



Disparities in the impact of access to and outcomes of bariatric surgery among different ethnoracial and socioeconomic populations: a narrative review of the literature

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Background and Objective: Obesity and its associated chronic medical conditions such as diabetes and hypertension are among the leading health concerns in the developed world. Bariatric and metabolic surgery has emerged as an established and definitive treatment for severe obesity. Given the disproportionate burden of obesity and diabetes on different racial and socioeconomic populations, studies have assessed the impact of these disparities in bariatric surgery patients.

Methods: A comprehensive search of the current literature utilizing the following keywords was performed: bariatric surgery and a combination of disparities, outcomes, complications, mortality, access to care or socioeconomic factors.

Key Content and Findings: We review the impact of ethnoracial differences on access to care and outcomes of bariatric surgery including weight loss, comorbidity remission, complications and mortality. Existing literature demonstrates reduced weight loss and higher complication rates in non-Hispanic Black patients compared to White patients with trends toward normalization of weight loss variation and comorbidity remission among ethnic groups over longer follow up times.

Conclusions: Bariatric surgeons should consider ethnoracial and socioeconomic when counseling patients regarding bariatric surgery to support patients at risk of poorer outcomes. Further prospective research is needed to examine impact of ethnoracial and socioeconomic disparities on bariatric surgery patients.

Keywords: Disparities; bariatric surgery; metabolic surgery; socioeconomic status; weight loss

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Introduction

Obesity is a leading cause of morbidity and mortality in the United States and represents a major health burden worldwide with wide-ranging economic implications (1,2).

A host of chronic medical conditions such as type 2 diabetes mellitus, hypertension, heart disease, stroke and certain types of cancer are associated with obesity, which has a dose-dependent effect on their prevalence. According to

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Table 1 The search strategy summary

Items	Specification
Date of search	August 1 to December 10, 2022
Databases and other sources searched	PubMed
Search terms used	Bariatric surgery, disparities, outcomes, complications, mortality, access to care, socioeconomic
Timeframe	2000–2022
Inclusion and exclusion criteria	Excluded case reports; English language only
Selection process	Selection process conducted independently by three team members

the National Health and Nutrition Examination Survey (NHANES) in 2021, the prevalence of obesity in the U.S. is 41.9% and severe obesity, defined by a body mass index (BMI) of 40 kg/m² or higher, is 9.2% (3). The prevalence and effects of obesity vary among racial and ethnic groups in the general U.S. population. When stratified by ethnicity, non-Hispanic Black adults (49.9%) had the highest age-adjusted prevalence of obesity, followed by Hispanic adults (45.6%), non-Hispanic White adults (41.4%) and non-Hispanic Asian adults (16.1%) (4). The association between obesity and socioeconomic status is complex. Weight loss may be achieved through multiple modalities including dietary changes, lifestyle modifications, pharmacological interventions and bariatric surgery (5). Bariatric surgery has been shown to be the most effective treatment for patients with severe obesity. While notably reviews of the literature were completed in 2017 looking at outcomes after bariatric surgery as landscaped by large databases and in 2021 exploring disparities in adolescents and children, this review focuses on adults and all sources of outcomes and disparities data (6,7). For the purposes of this review, when bariatric surgery is referred this is inclusive of metabolic and bariatric surgery. The purpose of this review is to demonstrate the impact of race and ethnicity on access to bariatric and metabolic surgery as well as postsurgical outcomes including weight loss, comorbidity remission, complications and mortality. We present this article in accordance with the Narrative Review reporting checklist (available at <https://ales.amegroups.com/article/view/10.21037/ales-22-81/rc>).

Methods

This literature review was performed using an analysis of PubMed studies from a search conducted between August and December of 2022. The search terms used to conduct

the search included bariatric surgery in conjunction with the follow words or phrases: disparities, outcomes, complications, mortality, access to care or socioeconomic factors. Case reports were excluded from the initial search and studies were restricted to those reported in the English language. The selection process was conducted independently by three team members and consensus was obtained by a review of study methods, results and conclusions prior to inclusion in this review. A summary of the search strategy is reviewed in *Table 1* and a summary of included studies and relevant significant findings are included in *Table 2*.

