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Title of Project. Safety Outcomes of Obese Residents in US Nursing Homes

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Report

1. Structured Abstract: *Purpose:* Document and compare nursing home (NH) resident outcomes by obesity status, characterize NHs that experience high rates of adverse outcomes, and explore NH staff experiences in the care of obese residents. *Scope:* Obesity rates among US NH residents are increasing. NHs are ill prepared to care for residents with obesity, resulting in poor and unsafe care that leads to adverse outcomes. *Methods:* Existing data were used to compare NH resident outcomes by obesity status and characterize NHs that experience high rates of adverse outcomes among obese residents. Qualitative interviews were used to explore NH staff experiences caring for obese residents. *Results:* Compared with normal weight, obesity was associated with clinically lower rates of falls, falls with injuries, and pressure injuries. There were significant differences in NHs with high and low rates of falls, falls with injuries, pressure injuries, and urinary tract infections (UTIs) among their obese residents. NH directors of nursing reported 1) challenges admitting obese persons, 2) the need for more staff education to provide proper care for obese residents, 3) that desirable weight loss among obese residents is possible with an interdisciplinary team and consistent effort over time, 4) that caring for young obese people in NHs with mostly older adults was complex, and 5) that limited resources make transitioning short-term residents with obesity out of the NH difficult. *Key Words:* Obesity, Nursing Homes, Quality of Care, Long-term Care, Patient Safety

2. Purpose. The overarching goal of the study was to describe and compare patient safety (henceforth, resident safety) outcomes among obese and non-obese residents of NHs in the US. The goal was achieved through execution of three specific aims:

Aim 1. Document and compare key resident safety outcomes between obese and non-obese NH residents.

Aim 2. Identify the resident, facility, and community factors that characterize NHs in which obese residents experience high rates of adverse safety events.

Aim 3. Explore the experiences of NH staff regarding disparities in resident safety among obese NH residents and their recommendations to prevent and eliminate obese resident safety disparities.

3. Scope. Background/Context. The US obesity epidemic now affects one third of adults.(1) As the population ages, persons with obesity (BMI \geq 30) are growing older(2) and increasingly needing NH care at significantly younger ages than their non-obese peers.(3) Our previous analysis found, over the last 10 years, there has been a significant increase in the proportion of NH residents who are obese, with 1 in 4 residents now severely obese (BMI \geq 35).(4) Ensuring high-quality care for all NH residents is a national priority, and resident safety is a priority issue.(5)

The scant existing literature shows that obesity complicates NH care. (3, 6-8) Residents with obesity have significantly more functional limitations, require significantly more assistance from staff for basic activities of daily living,(3, 9) have higher rates of urinary catheterization at admission,(10) and have different nutritional needs(11) than non-obese residents. Specific protocols to prevent/treat skin breakdown(12) and minimize falls/injuries in transfer(13-15) are required for their care to prevent negative outcomes. NHs are not prepared to provide this specialized care,(16) and this presents unsafe environments in which obese persons must reside.(17) Poor and unsafe NH care leads to adverse safety events. For example, lack of appropriately sized beds and mattresses can lead to the rapid development of pressure injuries

among obese residents.(17) Yet, the literature lacks coverage of NH-related factors contributing to adverse safety events among NH residents with obesity.

Settings: US nursing homes.

Participants. See Table 1 for enrollment numbers of participants. For Aim 1, participants

Table 1. Enrollment Tables									
For Aim 1 - Nursing Home Residents									
FIRST QUARTERLY ASSESSMENT & LOS>= 100 DAYS & NON-MISSING BMI									
	not Hispanic			Hispanic			unknown ethnicity		
	female	male	unknown	female	male	unknown	female	male	unknown
AIAN	3,344	2,793	0	10	11	0	0	0	0
Asian	15,935	9,642	0	7	3	0	0	0	0
NHOPI	1,085	786	0	1	1	0	0	0	0
Black	110,240	88,033	0	35	28	0	0	0	0
White	675,609	336,247	0	358	232	0	0	0	0
Multiple	2,028	1,298	0	4	0	0	0	0	0
Unknown	16,323	10,753	0	40,495	34,253	0	485	314	0
Total	824,564	449,552	0	40,910	34,528	0	485	314	0
For Aim 2 – Nursing home residents aggregated to the nursing home level									
QUARTERLY ASSESSMENTS WITH BMI>=30 & LOS>=100 DAYS									
	not Hispanic			Hispanic			unknown ethnicity		
	female	male	unknown	female	male	unknown	female	male	unknown
AIAN	1,803	1,363	0	5	7	0	0	0	0
Asian	3,535	1,701	0	2	2	0	0	0	0
NHOPI	499	326	0	2	0	0	0	0	0
Black	66,988	40,267	0	20	9	0	0	0	0
White	328,453	156,503	0	150	95	0	0	0	0
Multiple	599	312	0	1	0	0	0	0	0
Unknown	8,633	4,909	0	18,884	13,856	0	241	135	0
Total	410,510	205,381	0	19,064	13,969	0	241	135	0
For Aim 3 – Nursing Home Directors of Nursing									
	not Hispanic			Hispanic			unknown ethnicity		
	female	male	unknown	female	male	unknown	female	male	unknown
AIAN	0	0	0	0	0	0	0	0	0
Asian	2	0	0	0	0	0	0	0	0
NHOPI	0	0	0	0	0	0	0	0	0
Black	0	0	0	0	0	0	0	0	0
White	10	1	0	0	0	0	2	0	0
Multiple	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0
Total	12	1	0	0	0	0	2	0	0

Notes: AIAN=American Indian/Alaskan Native, BMI=Body Mass Index, LOS=Length of Stay, NHOPI=Native Hawaiian and other Pacific Islander

were long-stay (stay ≥ 100 days) residents in US NHs between 2017-2018. For aim 2, the unit of analysis was NH quarterly data using aggregated quarterly assessments among long-stay residents with obesity (BMI ≥ 30). Only complete records were included in the aims. Age of residents was top-coded at 89 years, and NH quarters with fewer than 11 residents with obesity were excluded from the aim 2 analysis for privacy reasons. For aim 3, participants were currently employed in a NH, were over the age of 18 years, had current or past experience as a director of nursing (DON), were willing to participate in a recorded interview, and were able to speak and understand English.

