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Surgical Outcomes and Sociodemographic Disparities Across All Races

An ACS-NSQIP and NHIS Multi-Institutional Analysis of Over 7.5 Million Patients

Dany Y. Matar, BA,*†# Samuel Knoedler,‡#* Anthony Y. Matar, BS,§ Sarah Friedrich, PhD,||
Harriet Kiwanuka, MD,* Ryoko Hamaguchi, MD,* Carla M. Hamwi, BS,¶ Gabriel Hundeshagen, MD, MMS,#
Valentin Haug, MD,# Ulrich Kneser, MD, PhD,# Keisha Ray, PhD,** Dennis P. Orgill, MD, PhD,* and
Adriana C. Panayi, MD, PhD*#

Background: This study aims to fill the gap in large-scale, registry-based assessments by examining postoperative outcomes across diverse races/ethnicities. The focus is on identifying disparities and comparing them with socioeconomic demographics.
Methods: In a registry-based cohort study using the 2008 to 2020 American College of Surgeons National Surgical Quality Improvement Program, we evaluated 24 postoperative outcomes through multivariable analysis, incorporating 28 preoperative risk factors. In a separate, independent analysis of the 2019 to 2020 National Health Interview Survey (NHIS) database, we examined sociodemographic racial/ethnic normative data.
Results: Among 7,504,734 American College of Surgeons National Surgical Improvement Database patients specifying race, 83.8% were White (WT), 11.8% Black or African American (B/AA), 3.3% Asian (AS), 0.7% American Indian or Alaska Native (AI/AN), 0.4% Native Hawaiian or Pacific Islander (NH/PI), 7.3% Hispanic. Reoperation trends reveal favorable outcomes for WT, AS, and NH/PI patients compared with B/AA and AI/AN patients. AI/AN patients exhibit higher rates of wound healing issues, while AS patients experience lower rates. AS and B/AA patients are more prone to transfusions, with B/AA patients showing elevated rates of pulmonary embolism, deep vein thrombosis, renal failure, and insufficiency. Disparities in discharge destinations exist. Hispanic patients fare better than non-WT Hispanic patients, contingent on race. Racial groups (excluding Hispanic patients) with superior surgical outcomes from the NSQIP analysis were found in the NHIS analysis to report higher wealth, better healthcare access, improved food security, greater functional and societal independence, and lower frailty.
Conclusions: Our study underscores racial disparities in surgical outcomes. Focused investigations into these complications could reveal underlying causes, informing healthcare policies to enhance surgical care universally.

Keywords: demographics, race, disparities, surgical outcomes, big data, quality improvement

INTRODUCTION

Since the advent of modern medicine, racial/ethnic inequalities have existed and persisted in healthcare worldwide, with surgery being no exception. The 2003 National Academy of Medicine report "Unequal Treatment" prompted a shift in surgical quality improvement policies, identifying racial/ethnic medical disparities rooted in patient, provider, and systemic factors.[1] However, most research has perpetually misclassified race as a biological, rather than a social construct; a misclassification that continues to fuel disparities.[2] Many healthcare disparities stem from the intersection of various systems, including socioeconomic inequalities, education, access to nutrition, and healthcare coverage, which manifest well before individuals seek treatment.

The current literature reports higher postoperative mortality and complications for Black patients compared with White patients[3–6] and comparable/superior outcomes in Asian patients,[7,8] while research on Indigenous, Pacific Islander, and Hispanic patients is scarce and inconclusive.[9–13] However, limiting the analysis of racial/ethnic disparities to a singular outcome, such as surgical outcomes, without comprehensive consideration of underlying factors, represents a limited investigation into this complex issue.[14] Moreover, most existing studies are limited in scope as they rely

*From the Division of Plastic Surgery, Department of Surgery, Brigham and Women's Hospital, Harvard Medical School, Boston, MA; †Johns Hopkins University School of Medicine, Baltimore, MD; ‡Department of Plastic, Hand and Reconstructive Surgery, University Hospital Regensburg, Regensburg, Germany; §School of Data Science, University of Virginia, Charlottesville, VA; ||Department of Mathematical Statistics and Artificial Intelligence in Medicine, University of Augsburg, Augsburg, Germany; ¶Department of Biology, Saint Louis University, St. Louis, MO; #Department of Hand-, Plastic and Reconstructive Surgery, Burn Center, BG Trauma Center Ludwigshafen, University of Heidelberg, Ludwigshafen, Germany; and **Center for Humanities and Ethics, University of Texas Health Science Center, Houston, TX.

D.Y.M. and S.K. contributed equally to the present work.

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Reprints: Samuel Knoedler, Department of Plastic, Hand and Reconstructive Surgery, University Hospital Regensburg, Franz-Josef-Strauß-Allee 11, 93053 Regensburg, Germany, Email: samuel.knoedler@stud.uni-regensburg.de, Adriana C. Panayi, MD, Department of Surgery, Division of Plastic Surgery, Brigham and Women's Hospital, Harvard Medical School, 75 Francis Street. Boston, MA 02115, Email: a.panayi@cantab.net.

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on single institution analyses, specific surgical specialties or procedures, and restricted comparisons to White and Black patients.

We aim to fill this gap by analyzing racial/ethnic variations in postoperative outcomes in a multicenter cohort from the American College of Surgeons National Surgical Improvement Database (ACS-NSQIP). By also independently analyzing normative data from the National Health Interview Survey (NHIS), a separate general population database, this study explores sociodemographic factors that may underlie observed disparities. The combination of these data sets provides a holistic investigation of healthcare areas for possible intervention, thereby informing clinical practices, research initiatives, and policymaking efforts.