Results

Ethnoracial considerations: weight loss and comorbidity remission

Obesity is known to be associated with a host of chronic medical conditions such as hypertension and diabetes that are generally more prevalent in minority populations. Following bariatric surgery, the primary outcomes of interest include weight loss as well as reduction of comorbidities such as diabetes, hypertension, and hyperlipidemia. On review of the literature, much of the data studying ethnic differences in weight loss and comorbidity remission stems from single institution studies. In a single-center study of 1,903 patients, African American patients were found to have higher postoperative BMI and less percentage of excess weight loss than Caucasian or Hispanic patients at 3-year follow up (16). These ethnic differences persisted throughout the 3-year period in Roux-en-Y gastric bypass patients (16). However, African American and Hispanic patients no longer differed by year 3 after Roux-en-Y gastric bypass patients and year 2 after laparoscopic gastric banding. No significant ethnic

Table 2 Summary of studies and significant findings

Study	Year	Study design	Type of surgery, %	Patient numbers (n)	Weight loss, %	Comorbidity Remission, %	Readmission, %	Complications, %	Mortality, %
Wood <i>et al.</i> (8)	2019	Retrospective cohort	Roux-en-Y gastric bypass, 33.6; sleeve gastrectomy, 54.1; adjustable gastric banding, 12.4	14,210: Black, 50%; White, 50%	1-year: Black, 26; White, 29	Hypertension: Black, 40; White, 56. Sleep apnea: Black, 62.6; White, 56.1. GERD: Black, 78.6; White, 75.4	Black, 5.8; White, 3.5	Black, 8.8; White, 6.8	30-day: Black, 0.1; White, 0.1
Sudan <i>et al.</i> (9)	2014	Retrospective database review	Roux-en-Y gastric bypass, 100	108,333: Black, 12%; Hispanic, 9%; White, 79%	1-year: Black, 30.2; White, 33.6	NR	NR	Black, 3.65; Hispanic, 2.01; White, 3.19	30-day: NED, 0.23–0.26
Coleman <i>et al.</i> (10)	2014	Retrospective database review	Roux-en-Y gastric bypass, 58; sleeve gastrectomy, 40; adjustable gastric banding, 2	20,296: Black, 18.5%; Hispanic, 35%; White, 46.5%	3-year: Black, 58; Hispanic, 60; White, 62	NR	NR	NR	NR
Turner <i>et al.</i> (11)	2011	Retrospective database review	Roux-en-Y gastric bypass, 70.3; adjustable gastric banding, 25.4	18,682	NR	NR	NR	Black: 2.5x PE; Hispanic: 4x acute renal failure, 3.1x transfusion	30-day: NED
Longitudinal Assessment of Bariatric Surgery (LABS) Consortium <i>et al.</i> (12)	2009	Prospective cohort	Roux-en-Y gastric bypass, 71.4; adjustable gastric banding, 25.1	4,776: Black, 10.9%; Hispanic, 6.1%	NR	NR	NR	NED	NED
Welsh <i>et al.</i> (13)	2020	Retrospective database review	Roux-en-Y gastric bypass, 29.4; sleeve gastrectomy, 70.0; duodenal switch, 0.6	212,970: Black, 17.4%; Hispanic, 13.5%; White, 68.1%	NR	NR	30-day: Asian, 0.2; Black, 0.1; Hispanic, 0.0; White, 0.1	Clavien-Dindo Grade 4: Asian, OR =0.62; Black, OR =1.22; Hispanic, OR =0.87; other, OR =0.60. Clavien-Dindo Grade 5: Asian, OR =2.77; Black, OR =1.43; Hispanic, OR =0.74; other, OR =1.7	30-day: Asian, 0.2; Black, 0.1; Hispanic, 0.0; White, 0.1
Edwards <i>et al.</i> (14)	2023	Retrospective database review	Roux-en-Y gastric bypass, 27.4; sleeve gastrectomy, 72.6	512,041: Black, 18.6; Hispanic, 14.6; White, 66.6	NR	NR	NR	VTE: Black, 27.8; Hispanic, 25.0; White, 13.3	30-day: Black, 0.08; Hispanic, 0.03; White, 0.05
Nafiu <i>et al.</i> (15)	2021	Retrospective cohort		44,090	NR	NR	Black, 4.5; White, 3.0	Black, 0.7; White, 0.4	NR

