Body Mass Index and Intensive Care Unit Outcomes in African American Patients

O'Dene Lewis, MD[1,2]; Julius Ngwa, MS, PHD[1,3]; Angesom Kibreab, MD [1,4]; Marc Phillpotts, MD[1]; Alicia Thomas, MD[1, 2]; Alem Mehari, MD[1, 2]

Purpose: We sought to determine whether body mass index (BMI) is associated with worse intensive care unit (ICU) outcomes among Black patients.

Methods: Patients admitted to the medical ICU during 2012 were categorized into six BMI groups based on the World Health Organization criteria. ICU mortality, ICU and hospital length of stay (LOS), need for and duration of mechanical ventilation and organ failure rate were assessed.

Results: A total of 605 patients with mean age 58.9 ± 16.0 years were studied. Compared with those with normal BMI, obese patients had significant higher rates of hypertension, diabetes mellitus and obstructive sleep apnea diagnoses (P<.001 for all). A total of 100 (16.5%) patients died during their ICU stay. Obesity was not associated with increased odds of ICU mortality (OR=.58; 95% CI, .16-2.20). Moreover, improved survival was observed for class II obese patients (OR, .031; 95% CI, .001–.863). There were no differences in the need for and duration of mechanical ventilation between the BMI groups. However, ICU and hospital LOS were significantly longer in patients with obesity.

Conclusion: Obesity was not associated with increased ICU mortality; however, obesity was associated with increased comorbid illness and with significant longer ICU and hospital length of stay. *Ethn Dis*. 2017;27(2):161-168; doi:10.18865/ed.27.2.161.

Keywords: Body Mass Index; Obesity; African American; Intensive Care

Introduction

Obesity defined by BMI ≥ 30 kg/m^2 has increased in the United States in the last three decades. More than one-third of US adults were obese in 2012[1,2] and obesity is projected to rise to more than 50% by the year 2030.[3] While the overall prevalence of obesity has increased, significant racial/ethnic disparities continue to exist; with highest prevalence found among non-Hispanic Black (47.8%) vs non-Hispanic White (32.6%) adults.[1,4] As the prevalence of obesity increases, the numbers of critically ill obese patients will continue to increase making this situation important to examine.

Obesity is associated with derangement of cardiovascular and metabolic function[5] leading to increase in comorbid illnesses[6] that can complicate ICU care. Obesity affects respiratory physiology[7,8] leading to decreased chest wall and lung compliance making mechanical ventilator management difficult. In addition to metabolism and clearance of medications, physical factors of obesity, such as a poor anatomical land marks, makes intubation and vascular access placement difficult,[9] adding challenges to ICU management.

Despite these challenges of obesity in the ICU and obesity's association with increased all-cause mortality,[10] the effect of obesity on critical illness is less understood. Few prior studies have assessed the effect of BMI on medical ICU outcomes in African American (AA) patients.[11,12] The results from previous studies and three meta-analyses addressing this topic[13-15] have mostly been from mixed medical-surgical ICU populations[13-18] and did not include a subgroup analysis by race or the type of ICU (trauma, surgical vs medical) to which patients were admitted. In studies including only patients admitted to medical ICUs (MICU), some lacked appropriate non-obese comparison,[19,20] others used a different definition of obesity[21] or included only limited BMI groups.[11]

Our study aimed to describe the relationship between a wide range of

[1]Department of Internal Medicine, [2]Division of Pulmonary and Critical Care, [3] Division of Cardiovascular Medicine, [4] Division of Gastroenterology, Howard University College of Medicine, Washington, DC

Address correspondence to Alem Mehari, MD; Howard University College of Medicine; Department of Medicine, Division of Pulmonary and Critical Care; 2041 Georgia Ave, NW, Washington DC, 20060; alem.mehari@howard.edu

BMI and outcomes in AA patients admitted to a MICU. We hypothesized critically ill AA obese patients would have worse ICU outcomes than those with normal BMI. Worse outcomes were defined as increased ICU mortality, greater need for mechanical ventilation, increased days spent on mechanical ventilation, increased ICU and hospital length of stay and number of organ failures.