METHODS

Data Sources

The ACS-NSQIP is a nationally validated, multi-institutional catalogue, reporting deidentified surgical data from approximately 600 United States, 50 Canadian, and 15 overseas hospitals. Trained personnel record data from medical charts and each site is audited for quality and reliability. Ethical approval was obtained from Brigham and Women's Hospital (protocol no.: 2013P001244).

The National Center for Health Statistics NHIS is publicly available and gathers deidentified sociodemographic data annually from US civilians through interviews (telephone or face-to-face household). It encompasses households and noninstitutional group quarters like homeless shelters and group homes. Employing a multistage area probability design that addresses nonresponse ensures a nationally representative sample.

Patient Selection and Variable Extraction

We analyzed the 2008-2020 ACS-NSQIP database. Patients could only self-identify with one race and ethnicity category: White (WT), Black or African American (B/AA), Asian (AS), American Indian or Alaska Native (AI/AN), or Native Hawaiian or Pacific Islander (NH/PI), and Hispanic or non-Hispanic. Patients missing information or marked as unknown race were excluded. We stratified patients by body mass index (BMI) and 5-year age subgroups based on WHO thresholds.[15,16] We preselected all preoperative and intraoperative variables, as well as general, surgical, and medical complications listed in the NSQIP data set from 2008 to 2020, for extraction a priori. Ten general and surgical outcomes, 13 medical complications, and 28 preoperative and intraoperative variables were extracted (Table 1).

A separate, independent analysis apart from the ACS-NSQIP database was conducted on the 2019-2020 NHIS Sample Adult Core files database, which comprised 64,706 adult interviews. Patients could only self-identify with one race and ethnicity category: WT, B/AA, AS or AI/AN, and Hispanic or non-Hispanic. NH/PI identification was not captured. Participants missing information or marked as unknown race were excluded. Data before 2019 were excluded due to an NHIS redesign. Over 600 survey variables were screened by 2 reviewers (D.Y.M. and C.M.H.) to identify relevant information.

Statistical Analysis

Data were collected and stored in an electronic laboratory notebook (LabArchives, LLC, San Marcos, CA) and analyzed using R software (V4.1.2). Categorical values were expressed as numbers (n) and percentages (%). Normality of continuous variables was confirmed before reporting averages and standard deviation.

In the ACS-NSQIP database analysis, complication rates for each race were compared with the WT cohort via univariable logistic regression to identify odds ratios (ORs). Multivariable logistic regression, adjusted for 28 preoperative and intraoperative variables, calculated adjusted ORs (aOR). A distinct subgroup multivariable analysis was conducted for Hispanic patients across races compared with non-Hispanic WT patients.

In the NHIS database analysis, survey variables for each racial group were evaluated against WT participants with Pearson's $\chi 2$ test for categorical variables and 1-way ANOVA testing for continuous variables. The analysis was repeated for Hispanic and non-Hispanic WT participants; however, Hispanic patients were not stratified based on race due to limited sample size. $P<0.05$ indicates statistical significance.

RESULTS

ACS-NSQIP Analysis: Preoperative and Intraoperative Data

We collected data for 7,504,734 surgical patients who reported their race from the 2008 to 2020 ACS-NSQIP. About 83.8% surgical patients identified as WT (n=6,291,527), 11.8% B/AA (n=882,960), 3.3% AS (n=249,436), 0.7% AI/AN (n=49,097), and 0.4% NH/PI (n=31,714; Supplemental Table 1, see http://links.lww.com/AOSO/A379). WT patients were the oldest on average (57.4 ± 17.6 years), while AI/AN patients were the youngest (51.3 ± 16.3 years). B/AA patients had the highest average BMI and obesity rate (32.1 ± 8.8 kg/m^2 and 53.8%,

TABLE 1.

Extracted Preoperative Data From the ACS-NSQIP

General and Surgical Complications	Medical Complications	Preoperative and operative Data
Planned/unplanned reoperation	Unplanned intubation	Year of surgery
Readmission	Ventilator use >48 hours	Sex [male/female]
Mortality	PE	Age
Operation time	Cardiac arrest and CPR	BMI
Length of hospital stay	MI	Sepsis
Blood transfusions	Pneumonia	Cancer history
SSI	Stroke	Diabetes
DSI	UTI	Smoking in the past year
Wound disruption	Acute renal failure	Dyspnea
Discharge destination	Progressive renal insufficiency	COPD
	Septic shock	Ascites
	Sepsis	Heart failure
	DVT	Hypertension
		Renal failure
		Ventilator dependency
		Current dialysis
		Steroid use
		Open/infected wound
		>10% weight loss in past 6 months
		Bleeding disorder
		Transfusion
		Functional status
		Wound class
		Anesthesia type
		Surgical specialty
		Setting (inpatient/ outpatient)
		Elective/emergency surgery
		ASA

ASA indicates, American Society of Anesthesiologists Classification; COPD, chronic obstructive pulmonary disease; DSI, deep incisional infection; SSI, superficial incisional infection; UTI, urinary tract infection.

respectively), whereas AS patients had the lowest values (26.1 ± 5.6 kg/m² and 19.3%). Notably, the majority of AI/AN (52%) and NH/PI (52.7%) patients were obese. Conversely, the AS cohort had the highest proportion of underweight (3.5%) and normal weight (43.8%) patients, followed by the WT cohort (1.6% and 23.2%, respectively).

