

# Characteristics Associated With Low Food and Fluid Intake in Long-Term Care Residents With Dementia

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This article describes the prevalence, assessment, and treatment of, as well as characteristics associated with, the food and fluid intake of 407 residents with dementia in 45 assisted living facilities and nursing homes. Overall, 54% of observed residents had low food intake, and 51% had low fluid intake. Staff monitoring of residents, having meals in a public dining area, and the presence of noninstitutional features were each associated with higher food and fluid intake.

**Key Words:** *Cognitive impairment, Nursing homes, Assisted living, Malnutrition, Dehydration*

Declining capacity to eat and drink independently, and subsequent malnutrition and dehydration, have long been recognized as serious problems for institutionalized elderly, particularly for those with impaired mobility and cognition (Van Ort & Phillips, 1995). Malnutrition, or undernourishment resulting from insufficient food intake, is reported in up to 85% of nursing home residents (Simmons & Reuben,

2000), and dehydration has been documented in as many as 60% of residents (Fries et al., 1997; Holben, Hassell, Williams, & Helle, 1999). Consequences of malnutrition include weight loss, infection, impaired wound healing, immune deficiency, development of pressure sores, and even mortality (Volicer, Warden, & Morris, 1999). Dehydration can result in constipation, urinary tract infections, renal disease, pneumonia, hypotension, and delirium (Spangler & Chidester, 1998; Volicer et al.).

The observed proportion of food and fluid consumed (of that served) is commonly used to identify problematic eating and drinking (Holben et al., 1999; Amella, 2002). Regulations reflected in the Minimum Data Set define clinically significant problem eating as the consumption of less than 75% of one's meal (Simmons & Reuben, 2000). Similarly, studies evaluate fluid consumption to identify intake deficiencies, with a daily minimum of 1,500 to 2,000 mL of fluid considered protective against dehydration among long-term care residents (Holben et al.). Assuming that each resident's meal has been served in accordance with a dietary service plan, this proportionate definition allows comparisons across residents and settings.

Resident characteristics contributing to food and fluid intake include cognitive status (Young, Binns & Greenwood, 2001), ability to eat independently (Kayser-Jones & Schell, 1997), and physical limitations, such as difficulty swallowing (dysphagia; Steele, Greenwood, Ens, Robertson, & Seidman-Carlson, 1997). Care provision also contributes to intake, with up to half of residents requiring assistance (Priefer & Robbins, 1997), including monitoring, verbal encouragement, and physical assistance (Van Ort & Phillips, 1995; Kayser-Jones & Schell). Environmental characteristics contributing to adequate intake include food quality, absence of environmental distractions (e.g., noise), and noninstitutional features (e.g., tablecloths),

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as well as social interactions (Kayser-Jones & Schell; McDaniel, Hunt, Hackes, & Pope, 2001).

Despite what is known about correlates of adequate food and fluid intake among cognitively impaired residents of long-term care, no single study has examined these problems in residential care/assisted living (RC/AL; nonnursing home settings that provide room, board, assistance with activities of daily living [ADLs], and 24-hour oversight) or comprehensively considered these factors among a large sample. This study fills this gap by describing the multiple factors present during mealtime that are associated with low intake. Understanding these factors may help form strategies to increase food and fluid intake and reduce the incidence of malnutrition and dehydration in long-term care. While the primary purpose of this study is to assess resident, staff, and environmental characteristics associated with low food and fluid intake to further contextualize these factors, data also provide a description across different facility settings, including both nursing homes and RC/AL facilities.

## Methods

### Sample

Participants were recruited from 45 facilities across four states, including 35 RC/AL facilities and 10 nursing homes. A total of 421 residents aged 65 and older with diagnosed dementia were enrolled, with a participation rate of 73%. For details on the sample and methods of the Dementia Care Study, see Zimmerman, Sloane, Reed, and Williams (2005, this issue). In this analysis of low food and fluid intake, 407 residents were observed using the Structured Meal Observation.

