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Does Severe Obesity Affect Postacute Care Outcomes in Older Adults?

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Abstract

This retrospective study investigated the impact of varying obesity levels on postacute care (PAC) outcomes in older adults at skilled nursing facilities. Three obesity classes were compared: overweight (body mass index [BMI], 25-29.9), class 1 (BMI, 30-34.9), and combined class 2/3 (BMI ≥35), involving 131 older adults consecutively admitted to a single PAC site posthospitalization between April and October 2018 (mean age, 73; mean BMI, 34). The younger class 2/3 group (mean age, 67) contrasted with class I (74) and overweight (78; *P*<.0001). Age and BMI did not influence AMPAC (an indicator of functional impairment), 90-day readmission, length of stay, or 15-month mortality. Obesity-related comorbidities were consistent across BMI groups. The study concluded that severe obesity and older age do not significantly affect key outcomes of 90-day readmissions, length of stay, or 15-month mortality post-PAC discharge, and illustrated the complexity of care of older adults with high BMI who need PAC rehabilitation.

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Obesity continues to increase in epidemic proportions among older adults, affecting 41% of those aged 60 and older in the US.[1] Class 2/3 obesity combined (body mass index [BMI], ≥35), is predicted to become the most common type of obesity in adults by 2030, affecting nearly one in every four adults.[2] The current classification of obesity is based on BMI, which is calculated as body weight in kilograms (kg) divided by height in meters (m) squared (kg/m2). Overweight is defined as BMI between 25 and 29.9; class 1 obesity as BMI between 30 and 34.9; class 2 obesity as BMI between 35 and 39.9; and class 3 obesity as BMI of 40 or greater and is sometimes referred to as “morbid” or “extreme obesity.” The combined BMI class 2/3 obesity category (BMI, ≥35, also called “severe obesity”)[3] is likely to become the most common among women, non-Hispanic Black people, and low-income adults.[2] The prevalence of severe obesity has nearly doubled in nursing homes in the last two decades and continues to increase,[4] with one-third of newly admitted residents with combined class 2/3 obesity being younger than age 65.[5]

Adults with obesity have a higher incidence of stroke, coronary events, diabetes-related complications, heart failure, pulmonary illnesses (eg, chronic obstructive pulmonary disease exacerbations, pulmonary embolism), musculoskeletal and joint disorders, joint surgeries, and increased risk for falls with or without injuries.[6-11] This high burden of comorbidity among older adults with obesity[12] leads to increased risk for hospitalization. Obesity has been associated with increased inpatient health care costs.[13]

Recent studies link obesity with increased risk for hospital readmission during rehabilitation for hip fracture.[14] Compared with patients with normal weight and class 1 obesity, patients with class 2 and 3 obesity have a higher risk for potentially avoidable hospital readmissions[15] particularly due to heart failure.[16] Obesity is associated with increased readmissions among residents older than 85 compared with younger residents (65-74 years); comorbidities and type of index hospitalization (ie, surgical) accounted for some of this age difference, especially among patients with severe obesity.[17] This suggests that the relationships between severity of obesity, age, comorbidities, and hospital readmissions during rehabilitation are complex and require further study.

With the demographic shift of obesity to older adults, patients with varying degrees of obesity, including those with severe obesity (classes 2 and 3) are likely to be admitted to skilled nursing facilities (SNF) for postacute care (PAC). Yet little is known about PAC outcomes in patients with varying obesity severity and other admitting diagnoses, and in particular the contribution of age and comorbidity. Accordingly, the purpose of this research was to analyze the relationships between age, BMI class, functional impairment, comorbid conditions, and key outcomes, such as 90-day hospital readmissions, PAC length of stay, and mortality. We hypothesized that PAC patients with higher BMI, compared with those with lower BMIs, are younger, have greater functional impairment, more comorbidities, and poorer outcomes.