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Methods

Patients admitted to an adult MICU for >24 hours during the calendar year 2012 were included. The study was conducted in accordance with amended Declaration of Helsinki; the institutional review board of Howard University approval was obtained. Howard University Hospital is an urban, level 1 trauma center, which serves inner city patients who are predominantly African Americans. All patients included in the study were self-identified as African Americans. Patients were excluded if ICU admission was a non-medical condition. If a patient had more than one admission to the ICU during a hospitalization, the first admission was used to generate data for the study.

The degree of obesity was assessed by BMI on admission. BMI was divided into six categories based on the National Institute of Health and the World Health Organization criteria[22,23] as: underweight (BMI≤18.4 kg/m^2); normal weight (18.5-24.9 kg/m^2); overweight (25-29.9 kg/m^2); and class I – class III obesity; (30-34.9kg/m^2), (35-39.9 kg/m^2), (≥40 kg/m^2), respectively.

Severity of illness was measured at the time of MICU admission using the Mortality Prediction Model II (MPM II) scoring system.[24] Laboratory values used were those obtained within 24 hours of admission. Comorbidities, number of days on mechanical ventilation, number of organs failed, hospital and ICU length of stay (LOS) were extracted from the medical records. The comorbidities data collected included diabetes mellitus, hypertension, hyperlipidemia, ischemic heart disease, congestive heart failure, atrial fibrillation, cerebrovascular disease, hypertensive cardiovascular disease, chronic kidney disease, chronic liver disease, asthma, chronic obstructive pulmonary disease, obstructive sleep apnea, pulmonary hypertension, human immunodeficiency virus and malignancy. The primary outcome measured, ICU mortality, was confirmed by a review of the hospital records and social security death index. Data on the need for, and duration of, mechanical ventilation, ICU and hospital length of stay, and the type and number of organ failure(s) were extracted from medical records.

Statistical Analysis

Descriptive statistics were computed to assess baseline clinical and demographic factors associated with BMI categories. For categorical variables, we obtained the counts (proportions) and evaluated significant differences using the chi-square and Fisher's exact test. Analysis of variance (ANOVA) with a Benferroni post Hoc analysis was used to assess significance for any differences in means across the BMI categories. Wilcoxon's rank-sum test was applied for comparisons of non-normal distributed data. We evaluated the relationship between mortality and BMI categories using logistic regression analysis. Univariate analysis was performed to assess potential confounders for the association between BMI category and mortality. Variables that were significantly associated with mortality (primary outcome) and BMI categories (primary independent) were included in a multivariate stepwise logistic regression analysis to examine the association between BMI and mortality. An interaction test and graphical plots were performed to assess the association between MPM II Score and BMI categories with mortality. P-value <.05 was considered statistically significant and CI were calculated at the 95% level. Data analysis was conducted using the Statistical Analysis System (SAS) software 9.3 (SAS Institute, Cary, NC) and Statistical Analysis and Graphics (NCSS 9.0.7, Kaysville, UT).

Results

A total of 605 patients were included in the study. Baseline characteristics are shown in Table 1. The

Table 1. Demographic and admission laboratory values between different body mass index categories