Most patients did not have diabetes (n = 6,322,148, 84.2%). NH/PI patients had the highest diabetes prevalence (21.8%), followed by B/AA (21.0%), AI/AN (18.4%), AS (17.6%), and WT patients (14.9%). Most patients were functionally independent (>95% in all groups). Inpatient procedures were the most common, with B/AA patients having the highest rate (59.6%) and NH/PI patients the lowest (51.9%). In terms of surgical specialty, general surgical procedures were the most common, with AS patients having the highest rate (50.6%) and NH/PI patients the lowest (42.1%). Orthopedic procedures were the second most common, occurring most frequently in NH/PI (22.6%) and least frequently in AS patients (16.4%). Gynecology procedures were the third most common, occurring most frequently in NH/PI (13.6%) and least frequently in WT patients (7.2%). AS patients were more likely to have American Society of Anesthesiologists Classification scores of 1 (14.1%) or 2 (52.0%) and least likely to have scores greater than 4 (4.0%). Conversely, B/AA patients were the least likely to have American Society of Anesthesiologists Classification scores of 1 (6.4%) or 2 (40.9%) and most likely to have scores greater than 4 (7.8%).

ACS-NSQIP Analysis: Postoperative Data

Postoperative data were analyzed univariably (Fig. 1, Supplemental Table 2, see http://links.lww.com/AOSO/A379) and multivariably (Fig. 2, Supplemental Table 2, see http://links.lww.com/AOSO/A379). Mortality was higher in B/AA patients in univariable analysis (OR = 1.05, P < 0.0001) but lower in multivariable analysis (aOR = 0.89, P < 0.0001). In the multivariable analysis, B/AA (aOR = 1.06, P < 0.0001) and AI/AN (aOR = 1.18, P < 0.0001) patients had higher reoperation. AI/AN patients experienced a higher risk of wound healing issues, including 15% higher risk of superficial incisional infection (aOR = 1.15, P = 0.0001), 26% higher deep incisional infection (aOR = 1.26, P = 0.0002) and 68% higher wound disruption (aOR = 1.68, P < 0.0001). AS patients were 37% more likely to receive transfusions (aOR = 1.37, P < 0.0001), followed by 24% higher risk in B/AA (aOR = 1.24, P < 0.0001) and 10% higher risk in NH/PI patients (aOR = 1.10, P = 0.004). The B/AA cohort experienced higher odds of thrombotic complications such as a 41% higher likelihood of pulmonary embolism (PE; aOR = 1.41, P < 0.0001) and 19% higher likelihood of deep vein thrombosis (DVT)/thrombophlebitis (aOR = 1.19, P < 0.0001). B/AA patients had a 32% higher chance of renal failure (aOR = 1.32, P < 0.0001) and a 61% higher chance of progressive renal insufficiency (aOR = 1.61, P < 0.0001). Significant disparities are presented in discharge destination. B/AA and AI/AN patients were over 8 (aOR = 8.63, P < 0.0001) and 2 times (aOR = 2.23, P < 0.0001) more likely, respectively, to be discharged to hospice care. AS patients were 87% less likely to be discharged to hospice (aOR = 0.13, P < 0.0001). AI/AN patients were less likely to be discharged to rehab (0.42, P < 0.0001), while all other cohorts had increased odds. The NH/PI cohort was less likely to be discharged to separate acute care (aOR = 0.88, P = 0.01) and more likely to skilled care (aOR = 1.08, P < 0.0001).

ACS-NSQIP Analysis: Hispanic Subgroup Data

Of 7,504,734 surgical patients, 7.3% identified as Hispanic (n=549,446), with 96% WT (n=527,665), 2.3% B/AA (n=12,666), 0.9% AI/AN (n=4,867), 0.5% AS (n=2,483), and 0.3% NH/PI (n=1,765; Supplemental Table 3, see http://links.lww.com/AOSO/A379). In multivariable analysis, Hispanic patients had a lower risk for 15 complications and a higher risk for 3 complications compared with WT non-Hispanic patients (Supplemental Table 4, see http://links.lww.com/AOSO/A379). When stratified by race, WT Hispanic patients had lower odds of 15 complications (Fig. 3, Supplemental Table 5, see http://links.lww.com/AOSO/A379). B/AA Hispanic and AI/AN Hispanic patients demonstrated lower odds of 4 and 5 complications, respectively. In contrast, AS and NH/PI patients were at higher risk for 3 and one complication, respectively. Notably, WT (aOR = 1.14, P < 0.0001), AS (aOR = 1.23, P = 0.02) and NH/PI (aOR = 1.33, P = 0.04) Hispanic patients were at higher risk for transfusions compared with WT non-Hispanic patients.

NHIS Analysis: Sociodemographic Data

Of 58,659 NHIS participants specifying race, 82.5% identified as WT (n=48,404), 10.9% B/AA (n=6,368), 5.8% AS (n=3,377), and 0.87% AI/AN (n=510; Supplemental Table 6, see http://links.lww.com/AOSO/A379). WT participants were the oldest (65.5 ± 12.8 years), while B/AA participants were the youngest (61.7 ± 13.2 years). Obesity rates were notably higher among AI/AN (37.3%) and B/AA (42.8%) participants compared with WT (30%), whereas AS had lower rates (9.7%). Regarding health conditions, both AI/AN and B/AA cohorts reported higher levels of prediabetes (21.2% and 19.8%, respectively) compared with the WT cohort (13.8%). Similarly, other health issues were more prevalent in these 2 cohorts, with varying significance levels (Supplemental Table 6, see http://links.lww.com/AOSO/A379).