Methods

We retrospectively reviewed the hospital and SNF electronic medical records of patients who were discharged from the University of Michigan (UM) Hospitals to a single SNF for PAC between April 15, 2018 and October 15, 2018. Following UM Institutional Review Board approval, we obtained demographic data that included age, sex, and other data, such as reason for index hospitalization and intensive care unit use. The most common primary hospital diagnoses before PAC admission included medical issues (57%), post–elective joint surgery (15%), post–injury surgery (10%), and joint-related infection or impairment (8%). Given our focus on obesity class and severity, we included residents who were overweight (BMI, 25-29.9), residents with class 1 obesity (BMI, 30-34.9), and residents with class 2 and class 3 obesity (BMI, >35). We also reviewed hospital and SNF medical records for comorbidities, encompassing cardiac and pulmonary conditions, cancer (obesity- and non-obesity-related), diabetes, mobility limitation, obesity-associated liver disease, acute kidney injury, chronic kidney disease (CKD; including end-stage renal disease), neurologic conditions (including cognitive impairment and dementias, delirium, stroke and neuromuscular conditions, including spinal stenosis), mood disorders, dysphagia, and malnutrition. As an indicator of functional impairment, we used the raw Activity Measure for Postacute Care (AM-PAC) “6-Clicks” Inpatient Short Form to assess basic mobility and daily activity scores as documented by the hospital physical and occupational therapists during their evaluations before hospital discharge to determine rehabilitation needs in PAC. The AM-PAC “6 Clicks” instrument is a validated measure proven to predict discharge destination from an acute hospitalization and has been studied among varying ages and preadmission living situations.18-20 In addition to determining SNF length of stay, we also obtained data for acute hospital readmission within the first 90 days and 15-month survival from the day of SNF discharge.

Statistical Analysis

Continuous variables were examined for normality and outliers. Means, standard deviations medians, and interquartile ranges were calculated for continuous variables Frequencies and percentage were tabulated for categorical variables. To compare the three obesity class groups, bivariate analyses were performed using analysis of variance (ANOVA), Kruskal-Wallis test, chi-square test, and Fisher exact tests. We used Fisher exact test for those comparisons with small cells. Logistic regression models were constructed to assess the relationship between BMI 90-day readmission. Logistic regression models with interaction terms were constructed to analyze age and BMI interaction. Statistical analyses were conducted using SAS version 9.4 (SAS Institute, Inc, Cary, NC).

Results

Our analysis found that in our cohort, the mean (SD) age was 73.1 (12.3) years, the mean (SD) BMI was 34.2 (9.5), and 60% were female. The three BMI groups differed with respect to age (*P*<.0001). Those with class 2/3 obesity were younger (mean [SD] age, 66.7 [12.2]) than those with class 1 obesity (mean [SD] age, 73.7 [10.9]), and those who were overweight (mean [SD] BMI, 77.7 [11.1]) (**Table 1**). Length of SNF stay, 90-day readmission, death at 15 months, and AM-PAC "6-Click" (functional mobility) scores did not differ between BMI classes (**Table 2**).

Table 1. Characteristics of Patients Who Required Postacute Care by Obesity Class