Characteristics[a]	Underweight N=61	Normal N=206	Overweight N=127	Class 1 N=90	Class 2 N=57	Class 3 N=64	P
BMI-kg/m^2	BMI<18.5	BMI 18.5-24.9	BMI 25-29.9	BMI 30-34.9	BMI 35-39.9	BMI>40	
Age, years	59.62 (18.73)	58.06 (16.08)	58.57 (16.74)	59.48 (15.72)	59.07 (16.51)	54.64 (17.41)	.429
Male	38 (62.30%)	122 (59.22%)	63 (49.61%)	37 (41.11%)	16 (28.07%)	19 (29.69%)	<.001
Female	23 (37.70%)	84 (40.78%)	64 (50.39%)	53 (58.89%)	41 (71.93%)	45 (70.31%)	<.001
Lactate, mmol/L	2.99 (2.82)	3.81 (4.60)	2.82 (2.71)	2.10 (1.05)	2.99 (3.39)	2.33 (2.44)	.513
Bilirubin, mg/dL	.86 (.51)	1.42 (2.24)	1.38 (1.93)	1.01 (1.03)	1.59 (3.87)	1.01 (.78)	.854
Total protein, mg/dL	5.74 (1.16)	8.71 (38.12)	5.86 (1.02)	5.74 (.91)	5.84 (1.04)	5.84 (.85)	.678
Albumin, g/dL	2.41 (.77)	2.58 (.76)	2.60 (.71)	2.67 (.70)	2.66 (.85)	2.60 (.69)	.367
Platelets	220.38 (130.02)	190.78 (104.16)	194.88 (99.86)	200.68 (115.17)	182.00 (89.34)	203.66 (102.03)	.652
INR	1.42 (.45)	1.39 (.72)	1.26 (.42)	1.35 (.49)	1.32 (.40)	1.52 (1.02)	.123
MPM II Score	37.19 (27.80)	39.61 (28.54)	36.28 (28.76)	33.04 (27.70)	38.21 (29.59)	34.90 (27.63)	.488
PaO_2 / FiO_2 Ratio	300.72 (136.59)	291.39 (126.48)	283.86 (122.27)	299.92 (135.74)	295.87 (113.05)	236.64 (118.43)	.131

BMI, body mass index; INR, international normalized ratio; MPM II, mortality prediction model II; PaO_2, partial pressure of oxygen; FiO_2, fraction of inspired oxygen.
a. Data are expressed as mean (SD) or n (%).

mean age of the participants was 58.9 ± 16.0 years and 295 (48.8%) were men. The distribution of the BMI is shown in Table 1. The overall rate of obesity (BMI ≥30kg/m^2) was 35%. Physiologic derangements at ICU admission, as measured by the MPM II score were similar for all BMI categories. Patients in BMI classes I-III obesity were more likely to be female (P<.0001) and to suffer from diabetes (P<.0002) and hypertension (P<.0001) (Table 2). Moreover, patients in BMI class I obesity were more likely to suffer from dyslipidemia (P=.010) and patients in BMI class III were more likely to have obstructive sleep apnea (P<.0001)

Table 2. Comorbidities between body mass index categories

Characteristics[b]	Underweight N=61	Normal N=206	Overweight N=127	Class 1 N=90	Class 2 N=57	Class 3 N=64	P
BMI, kg/m^2	BMI<18.5	BMI= 18.5-24.9	BMI= 25-29.9	BMI= 30-34.9	BMI= 35-39.9	BMI>40	
CHF	11 (18.03)	43 (20.87)	18 (14.17)	18 (20.00)	18 (31.58)	19 (29.69)	.064
IHD	3 (4.92)	28 (13.59)	20 (15.75)	12 (13.33)	10 (17.54)	7 (10.94)	.396
HCVD	22 (34.43)	74 (35.92)	45 (35.43)	27 (30.00)	27 (47.37)	26 (40.63)	.397
COPD	13 (21.31)	31 (15.05)	11 (8.66)	14 (15.56)	12 (21.05)	14 (21.88)	.096
OSA	2 (3.28)	0 (0)	2 (1.57)	2 (2.22)	3 (5.26)	17 (26.56)	<.0001[a]
PH	5 (8.20)	11 (5.34)	6 (4.72)	8 (8.89)	7 (12.28)	9 (14.06)	.171
Asthma	5 (8.20)	17 (8.25)	8 (6.30)	10 (11.11)	12 (21.05)	13 (20.31)	.069
CVD	18 (29.51)	35 (16.99)	36 (28.35)	19 (21.11)	12 (20.88)	10 (15.63)	.091
CKD	10 (16.39)	62 (30.10)	28 (22.05)	13 (14.44)	14 (24.56)	12 (18.75)	.040
DM	16 (26.23)	59 (28.64)	63 (49.61)	42 (46.67)	27 (47.37)	29 (45.31)	.0002
HTN	30 (49.18)	139 (67.48)	85 (66.93)	72 (80.00)	49 (85.96)	47 (73.44)	.0001
Malignancy	15 (24.59)	35 (16.99)	16 (12.60)	14 (15.56)	6 (10.53)	4 (6.25)	.064
HIV	6 (9.84)	29 (14.08)	12 (9.45)	3 (3.33)	1 (1.75)	3 (4.69)	.008[a]
CLD	5 (8.20)	35 (16.99)	12 (9.45)	9 (10.00)	6 (10.53)	6 (9.38)	.216
Atrial fibrillation	5 (8.20)	10 (4.85)	10 (7.94)	9 (10.00)	7 (12.28)	1 (1.56)	.105[a]
Hyperlipidemia	6 (9.84)	34 (16.50)	29 (22.83)	29 (32.22)	10 (17.54)	15 (23.44)	.010