GERD, gastroesophageal reflux disease; NR, not recorded; NED, no ethnic differences; OR, odds ratio; PE, pulmonary embolism; VTE, venous thromboembolism.

differences were identified in remission of hypertension, hyperlipidemia, diabetes and sleep apnea at 1 year (16). In contrast, a study of 1,025 patients at a university hospital in Virginia found that African Americans had a higher risk of preoperative hypertension and were less likely to correct their hypertension than Whites at one year after gastric bypass surgery (17).

Genetic variations seen in those of Caucasian descent compared to those of Hispanic descent has been implicated as factors in the development of development of obesity and disparities in outcomes among patients undergoing metabolic surgery. Forty to seventy percent of the difference in the development of obesity between individuals can be attributed to genetic variations (18). Four genetic variants—INSIG-2, FTO, MC4R, and PCSK-1—are associated with class III obesity in white patients, and there are statistically significant differences in the frequencies of the FTO, MC4R, and PCSK-1 variants between obese white and Hispanic patients (18). Further, genetics play a role in outcomes after bariatric surgery. For example, in patients with BMI <50 kg/m², the presence of genetic variants INSIG-2, FTO, MC4R, and PCSK-1 is associated with worse weight loss outcomes (19).

A series of single-center studies have shown disparities in weight loss particularly among the African American bariatric surgery population. In a prospective study of 180 patients who underwent laparoscopic gastric bypass, Caucasian patients achieved a higher percentage of excess weight loss than African Americans of 82.9% *vs.* 60% at 1 year, though this finding was not statistically significant (20). Despite no significant differences in preoperative body weight, percentage of ideal weight, or BMI, a small study of 37 patients found that African Americans had poor weight loss with laparoscopic adjustable silicone gastric banding compared with Whites with a significantly smaller percentage decrease in excess body weight at 12, 24, and 36 months (21). Another study of patients undergoing laparoscopic adjustable gastric banding from 2001 to 2004 matched 65 White patients to 58 African American patients (22). This study similarly found a significant difference in percentage of excess weight loss between Whites and African Americans of 49% *vs.* 39% at 1 year and 55% *vs.* 44% at 2 years (22). Studies of female bariatric surgery patients with up to 3 years of follow up have found that African American women have higher preoperative weight and lose significantly less weight than Caucasian women after laparoscopic adjustable gastric banding and Roux-en-Y gastric bypass (23).

Emerging data suggests trends toward reduced weight loss variation after bariatric surgery and equivalency of comorbidity remission among different ethnic groups over longer periods of time. A meta-analysis of 14 studies comparing outcomes in 2,714 Caucasian and 1,087 African American patients 1–2 years after bariatric surgery found that African Americans had a significantly lower percentage of excess weight loss than Caucasians with a mean deficit of 8.4% (24). Contrary to prior studies, a recent systematic review that included 23 studies of 71,679 patients who underwent bariatric surgery, and their one-year outcomes found no difference in BMI or percentage of excess weight loss among White *vs.* African American or Hispanic *vs.* non-Hispanic groups (5). However, the study showed a statistically significant reduction in waist circumference, hypertension, hyperlipidemia and diabetes variables such as HbA1c in the Asian population (5). Study limitations include the possible influence of multiple confounding factors on the results. Emerging data suggests trends toward normalization of weight loss variation after bariatric surgery and equivalency of comorbidity remission among different ethnic groups over longer periods of time.

