Class II/III Obesity Prevalence in Residents of US Nursing Homes: Cross-sectional Study and Forecasting 2030 with COVID-19 Perspective

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ABSTRACT

OBJECTIVES: This study aimed to better understand Class II/III obesity prevalence trends among older adults residing in nursing homes (NH) nationwide.

METHODS: Our retrospective cross-sectional study evaluated Class II/III obesity (BMI ≥35 kg/m^2) prevalence among NH residents in two independent national NH cohorts. We used databases from Veterans Administration NHs called Community Living Centers (CLCs) covering 7 years to 2022, and Rhode Island Medicare data covering 20 years ending in 2020. We also performed forecasting regression analysis of obesity trends.

RESULTS: While VA CLC resident obesity prevalence was less overall and dipped during the COVID-19 pandemic, obesity prevalence increased in NH residents in both cohorts over the last decade and is predicted to do so through 2030.

CONCLUSION: Obesity prevalence in NHs is on the rise. It will be important to understand clinical, functional, and financial implications for NHs, particularly if predictions on increases materialize.

KEYWORDS: obesity; nursing homes; COVID-19

INTRODUCTION

The Centers for Disease Control and Prevention (CDC) reports that the US obesity prevalence was 41.5% among community-dwelling older adults. In 2019, obesity cost the US healthcare system nearly $173 billion.[1] Obesity has been associated with increased mortality rates for those hospitalized with COVID-19[2] and in older adults causes functional decline.[3,4] While obesity contributes to cardiovascular disease, type 2 diabetes mellitus, hyperlipidemia, metabolic syndrome, and cancer [5-8], it has an inverse association with mortality in patients with heart failure and chronic obstructive lung diseases.[9-11]

This paradox is relevant for older nursing home (NH) residents, who have a lower mortality rate if they are overweight and obese.[12] The COVID-19 pandemic further confounded the paradox with dramatic changes in NH care processes such as therapeutic activity, isolation, and assistance with eating. On face value, these changes could have mixed effects on diet and activity which affect those with obesity.[13,14] We undertook this cross-sectional observational study to better understand the trends of Class II/III obesity prevalence among older adults residing in NHs before and during the COVID-19 pandemic. We used two data sources to identify the national trends ,and secondarily, the trends in Rhode Island NHs. We hypothesized that Class II/III obesity prevalence would reflect the community and that the COVID-19 period would have limited effect on the trend.

METHODS

Study design

We performed a retrospective cross-sectional study using two data sources from a) Veterans Administration-managed nursing homes called Community Living Centers (CLC) and b) publicly available Medicare data from LTCFocus. We used two large datasets to demonstrate representativeness and generalizability of obesity prevalence in the nursing home population. LTCFocus data set was only available till April 2020. We included available VA dataset of 2021 and 2022 to represent COVID-19 period more precisely. We used a linear regression model to forecast future obesity prevalence rates by using past data trends. The secondary analysis of CLC data was approved by the Providence VAMC IRB and R&D committees.

DATA SOURCES

VA CLC data

Our VA CLC study population includes long-stay residents, defined as residents who resided in a community nursing home (CNH) or CLC at least 90 days over a specified year. We used data available through the VA's Clinical Data Warehouse (CDW) electronic medical records system from January 1, 2015 to October 20, 2022. The CDW contains sociodemographic characteristics and past medical history. Date cutoff for the "Pre-COVID" and "COVID" periods for CLC dataset was March 1, 2020.

Community nursing homes

For community nursing homes (CNH) we used data from the Medicare-administered Minimum Data Set which was

aggregated by LTCFocus. LTCFocus provides aggregated variables by year for all US nursing home residents from the 50 states and the District of Columbia (DC). We used LTCFocus to calculate nationwide Class II/III obesity trends from April 2015 to April 2020, with the latter being the most recent data. LTCFocus is sponsored by the National Institute on Aging (1P01AG027296) through a cooperative agreement with the Brown University School of Public Health.[15] We used the same dataset to calculate Class II/III obesity trends in Rhode Island from April, 2000 to April, 2020. Date cutoff for "Pre-COVID" and "During COVID" for the LTCFocus dataset was the April 2020 measurement.