Incidence and Prevalence. The prevalence rate of obesity within US nursing homes was estimated to be 28% in 2015. The prevalence rate of obesity overall, and among class III obesity (BMI ≥ 40) increased in US NHs between 2005 and 2015.(18)

4. Methods

Aim 1. Document and compare key resident safety outcomes between obese and non-obese NH residents.

Study Design. This study used a cross-sectional observational design.

Data Sources/Collection. Resident-level data came from the Minimum Data Set (MDS) quarterly assessments in 2017-2018. The MDS contains federally required data on health conditions, characteristics, and care needs of all US NH residents. NH facility characteristics (e.g., size, ownership type, inspection deficiencies) are obtained through federal inspections and are contained in CMS' Certification and Survey Provider Enhanced Reporting (CASPER) dataset and the LTCFocus dataset available from Brown University. These facility data do not contain protected health information that would allow for the identification of individuals. Community characteristics (e.g., percentage of population < 65 years, percentage of county with BMI ≥ 30) came from the Area Health Resource File, US Census data, County Health Rankings, or other publicly available sources.

Interventions. Not applicable.

Measures. There were four outcome variables for Aim 1: falls, falls with injuries, pressure injuries and UTIs among NH residents. These were set up as dichotomous variables indicating whether a NH resident had had the outcome (coded as 1) or not (coded as 0).

The independent variable of interest was the first quarterly assessment obesity status for residents. BMI classes were used to assess obesity state (underweight [BMI = 18.5], normal weight [BMI = 18.5-24.5], overweight [BMI = 25-30], obesity class 1 [BMI = 30-<35], obesity class 2 [BMI = 35-<40], and obesity class 3 [BMI ≥ 40]). Other variables in the model included age, gender, race, marital status, length of stay in the NH, make self understood, understands others, level of support for various activities of daily living (bed mobility, transfer, walking in corridor, locomotion on unit, locomotion off unit, dressing, eating, toileting, personal hygiene, bathing, walking in room), and facility characteristics (chain affiliation, number of beds, for profit status, acuity index, total health inspection deficiencies, total severe health inspection deficiencies), and the Herfindahl-Hirschman Index (HHI), a measure of market competition.

Limitations. Due to model convergence issues, we were unable to include all of the county- and state-level variables in our hierarchical model. This resulted in omitted variable bias. Nevertheless, our limited findings help to fill the gap in the literature on variation in adverse safety outcomes between obese and non-obese NH residents.

Aim 2. Identify the resident, facility, and community factors that characterize NHs in which obese residents experience high rates of adverse safety events.

Study Design. The study used a cross-sectional observational design.

Data Sources/Collection. Resident-level data came from the Minimum Data Set (MDS) assessments in 2017-2018 but was aggregated to the level of the NH quarter. NH facility characteristics (e.g., size, ownership type, inspection deficiencies) that are obtained through federal inspections came from CMS' Certification and Survey Provider Enhanced Reporting (CASPER) dataset and the LTCFocus 2017-2018 dataset. These facility data do not contain protected health information that would allow for the identification of individuals. Community characteristics (e.g., percentage of population < 65 years, percentage of county with BMI \geq 30) came from the Area Health Resource File, US Census data, County Health Rankings, or other publicly available sources. State Medicaid per diem was from Genworth Financial, Inc.

Interventions. Not applicable.

Measures. There were four outcome variables of interest among residents with obesity for Aim 2: rates of falls, falls with injuries, pressure injuries and UTIs. These outcomes in each NH were categorized into four groups: zero percent of the rate of the outcome, quartile 1 of the rate of the outcome, quartile 2 of the rate of the outcome, and quartile 3 of the rate of the outcome. The zero percent and quartiles 1 and 2 were combined to represent low rates of the outcomes (separately for each of the four outcomes), and quartile 3 represented high rates of the outcomes (separately for each of the four outcomes). Structure characteristics included occupancy rate, chain affiliation, for-profit status, the Herfindahl-Hirschman Index (HHI, sum of the NH market share of beds squared for that county) as a measure of competition, and size in categories based on number of beds: small facilities of \leq 100 beds, medium facilities of 101-150 beds, and large facilities of $>$ 150 beds. Process measures included percent of residents who were restrained, acuity index, skill mix (ratio of registered nurses (RN) to other nurses), the number of RN hours per patient day (HRPPD), the number of Licensed Practical Nurse (LPN) HRPPD, the number of Certified Nursing Assistant (CNA) HRPPD, the number of severe life safety inspection deficiencies, and the number of severe health inspection deficiencies. Resident antecedent conditions included the percent of all residents on Medicaid, percent of all residents on Medicare, percent of racial/ethnic minority residents, and the percent of all residents with obesity (divided into quartiles). Environmental characteristics included rurality (measured by CBSA), county income, percent of racial/ethnic minorities in the county, percent of residents of county under the age of 65 years, and county obesity rate.

Limitations. There were more than 15,000 NHs included in the facility-level dataset. Because we only included NHs with complete information, our final sample included only 8,814 individual NHs. It is possible that NHs with missing information are different from NHs with complete information, thereby introducing selection bias into our results. Despite this limitation, this is one of the first studies to examine adverse safety outcomes among residents with obesity and organizational factors related to those adverse outcomes.

Aim 3. Explore the experiences of NH staff regarding disparities in resident safety among obese NH residents and their recommendations to prevent and eliminate obese resident safety disparities.

Study Design: This study employed a qualitative descriptive design.