Large population-based clinical data registry studies have previously found ethnic differences in both weight loss and remission of comorbidities after bariatric surgery. A retrospective analysis of 14,210 bariatric surgery patients in the Michigan Bariatric Surgery Collaborative (MBSC) registry showed that Black patients undergoing bariatric surgery in Michigan experienced lower weight loss at 1 year than a matched cohort of White patients (8). The same study showed that Black patients when compared to White patients had lower remission of hypertension, higher remission of sleep apnea and gastroesophageal reflux disease, and no difference in remission of insulin-dependent diabetes or hyperlipemia (8). Interestingly, when stratified by annual income levels, the difference in overall weight loss at 1 year between the racial cohorts did not vary across the income strata (8). Three-year follow up outcomes from a bariatric surgery registry of 20,296 patients from a large integrated healthcare system in California showed that non-Hispanic Whites had a significantly higher percentage of excess weight loss than non-Hispanic Blacks and Hispanics after Roux-en-Y gastric bypass patients (10). This difference was not shown in sleeve gastrectomy patients throughout the 3-year follow up period (10).

The Bariatric Outcomes Longitudinal Database (BOLD) is a bariatric surgery specific registry containing data submitted by over a thousand surgeons and over seven

hundred hospitals that participate in the American Society of Bariatric and Metabolic Surgery (ASBMS) Bariatric Surgery Center of Excellence (BSCOE) program. A large study by Sudan *et al.* analyzed BOLD data of 108,333 patients who underwent Roux-en-Y gastric bypass with 1-year follow up (9). The authors found that although weight and comorbidity burden significantly declined in all races, there was less of a decline in Blacks despite adjustment for baseline characteristics (9). The percentage decrease in prevalence of hypertension was 35% in Blacks versus 49% in Whites and 50% in Hispanics (9). A possible explanation provided by the authors for these results was that Black patients may present for bariatric surgery with more advanced comorbidities as the study did not stratify for the severity of baseline comorbid conditions. Another analysis from BOLD of 827 adolescent patients between ages 11 and 19 years at 1 year follow up after either gastric bypass or adjustable gastric banding surgery showed no significant difference in mean estimated weight loss between Hispanics, non-Hispanic Blacks, and non-Hispanic Whites (9).

Outcomes: complications and mortality

Multiple prior studies have addressed the question of ethnic variation in complication rates and mortality after bariatric surgery and identified significant disparities. Multivariate analyses by stepwise logistic regression of 7,868 bariatric surgery patients in New York identified age greater than or equal to 50 years, male gender, and Hispanic ethnicity as predictors of post-operative complications (25). In a single-center study of 493 patients who underwent laparoscopic Roux-en-Y gastric bypass and completed a 1- and 2-year follow-up, Black patients and women were more likely to have vitamin deficiencies than other groups (26). A systematic review of the literature suggested increased 30-day mortality and morbidity and length of stay in non-Hispanic Black relative to non-Hispanic White patients following bariatric surgery (27). All seven of the studies that found a higher mortality rate in non-Hispanic Black compared to non-Hispanic White patients employed adjustment analysis of multistate, multicenter standardized databases (27). A case-control study of 80,238 matched non-Hispanic Black and White patients who underwent primary Roux-en-Y gastric bypass or sleeve gastrectomy found similar racial disparities in peri-operative outcomes (28). Non-Hispanic Black patients had two-fold higher all-cause mortality with significantly higher rates of readmission, reintervention, pulmonary embolism, venous

thromboembolism, and renal complications (28).