### Measures

*The Structured Meal Observation (SMO).*—The SMO was developed for the Dementia Care Study to provide a research tool capable of capturing resident experience during mealtime. The SMO draws from the Meal Assistance Screening Tool (MAST; Steele et al., 1997), and incorporates other items relevant to resident need, staff assistance, environmental context, and mealtime outcomes. The SMO, as used in these analyses, consists of 28 items and is administered by observing up to five residents during the course of a single meal. It was developed using an iterative process of literature review and consensus building among study investigators, yielding an instrument with good content validity and high interrater reliability (all items in these analyses had  $\geq 70\%$  agreement with only 4 [14%] having a kappa or intraclass correlation below 0.6, based on a sample of 48–56 paired observations). Structured meal observations were conducted by 10 data collectors, each of whom was a member of the research team and underwent training and interrater reliability testing on the SMO instrument.

In these analyses, the two outcomes of interest were

amount of food and fluid consumed during a single meal, with low intake being  $\leq 75\%$  of food and  $\leq 8\text{oz.}$  of fluid consumed. Other resident characteristics observed using the SMO included alertness (low/high), utensil use (low/high), and postural stability and movement (assessed dichotomously as per presence or absence of at least one of six types of movement/instability). The SMO also assessed several staff assistance variables and environmental features: whether staff provide monitoring, talk to the resident, and offer physical assistance; the number of staff that provide assistance relative to the number of residents in the room; whether residents eat in a dining area; noise level; food texture; if fluids are thickened; and the number of noninstitutional features present (e.g., not eating off a tray). Social environment items included the number of people grouped with the resident and presence of the resident's family.

*Other resident characteristics.*—Care supervisors reported whether or not a resident had at least one of 13 different mouth and throat problems, including dysphagia. Facility staff also provided data to determine residents' affect, behavior, activity involvement, and pain (Zimmerman et al., 2005). Cognitive status was assessed using either the resident's Mini-Mental State Exam score (Folstein, Folstein, & McHugh, 1975) or the supervisor-reported Minimum Data Set Cognition Scale (Hartmaier, Sloane, Guess, & Koch, 1994). Resident mobility was assessed through direct observation (Williams et al., 2005, this issue).

*Facility characteristics and care.*—The conceptual model underlying this study (Zimmerman et al., 2005) understands a resident's unmet need as the product of resident and care factors. Care factors under study include assessment of residents' difficulty eating and drinking, staff's perceived current status of residents' eating and drinking difficulties, treatment strategies employed by the staff to address eating and drinking difficulties, and the staff's perception of the success of the treatment provided. Additional facility characteristics reported by administrators include the proportion of direct care and supervisory staff with formal training in care of resident nutrition and hydration problems, facility ownership, and facility type.

### Analyses

Bivariate linear and logistic regression models, with facility type as the independent variable, were estimated to assess differences between facility settings (i.e., RC/AL facility vs nursing home). Logistic regression models were used to estimate odds ratios and 95% confidence intervals for the association between resident and facility characteristics and each intake outcome. Multivariable models provided estimates adjusted for gender, race, age, cognitive status, comorbidities, and impairments in ADLs. All analyses were adjusted for facility clustering effects using

Table 1. Prevalence of Low Food and Fluid Intake and Relevant Components of Care in Dementia Care Study Sample, by Setting