Compared with WT participants, both AI/AN (1.79 ± 1.24, P < 0.0001) and B/AA (2.58 ± 2.18, P < 0.0001) cohorts reported higher lower mean family income-poverty ratios compared with the WT cohort (3.54 ± 2.58), along with lower insurance coverage (67.7%, P = 0.93 and 68.6%, P = 0.21 vs 67.3%, respectively). Moreover, AI/AN participants were most likely to skip medication doses (2.8% vs 67.3%, P < 0.0001), take less medication (1.8% vs 67.3%, P < 0.0001), and delayed prescription filling (5.3% vs 67.3%, P < 0.0001) for financial reasons. In terms of food security, AS participants reported higher levels of "high" food security (88.8%, P < 0.0001), followed by WT (87.8%) and lower rates among AI/AN (67.1%, P < 0.0001) and B/AA participants (71.4%, P < 0.0001).

Compared with WT participants, again AI/AN and B/AA cohorts reported lower levels of functional and societal independence, with AS participants exhibiting a superior profile in all these categories. AI/AN individuals faced more difficulties with walking or using stairs (25.9% vs 22.4%, P < 0.0001). Both AI/AN (6.5%, P = 0.02) and B/AA (6%, P <0.0001) groups encountered more challenges with self-care compared with the WT cohort (2%), and running errands (14.5% and 10.8% vs 8.7% respectively, P <0.0001 for both). In contrast, AS individuals experienced fewer difficulties in these areas (9.7%, 2.6%, and 5.7% respectively, P < 0.0001 for all). In terms of physical activity, AS participants were more likely to engage in weekly exercise (58% vs 52.1%, P < 0.0001) compared with lower rates in AI/AN (40.4%, P < 0.0001) and B/AA participants (46.1%, P < 0.0001). In terms of home living, B/AA individuals were most likely to live alone (38.1% vs 31%, P < 0.0001) and receive care at home (6.1% vs 4.3%, P < 0.0001). Contrastingly, AS individuals are less likely to live alone (22.5%, P < 0.0001), more likely to have multiple families in the household (4.4%, P < 0.0001), and least likely to receive care at home (2%, P <0.0001). Furthermore, AI/AN participants were more likely to live in a nonmetropolitan area (70% vs 17.6%, P < 0.0001), with AS participants being the least likely (2.1%, P < 0.0001).

Furthermore, 13.6% of individuals identified as Hispanic (n=7,985) and 75% as non-Hispanic WT (n=44,005) (Supplemental Table 7, see http://links.lww.com/AOSO/A379). Despite sharing a socioeconomic SES profile similar to the B/AA and AI/AN cohorts,

