laparoscopic-converted-open procedures, and experience complications than their white counterparts. They are also more likely to be uninsured, resulting in higher charges associated with the management of the same condition.

Continued efforts to improve rates of healthcare coverage and education should be evaluated in an effort to reduce perioperative differences in the treatment of gallbladder disease.

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**HIGHLIGHTS:**

- Minority patients are more likely to be younger at admission for cholecystectomy
- Minority patients have poorer outcomes from cholecystectomies
- Minority patients more likely to have no insurance or require emergency Medi-Cal
- Uninsured patients have higher charges of admission and financial burden
- Limited health literacy and access contribute to poor health outcomes in minorities

**Table 1:**

Demographics, admission and procedure information, and outcomes by race/ethnicity group, White (n=568) and Non-white (n=971). Non-whites are comprised of Hispanic, Asian, Black/African-American, and Native Hawaiian or Other Pacific Islander.

Variable	N (%) or Mean (SD)		P-value
	White	Hispanic/Asian/Black/Native Hawaiian	
Age	53.9 (16.2)	45.5 (17.1)	<0.001
Gender			<0.001
Female	333 (58.6)	656 (67.6)	
Male	235 (41.4)	315 (32.4)	
Insurance			<0.001
Managed MediCal	79 (14.0)	239 (24.6)	
Commercial/Contracts/Private	278 (49.2)	240 (24.7)	
Medicare/Managed Medicare/County	171 (30.3)	180 (18.5)	
Self/None/MediCal	37 (6.6)	312 (32.1)	
Emergent Admission	385 (68.4)	736 (76.2)	0.001
Procedure			<0.001
Laparoscopic	449 (79.1)	861 (88.7)	
Open	90 (15.9)	73 (7.5)	
Conversion	26 (4.6)	36 (3.7)	
Length of Stay (in Days)	4.8 (5.7)	4.4 (5.2)	0.42
Days in the ICU (continuous)	0.42 (5.9)	0.15 (1.2)	0.54
Charge (in Dollars)	101,692 (128,667)	80,431 (100,818)	0.03
Number of Intraoperative Complications			0.16
0	519 (92.0)	909 (93.9)	
1	45 (8.0)	59 (6.1)	
Number of Postoperative Complications			0.07
0	495 (87.6)	884 (91.2)	
1	66 (11.7)	77 (8.0)	
2	4 (0.7)	7 (0.7)	
3	0 (0.0)	1 (0.1)	
Disposition			0.37
Home	534 (94.5)	933 (96.2)	
SNF	17 (3.0)	16 (1.7)	
Acute Care Facility	9 (1.6)	8 (0.78)	
Discharged Elsewhere	1 (0.18)	4 (0.41)	
Left Against Medical Advice	2 (0.35)	3 (0.31)	
Expired	1 (0.18)	2 (0.21)	
Short-term Inpatient Care	0 (0)	3 (0.31)	
Unknown	1 (0.18)	1 (0.10)	

Variable	N (%) or Mean (SD)		P-value
	White	Hispanic/Asian/Black/Native Hawaiian	
Transfer from Other Hospital			0.02
Yes	76 (13.5)	85 (8.8)	
No	485 (85.8)	877 (90.5)	
Unknown	4 (0.71)	7 (0.72)	

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**Table 2:**

Multivariable logistic regression results for disposition outcome on Race/Ethnicity and Insurance Status , adjusted for Age, Gender, Conversion, and Emergent Admission.

Variable	Morbidity/Mortality		
	Adjusted Odds Ratio	95% Confidence Interval	P-value
Race/ethnicity			
White	1.0 (ref)	--	
Non-white	0.89	0.50–1.60	0.71
Insurance			
Managed MediCal	1.41	0.42–4.70	0.58
Commercial/Contracts/Private	1.59	0.51–4.96	0.43
Medicare/Managed Medicare/County	5.22	1.63–16.75	0.005
Self/None/MediCal	REFERENCE		

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**Table 3:**

Multivariable linear regression results for Total Cost (per 1000 dollars) outcome on Race/Ethnicity and Insurance Status, adjusted for Age, Gender, Conversion, and Emergent Admission.

Variable	Total Cost		P-value
	Estimate	95% Confidence Interval	
Race/ethnicity			
White	(ref)	--	
Non-white	-11.6	-23.5, 0.29	0.056
Insurance			
Managed MediCal	12.0	-4.2, 28.2	0.15
Commercial/Contracts/Private	27.8	11.4, 44.2	0.001
Medicare/Managed Medicare/County	39.3	19.2, 59.3	<0.001
Self/None/MediCal	REFERENCE		

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