Variable	% or M (SD)		p
	RC/AL (n = 276)	NH (n = 131)	
Prevalence of low food and fluid intake			
Residents with low food intake	50.4	61.8	.046
Residents with low fluid intake	45.8	63.4	.011
Assessment of food and fluid intake			
Professional assessment for eating difficulty	32.5	66.7	.008
Written assessment for eating difficulty	26.1	43.3	.031
Professional assessment for drinking difficulty	34.6	63.2	.031
Written assessment for drinking difficulty	23.5	36.9	.200
Perceived presence of eating difficulty	11.0	19.6	.295
Perceived presence of drinking difficulty	5.5	10.2	.485
Mouth and throat problems	0.61 (1.3)	1.02 (1.6)	.101
Observed resident dependency			
Unresponsive or nonalert	4.4	2.3	.221
Poor utensil use	15.7	33.1	.020
Posture–movement problems	7.5	16.9	.057
Treatment of food and fluid intake			
Professionally treated for eating problems	7.1	30.2	.007
Informally treated for eating problems	15.6	34.9	.048
Professionally treated for drinking problems	5.2	22.6	.055
Informally treated for drinking problems	8.7	26.4	.040
Perceived success (if eating problem; quite a bit or extremely)	58.6	60.0	.825
Perceived success (if drinking problem; quite a bit or extremely)	65.0	65.6	.375
Observed staff assistance during meal			
Residents monitored	87.3	73.6	.227
Residents verbally encouraged	37.1	47.2	.185
Residents physically assisted	26.7	44.3	.045
Residents per staff	8.2 (7.4)	4.7 (3.1)	.005
Observed environmental characteristics			
Residents eating in dining area	96.7	81.5	.038
Noninstitutional features	3.7 (1.49)	2.0 (1.36)	< .001
Low noise level	51.6	35.1	.029
Pureed food	6.9	26.7	.007
Residents receiving thickened fluids	3.7	9.2	.170
Family present	5.4	9.3	.337
Number of residents grouped together	3.3 (1.5)	3.6 (4.9)	.803
Training to detect and treat eating problems <sup>a</sup>			
Supervisory staff			
None in facility	15.7	2.2	
Some in facility	7.7	36.5	
Most (≥ 75%) in facility	76.6	61.31	.576
Direct care providers (% in facility)			
None	16.4	2.2	
Some	11.7	0	
Most (≥ 75%)	71.9	97.8	.051
Staff feels adequately trained to assess	88.8	94.9	.582
Staff feels adequately trained to treat	87.0	91.2	.735
Training to detect and treat drinking problems <sup>a</sup>			
Supervisory staff (% in facility)			
None	25.9	25.6	
Some	11.3	36.5	
Most (≥ 75%)	62.8	37.9	.879
Direct care providers (% in facility)			
None	24.5	25.6	
Some	15.3	0	
Most (≥ 75%)	60.2	74.5	.403

(Table continues on next page)

Table 1. (Continued)

Variable	% or M (SD)		<i>p</i>
	RC/AL ( <i>n</i> = 276)	NH ( <i>n</i> = 131)	
Staff feels adequately trained to assess	79.9	95.6	.270
Staff feels adequately trained to treat	82.3	90.5	.522

Notes: SMO = structured meal observation; RC/AL = residential care/assisted living; NH = nursing home. Low food and fluid intake were assessed by observation using the SMO, and refer to  $\leq 75\%$  of food and  $\leq 8$  oz. of fluid consumed. Except as noted for training, all data are resident level and are for those residents observed using the SMO. Due to missing data, *n* varies from 203 to 276 for RC-AL and 87 to 131 for NH, except in the case of perceived success of treatment, which is relevant only for those with reported eating and drinking difficulties and for whom there are data for 58 (25%) and 45 (41.6%) RC-AL and NH participants, respectively, for eating difficulties and 40 (17.2%) and 32 (29.9%) RC-AL and NH participants, respectively, for drinking difficulties. *p* values are based on score statistics and were adjusted for facility-level clustering using generalized estimating equations (exchangeable correlation matrix).

<sup>a</sup>Data regarding supervisory staff training and direct care provider training are facility level and reported by administrators. Staff feelings of training adequacy are reported by the one supervisor (or direct care provider if supervisor data are missing) who is most involved in the resident's care; adequately is quite or extremely well trained.

generalized estimating equations (GEE), and an exchangeable correlation structure (Stokes, Davis, & Koch, 2000). Interactions of predictors with facility setting also were tested to confirm that factors' associations with food and fluid intake did not differ between nursing homes and RC/AL.

## Results

The mean age of the 407 cognitively impaired long-term care residents observed for these analyses was 85 years old; 21% were males; and 11% were non-White. Approximately 37% of the residents had very severe cognitive impairment, while 27% had severe, 25% had moderate, and 12% had mild cognitive impairment.

The prevalence of low intake observed in this study was 54.1% (food,  $\leq 75\%$  consumed) and 51.3% (fluid,  $\leq 8$ oz. consumed). As shown in Table 1, a significantly lower proportion of RC/AL residents had low food and fluid intake relative to those living in nursing homes (50.4% vs 61.8%, 45.8% vs 63.4%, respectively,  $p < .05$ ). Several components of assessment and resident status differed by setting. RC/AL residents were significantly less likely to be assessed for eating and drinking difficulties, with assessment twice as prevalent in nursing homes. Treatment varied across settings as well. RC/AL residents were less likely to receive treatment for eating difficulty, either formally, for example by a professional (7.1% vs 30.2%,  $p = .007$ ), or informally (15.6% vs 34.9%,  $p = .048$ ). Further, staff were observed providing physical assistance to a higher proportion of residents in nursing homes (44.3%) versus RC/AL facilities (26.7%;  $p = .045$ ). In addition, the number of residents per staff member providing care was lower in nursing homes, with an average of 4.7 versus 8.2 residents per staff member ( $p = .005$ ).