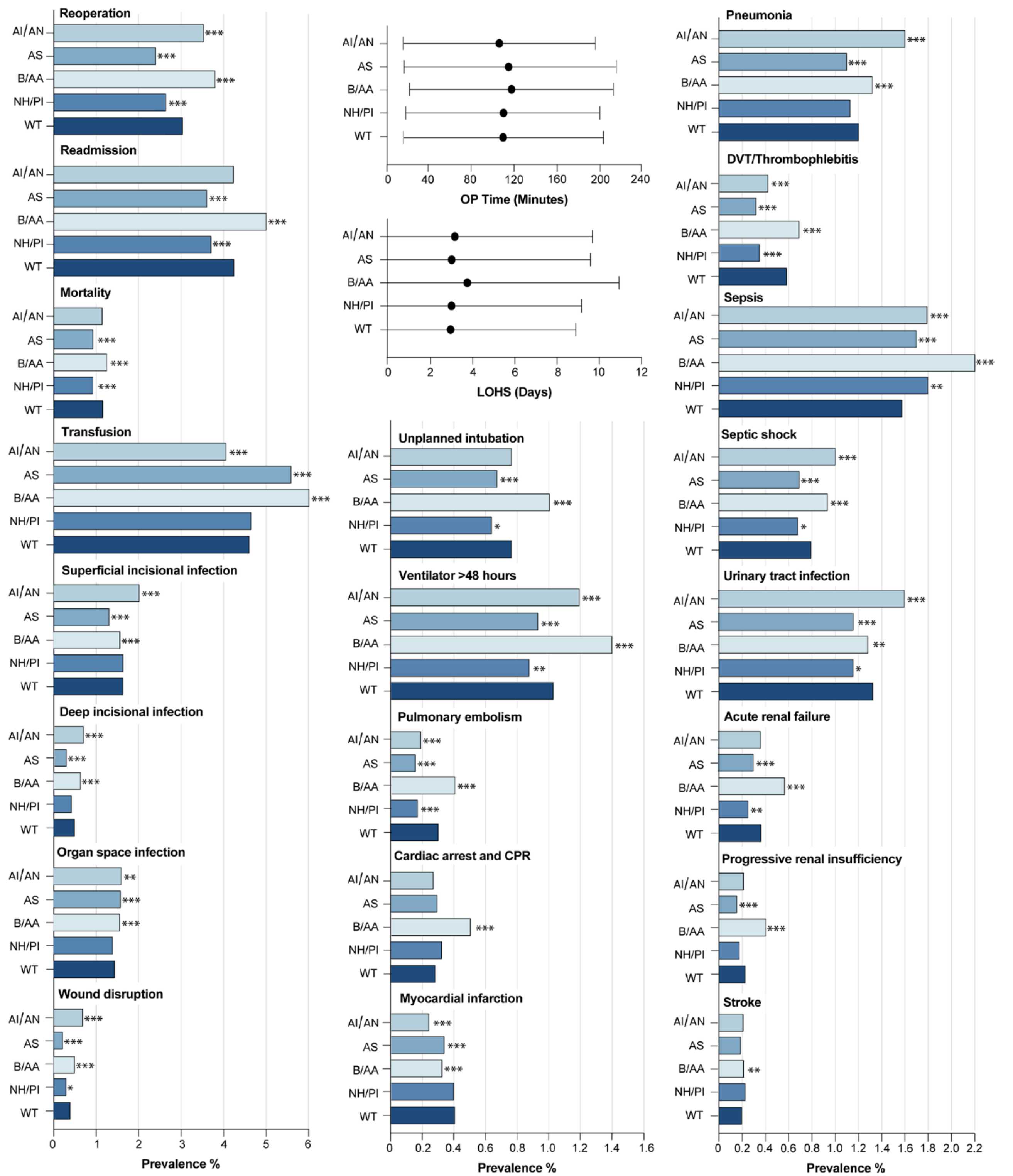

FIGURE 1. Univariable analysis of the surgical complications and outcomes. Reoperation, readmission, and mortality were the highest in B/AA patients. Transfusions occurred most frequently in B/AA patients. AI/AN patients experienced the highest rates of superficial, deep, and organ space infection and wound disruption. AS patients experienced the lowest rates of reoperation, readmission, mortality, superficial and deep incisional infection, and wound disruption. Length of hospital stay was longest in B/AA patients and shortest in WT and NH/PI patients. B/AA patients showed the highest rate of 8 medical complications. Of the remaining 5 complications, pneumonia, septic shock, and urinary tract infection were highest in AI/AN patients. Stroke occurred the least frequently and was highest in NH/PI patients. Postoperative sepsis occurred the most frequently and was highest in B/AA patients. *$P < 0.05$, ** $P < 0.01$, ***$P < 0.001$.

Hispanic participants reported lower rates of cholesterol (24 vs 32%, $P < 0.0001$), chronic obstructive pulmonary disease/emphysema/chronic bronchitis (2.6 vs 6.7%, $P < 0.0001$), coronary heart disease (3.4 vs 6.7%, $P < 0.0001$), and myocardial infarction (MI; 1.9% vs 4.4%, $P < 0.0001$). They also reported stronger social networks, and functional independence, as they were least likely to live alone (20.9% vs 32.1%, $P < 0.0001$) and have difficulty doing errands alone (92.4% vs 91.1%, $P = 0.005$).

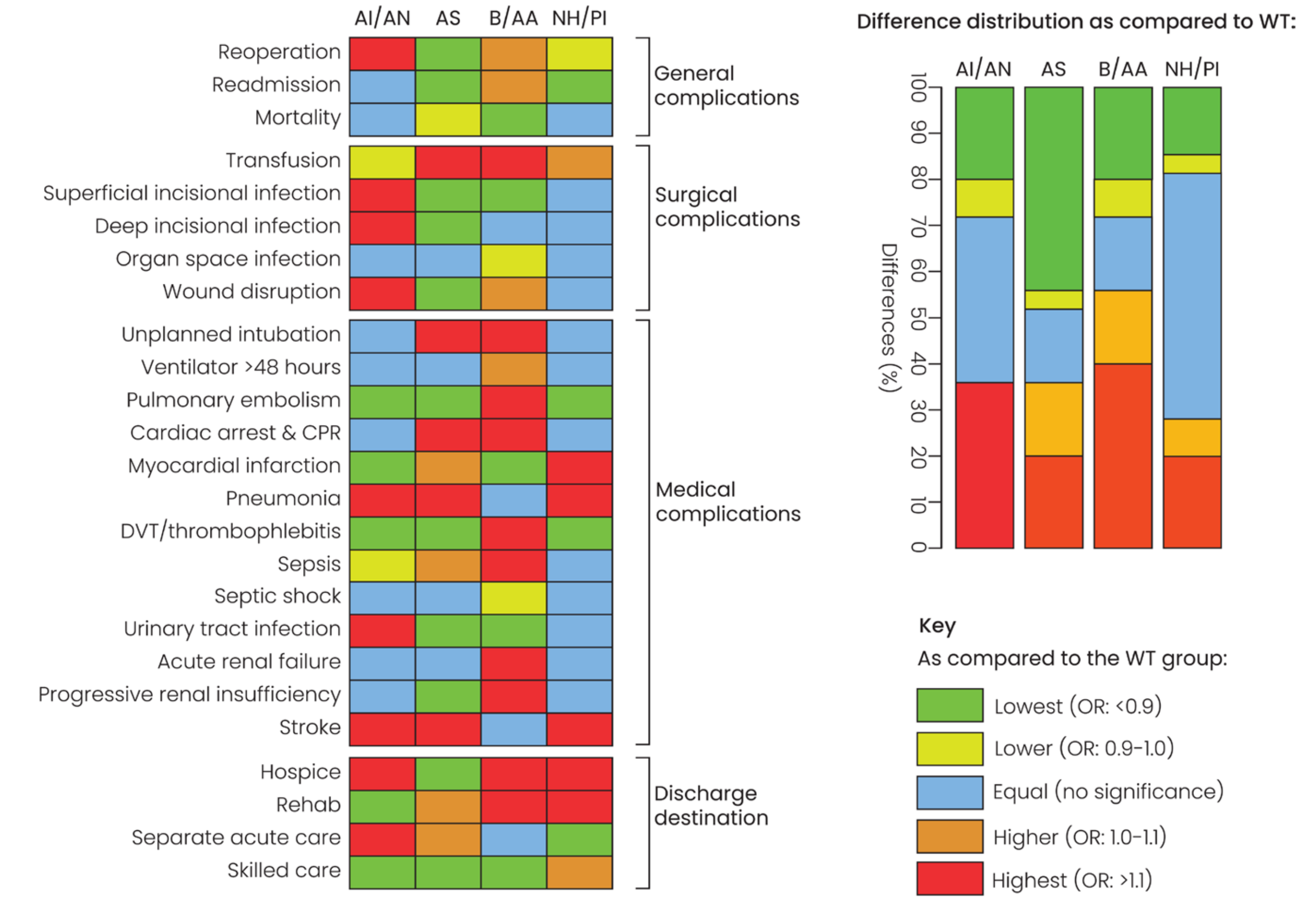

Figure 2. Multivariable analysis of the surgical complications and outcomes across different races as compared with WT patients. Overall, in comparison to WT patients, AI/AN patients underperformed in 9 variables and overperformed in 6. AS patients underperformed in 8 variables and overperformed in 12. B/AA patients underperformed in 14 variables and overperformed in 7 variables. NH/PI patients underperformed in 7 variables and overperformed in 5 variables.