BMI, body mass index; CVD, cerebrovascular disease; CHF, congestive heart failure; CLD=chronic liver disease; IHD, ischemic heart disease; HCVD, hypertensive cardiovascular disease; COPD, chronic obstructive pulmonary disease; OSA, obstructive sleep apnea; PH, pulmonary hypertension; CKD, chronic kidney disease; DM, diabetes mellitus; HTN, hypertension; HIV, human Immunodeficiency virus.
a. Fisher exact test.
b. Data expressed as n (%).

Table 3. Intensive care unit survival status between different body mass index categories

BMI, kg/m²	Non-survivors, n=100[a]	Survivors, n=505[a]	Odds ratio (95% CI)	P
Underweight, n=61	17 (17)	44 (8.71)	1.71 (.88, 3.31)	.070
Normal, n=206	38 (38)	168 (33.27)	-	-
Overweight, n=127	13 (13)	114 (22.57)	.50 (.26, .99)	.043
Obese class 1, n=90	16 (16)	74 (14.65)	.96 (.50, 1.82)	.891
Obese class 2, n=57	2 (2)	55 (10.89)	.16 (.04, .69)	.003
Obese class 3, n=64	14 (14)	50 (9.90)	1.24 (.62, 2.47)	.548

Underweight, BMI≤18.4 kg/m²; normal weight, 18.5-24.9 kg/m²; overweight, 25-29.9 kg/m²; class 1 obesity, 30-34.9 kg/m²; class 2; 35-39.9 kg/m²; class 3; ≥40 kg/m².
a. Data expressed as n (%).

when compared with those with a normal BMI. Additionally, normal weight patients were more likely to have comorbid illnesses such as human immunodeficiency virus (HIV) (P=.008) and chronic kidney disease (CKD) (P=.040 respectively) than obese patients. A higher rate of malignancy was present in the underweight patients and malignancy was found to be significantly related to mortality.

A total of 100 (16.5%) patients died during ICU stay; of those, 17% were underweight, 38% normal weight, 13% overweight and 16%, 2%, 14% were in class 1-III obese, respectively. To estimate the association of BMI and ICU mortality rate, the normal BMI was used as a reference category (Table 3). There was no increased risk of ICU mortality among the BMI categories compared with the normal BMI patients (OR=1.71; 95% CI, .88-3.31 for underweight, OR=.50; 95% CI, .26-.99 for overweight, OR=.96; 95% CI, .50-1.82 for class I obese, OR=.16; 95% CI, .04-.96 for class II obese, OR=1.24; 95% CI, .62-2.47 for class III obese). Patients who were classified as overweight and class II obese were more likely to survive (P = .043 and P=.003 respectively). Additionally, there was a trend for increased mortality for patients who were underweight (OR=1.7; 95% CI, .88-3.31) and class III obese (OR=1.24; 95% CI, .62-2.47).