Characteristics of the physical environment also differed by facility setting. More residents had meals in dining areas in RC/AL living (96.7% vs 81.5%,  $p = .038$ ), and these areas had, on average, more non-institutional features ( $p < .001$ ). The proportion of

residents in a low-noise environment was higher in RC/AL (51.6% vs 35.1%,  $p = .029$ ), and only 6.9% of RC/AL residents received pureed food, versus 26.7% in nursing homes. Additionally, administrators reported a higher proportion of direct care staff in nursing homes were trained to assess and treat eating difficulties, with 97.8% reporting most were trained versus 71.9% in RC/AL facilities ( $p = .051$ ).

Table 2 displays risk factors for low intake, limited to a smaller sample ( $n = 326$ – $335$ ) of residents with complete data on factors used as covariates. The characteristics of this smaller sample did not differ in respect to age, gender, race, or cognitive status. After adjustment, only one resident characteristic was associated with low food intake (i.e., being nonalert), and none were associated with low fluid intake. Facility type was associated with intake, with residents of small RC/AL facilities less likely to have low food intake (OR = 0.26; 95% CI = .10, .65) and residents of new-model RC/AL facilities less likely to have low fluid intake (OR = 0.46; 95% CI = .27, .79). Ownership status also was related to both outcomes: Residents of for-profit facilities were less likely to have low food intake (OR = 0.29; 95% CI = .15, .57) and low fluid intake (OR = 0.34; 95% CI = .22, .53).

While formal assessment was not related to intake, residents monitored by staff were less likely to have low food intake (OR = 0.37; 95% CI = .18, .76) and low fluid intake (OR = 0.25; 95% CI = .12, .55). Also, a higher number of residents per staff member was linked to poorer fluid intake before and after adjustment (OR = 0.95; 95% CI = .91, .99). Finally, supervisor reports of treatment success were related to better fluid intake (OR = 0.30; 95% CI = .09, .94).

Two environmental features were significantly associated with both food and fluid intake. Residents having meals in the facility dining area rather than in their bedrooms were less likely to have low food intake (OR = 0.17; 95% CI = .04, .73) and low fluid intake (OR = 0.18; 95% CI = .06, .63). Similarly, residents in dining areas with more noninstitutional features were less likely to have low food intake (OR = 0.84; 95% CI = .72, .97) and low fluid intake (OR = 0.65;

Table 2. Characteristics Associated With Low Food ( $n = 335$ ) and Fluid Intake ( $n = 326$ ), Unadjusted and Adjusted