DISCUSSION

Social determinants significantly influence disparate preoperative health states.[14] To uncover potential structural influences contributing to racial/ethnic postoperative disparities that may explain the differences in outcomes of the ACS-NSQIP, we conducted a separate analysis of over 60,000 general population participants from the NHIS database to identify challenges and opportunities, as outlined below.

Intra-Hospital Challenges and Opportunities

AI/AN patients experienced a higher risk for reoperation, a phenomenon possibly owing to their elevated incidence of wound healing complications, including incisional infections and wound disruption. The higher prevalence of prediabetes and diabetes among this demographic, as corroborated by both NHIS and ACS-NSQIP analyses, may contribute to disparities, as these conditions are associated with chronic wounds and a higher susceptibility to infections.[17] However, having diabetes was considered in the multivariable analysis, suggesting it is not the sole causative factor. AI/AN individuals were more likely to report forgoing medication doses, consuming reduced quantities of prescribed medications, delaying prescription refills, and refraining from purchasing prescriptions due to costs. Along with a combination of diabetes and financial constraints, AI/AN individuals face disproportionate healthcare access, including a higher likelihood of residing in rural areas. Surgical site infections prolong hospital stays, prompting the exploration of preventative measures for AI/AN patients, which in addition to monitoring perioperative glucose concentrations, can include abstaining from hair removal with razors, maintaining normothermia, employing antistaphylococcal skin antiseptics, and incorporating negative pressure wound therapy. Optimizing provision for these communities necessitates multifaceted strategies, including patient education emphasizing the importance of frequent evaluation by healthcare providers, and enhancing accessibility to care and medication.[14,18] Such measures address postoperative wound healing concerns and hold promise in mitigating higher rates of other observed complications such as UTIs within this population.

B/AA patients had higher reoperation rates, possibly due to higher wound disruption, in turn linked to the higher prevalence of obesity within this cohort, a factor associated with dehiscence and compromised wound healing.[17,19] As our multivariable analysis accounted for obesity, this may not be an exclusive causative factor, underscoring the need to consider a broader range of factors in understanding the complexities of reoperation rates and wound healing outcomes. Increased awareness of the elevated risk among B/AA individuals can inform more effective preoperative planning. Heightened vigilance for the prompt recognition of wound complications and timely reoperation could mitigate the need for prolonged hospital stays, thus optimizing patient outcomes.[17,19]

AS and B/AA were more likely to receive perioperative transfusions, aligning with prior single-center studies.[20–22] NH/PI were also at higher risk for transfusions. These findings address the existing knowledge gap regarding racial disparities in transfusion rates, showing that commonly cited contributors such as BMI, preexisting pulmonary comorbidities, and prolonged