OBESITY DEFINITION

From the VA CLC dataset, we included the closest available weight taken within ±365 days of a resident's first admission to a CLC and the Veteran's first height on the record, given the unlikely event of a significant change in height within ±365 days of their first CLC admission. After 365 days of the first index date admission, residents were eligible to be included in the subsequent year's cohort by the closest non-missing weight. We calculated BMI as weight divided by height in meters squared. We excluded residents with no data and extreme outlier values. Data was categorized according to the CDC obesity classification system. LTCFocus provides information for the proportion of residents with data on the first Thursday in April of the corresponding year who had a BMI of ≥ 35 kg/m^2 or higher. For consistency between the two datasets, we report CDC Class II/III (BMI ≥ 35 kg/m^2) in our comparisons, analyses, and forecasting.

STATISTICAL ANALYSIS

Between 2015 and 2022, yearly differences among VA CLC residents in association with BMI were analyzed using likelihood ratio tests. We also tested differences between pre- and during COVID-19 eras. Statistical analyses were conducted using R statistical software (Vienna, Austria Version 4.0.1) for CDW data and STATA 15.1 was used to perform all analyses on data collected from LTCFocus. As standardized mean difference values increase from 0, so does dissimilarity between the groups compared; we interpret values > 0.1 as potentially meaningful differences. We set significance at p values < 0.05. We applied a regression analysis model to evaluate the association between years and Class II/III obesity rate.

Forecasting

A linear regression model was used to predict future obesity prevalence rates, which assumes a linear trend in rates of obesity. Model was formalized as y=c + b*x (y= Class II/III obesity prevalence rate, c=constant, b=regression coefficient and x=year).

RESULTS

Table 1 describes selected characteristics of the two cohorts separated by the COVID-19 pandemic period. In general, VA CLC residents were younger and male with a higher prevalence of heart failure and hypertension and less dementia (See **Table 1**) relative to CNH residents. There was moderate positive correlation between Class II/III obesity rates in CNH and VA nursing homes in 2020 (r=0.39, p=0.0002) (**Figure 2**). Class II/III obesity was lower in the CLC residents relative to CNH residents.

The trend in Class II/III obesity for both cohorts is presented in **Figure 1** and detailed in **Table 2**. In both CLC and CNH residents, the prevalence of Class II/III obesity increased in long-term care residents since 2015, but the change was more pronounced in CNH (25.9% to 28.4%). In the COVID pandemic, there was a slight decrease in CLC resident Class II/III obesity, but the upward trend continued.

The forecasting analyses project significant increases in Class II/III obesity through 2030 in both cohorts with an approximate 10% increase in prevalence [VA CLC residents (R^2=0.83, F(1,14)=71.5, p<0.00001); and CNH residents (R^2=0.99, F(1,14)=29091 p<0.00001)]. Among RI CNH residents, Class II/III obesity prevalence rates more than doubled from 12.4% in 2000 to 28.6% in 2020 (**Figure 3**). The prevalence is projected to increase to 37.8% in 2030. (Forecasting regression model: Class II/III obesity prevalence rate = –1686.224 +0.8492857*year).

DISCUSSION

Using two available data sources, we observed upward trends in Class II/III obesity prevalence among nursing home residents within the last decade nationally, and also specifically in Rhode Island. Our analysis predicts that this trend will continue for the next decade. These trends add to the 2015 results of Zhang et al, for US nursing home residents from 2005 to 2015[17] and have important implications for clinicians, particularly those who care for nursing home residents.

Obesity rates in nursing homes mirror those in the general population. While Rhode Island ranked 41st among states in the US in 2021 with an adult obesity rate of 30.1%,[18] our study also shows that the population and NH prevalence are similar. However, a doubling in prevalence in RI over the past two decades [12.5% (2000) to 28.6% (2020)] and further increases forecast in RI and nationally, could generate added care burden in this healthcare sector, as older adults with obesity have a greater likelihood of eventually needing nursing home care.[19]

Rising obesity may increase the overall rate of functional disabilities in the population, producing greater needs for long-term services and supports.[20-22] More severe obesity (Class II/III) can impact functional dependence, increasing daily care needs.[19] For example, obese residents may require

Table 1. Baseline characteristics of residents before (CLC and community nursing homes) and during COVID-19.