In contrast, other studies have identified no significant difference in mortality after bariatric surgery when comparing different racial and ethnic groups. A prospective, multicenter study of 30-day outcomes including death, need for reintervention and venous thromboembolism in 4,776 patients found that extreme values of BMI were significantly associated with an increased risk of the composite end points, but age, sex, race and ethnic group were not (12). This study was possibly limited by its statistical power as only 10.9% of the patients were non-White. In an analysis of the American College of Surgeons National Surgical Quality Improvement Program database from 2005 to 2007, a total of 18,682 bariatric procedures including Roux-en-Y gastric bypass, adjustable gastric banding, vertical banded gastroplasty and biliopancreatic diversion/duodenal switch were identified (11). After an assessment of postoperative outcomes, there was again no increased association with mortality when stratified by age, race, or sex. However, ethnic disparities were found in the occurrence of postoperative complications. Hispanic patients were nearly four times more likely to have postoperative acute renal failure requiring dialysis within 30 days of the surgery and both Hispanics and American Indians/Alaskan Natives were more likely to require postoperative blood transfusions. Additionally, the study found that pulmonary embolisms more frequently occurred in African Americans than Whites or Hispanics (11).

Large data registry studies from the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) have shown that Black and Hispanic bariatric surgery patients have higher rates of complications, readmission, and reintervention compared to White patients. In a study of 212,970 queried from the 2015 and 2016 MBSAQIP data registry, Welsh *et al.* found that Black patients have higher odds of readmission and multiple grades of complications including death and Hispanic patients have higher odds of a moderately severe complication compared with White patients (13). Another MBSAQIP analysis including 512,041 cases of Roux-en-Y gastric bypass and sleeve gastrectomy found that venous thromboembolic (VTE) complication was the most common reason for overall mortality in non-Hispanic Black (27.8%) and Hispanic (25%) patients (14). VTE-related mortality directly associated with the bariatric procedure was also higher in non-Hispanic Black (34.6%) and Hispanic (33.3%) patients when compared to non-Hispanic White (21.0%) patients (14). In the sleeve gastrectomy cohort, the

proportion of VTE-related mortality varied significantly among ethnic groups ($P < 0.043$) with a mortality of 39.2% in non-Hispanic Black patients, 40.0% in Hispanic patients, and 20.5% in non-Hispanic White patients (14).

Prior studies have also shown differences in health care resource utilization among varying patient populations. In addition to reduced weight loss at 1 year, the multicenter study by Wood *et al.* found that Black bariatric surgery patients in Michigan had significantly higher rates of 30-day complications and resource utilization (8). Black patients were found to have a greater length of stay and higher rates of emergency department visits and readmissions (8). A prospective BSCOE observational study of 24,662 patients undergoing primary Roux-en-Y gastric bypass and 26,002 patients undergoing primary adjustable gastric banding surgery found that African American patients had 34% higher odds of readmission than Caucasian patients and that male patients had 50% higher odds of readmission than female patients (29). A multicenter study out of New York including 10,448 bariatric surgeries identified race, surgical approach and presence of a surgical complication as the most significant predictors of potentially preventable readmissions (PPR) within 30 days of bariatric surgery discharge. Non-Hispanic Black patients had two-fold greater risk of PPR ($P < 0.0001$) compared to non-Hispanic White patients (30). Similarly, analysis of 44,090 propensity-matched cohorts of non-Hispanic Black and non-Hispanic White patients from the MSBQIP database found significantly higher resource utilization in patients of black race including unplanned interventions, reoperations, readmissions, and extended hospital lengths of stay (15).

Impact of socioeconomic status

Several studies examine the disparities in relation to patient socioeconomic status, displaying a direct correlation to access and ultimately outcomes for those undergoing bariatric surgery. Recent studies based on census data indicate that patients with private insurance and who identify as Caucasian were more likely to undergo bariatric surgery (31). Moreover, rates of attrition to surgery have a statistically significant correlation with those receiving social security, with lower incomes, and without private insurance (31). Among all identifying factors for the patients examined, race and insurance were the strongest predictors for those to undergo surgery. Hecht *et al.* determined that 1-year outcomes for those making it to surgery saw no statistically significant difference in excess weight loss,