Multivariate analysis was performed on all significant variables to determine the association with ICU mortality (Table 4). Multiple stepwise logistic regressions showed association of the following variables with mortality: lactate level (OR 1.31; 95% CI, 1.12–1.62), international normalization ratio (OR 8.28; 95%CI, 2.2–30.77), and number of organs failed (OR 2.02; 95% CI, 1.25-3.28) and malignancy (OR 5.57; 95% CI 1.57–19.71) (Table 4). There was no association with mortality and the different BMI categories. Obesity was not associated with an increased odds of ICU mortality (OR, .58; 95% CI, .16–2.20). Moreover, improved survival was observed for class II obesity patients compared with normal weight patients (OR, .031; 95% CI, .001–.863), suggesting a protective effect from the obesity.

Table 4. Multivariate stepwise logistics regression analysis for ICU mortality predictors

Characteristics	Odds ratio	95% CI
Underweight- BMI≤18.4kg/m²	1.034	.202, 5.299
Overweight, BMI=25-29.9kg/m²	.272	.057, 1.301
Obese class 1, BMI=30-34.9kg/m²	.925	.123, 6.943
Obese class 2 BMI=35-39.9kg/m²	.031	.001, 0.863
Obese class 3 BMI= ≥40 Kg/m²	1.658	.276, 9.953
Lactate level- mmol/L	1.306	1.052, 1.621
International normalized ratio	8.276	2.226, 30.769
Number of failed organs	2.028	1.254, 3.281
Malignancy	5.567	1.573, 19.709
Mechanical ventilation	33.774	6.383, 178.71

Differences in secondary outcomes among BMI categories are listed in Table 5. There was no difference in the need for mechanical ventilation (P=.553), duration of ventilator use (P=.331) or organ failure rate (P=.052) between BMI categories. However, ICU and hospital LOS were significantly longer in patients with class II and III obesity compared with the other categories (ICU LOS 6 ± 6 and 8 ± 9, respectively, P=.035; hospital LOS 15 ± 15 and 15 ± 21, respectively, P=.012) (Table 3). The post hoc analysis showed ICU LOS was significantly longer for class III obese patients when compared with

Table 5. Intensive care unit outcomes between the different body mass index categories

ICU Outcomes	Underweight	Normal	Overweight	Class 1	Class 2	Class 3	P
BMI-Kg/m^2	BMI≤18.5	BMI 18.5-24.9	BMI 25-29.9	BMI 30-34.9	BMI 35-39.9	BMI≥40	
Mechanical ventilation, n (%)	23 (37.70)	65 (31.55%)	41 (32.28)	24 (26.67)	16 (28.07)	25 (39.06)	.553
Ventilation days, mean (SD)	5.67 (5.87)	7.75 (9.05)	7.56 (6.57)	6.79 (7.17)	9.63 (7.10)	10.36 (8.70)	.331
Hospital LOS, mean (SD)	11.93 (11.53)	11.11 (10.77)	11.09 (10.77)	9.21 (9.02)	15.14 (15.43)	15.67 (21.40)	.012
ICU LOS, mean (SD)	5.38 (4.87)	5.43 (6.89)	5.55 (6.29)	5.02 (6.18)	6.38 (6.23)	8.41 (9.62)	.035
Organ failure, n (%)	52 (85.25)	163 (79.13)	98 (77.17)	59 (65.56)	43 (75.44)	44 (68.75)	.052
Number of organ failures, mean (SD)	2.22 (1.42)	2.33 (1.32)	2.19 (1.30)	2.02 (1.20)	2.19 (1.13)	2.36 (1.57)	.709

Underweight, BMI<18.4 kg/m^2; normal weight, 18.5-24.9 kg/m^2; overweight, 25-29.9 kg/m^2; class 1 obesity, 30-34.9 kg/m^2; class 2; 35-39.9k g/m^2; class 3; ≥40 kg/m^2; ICU, intensive care unit; LOS, length of stay.

normal weight individuals (P=.023) and class I obese (P=.004) patients. Similarly, the hospital LOS was significantly longer for class III obesity compared with class I obese (P=.004) patients. In addition, although non-significant, obese class II and III patients had longer hospital LOS (4.0 and 4.6 days, respectively) compared with normal weight patients.