Data Sources/Collection. We drafted a semi-structured questionnaire based on our conceptual framework that was reviewed by our external advisory board. The questionnaire was then field tested with five interviews at the National Association of Directors of Nursing

Administration's (NADONA) annual conference in 2019. No changes were made to the questionnaire, so the original questionnaire was used for the remaining data collection. Target respondents were DONs of US NHs. Recruitment for additional interviews took place at NADONA's 2020 conference, which was converted to a virtual conference due to the COVID-19 pandemic. Recruitment suffered from the new conference format and DONs' focus on their facilities during the pandemic. Additional strategies were employed for recruitment, including word of mouth and posting notices on nursing and geriatric association blogs. Remuneration was initially a \$50 gift card but was increased to a \$100 gift card due to recruitment issues. Data collection was either in person or via internet streaming video. All interviewers were recorded and later transcribed for analysis purposes. Transcripts were coded individually and then reviewed jointly by two investigators using a priori codes derived from the study's conceptual framework and new codes derived from emerging interview content.

Interventions. No intervention took place through this study aim.

Measures. Given that this was a qualitative aim, there were no statistical analyses performed and no actual measures used. However, codes were created to categorize content and themes of the interview data. Initial codes were drawn from our conceptual framework: antecedents, structure, process, and outcomes. Subcategory codes for antecedents were environment, NH, individual personal characteristics. Subcategory codes for structure were equipment, physical environment, staffing and organizational characteristics. Subcategory codes for process were professional staff, residents with obesity, and family members. Subcategory codes for outcomes were residents with obesity, staff, and NHs.

Limitations. It is possible that our study suffered from self-selection bias where those with a strong interest in the care of NH residents with obesity agreed to participate in the semi-structured interviews. Additionally, our sample of 15 participants limited diversity of participant demographics. Nevertheless, the perspectives of these participants are relevant, given the limited coverage of this topic in the existing literature.

5. Results

Aim 1

Principal Findings. We found that the rate of obesity in US NHs was 28.3%. Overall, 21.1% of residents experienced a fall. Rate of falls was highest among underweight residents (23.8%) and lowest among residents with class 3 obesity (13.7%). Overall, 6.9% of residents experienced a fall with an injury. Rates of falls with injuries was highest among underweight residents (8.9%) and lowest among residents with class 3 obesity (3.7%). Overall, the rate of stage 2-4 pressure injuries was 4.5%. Rates of stage 2-4 pressure injuries was highest among underweight residents (7.7%) and lowest among residents with class 1 obesity (3.7%). Overall, 3.1% of residents had a UTI. Rates of UTIs were highest among residents with class 3 obesity (3.6%) and

Table 2. Rates of Adverse Safety Events by BMI Category

	Falls	Falls with injuries	Pressure Injuries	UTIs
Underweight	23.8%	8.9%	7.7%	2.8%
Normal Weight	23.5%	8.2%	4.8%	3.1%
Overweight	21.0%	6.7%	3.9%	3.1%
Class 1 obesity	18.9%	5.7%	3.7%	3.1%
Class 2 obesity	17.1%	4.9%	3.8%	3.3%
Class 3 obesity	13.7%	3.7%	4.1%	3.6%
Overall	21.1%	6.9%	4.5%	3.1%

Notes: BMI=Body Mass Index, UTI=Urinary Tract Infection

lowest among underweight residents (2.8%). The variation in rates of the four adverse safety events across the BMI categories was significant (each chi square $p < 0.001$).

Due to the large sample size ($n=1,350,353$), many associations assessed in the multivariate logistic regressions were statistically significant but not likely clinically significant (i.e., ORs were very close to 1.0). We elected to focus on more clinically meaningful results, which we defined as having a relative difference of 10% or more (i.e., an aOR ≤ 0.9 or ≥ 1.1). In our preliminary analysis, we examined characteristics of NH residents and NHs that were associated with the four adverse resident outcomes. For the falls model, we found that increasing BMI was a protective factor for falls, after accounting for resident personal and clinical characteristics and facility characteristics. Specifically, relative to normal weight residents, residents who were overweight were 10.1% less likely to fall (SE=0.01, $p < 0.001$), residents who were obese class 1 were 17.8% less likely to fall (SE=0.01, $p < 0.001$), residents who were class 2 obese had 22.0% less likely to fall (SE=0.01, $p < 0.001$), and residents who were class 3 obese were 34.2% less likely to fall (SE=0.01, $p < 0.001$). Women had significantly lower odds of falling than men did (OR=0.80, SE=0.00, $p < 0.001$). Relative to White residents, Black residents were 30.7% less likely to fall (SE=0.01, $p < 0.000$), Hispanics were 22.7% less likely to fall (SE=0.01, $p < 0.000$), and residents of other racial/ethnic groups were 19.9% less likely to fall (SE=0.01, $p < 0.000$). Relative to making self understood, those who usually made self understood or sometimes made self understood were significantly more likely to experience a fall (OR=1.29, SE=0.01, $p < 0.001$; OR=1.28, SE=0.01, $p < 0.001$; OR=0.84, SE=0.01, $p < 0.001$, respectively). Relative to those needing help staff, those who needed one person to help with bed mobility were significantly less likely to fall (OR=0.69, SE=0.01, $p < 0.001$). Relative to those needing no help to transfer, those who needed one person to assist with transfers had significantly greater odds of falling (OR=1.28, SE=0.02, $p < 0.001$), and those who needed two+ persons to assist had significantly lower odds of falling (OR=0.58, SE=0.02, $p < 0.001$). Relative to those who do not walk in the corridor, those who need one or two+ persons to assist with walking in the corridor were significantly more likely to experience a fall (OR=1.11, SE=0.01, $p < 0.001$; and OR=1.28, SE=0.03, $p < 0.001$). Relative to those who need to help to engage in locomotion on the unit, those needing two or more staff to assist were significantly less likely to experience a fall (OR=0.48, SE=0.01, $P < 0.001$). Relative to needing no assistance to dress, those who needed some set-up help, help from one person, or help from two+ persons were 17.5% (SE=0.02, $p < 0.001$), 24.8% (SE=0.02, $p < 0.001$), and 28.6% (SE=0.17, $p = 0.05$) more likely to fall, respectively. Those who needed two+ persons to assist with eating were 32.5% (SE=0.10, $p = 0.006$) less likely to have a fall than those who needed no help to eat. Compared with those who needed no help bathing, those who needed some set-up help or two+ persons to assist with bathing were significantly more likely to experience a fall (OR=1.30, SE=0.02, $p < 0.001$, and OR=1.46, SE=0.03, $p < 0.001$, respectively). Residents in a for-profit facility were significantly less likely to experience a fall than those in a non-profit facility (OR=0.87, SE=0.01, $p < 0.001$). Residents in facilities with a higher HHI were significantly more likely to experience a fall than were those in facilities with a lower HHI (OR=1.18, SE=0.02, $p < 0.001$).