Variables	Total Sample (n=131)	Overweight (BMI 25-29.9) (n=56)	Moderate Obesity (Class I/BMI 30-34.9) (n=32)	Severe Obesity (Class 2 and 3/BMI ≥35) (n=43)	*P*
Sex, n (%)					0.19[a]
Male	52 (39.7%)	27 (48.2%)	12 (37.5%)	13 (30.2%)	
Female	79 (60.3%)	29 (51.8%)	20 (62.5%)	30 (69.8%)	
Age (years)					
Mean (SD)	73.1 (12.3)	77.7 (11.1)	73.68 (10.9)	66.7 (12.2)	<0.0001[b]
Median (Q1, Q3)	74.1 (64.5, 82.44)	78.3 (71.0, 87.1)	73.3 (66.1, 80.7)	68.0 (58.7, 76.1)	
Index Hospitalization, No. (%)					0.81[c]
Medical	73 (55.7%)	29 (51.8%)	19 (59.4%)	25 (58.4%)	
Injury needing surgery	13 (9.9%)	9 (16.1%)	2 (6.3%)	2 (4.7%)	
Injury with no surgery	5 (3.8%)	2 (3.6%)	1 (3.1%)	2 (4.7%)	
Elective orthopedic surgery	20 (15.3%)	7 (12.5%)	5 (15.6%)	8 (18.6%)	
Others	20 (15.3%)	9 (16.1%)	5 (15.6%)	6 (14.0%)	
Intensive Care Use, No. (%)	18 (13.7%)	7 (12.5%)	5 (15.6%)	6 (14.0%)	0.92[a]
AM-PAC (PT), mean (SD)	14.9 (4.0)	14.9 (4.0)	14.7 (4.2)	15.0 (4.1)	0.95[b]
AM-PAC (OT), mean (SD)	16.6 (3.4)	16.0 (3.6)	16.5 (3.0)	17.4 (3.4)	0.19[b]
Comorbid Conditions, No. (%)					
Cardiac disease	76 (58.0%)	32 (57.1%)	21 (65.6%)	23 (53.5%)	0.57[a]
Obstructive sleep apnea and obesity hypoventilation syndrome	14 (10.7%)	3 (5.4%)	3 (9.4%)	8 (18.6%)	0.11[c]
Obesity-related cancer	12 (9.2%)	8 (14.3%)	4 (12.5%)	0 (0.0%)	0.017[c]
Diabetes mellitus	56 (42.8%)	20 (35.7%)	12 (37.5%)	24 (55.8%)	0.11[a]
Mobility limitation	35 (26.7%)	12 (21.4%)	7 (21.9%)	16 (37.2%)	0.17[a]
Obesity-related liver disease	6 (4.6%)	1 (1.8%)	0 (0.0%)	5 (11.6%)	0.028[c]
Acute kidney injury	18 (13.7%)	7 (12.5%)	7 (21.9%)	4 (9.3%)	0.28[a]
Chronic kidney disease	48 (36.6%)	15 (26.8%)	16 (50.0%)	17 (39.5%)	0.08[a]
Dementia and delirium	19 (14.5%)	10 (17.9%)	5 (15.6%)	4 (9.3%)	0.48[a]
Stroke and other neurologic condition	28 (21.4%)	12 (21.4%)	7 (21.9%)	9 (20.9%)	0.99[a]
Mood disorder	29 (22.1%)	9 (16.1%)	6 (18.8%)	14 (32.6%)	0.13[a]
Malnutrition	17 (13.0%)	11 (19.6%)	6 (18.8%)	0 (0.0%)	0.0084[a]

Abbreviations: BMI, body mass index; AM-PAC (PT), Activity Measure for Postacute Care (Physical Therapy); AM-PAC (OT): Activity Measure for Postacute Care (Occupational Therapy).

[a]Indicates chi-square test.

[b]Indicates analysis of variance (ANOVA).

[c]Indicates Fisher exact test.

Table 2. Comparison of Outcomes by Obesity Class

Variables	Total Sample (N=131)	Overweight (BMI 25-29.9) (n=56)	Moderate Obesity (BMI 30-34.9) (n=32)	Severe Obesity (BMI ≥35) (n=43)	*P*
SNF LOS					
Mean (SD)	26.7 (18.2)	26.6 (17.2)	26.2 (16.1)	27.1 (21.2)	0.99[a]
Median (Q1,Q3)	20.0 (13.0, 35.0)	21.5 (13.0, 37.0)	21.0 (13.0, 34.0)	17.0 (14.0, 35.0)	
90-day Readmission, N. (%)	52 (39.7)	18 (32.1%)	15 (46.9%)	19 (44.2%)	0.30[b]
Death at 15 Months, N(%)	29 (22.1)	16 (28.6%)	8 (25.0%)	5 (11.6%)	0.12[b]

Abbreviation: SNF LOS, skilled nursing facility length of stay.

[a]Indicates Kruskal-Wallis test.

[b]Indicates chi-square test.

The most common comorbidities across all groups were cardiac disease (58%), diabetes mellitus (43%), CKD (37%), mobility limitations (27%), mood disorders (22%), and stroke and other neurologic conditions (21%). Prevalence of obesity-related liver disease was 1.8% in the overweight BMI group, 0% in class 1, and 11.6% in class 2/3 combined (P=.028). Prevalence of obesity-related cancer was 14.3% in overweight group, 12.5% in class 1, and 0% in class 2/3 combined (*P*=.017). Prevalence of malnutrition was 19.6% in overweight group, 18.8% in class 1, and 0% in class 2/3 combined (*P*=.0084).