Discussion

Among critically ill African American patients admitted to MICU, obesity was not associated with increased odds of ICU mortality. Moreover, improved survival was observed for class II obese compared with normal weight patients, suggesting obesity may be protective. The need and duration on mechanical ventilation was not significantly different among the BMI groups. However, ICU LOS was 3.04 days longer (95% CI, .71–12.45; P=.015) and hospital LOS was 6.5 days longer (95% CI, .22–5.68; P=.023) for obese compared with normal weight patients.

Our findings provide valuable information that is reported less often. Obesity is associated with increased morbidity and all-cause mortality.[10,25] In secondary analyses of large ICU cohorts, Black patients were found to have more severe acute physiologic derangements at ICU admission[12,26] suggesting that Black's physiologic response to critical illness might be different. Intuitively, one would think, these factors would contribute to worse outcomes among critically ill obese AA compared with AA patients having a normal weight. However, contrary to our hypothesis, we found obesity was not associated with increased odds of ICU mortality.

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Our findings from a single center MICU can be compared with the findings of three large meta-analyses of obesity and mortality in critical illness. The first meta-analysis, which included 14 studies with 62,045 total and 15,437 obese patients,[14] reported that obesity was not associated with an increased risk of ICU mortality (relative risk [RR], 1.00; 95% CI, .86–1.16; P=.970) and improved survival was observed for class I and class II obesity patients compared with none obese patients (RR, .86; 95% CI, .81–.91; P<.001). However, ICU length of stay was 1.08 days longer for obese (95% CI, .27–1.88; P=.009) compared with non-obese individuals. Other studies also suggest that the relationship between BMI and patient outcomes is "U" shaped[27-30] with worse outcomes for both underweight (BMI<18.5 kg/m^2) and morbidly obese (>40 kg/m^2) patients. Similarly, we showed that overweight and obesity class I had no significant lower rates of mortality and obesity class II patients had significant lower rates of mortality compared with normal weight patients. On the other hand, the underweight and class III obesity groups had non-significant increased odds of death compared with patients with a normal weight. Similar to our findings, a second meta-analysis, which evaluated 12 studies, reported that overweight, obesity class I and II patients had lower rates of mortality and ICU LOS was increased for obesity class III patients

compared with patients with normal weight.[15] A third meta-analysis, which evaluated 22 studies and pooled the analysis, showed no significant difference in ICU mortality between obese and normal individuals.[13] Unlike the previous analyses and our study, there was no difference in ICU LOS and the duration of mechanical ventilation between obese and non-obese individuals in this third meta-analysis. Some of the discrepancies between these studies and ours may be due to differences in the population studied.

Results from other studies on obesity and ICU outcomes have also reported similar findings to ours. In a secondary analysis of data from a multicenter international observational study on nutrition, Martino et al found no differences in mortality rates, but longer ICU LOS and duration of mechanical ventilation in extremely obese patients.[16] Similarly, O'Brien et al[30] found no difference in ICU mortality and duration of mechanical ventilation between obese and non-obese patients. Most recently, Lee and collegues reported obesity did not influence outcomes in critically ill patients requiring invasive mechanical ventilation in MICU.[11] In their subgroup analysis of 381 Black patients, 30-day mortality, ICU and hospital LOS and duration of mechanical ventilation were not different between obese and non-obese. Unlike the study by Lee et al who had two BMI groups (obese and non-obese),[11] our study used a larger sample of AA patients stratified by wide BMI groups; ICU and hospital length stays were longer for the obese and class III obese compared with those with normal weight patients.

Our findings of longer ICU and hospital stay with class II and III obesity is aligned with previous work in this area. Subgroup analyses of previous studies suggested that very obese patients might have longer ICU LOS and hospital LOS.[18,19,31] These findings might simply reflect the difficulties of providing nursing care for the very obese. Challenges with mobilizing obese patients can also lead to an increased risk of skin breakdown and complications. These factors often lead to retention of obese patients in the ICU despite improvements in their level of acuity.