For the falls with injury model, underweight residents were 18% more likely to experience a fall with injury than a normal-weight resident (SE=0.02, $p < 0.001$). Relative to normal weight, obesity was an increasing protective factor: overweight (OR=0.84, SE=0.01, $p < 0.001$), obese class 1 (OR=0.75, SE=0.01, $p < 0.001$), obese class 2 (OR=0.69, SE=0.01, $p < 0.001$), obese class 3 (OR=0.58, SE=0.01, $p < 0.001$). Women were significantly less likely to experience a fall with an injury than men were (OR=0.77, SE=0.01, $p < 0.001$). Relative to White residents, residents who were Black, Hispanic, and or of another racial/ethnic group were significantly less likely to have a fall with injury (OR=0.37, SE=0.01, $p < 0.001$; OR=0.71, SE=0.02, $p < 0.001$; and OR=0.68, SE=0.02, $p < 0.001$, respectively). Married residents were 12% more likely to have a fall with injury than non-married residents (SE=0.01, $p < 0.001$). Compared with those who make

self understood, those who usually are understood or sometimes understood were 29% (SE=0.01, $p<0.001$) and 31% (SE=0.02, $p<0.001$) more likely to experience a fall with injury, respectively. Residents who needed one person to assist with bed mobility were 34% (SE=0.02, $p<0.001$) less likely to experience a fall with injury than those who did not any need support for bed mobility. Compared with those who needed no transfer assistance, those who needed set up (OR=1.25, SE=0.03, $p<0.001$) or one person to help with transfers (OR=1.13, SE=0.03, $p<0.001$) were significantly more likely to experience a fall with injury; conversely, those who needed two+ persons to assist with transfers were less likely to experience a fall with injury (OR=0.65, SE=0.05, $p<0.001$). Compared with those who needed no help to walk in the corridors, those who needed one person to assist were significantly less likely to experience a fall with injury (OR=1.11, SE=0.04, $p<0.001$). Those who needed two+ persons to assist with locomotion on the unit were 47% (SE=0.02, $p<0.001$) less likely to experience a fall with injury than those who needed no assistance. For locomotion off the unit, those who needed assistance from one person were more likely to experience a fall with injury than those who needed no assistance (OR=0.88, SE=0.03, $p<0.001$). Those who needed progressing levels of support for dressing from set-up (OR=1.20, SE=0.03, $p<0.001$) to one person assist (OR=1.34, SE=0.04, $p<0.001$) to two+ persons assist (OR=1.53, SE=0.30, $p=0.03$) were significantly more likely to experience a fall with injury than were those who needed no assistance to dress. Residents who needed set up help or needed one person assist with toileting were significantly more likely to have a fall with injury than those who needed no assistance with toileting (OR=1.22, SE=0.03, $p<0.001$ and OR=1.44, SE=0.04, $p<0.001$, respectively). Relative to needing no assistance to walk in one's room, residents who needed one person to assist them were 30% more likely to experience a fall with injury (SE=0.04, $p<0.001$) whereas those who needed two+ persons to assist were 34% less likely to experience a fall with injury (SE=0.02, $p<0.001$). Residents in for-profit NHs were 18% less likely to experience a fall with injury than were those in a not-for-profit NH (SE=0.01, $p<0.001$). Residents in NHs with higher HHIs were 25% more likely to experience a fall with injury than were residents in NHs with lower HHIs (SE=0.03, $p<0.001$).

For the pressure injury model, underweight residents were significantly more likely (OR=1.55, SE=0.02, $p<0.001$) to experience a pressure injury than normal-weight residents. Relative to normal-weight residents, overweight (OR=0.78, SE=0.01, $p<0.001$) and obese (class 1 obesity: OR=0.71, SE=0.01, $p<0.001$, class 2 obesity: OR=0.67, SE=0.01, $p<0.001$, class 3 obesity: OR= 0.59, SE=0.01, $p<0.001$) residents were significantly less likely to experience a pressure injury. Female residents were 15% less likely (SE=0.01, $p<0.001$) to experience a pressure injury compared with male residents. Black residents (OR=1.31, SE=0.02, $p<0.001$) were significantly more likely to experience a pressure injury than were White residents. Residents who were progressively less likely to make themselves understood were significantly more likely to experience a pressure injury than residents who were able to make themselves understood (OR=0.73, SE=0.01, $p<0.001$; OR=0.69, SE=0.01, $p<0.001$, OR=0.86, SE=0.02, $p<0.001$, respectively). Residents who needed set up help or assistance from one person for bed mobility were significantly more likely to experience a pressure injury (OR=1.18, SE=0.05, $p<0.001$ and OR=1.61, SE=0.08, $p<0.001$, respectively) than were residents who needed no assistance for bed mobility. Residents who needed set-up help to transfer were 19% less likely (SE=0.04, $p<0.001$) to experience a pressure injury compared with those who needed no assistance for transfers. In contrast, residents who needed one person or two+ persons to assistant with transfers were 54% (SE=0.07, $p<0.001$) and 70% (SE=0.09, $p<0.001$) more likely to experience a pressure injury than those who needed no assistance for transfers. The more assistance residents needed to walk in the corridor, the more likely they were to experience a pressure ulcer (set-up assistance: OR=1.31, SE=0.07, $p<0.001$; one person assistance: OR=1.31, SE=0.09, $p<0.001$; and two+ person assistance: OR=2.19, SE=0.12, $p<0.001$). Residents who needed set up assistance for locomotion off the unit were 10% less likely to