Logistic regression models showed a positive relationship between 90-day readmission and BMI, but not statistically significant (odds ratio [OR], 1.03; 95% CI 0.98–1.09) (**Table 3**). After adjustment for key covariates (model 3), age also showed a borderline significant association (*P*=.057); 1-year increase in age was associated with 4% decrease in odds of 90-day readmission (OR, 0.96; 95% CI, 0.93–1.00). The interaction between age and BMI was not statistically significant (*P*=.58).

Table 3. Logistic Regression Models for 90-Day Readmission Using Body Mass Index (BMI) and Age as Primary Predictors

Models	OR (95% CI)	*P*
Unadjusted		
BMI	1.03 (0.99–1.08)	0.11
Model 1[a]		
BMI	1.02 (0.98–1.07)	0.3
Age (years)	0.96 (0.93–0.99)	0.026
Model 2[b]		
BMI	1.02 (0.97–1.07)	0.42
Age (years)	0.96 (0.92–0.99)	0.026
Model 3[c]		
BMI	1.03 (0.98–1.09)	0.29
Age (years)	0.96 (0.93–1.00)	0.057

[a]Model 1 was adjusted for sex.

[b]Model 2 was adjusted for sex, diabetes, cardiac disease, pulmonary disease, and psychiatric mood disorders.

[c]Model 3 was adjusted for sex, diabetes, cardiac disease, pulmonary disease, psychiatric mood disorders, and index hospitalization diagnosis.

Discussion

To our knowledge, this is the first study to analyze the relationships between age (among older adults), BMI class, functional impairment, comorbid conditions, and key PAC-relevant outcomes, such as 90-day hospital readmissions, length of stay, and mortality. In this retrospective cohort study, among older adult residents who needed PAC rehabilitation in SNF, those with class 2 and 3 obesity were significantly younger than residents who were overweight or with class 1 obesity. This suggests that “younger” older adults with severe obesity have a level of functional impairment at the time of hospital discharge to qualify for PAC. Previous studies in PAC residents with hip fracture[14] and hospital readmissions relating to obesity[17] have shown similar trends of increasing obesity among younger age individuals.

The AM-PAC “6-Clicks” raw score did not differ significantly across BMI class; these low scores indicated the need for PAC in older adults with obesity, even in the “younger” older adults and regardless of severity of obesity and extent of comorbidities. This highlights the effect of higher BMI (ie, increased adiposity) serving as a proxy for functional impairment despite younger age.

Comorbidities were common in all BMI groups, with a few group differences. Compared with the patients with overweight and class 1 obesity, patients with class 2 and 3 obesity had higher prevalence of obesity-associated liver disease (including nonalcoholic fatty liver disease [NAFLD], nonalcoholic steatohepatitis [NASH], and NASH with fibrosis and cirrhosis), and lower rates of malnutrition and obesity-related cancer. Patients with obesity are at high risk for cirrhosis and complications given that 20% of patients with NASH develop cirrhosis,[21] and that severe obesity has been implicated in acute-on-chronic liver failure.[22] In addition, because NAFLD may be linked to type 2 diabetes mellitus, cardiovascular disease, and CKD,[23] the severity of these diseases should be monitored and addressed as necessary during PAC. Ultimately, coordination with the primary care provider and specialists at discharge may reduce the likelihood of progression to advanced liver, cardiovascular, and kidney disease.

Hospitalized older adults with obesity may be malnourished, which can manifest as over-nutrition or under-nutrition, with or without inflammatory activity, and lead to a change in body composition and diminished function.24 The lower rates of malnutrition with higher obesity class in this study may suggest the failure to diagnose malnutrition, although the sample size is small. This paradox, such that hospitalized patients with obesity are malnourished and may lack proper nutritional care, may result in adverse outcomes.[25,26] The nutritional needs during the rehabilitation phase of older adults with obesity should be evaluated, with the consideration that weight loss may also cause muscle loss in these patients who may already have reduced muscle mass for their weight (ie. sarcopenic obesity).

Finally, while obesity is associated with malignancies at 13 anatomic sites,[27,28] these cancers are often less aggressive. Consistent with this observation, the present study found that the actual cancer prevalence among the highest BMI group was lower than among the lower BMI classes.