	VA CLCs				Community Nursing Homes	
	Overall n (%)	Pre-COVID* n (%)	COVID* n (%)	RMD/ SMD	Pre-COVID* (%)	COVID* (%)
Residents (n)	208,780	168,783	39,997			
Age, years (SD)	71 (11.9)	70.8 (12)	72 (11.3)	0.10	79.1	78.1
Male	200,427 (96%)	162,225 (96.1)	38,202 (95.5)	0.03	39.8	37.0
BMI	27.6 (7.2)	27.6 (7.2)	27.7 (7.2)	0.01	NA	NA
Normal: BMI 18.5 to <25 kg/ m²	69,730 (33.4)	56,601 (33.5)	13,129 (32.8)	0.01	NA	NA
Overweight BMI 25 to <30 kg/m²	60,866 (29.1)	49,146 (29.1)	11,720 (29.3)	0.004	NA	NA
Class I Obesity BMI 30 to <35 kg/m²	35,801 (17.1)	28,816 (17.0)	6,985 (17.4)	0.01	NA	NA
Class II/III Obesity BMI ≥ 35 kg/m²	28,813 13.8	23,217 (13.7)	5,596 (13.9)	0.006	26.0	28.4
Race: White	149,381 (71.6%)	121,406 (71.9%)	27,975 (69.9%)	0.04	76.1	73.3
Long Stay >90 days	58,983 (28.3%)	4,519 (26.4%)	14,464 (36.2%)	0.21	NA	NA
Heart Failure	54,058 (25.9%)	42,529 (25.2%)	11,529 (28.8%)	0.08	20.1	22.3
Hyper-tension	172,820 (82.8%)	138,648 (82.2%)	34,172 (85.4%)	0.08	75.0	77.6
ADRD	70,164 (33.6%)	54,093 (32.1%)	16,071 (40.2%)	0.17	51.3	50.1
MACE	76,652 (36.7%)	60,242 (35.7%)	16,410 (41%)	0.10	NA	NA
Chronic pulmonary diseases	75,009 (35.9%	60,686 (36%)	14,323 (35.8%)	0.003	NA	NA

SMD: Standardized mean difference (values farther from 0 indicate dissimilar groups, and values >0.1 can be interpreted as potentially meaningful differences). NS: Non-significant; NA: Not available; ADRD: Alzheimer's disease-related dementias; MACE: Major adverse cardiac events. Class II/III obesity (BMI ≥ 35 kg/m²) *Date cutoff between "Pre-COVID" and "During COVID" for the CLC dataset was March 1st, 2020, and date cutoff between "Pre-COVID" and "During COVID" for the LTCFocus dataset was first Thursday in April of 2020.

Table 2. Overall obesity (BMI ≥ 30) and Class II/III (BMI ≥ 35) obesity prevalence in long-stay long-term care residents 2015–2022 nationally (n (%)).

	VA CLCs			Community Nursing Homes
Year	Total number CLC subjects	Obesity n (%)	Class II/III Obesity n (%)	Class II/III Obesity %
2015	35,266	10,758 (30.5)	4,760 (13.5)	25.9
2016	31,686	9,646 (30.4)	4,250 (13.4)	26.3
2017	31,571	9,741 (30.8)	4,389 (13.9)	26.8
2018	31,960	9,971 (31.2)	4,493 (14.1)	27.4
2019	32,378	10,115 (31.3)	4,528 (14.0)	28.1
2020	19,066	5,820 (30.5)	2,541 (13.3)	28.4
2021	18,290	5,787 (31.6)	2,619 (14.3)	N/A
2022	8,563	2,776 (32.4)	1,233 (14.4)	N/A

Obesity (BMI ≥ 30), Class II/III obesity (BMI ≥ 35)

Figure 1. Trends in Class II/III obesity prevalence rates in long-stay nationwide VA CLC residents and nationwide community NH residents from 2015 with forecasted Class II/III obesity prevalence rate to 2030 (dashed lines).

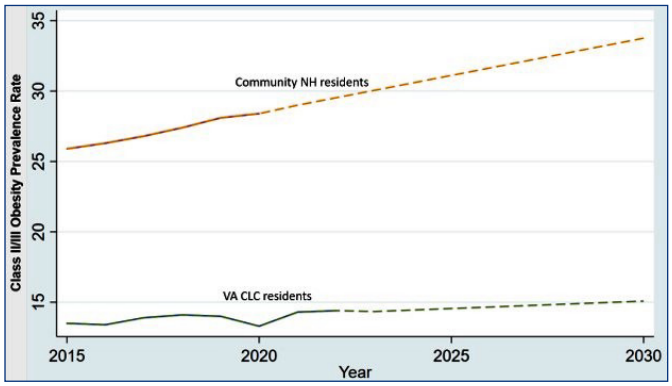


Figure 2. Correlation Plot of Community Living Center and Community Nursing Home Class II/ III Obesity Prevalence in 2020 (r=0.53, p=0.0002) (Rhode Island and Alaska do not have CLCs and are not included).