experience a pressure injury (SE=0.02, $p<0.001$) than were those who needed no assistance for locomotion off the unit. Residents who needed one person to assist with locomotion off the unit were 13% more likely to experience a pressure injury (SE=0.04, $p=0.005$) than were those who needed no assistance for locomotion off the unit. Residents who needed set-up assistance for eating (OR=1.22, SE=0.01, $p<0.001$) and who needed assistance from one person for eating (OR=1.33, SE=0.07, $p<0.001$) were more likely to experience a pressure injury than were those who needed no assistance with eating. Residents who needed set-up assistance or two+ persons for assistance with toileting were 17% (SE=0.06, $p=0.003$) and 85% (SE=0.17, $p<0.001$) more likely, respectively, to experience a pressure ulcer compared with those who needed no assistance for toileting. Residents who needed progressively more assistance with personal hygiene (set-up assistance: OR=.76, SE=0.03, $p<0.001$; one person assistance: OR=0.78, SE=0.03, $p<0.001$; two+ person assistance: OR=0.51, SE=0.14, $p=0.01$) had increasing odds of experiencing a pressure injury compared with those who needed no assistance for personal hygiene. Residents who needed one person assistance or two+ person assistance for bathing were 31% (SE=0.07, $p<0.001$) and 29% (SE=0.08, $p<0.001$) more likely, respectively, to experience a pressure injury than were residents who needed no assistance for bathing. Residents who need set-up help to walk in their room were 38% (SE=0.07, $p<0.001$) more likely to experience a pressure injury than were residents who needed no assistance. Residents who needed one person to two+ person assistance to walk in their room were 26% (SE=0.08, $p<0.001$) and 123% (SE=0.12, $p<0.001$) more likely to experience a pressure injury than were residents who needed no assistance to walk in their room.

For the UTI model, residents who were underweight relative to being normal weight had significantly lower odds of experiencing a UTI (OR=0.86, SE=0.02, $p<0.001$). Women had significantly greater odds of experiencing a UTI (OR=1.30, SE=0.02, $p<0.001$) than did men. Black residents, Hispanic residents, and residents of other racial/ethnic groups had significantly lower odds of experiencing a UTI (OR=0.74, SE= 0.02, $p<0.001$; OR=0.81, SE=0.03, $p<0.001$; and OR=0.85, SE=0.03, $p<0.001$, respectively) than White residents. Residents who were sometimes understood (OR=0.80, SE=0.02, $p<0.001$) or were rarely/never understood (OR=0.55, SE=0.02, $p<0.001$) were significantly less likely to experience a UTI than residents who were understood. Residents who needed assistance with transfers had significantly higher odds of experiencing a UTI than those who needed no assistance for transfers (set-up assistance: OR=1.19, SE=0.04, $p<0.001$; one person assistance: OR=1.43, SE=0.06, $p<0.001$; and two+ person assistance: OR=1.18, SE=0.08, $p=0.01$). Relative to needing no assistance to walk in corridors, persons who need set-up help or two+ person assistance to walk in corridors were significantly more likely to experience a UTI (OR=1.12, SE=0.04, $p=0.002$ and OR=1.27, SE=0.05, $p<0.001$, respectively). Residents who needed two+ person assistance for locomotion on the unit were 33% (SE=0.06, $p<0.001$) more likely to experience a UTI than residents who needed no assistance with locomotion on the unit. Residents who needed one person assistance for dressing were 11% (SE= 0.05, $p=0.018$) more likely to experience a UTI than residents who needed no assistance for dressing. Residents who needed progressively more assistance with toileting had greater odds of experiencing a UTI than residents who needed no assistance with toileting (set-up assistance: OR=1.48, SE=0.06, $p<0.001$; one person assistance: OR=1.46, SE=0.06, $p<0.001$; two+ person assistance (OR=1.50, SE=0.20, $p=0.002$). Relative to needing no assistance with personal hygiene, residents who needed set-up help for personal hygiene had significantly lower odds of experiencing a UTI (OR=0.90, SE=0.03, $p=0.002$). Residents who needed progressively more assistance walking in their room were more likely to experience a UTI than residents who needed no assistance (set-up assistance: OR=1.18, SE=0.04, $p<0.001$; one person assistance: OR=1.35, SE=0.07, $p<0.001$; and two+ person assistance: OR=1.23, SE=0.05, $p<0.001$). Residents who resided in NHs affiliated with chains were significantly less likely (OR=0.87, SE=0.02, $p<0.000$) to experience a

UTI than residents who resided in NHs not affiliated with chains. Residents of for-profit NHs were less likely to experience a UTI than residents of not-for-profit NHs. Residents of NHs with high HHIs had significantly greater odds (OR=1.35, SE=0.05, $p<0.001$) of experiencing a UTI than residents of NHs with lower HHIs.

Outcomes. There are no outcomes other than the principal findings.

Discussion. This study examined whether NH residents with obesity (based on BMI classes) on their first quarterly assessment after having been in the nursing home at least 100 days were more likely to experience adverse safety events (as measured by falls, falls with injuries, pressure injuries and UTIs) than residents without obesity. We found that obesity rates in our 2017-2018 data of 28.3% were similar to obesity rates in NHs reported for 2015. (18) This shows a slower increase in obesity in NHs than shown among the general population for a similar time frame.(19) Our expectation was that residents with obesity would have higher rates of adverse safety events than their non-obese peers. However, our preliminary findings did not support our expectations. In fact, across the adverse safety events, we found that obesity was actually a protective factor for three of the four outcomes: falls, falls with injuries and pressure injuries. There was no difference found between being of normal weight and being obese and experiencing a UTI in the fully adjusted model. Being underweight increased the odds of experiencing a fall, fall with injury, or pressure ulcer but was protective of experiencing a UTI.