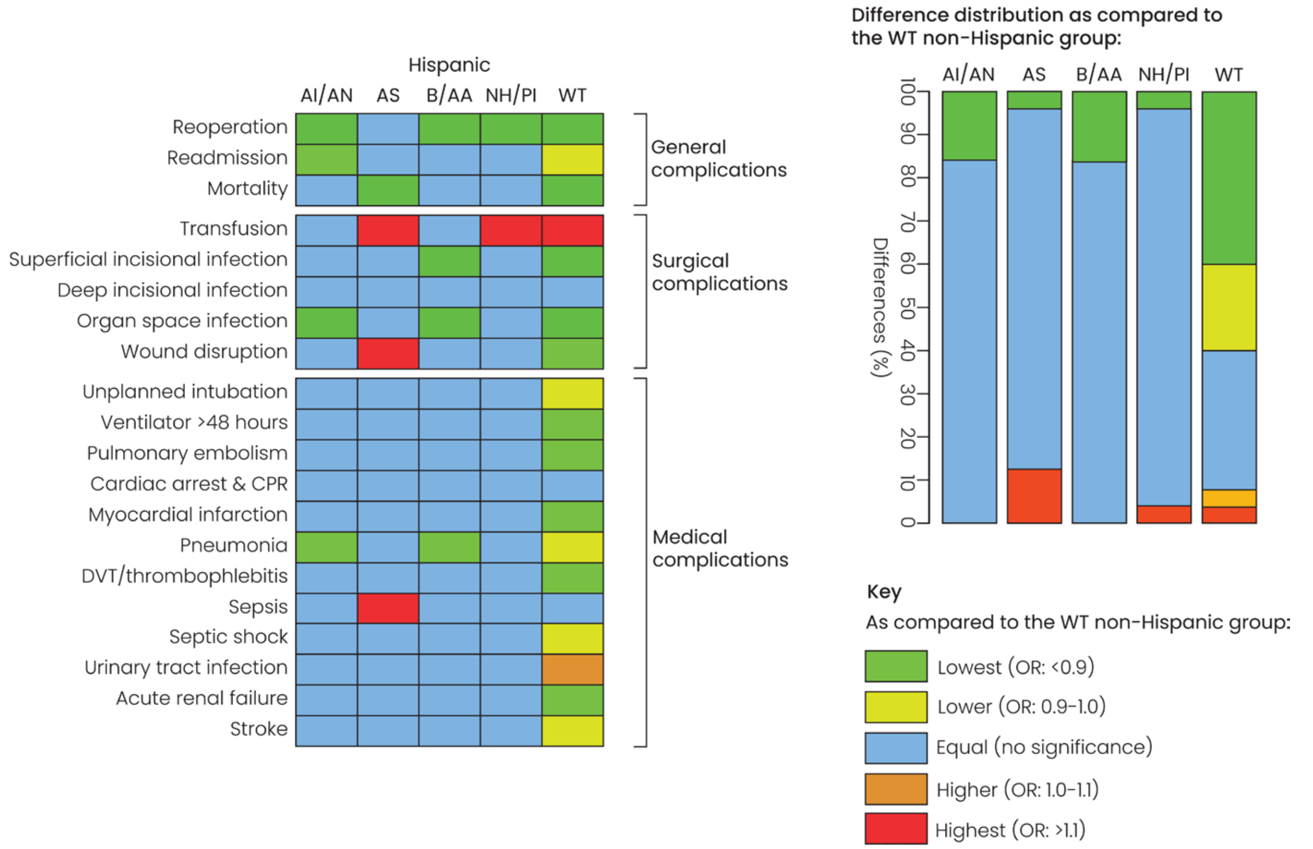

Figure 3. Multivariable analysis of the surgical complications and outcomes of Hispanic patients across different races as compared with WT non-Hispanic patients. Overall, in comparison to WT non-Hispanic patients, AI/AN Hispanic patients overperformed in 4 variables. AS Hispanic patients underperformed in 3 variables and overperformed in 1. B/AA Hispanic patients overperformed in 4 variables. NH/PI Hispanic patients underperformed in 1 variable and overperformed in 1 variable. WT Hispanic patients underperformed in 2 variables and overperformed in 15 variables.

operation times,[22,23] which were considered in multivariable analysis, are not the sole causative factors. Consequently, preoperative planning should consider these racial disparities. In elective cases, optimizing patients' hemodynamic conditions (addressing hypertension and anemia through medical and lifestyle measures), and in emergency cases, adequately preparing for potential transfusion requirements, becomes imperative.

Although B/AA patients exhibited a higher risk of acute renal failure and progressive renal insufficiency, these risks decreased from univariable to multivariable analysis, which may be attributed to the consideration of factors such as hypertension and diabetes.[24] To address this persistent disparity, clinicians may consider preoperative optimization of renal health, involving measures such as administering antihypertensive medications and promoting lifestyle changes to improve renal function. During hospitalization, awareness of this predisposition should inform care decisions, including acknowledgment of the possible inaccuracies of the eGFR formula for certain Black and obese populations[25] and adjusting pain medication administration to account for renal health considerations.[26]

Our findings of significantly higher risk of DVT and PE in B/AA patients support previous research indicating higher thrombotic risk in B/AA individuals due to higher average proclotting factor and lower protein C levels.[27] Additionally, diagnostic indicators with subjective elements may be susceptible to diagnostic bias. DVT symptoms such as pain and skin changes have been historically under-documented in B/AA patients.[28] PE symptoms, like reduced oxygen saturation, are more challenging in B/AA patients due to pulse oximeter error rates with darker skin.[29] Although this is subject to clarification through future patient studies, clinicians may consider taking these findings into consideration when managing B/AA patients, potentially necessitating adjustments to diagnostic or prophylactic thresholds.

B/AA patients exhibited a heightened risk for sepsis, a disparity previously associated with factors like underlying comorbidities, socioeconomic status (SES), insurance status, and geographical barriers to sepsis management health services.[30] Future research efforts should prioritize examining the impact of quality initiatives on reducing disparities in managing chronic comorbidities, such as diabetes and chronic kidney disease.[31,32] Administrative strategies should be explored to mitigate the effects of insurance status as a source of disparities in sepsis management.[33–35] Community-based interventions should concentrate on improving access to primary care health services in lower SES neighborhoods, potentially through expanding community health centers and addressing barriers like service availability and financial burdens. Patient-based interventions should address the underrepresentation of minority patients in genomic studies of sepsis.[35]

AS American patients exhibited a higher likelihood of experiencing postoperative unplanned intubation and pneumonia. This aligns with prior research indicating racial disparities in AS communities for pulmonary conditions such as pneumonia, tuberculosis, and lung cancer.[36] Research suggests that one possible explanation for the disparity lies in cultural factors, with older Asian American patients being less inclined to discuss health problems or voice concerns about treatment plans due to cultural reasons, prioritizing politeness over contradiction with healthcare providers. Additional factors contributing to this disparity include unwillingness to share information due to mistrust, cultural belief differences, language barriers, or concerns over privacy.[37] Addressing these cultural gaps is imperative, particularly considering the disproportionate impact of pulmonary health conditions on AS patients. For instance, while the AS American population has a higher proportion of smokers compared with the WT American population, AS patients facing lung cancer are 15% less likely to be diagnosed early, 10% more likely to forego treatment, and experience longer delays before treatment initiation.[36,38] The persistence of racial disparities in pulmonary and other complications among AS patients, particularly in detection/diagnosis and early management, emphasizes the need for treatment and cultural competence in healthcare practices.

NH/PI patients were at higher risk for MI and stroke compared with other racial groups. This discrepancy aligns with previous research indicating that NH/PI ethnic groups have elevated rates of cardiovascular risk factors, including hypertension, diabetes, and obesity.[39] These patients experience prolonged hospitalizations and require more medical interventions for MI. To address these disparities, one Hawaiian hospital successfully implemented a novel initiative to develop culturally tailored educational materials for disease management, providing patients with daily weight scales and blood pressure cuffs for self-management. NH/PI patients received individualized education and treatment plan reviews from an Advanced Practice Registered Nurse during outpatient follow-up planning. The hospital established a discharge medication reconciliation process with changes to physician order sets for accurate reconciliation and pharmacy oversight. A prospective study following these changes revealed substantial reductions in periprocedural MI, renal failure, emergent/urgent coronary bypass surgery, and death among NH/PI patients.[40] This underscores the impact of specific policy changes aimed at delivering optimal care despite language barriers, diverse health beliefs, practices, and unique medical issues within diverse ethnic and racial groups, thereby improving racial disparities.