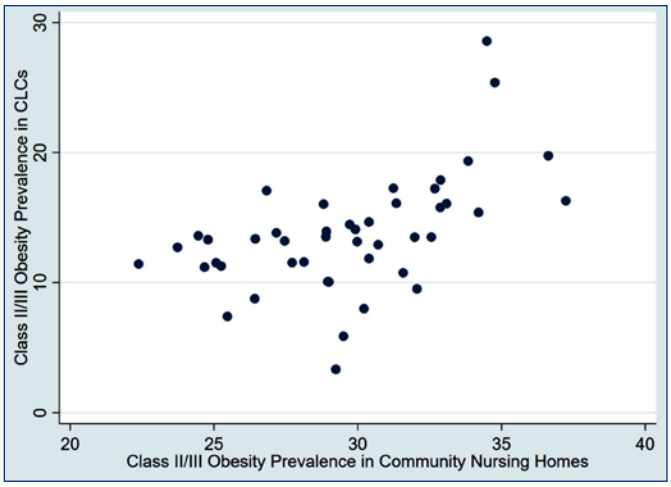
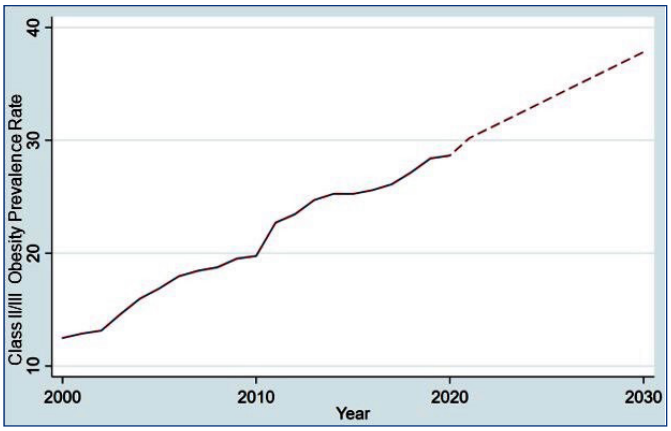


Figure 3. Trend in Class II/III obesity prevalence rate in RI community NH residents from 2000 to 2020, and forecasted obesity prevalence rate among same population to 2030 (dashed line).



more personal care assistance, often from two or more helpers. Residents with Class II/III obesity may need special equipment including enhanced designed wheelchairs, commodes, lifts, and basic diagnostic tools such as larger sphygmomanometer cuffs.[23] Obesity can potentially impact access to NHs, structural preparedness of NHs to respond to the needs of obese residents, and quality care of individuals admitted to NHs.

Obesity, as part of the metabolic syndrome, often presents with a constellation of glucose impairment, hypertension, and hyperlipidemia. The prevalence of metabolic syndrome increases to 42% by age 70.[24] This increase is mainly due to predisposing conditions including obesity, insulin resistance, inflammation, hypertension, which all increase with aging. [25] With aging, metabolic syndrome increasingly contributes to the risk for development of cardiovascular comorbidity, functional decline, and mortality. Major clinical implications of Class II/III obesity on older adults include increased risk of type-2 diabetes, high blood pressure, cardiovascular diseases and stroke.[7] These conditions help explain why NH residents with Class II/III obesity have higher mortality (OR 1.75; 95% CI, 1.10–2.80).[26] Unfortunately, the metabolic syndrome, obesity and related conditions remain understudied for nursing home residents.

A major strength of this study is the use of two national data sources from independent sample populations across the US, inferring highly generalizable findings. The CLC dataset allows for estimation of pre- and intra-pandemic obesity prevalence rates. The historical data permit linear regression-based forecasting for future obesity. More accurate and sensitive forecasting models are necessary to better understand and prepare for the impact of the worsening obesity epidemic in US NH residents.

Limitations

We note four significant limitations. First, LTCFocus does not report obesity according to the CDC obesity classification. We focused our analyses on Class II/III obesity for consistency across systems. Second, as one long-term resident may appear in several yearly cohorts means we cannot interpret changes in incidence as compared with prevalence. Third, height is collected less frequently than weight in these settings, and this may bias the ascertainment of BMI. Finally, our forecasting approach assumes a linear change in obesity rates and if rates change non-linearly may be biased, and forecasting would also benefit from inclusion of other predictors (such as case-mix, age, gender, etc.).

CONCLUSION

We found that there is an upward trend in the Class II/III obesity prevalence rate among VA CLC residents and nationwide CNH residents. We are forecasting that this trend will continue and expect it will impact the care and clinical health of NH residents, particularly the group with metabolic syndrome. Given structural, functional, and medical complexity, and the impact of obesity on NHs and NH residents, dynamic health policy changes and their implementation into the NH system are needed.

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