For falls and falls with injuries, our preliminary findings are supported by existing research that found that residents with obesity were less likely to fall or experience a fall-related hip fracture than their normal-weight peers.(20)

Previous research has noted that being underweight is a risk factor for development of pressure injuries, and obesity reduces the risk.(21) However, a systematic review and meta-analysis found the odds of pressure injuries among persons with obesity versus those who were not obese was not significant.(22) However, recent research in 2023 has identified a U-shaped relationship between obesity and pressure injuries. Specifically, for every one-unit increase in BMI, the risk of a pressure injury decreased by 8.6% until BMI reached 27.5. For every one-unit increase in BMI after 27.5, the risk of a pressure injury increased by 1.4%.(23) Our preliminary research did not detect the U-shaped relationship between obesity and pressure injuries. It is possible that the variables excluded from the preliminary analyses masked the actual relationship or that our use of quarterly assessments among long-stay residents leads to different findings. Therefore, it is important to conduct additional research to verify the findings to provide more clarity about the relationship between obesity and pressure injuries.

Studies have shown a strong association between obesity and risk for contracting UTIs. For example, a study of 5 years of medical claims data of 95,598 patients revealed that, at all levels of obesity, there was a significant association between obesity and the likelihood of contracting a UTI(24). A meta-analysis of 19 studies found a significantly higher risk for contracting UTIs among individuals with obesity (Relative Risk: 1.45, 95% Confidence Interval (CI): 1.28-1.63) (25). Finally, a study in Korea found that middle-aged and older adults with obesity were 66% more likely to contract a UTI than their normal weight peers(26). Although our descriptive statistics showed a slightly higher rate of UTIs among residents with class-3 obesity compared with residents of normal weight, the multivariate analysis did not find that any of the obesity classes had a clinically significant increased likelihood of contracting UTIs. It is possible that the present results suffer from omitted variable bias that hides a possible relationship between obesity and contracting UTIs. More research with additional resident, county, and state variables should be undertaken to complement our preliminary findings.

Conclusions. Contrary to our expectations, we did not find that obesity was clinically significantly associated with the four adverse safety outcomes: falls, falls with injuries, pressure

injuries, or UTIs. Additional research is warranted to include other variables of importance to verify or disprove current findings.

Significance. Although obesity rates are increasing among NH populations, it does not appear that obesity is associated with adverse safety outcomes, indicating that they are not a more challenging resident population as suggested by previous reports or that obese patients are getting the care that they need to prevent such events.(16)

Implications. In the preliminary analysis, we accounted for resident demographic characteristics, length of stay, being understood, and level of support to perform activities of daily living. We also accounted for several facility-level characteristics (e.g., chain, profit status, size, level of survey deficiencies). We did not account for resident health conditions (e.g., diabetes, hypertension), county characteristics (e.g., extent of obesity among county residents), or state Medicaid per diem. It is possible that accounting for these additional characteristics may reverse the current findings that obesity is not associated with adverse safety outcomes or provide further support for the preliminary findings. Additional analyses are underway to account for these other characteristics to better understand rates of adverse safety events by obesity status. Model convergence issues prevented us from conducting the proposed hierarchical model; however, alternative methods, such as use of county-level fixed effects, are being considered.

Aim 2

Principal Findings. Due to the large sample size, many associations were statistically significant but not likely clinically significant (e.g., ORs were very small). We elected to focus on more clinically meaningful results, which we defined as having a relative difference of 10% or more. We examined characteristics of NHs that were associated with adverse resident outcomes. We found that rates of falls among residents with obesity were significantly less likely to be in the highest category of falls if they were for profit (OR=0.74, $p<0.001$), were large sized (OR=0.85, $p<0.001$), had a higher acuity index (OR=0.88, $p<0.001$), and had more registered nurse (RNs) hours per patient day (HRPPD) (OR=0.61, $p=0.01$). We found that NHs that were for profit (OR=0.74, $p<0.001$), had a higher acuity index (OR=0.90, $p<0.001$), and had more RNs HRPPD (OR=0.69, $p=0.05$) were less likely to have high rates of falls with injuries among their residents with obesity. NHs with more certified nursing assistant (CNA) HRPPD (OR=1.12, $p<0.001$) were significantly more likely to have high rates of falls with injuries among their residents with obesity. We found that for-profit NHs were significantly more likely to have high rates of stage 2-4 pressure injuries among their high-risk residents with obesity (OR=1.13, $p=0.01$). We found that large-sized NHs (OR=0.70, $p<0.001$) and more CNA HRPPD (OR=0.89, $p<0.001$) were significantly less likely to have high rates of stage 2-4 pressure injuries among their high-risk residents with obesity. We found that NHs were significantly less likely to have high rates of UTIs among their residents with obesity if they were affiliated with a chain (OR=0.89, $p=0.002$), were for profit (OR=0.86, $p<0.001$), were medium (OR=0.81, $p<0.001$) or large (OR=0.57, $p<0.001$) sized, and had increasing rates of obesity among their entire resident population (Quartile 2, OR=0.86, $p=0.002$; Quartile 3, OR=0.82, $p<0.001$; Quartile 4, OR=0.74, $p<0.001$). In contrast, NHs were significantly more likely to be in the high category of UTIs among their residents with obesity when market competition was less competitive (OR=1.33, $p<0.001$).

Outcomes. There were no outcomes beyond the principal findings.