This study distinguishes itself from others by investigating complications among Hispanic patients across all racial groups. Despite the diverse racial identities, socioeconomic profiles, and migration patterns among Hispanic groups in the United States, they are often treated as a homogeneous entity in research. Our findings demonstrate that despite lower SES among Hispanic populations,[11,14,41] there is an overall reduction in risk for complications among the Hispanic population, with Hispanic patients in every racial group experiencing lower complication risks compared with the overall risks within their respective racial groups. However, this is not consistent when broken down by race; WT Hispanic, B/AA Hispanic, and AI/AN Hispanic cohorts had a lower risk for complications than non-Hispanic WT patients, while AS Hispanic and NH/PI Hispanic patients exhibited a higher risk for complications compared with non-Hispanic WT patients. While the "Hispanic Paradox" is a well-documented phenomenon, that is Hispanics perform better despite their lower SES,[10,11] our findings suggest its persistence across various specialties and complications, though not uniformly across all racial groups. While researchers speculate that this phenomenon may be linked to robust social networks, genetic variations, differences in immunological response, gut flora, or a combination thereof, our NHIS analysis suggests that the Hispanic population may on average have larger social networks, greater functional independence, lower rates of chronic obstructive pulmonary disease and heart disease, influencing their frailty index. Subsequent research should delve into the reasons behind the variation of this phenomenon across all racial categories. Additionally, the elevated risk of transfusions observed in WT, AS, and NH/PI Hispanic patients is notable and warrants further investigation.

Postdischarge Challenges

Previous single-center studies found persistent racial disparities in discharge destination, linking differences to hospital-level segregation, and disparities in referral, patient responses, payer mix, cultural practices, and community resources.[14,42] Our multivariable analysis found that discharge patterns vary among all racial groups. In understanding why individuals from different racial backgrounds are discharged to different places after surgery, our NHIS analysis highlights that B/AA individuals are more likely to live alone or in smaller households, less likely to have multiple families in one household, and more likely to receive care at home. AS individuals, on the other hand, are less likely to live alone, have multiple families in one household, and least likely to receive care at home. While AS individuals have the highest family income-poverty ratio, AI/AN individuals have the lowest. When it comes to difficulty with daily activities like walking, self-care, and running errands, AI/AN and B/AA individuals face more challenges compared with AS individuals, who experience the least difficulty.

These differences highlight the importance of considering living situations, cultural factors, and economic conditions when planning postsurgery care for individuals from diverse racial backgrounds for both elective and emergent procedures. For instance, if there is a lack of at home care, this would necessitate prompt mobilization of postdischarge specialized care. Encouraging a cultural ethos that promotes maintaining functional independence, particularly through regular physical exercise, is vital to promoting postdischarge recovery. For example, frequent exercise in older age is a significant part of various East Asian cultures, leading to lower frailty.[43] This is illustrated in our NHIS analysis, where AS individuals are more likely to exercise, whereas AI/AN and B/AA report exercising substantially less often. Focusing on functional independence at the preadmission stage can increase home discharge.

LIMITATIONS

We highlight racial/ethnic disparities in surgical outcomes but face limitations due to the absence of sociodemographic data in ACS-NSQIP. Future inclusion of such data in the ACS-NSQIP is recommended. Limitations include potential inaccuracies in self-reported race in NHIS and ACS-NSQIP. The ACS-NSQIP's voluntary participation is primarily from urban, well-equipped academic institutions, affecting geographical influences. Another ACS-NSQIP limitation is the variations in data collection quality between institutions, although research deems it reliable with low heterogeneity.[44] While our findings hold particular relevance to the US due to the predominant representation of US hospitals (90%) in the ACS-NSQIP data set, it should be noted that not all hospitals within the ACS-NSQIP are in the United States. The NHIS data is, however, entirely US-based. The study did not control for specific surgical procedures, although it did consider surgical specialty as a confounding variable in the multivariable analysis. The 30-day focus of ACS-NSQIP limits long-term care investigation, and complications treated elsewhere are not captured. NHIS lacks NH/PI race data, relies on self-reported survey data, and has limited generalizability due to its population subset. A limited subset of surgical patients and the general population are sampled; therefore, generalizability is an issue.

CONCLUSIONS

This study underscores disparities in surgical outcomes and sociodemographics among various racial/ethnic groups in the United States. The findings provide valuable insights to investigate the root causes of these differences and highlight the significance of enhancing our data collection at the point of healthcare provision, for example, through questionnaires aimed at capturing the socioeconomic level of patients. Through better data collection, healthcare providers can develop targeted strategies to address specific health disparities through healthcare and policy improvements.

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A.C.P., S.K., and D.Y.M. planned, conceptualized, and orchestrated the analysis and writing; D.Y.M., A.Y.M., S.F., and C.M.H. performed the data extraction and analysis; D.Y.M., S.K., G.H., V.H., U.K., and K.R. made critical contributions to the concept and writing; D.P.O. critically edited the manuscript; the manuscript was reviewed by all authors. The content of this study was exclusively contributed and written by the authors listed and no ghost writers were involved in the writing of this article. A.C.P. and D.P.O. take responsibility for the integrity of the data and the accuracy of the data analysis. The authors had no conflicts of interest in the writing of this study.

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