Obesity-associated comorbidities may combine to accelerate functional decline and risk for geriatric syndromes, such as delirium and incontinence. Index hospitalizations for the present PAC cohort of older patients with obesity included the following multicomorbid examples: (1) heart failure with preserved ejection fraction and acute kidney injury due to underlying CKD; (2) delirium related to acute kidney injury with or without previous underlying cognitive impairment; (3) delirium related to pain medication use for management of chronic osteoarthritis; and (4) leg edema with cellulitis complicated by incontinence due to obesity and then worsened by frequent diuresis. Higher BMI class may also contribute to increased comorbidity severity and is associated with higher prevalence of hypertensive heart disease and metabolic syndrome and hence higher risk for stroke and coronary events.

There was no statistically significant difference between obesity class groups when analyzed for readmissions or SNF length of stay. This latter finding was anticipated because PAC length of stay is driven by the PAC copayment policy29 and hence may not reflect the time needed for full optimization of function and comorbidity treatment.

Obesity is a risk factor for disability, dependency on caregivers, increased health care use, and earlier nursing home admission.[30-32] Older adults who are discharged for PAC rehabilitation are at risk for new institutionalization in a long-term care setting.[33] More than 30% of newly admitted patients to long-term care aged 65 and older have a BMI of 30 or greater.[5] Thus, determining the trajectory of patients with obesity who demonstrate functional decline is important to determine how to slow the decline and enhance recovery. While there no guidelines of rehabilitation of adults with obesity in the PAC setting, Capodaglio and colleagues[34] have shown that a multidisciplinary team approach in the inpatient setting involving cardiorespiratory fitness, resistance training, and caloric restriction, all of which is reinforced by group educational sessions, reduced functional decline and disability. Evidence-based guidelines for PAC of adults with obesity in SNFs are lacking. There is a need for patient- and obesity-centered rehabilitation that focuses on aerobic and resistance exercise, dietary support, psychosocial support with staff training, and education to reduce weight bias as described by Seida and colleagues.[35]

Limitations and Directions for Future Research

There are several limitations in this study. First, there was no comparison group with normal or underweight BMI categories. This may be one reason for the few differences in the outcomes or comorbidities with increasing BMI. On the other hand, it is also possible that the underweight category might represent those with chronic cachexia and frailty who could exhibit equally negative outcomes or comorbidities. Another possible explanation for this lack of differences among the BMI groups is that the comorbidities and conditions that resulted in PAC admission were highly heterogenous (particularly given the chronic multisystem involvement of obesity) and lacking a measure of comorbidity severity, and thus mitigated any meaningful BMI effect. A possible comparison could be a group with equivalent functional impairment that included patients with overweight and obesity discharged from an inpatient stay and did not enter PAC (eg, a group discharged to home care); however, the group designation is likely to be biased (eg, presence of a caregiver for home care). Adding a broader range of older adults with BMI and increasing the modest sample size might give a clearer view of these relationships, particularly given that a few of the outcomes were trending but did not reach statistical significance.

Future studies might consider pre-hospital admission functional status, the living environment, and extent of caregiver support, to better understand the trajectory of decline and what might be best expected in terms of rehabilitation goals and return home. Moreover, longer term follow-up might be useful, particularly in determining whether this PAC admission was part of a longer functional decline and whether the patient eventually needed long-term care placement.

Conclusion

Among older adults with obesity and a level of functional impairment that requires PAC, older age and severe obesity do not affect key outcomes, such as 90-day hospital readmissions, SNF length of stay, or mortality. In addition, obesity severity with associated functional impairment and frequent obesity-related comorbidities present in this population may negatively influence rehabilitation course. With an increasing rate of obesity and its severity, the PAC interdisciplinary team must be aware of the medical, nutritional, and rehabilitative needs of this special population. Discharge planning of older adults with obesity should be individualized based on the complexity and severity of their comorbidities. Given the lack of prior studies on older adult PAC residents with obesity, future obesity-centered PAC studies are needed to evaluate the effect of multidisciplinary interventions on improving key outcomes, such as decreasing the need for long-term care.

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Disclosure:

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