however disparities re-emerge at 10-year follow up with greater percentage of excess weight loss held in those with higher median incomes (31). A national population-based study performed in 2006 identified socioeconomic factors of the patient population undergoing bariatric procedures, 374 of the 87,749 recorded procedures performed, 82% of the patients held private insurance and only 15% were living on incomes below the poverty line (32). Access to bariatric programs and ultimately surgical intervention was drastically altered after it was covered by Medicaid. Medicaid is a jointly funded public payer (by states and the federal government) that covers eligible low-income adults, children, pregnant women, elderly adults and people with disabilities (33). Following the expansion of Medicaid after 2012, there was a reduction in disparity of bariatric surgery rates based on insurance and income (34). Low-income patients within Medicaid expansion states saw an increase of 5.1% greater surgeries while those dependent on Medicaid or formally uninsured experienced a 15.8% rise in incidence. Among those with private insurance and documented “high-income”, no marginal change was seen. Socioeconomic factors including type of insurance and median income are strong predictors for access to bariatric procedures. Immediate results show no correlation to the original access-dependent variables. Presentation of disparities appear to be represented in long-term follow-up but lack adequate investigation (34).

Influence of access to care

Access to healthcare often lies at the root of ethnic and socioeconomic disparities among patients receiving metabolic and bariatric surgery. Varying access to the healthcare system secondary to demographic and socioeconomic factors often results in barriers to surgical evaluation and delays in surgery. In a large single-institution study, retrospective chart review was performed for patients meeting referral criteria to bariatric surgery to identify racial or ethnic disparities in referral patterns (35). The results showed that Hispanic patients were less likely to be referred for bariatric surgery compared with white or black patients (35). This finding was attributed in part to the disproportionate number of Hispanic patients without the insurance coverage necessary for bariatric surgery referral (35). A survey study of primary care patients in Boston with a BMI greater than 35 kg/m² revealed that African Americans and male patients were less likely to have been recommended for bariatric surgery by their physicians (36).

Interestingly, the major deterrent for patients was found to be high perceived risk as opposed to financial barriers (36). Even among patients who were referred for bariatric surgery, additional disparities have been identified in specialty care and time to surgery. In another single-institution study, patients undergoing metabolic and bariatric surgery were evaluated for racial disparities in preoperative cardiovascular evaluation (37). White patients notably underwent more preoperative cardiac testing yet had shorter wait times for surgery (37). Policies restricting Medicare beneficiaries to Centers of Excellence for bariatric surgery were associated with decreased bariatric surgery among non-white patients (38). Restrictions to the availability of metabolic and bariatric surgery may further limit access to care for vulnerable populations.

Conclusions

We have demonstrated the impact of race, ethnicity, and socioeconomic status on access to bariatric and metabolic surgery as well as postsurgical outcomes. Race has been identified as a contributing factor to disparities in weight loss and remission of comorbidities after bariatric surgery, though the data suggests equivalency in weight loss and comorbidity remission over time. Systematic reviews suggest increased 30-day mortality and morbidity in non-Hispanic Black relative to non-Hispanic White patients following bariatric surgery. These include 30-day complications such as readmission, reintervention, and pulmonary embolism. Socioeconomic factors including type of insurance and median income are strong predictors for access to bariatric procedures, however immediate results show no correlation to the original access-dependent variables. Genetic variations have been shown to be associated with development of obesity and outcomes after bariatric surgery. Some data suggests that when able to adjust for all factors including behavioral and metabolic risk factors in mortality in those with cardiovascular disease, ethnoracial differences diminish (39). Given the disproportionate burden of obesity on minority groups and people of lower socioeconomic status and the apparent correlation with access and outcomes, further investigation is required to assess strategies to eliminate these disparities. Studies focused on exploring all factors that affect different ethnoracial backgrounds to include behavioral and metabolic risk factors, may help us better understand the disparities seen in outcomes and access to bariatric surgery.

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