Discussion. Previous research has indicated that residents with obesity are concentrated in lower-quality NHs.(27) As such, we expected that NHs with high rates of adverse outcomes among (falls, falls with injuries, pressure ulcer/injuries, and UTIs) would have high rates of obesity among their resident population. However, the extent of obesity among residents (measured in quartiles) was not clinically significantly associated with falls, falls with injuries, or

pressure injuries. However, we found that the quartile of obesity was clinically significantly associated with UTIs, with shifts to higher quartiles of obesity being associated with lower rates of UTIs, a finding opposite of our expectations.

Several other variables were found to be associated with more than one outcome. See Table 3. For-profit NHs were clinically significantly less likely to have higher rates of falls, falls with injuries, and UTIs among obese residents, but were clinically significantly more to be associated with high rates of pressure injuries among obese residents. Previous research has shown that for-profit NHs had lower quality of care than not-for-profit NHs (28, 29). Thus, it was unexpected that for-profit NHs had lower adverse events among their residents with obesity for three of the four adverse safety outcomes. It is possible that for-profit NHs do a better job caring for their obese residents but, when taken as a whole, looking at survey deficiencies for the entire facility, those NHs are rated as lower quality.

Larger-sized facilities (higher bed count) have also been found to be associated with poor quality of care.(30) However, for pressure /injuries and UTIs, larger facilities (beds > 150 beds) were associated with lower rates of those outcomes among their residents with obesity. It may be that larger facilities have more staff on hand to help provide the additional assistance residents with obesity need (e.g., turning and toileting) to prevent pressure ulcers/injuries and UTIs.

The acuity index was negatively associated with lower rates of falls and falls with injuries. This is contrary to research that indicates a lower acuity rate is associated with better care.(31) It is likely that those with higher acuity rates are more likely to be limited in the ambulation and thus at lower risk for falls and falls with injuries. Additionally, of note is that the acuity index was for the entire nursing home and not for our sample population of residents with obesity.

We found that more RNs hours per patient day (HRPPD) were associated with lower rates of falls and falls with injuries. A review of nursing staff and nurse sensitive outcomes, including falls, identified two studies with contradictory results of the effect of RN staffing on falls.(32) A Dutch study found that more RNs with bachelor's degrees was associated with an increase in falls among residents, while a Korean study found an increase in one HRPPD of RN care was associated with a decrease in falls.(33, 34) Taken together, this suggests the level of education is less important than the time for direct care in minimizing the risk of an adverse event among residents. Our findings indicate the rates of falls and falls with injuries could be reduced by a third with the addition of one more RN HRPPD.

A systematic literature review found that, in six of seven studies, more CNAs resulted in better quality of care.(34) This runs counter to our findings that showed that higher CNA HRPPD increased the likelihood that NHs would have high rates of falls with injuries among residents with obesity. An explanation for these mixed results is not clear; however, the CNAs

Table 3. Direction of Clinically* Significant Relationships between Covariates and Resident Safety Outcomes				
	Falls	Falls with Injuries	Pressure Injuries	UTIs
HHI				↑
Chain				↓
For Profit	↓	↓	↑	↓
101-150 Beds				↓
>150 Beds			↓	↓
Acuity Index	↓	↓		
RN HRPPD	↓	↓		
CNA HRPPD		↑	↓	
Obesity Q2				↓
Obesity Q3				↓
Obesity Q4				↓
CNA=Certified Nursing Assistant, HHI=Herfindahl-Hirschman Index, HRPPD=Hours Per Patient Day, LPN=Licensed Practical Nurse, RN=Registered Nurse, Q=Quartile, UTI=Urinary Tract Infection. *Clinically significant represents at least a significant 10% difference from comparison variable.				

may be more involved in direct personal care (e.g., bathing, grooming, toileting, turning) and less available to monitor residents at risk for falls or minimize the risk of injuries with falls. Moreover, DONs have noted that some CNAs do not want to work with residents with obesity for fear of personal injury.(35) As such, some CNAs may not try to prevent a fall they saw in process to avoid injury to themselves. Because they are more involved in personal care, they may be better able to prevent or address pressure injuries among obese residents as indicated by our results.

The level of NH competition in a market area can affect the behavior of NHs in that market. (36-38) The HHI for NHs (the sum of the NH market share of beds squared for its county) (39) is a measure used to determine the industry's level of competition in a given market. In the present study, we found that, as the HHI increases, indicating the marketplace is becoming less competitive, NHs are 33% more likely to have higher rates of UTIs among their residents with obesity ($p < 0.0011$). Previous research has indicated that NHs in highly competitive markets are more likely to innovate (e.g., adopt Total Quality Management, open specialty units) to attract new NH residents.(36, 38) Conversely, in less competitive markets, NHs may be less likely to adopt practices to care for a new NH resident group (persons with obesity) and thus provide lower quality of care for that group (poor continence care).

Conclusions. We identified several NH characteristics that were positively and negatively associated with adverse safety outcomes among NH residents with obesity. Of particular note are staffing measures – increasing RN HRPPD and CNA HRPPD -- that can help address lowering the risk of falls, falls with injuries, and pressure injuries among obese residents. Higher concentrations of obese residents as well as larger-sized facilities decreases the risk for UTIs. These findings might also support the development of bariatric specialty care units within NHs.

Significance. The research literature is limited on its coverage of the care of residents with obesity in NHs. Our three papers looking at characteristics of NHs and their relationship with adverse safety outcomes – falls, falls with injuries, pressure injuries, and UTIs – fill a gap in the literature and points to several intervention points to be developed and tested in future research to reduce adverse safety outcomes among this growing and unique resident population group.

Implications. Future research should be considered to develop and test interventions related to staffing levels, size (number of beds), and specialty care units to improve care and avoid adverse safety outcomes for obese NH residents.