The lower mortality rate observed in patients with obesity has led to the hypothesis that obesity provides a protective effect against mortality during critical illness – the obesity paradox.[15,32,33] The obesity paradox was first described in overweight and obese patients undergoing hemodialysis; similar findings have since been described in patients with congestive heart failure, advanced malignancies and AIDS.[34-36]

The mechanisms behind the obesity paradox in the ICU remain unclear.[5,13,37] It has been proposed that obese patients have an increased release of anti-inflammatory adipokines, interleukin (IL)-10 and leptin.[13] In critically ill obese patients, elevation in leptin is thought to positively modulate deleterious inflammatory processes favoring survival.[37] On the other hand, leptin has strong pro-inflammatory effects that activate macrophages and induce tumor necrosis factor alpha (TNF-α), IL-6 and IL-12 and monocyte chemotactic protein 1 production.[38] Another hypothesis is that excess adipose tissue is readily available for unitization in critically ill patients resulting in a survival benefit due to increased nutritional reserves to mediate the response to inflammation and metabolic stress.[15] Additionally, high cholesterol and lipid levels common in obese patients might confer benefits during sepsis by binding endotoxins or by providing necessary precursors for adrenal steroid synthesis during acute illness.[37] Others suggest acute calorie restriction due to underfeeding increases insulin sensitivity and might help improve metabolic function acutely. Yet, others suggest more attention is given to the care of obese patients in the ICU and the physicians' adherence to practice guidelines in the care of critically ill, in general, might have also improved their survival.

Obese patients have been noted to have an increased duration of mechanical ventilation when compared with non-obese patients.[14] Our findings showed a non-significant increase in duration of mechanical ventilation for patients with class II and III obesity. This observation is unusual, as obese patients have reduced lung and chest wall compliance resulting in increased risk of atelectasis, aspiration and pneumonia, and would therefore be expected to have longer duration of mechanical ventilation. The process of care that affects outcomes might have contributed to these findings. For example, physicians may be more vigilant because of obesity, perhaps opting to intubate electively more often because of anticipated need for difficult airway; in addition, obese people may be triaged to higher standards of care.

The limitations of our study include the relatively small sample size

(N=605), the limited generalizability of a single hospital experience to other AA MICU populations. However, the finding of no increased mortality with increasing BMI is consistent between our study and the larger ICU studies. Moreover, BMI is used as a proxy of obesity but BMI measurements lack the ability to differentiate between lean, fat mass and the distribution of fat, which might have a deferential effect on ICU outcomes. In NHANES, however, BMI was found to be highly correlated with percentage body fat as measured by DEXA.[39] US and international definitions of overweight and obesity for adults are also based on BMI. Standard BMI categories are well-established and widely used; most studies that have examined the effects of obesity on ICU outcomes have used BMI. Moreover, this was a cross-sectional study and a cause-and-effect relationship between obesity and ICU outcomes could not be inferred. Despite these limitations, our study is noteworthy as it demonstrates obesity was not associated with increased ICU mortality among African American patients.

Conclusions

Further prospective work is needed to assess the pathophysiologic mechanism of the relationship between obesity and mortality in critically ill adults. Consequently, an attempt can be made to address the multifactorial processes that result in ICU mortality in African American patients with the aim of developing precision medicine capabilities to identify, stratify and treat this at-risk group.

Conflict of Interest

No conflicts of interest to report.

Author Contributions

Research concept and design: Lewis, Ngwa, Thomas, Mehari; Acquisition of data: Lewis, Ngwa, Phillpotts, Thomas, Mehari; Data analysis and interpretation: Lewis, Ngwa, Kibreab, Phillpotts, Thomas, Mehari; Manuscript draft: Lewis, Ngwa, Kibreab, Phillpotts, Thomas, Mehari; Statistical expertise: Ngwa; Acquisition of funding: Mehari; Administrative: Lewis, Kibreab, Phillpotts, Thomas, Mehari; Supervision: Ngwa, Kibreab, Mehari. Senior authors AT and AM contributed equally.

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