Aim 3

Principal Findings. We interviewed NH DONs to assess their experiences caring for residents with obesity. They reported challenges with admitting persons with obesity to their facility, noting that issues of whether staff were able to provide safe and proper care, comorbid conditions of the persons being considered for admission, available space, and reimbursement for their care were evaluated in admission decisions. They acknowledged the need to train CNAs to provide proper care for residents with obesity and noted the need for more staff education. DONs reported that desirable weight loss among the residents with obesity is possible but took a lot of time from an interdisciplinary team working with those committed to their weight loss goal. Caring for young people with obesity in the NH with an older adult population was noted to be complex. Finally, we learned that limited resources make transitioning short-term residents with obesity out of the NH back to the community difficult.(35)

Outcomes. One outcome of this aim was the development of a questionnaire that can be used in the future to survey a random selection of US NHs personnel so that representative estimates can be made for all US NHs in terms of their experience caring for obese residents.

Discussion. Limited knowledge about the care of NH residents with obesity is available in the literature, despite rising rates of obesity among US NHs residents. (18) We interviewed DONs of US nursing homes to inquire about their experience caring for residents with obesity. We applied an adapted Structure-Process-Outcome framework to analyze their responses. (40, 41) The adapted model included antecedent conditions of the environment and the person being considered for admission as being important to outcomes, as are the structure of the NH and their processes of care.

In terms of antecedent conditions, DONs focused on absolute weight rather than a resident's BMI and were most concerned about residents with severe obesity (e.g., weights upward of 550 pounds). Reports on obesity in NHs have shown that residents with obesity are significantly younger than residents without obesity. (3) DONs were particularly concerned about challenges with caring for younger residents with obesity (age < 65 years) in a facility with a population of older residents (age ≥ 65 years). When making admission decisions, DONs noted that many factors are taken into consideration as they relate to persons with obesity. DONs mentioned the lack of sufficient reimbursement to care for the high cost of care of residents with obesity that has been previously reported. (42) They reported that they considered the ability of local healthcare and medical transportation providers to support emergency care for residents with obesity.

In terms of structure, DONs reported appropriate resources, medical equipment, and staffing were important for ensuring safe care for residents with obesity. These have also been noted as problematic when caring for residents with obesity. (6, 16) They reported the availability of those items were considered in admission decisions for persons with obesity. They also reported the need to provide additional training and coaching to staff specific to providing appropriate, high-quality care for residents with obesity. Additional research is needed to develop and test staff training curricula and training modes for the care of residents with obesity.

In terms of process of care, DONs noted that two staff members were needed to care for residents with obesity compared with only one staff member needed to care for residents without obesity. More intensive staffing needs for residents with obesity has been observed in other studies. (3, 9) DONs described efforts to prevent and care for the skin of residents with obesity. Previous studies have found that residents with obesity had higher odds of pressure injuries than residents without obesity. (43) They did not note anything about specific staffing levels to prevent pressure injuries. However, in aim 2 of our study, we found that higher hours per patient day of CNAs on staff reduced the odds of residents with obesity obtaining pressure injuries. (44) DONs also mentioned that some residents with obesity could be "noncompliant" in healthy eating and exercise behaviors; however, DONs also acknowledged resident rights. Additional resources for higher staffing and/or prescribed legislation on staffing levels may be necessary to ensure that adequate staff are available for the safe care of residents with obesity. Future research related to facilitating weight loss among residents with obesity is also warranted.

In terms of positive outcomes, DONs reported that some residents with obesity were able to lose weight and improve their mobility with support provided by NH staff. In terms of negative outcomes, they noted that short-term rehabilitation residents with obesity often transitioned into long-term care residents even though that wanted to return to the community because of challenges presented with community living. They also reported staff injuries even when safe patient handling procedures (e.g., two staff members and mechanical lift) were applied. Finally, increases in the cost of care were reported for residents with obesity. Based on these findings, we recommend additional research to examine transitions to the community to ensure that persons with obesity can reside in the community if desired and research on new safe patient handling procedures for residents with obesity to minimize staff injuries.

Conclusions. This study provided the first known report of the experience of a national group of nursing home DONs with the care and safety of their residents with obesity. Our findings reveal that cost of care is considered when persons with obesity are considered for admission to nursing homes, that training and coaching of CNAs to provide safe care is needed, and that transitioning short-stay residents with obesity back to the community can be difficult. More research in these areas is needed to develop interventions to aid nursing homes in the care of residents with obesity.

Significance. Our findings are the first known report on the experiences of DONs caring for obese residents. DONs have the unusual perspective of both an administrator and a clinician and provided valuable insight on considerations for admitting obese persons and staffing issues with caring for obese residents, in particular the need for more staff training to ensure optimal outcomes.

Implications. This research noted challenges for caring for obese NH residents that may limit their admission to NHs. Addressing those challenges, including with additional reimbursement for extra costs of care and developing and testing trainings for the proper care by staff of obese residents, are recommended to ensure that persons with obesity have access to quality long-term care when needed.

6. List of Publications and Products

Felix HC, Brown CC, Narcisse MR, Vincenzo JL, Weech-Maldonado R, Bradway CK. Characteristics of nursing homes with high percentages of falls and falls with injuries among residents with obesity. *Geriatr Nur.* 2023 Aug 2; 53:191-197. doi: 10.1016/j.gerinurse.2023.07.017.

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Felix HC, Bradway C, Bird TM, Pradhan R, Weech-Maldonado R. Safety of obese persons in nursing home. *Med Care.* 2018; 56(12): 1032–1034. doi: 10.1097/MLR.0000000000000997

Felix HC, Brown CC, Narcisse MR, Vincenzo JL, Andersen JA, Weech-Maldonado R, Bradway CK. Characteristics of United States nursing homes with high percentages of stage 2-4 pressure injuries among high-risk nursing home residents with obesity. In Press, *Wound Practice and Research*, September 2023.

Felix HC, Brown CC, Narcisse MR, Vincenzo JL, Andersen JA, Weech-Maldonado R, Bradway CK. Characteristics of United States nursing homes with high percentages of UTIs among residents with obesity. Submitted, under review, *Urol Nurs*, August 2023.

Questionnaire to quantify nursing homes experience with caring for nursing home residents with obesity

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