Characteristic <sup>b</sup>	Distribution of Characteristic as % or <i>M</i> ( <i>SD</i> )				Relationship Between Characteristic and Presence of Low Food Intake		Relationship Between Characteristic and Presence of Low Fluid Intake	
	Food Intake		Fluid Intake		Unadjusted	Adjusted <sup>a</sup>	Unadjusted	Adjusted <sup>a</sup>
	Low ( $n = 176$ )	High ( $n = 159$ )	Low ( $n = 167$ )	High ( $n = 159$ )	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
<b>Resident</b>								
Cognitive status								
Mildly impaired	8.6	16.9	10.9	14.2	1.00	1.00	1.00	1.00
Moderately impaired	30.5	25.1	23.8	29.0	0.98 (0.93, 1.05)	1.00 (0.93, 1.07)	0.95 (0.89, 0.99)	0.96 (0.89, 1.02)
Severely impaired	24.1	22.9	22.6	28.4	0.97 (0.86, 1.09)	1.00 (0.87, 1.53)	0.89 (0.80, 0.99)	0.92 (0.80, 1.05)
Very severely impaired	36.8	35.1	42.7	28.4	0.95 (0.79, 1.14)	1.00 (0.82, 1.24)	0.85 (0.72, 0.99)	0.87 (0.72, 1.07)
Depressed	22.3	24.3	25.3	19.9	0.89 (0.54, 1.48)	0.76 (0.48, 1.21)	1.67 (0.97, 2.88)	1.46 (0.83, 2.56)
Low activity	47.7	46.4	48.2	45.9	0.94 (0.61, 1.45)	0.95 (0.59, 1.51)	0.85 (0.55, 1.31)	0.80 (0.52, 1.24)
High pain	21.1	19.9	21.4	18.1	1.06 (0.51, 2.19)	0.92 (0.44, 1.92)	1.21 (0.64, 2.29)	1.17 (0.62, 2.24)
Immobile	14.9	8.1	15.2	7.9	2.23 (1.12, 4.45)	1.96 (0.92, 4.17)	2.19 (0.84, 5.72)	1.93 (0.69, 5.40)
Behavioral symptoms	61.5	54.1	60.5	55.6	1.34 (0.79, 2.26)	1.45 (0.85, 2.47)	1.10 (0.66, 1.85)	1.03 (0.62, 1.71)
Unresponsive or nonalert	5.8	0.7	4.9	1.9	8.02 (0.99, 64.95)	7.10 (1.09, 49.09)	2.33 (0.77, 7.08)	1.96 (0.58, 6.62)
Poor utensil use	21.4	19.6	26.9	13.6	1.06 (0.54, 2.06)	0.75 (0.36, 1.55)	2.19 (1.14, 4.22)	2.09 (0.89, 4.88)
Posture or movement problems	10.9	10.4	11.4	9.3	1.02 (0.53, 1.98)	0.92 (0.47, 1.79)	1.09 (0.53, 2.24)	0.91 (0.42, 1.98)
<b>Facility</b>								
Facility type								
NH	37.4	22.7	37.2	20.0	1.00	1.00	1.00	1.00
RC/AL, < 16 beds	7.5	20.1	14.0	13.6	0.32 (0.12, 0.82)	0.26 (0.10, 0.65)	1.10 (0.52, 2.38)	1.08 (0.48, 2.45)
RC/AL, traditional	20.7	24.0	20.7	24.5	0.83 (0.46, 1.49)	0.92 (0.49, 1.68)	0.79 (0.43, 1.44)	0.83 (0.44, 1.55)
RC/AL, new model	34.5	33.1	28.1	41.9	1.11 (0.68, 1.79)	1.18 (0.70, 1.98)	0.48 (0.30, 0.78)	0.46 (0.27, 0.79)
Facility size (OR per 10 beds)	92.9 (51.2)	76.8 (51.8)	85.4 (54.7)	84.6 (49.5)	1.08 (1.03, 1.14)	1.09 (1.03, 1.16)	1.00 (0.95, 1.06)	1.00 (0.94, 1.07)
For-profit ownership	59.4	79.8	58.4	79.3	0.32 (0.19, 0.55)	0.29 (0.15, 0.57)	0.34 (0.23, 0.52)	0.34 (0.22, 0.53)
Assessment of low intake								
Professional	43.5	42.8	44.6	44.5	1.17 (0.74, 1.85)	1.07 (0.62, 1.87)	0.98 (0.55, 1.73)	0.87 (0.50, 1.49)
Written or standardized	33.3	29.5	28.5	27.8	1.31 (0.74, 2.30)	1.21 (0.68, 2.16)	1.01 (0.57, 1.77)	0.94 (0.53, 1.65)
Perceived presence, current	14.6	11.1	6.5	5.9	1.46 (0.68, 3.15)	1.04 (0.43, 2.52)	1.09 (0.42, 2.88)	0.95 (0.37, 2.46)
Mouth or throat problems	31.5	34.5	37.9	27.8	0.82 (0.53, 1.26)	0.72 (0.43, 1.18)	1.42 (0.85, 2.37)	1.39 (0.76, 2.57)
Treatment of low intake								
Professional	14.5	13.2	11.5	9.1	1.15 (0.51, 2.61)	0.86 (0.36, 2.03)	1.18 (0.65, 2.16)	1.06 (0.56, 2.01)
Informal	21.7	20.4	15.8	12.9	1.13 (0.64, 1.99)	0.93 (0.44, 1.95)	1.13 (0.65, 1.97)	0.96 (0.49, 1.89)
Monitored	78.2	90.9	76.2	92.9	0.39 (0.19, 0.80)	0.37 (0.18, 0.76)	0.28 (0.13, 0.57)	0.25 (0.12, 0.55)
Verbally encouraged	47.9	30.9	43.5	36.9	2.14 (1.15, 4.01)	2.28 (1.16, 4.24)	1.21 (0.68, 2.15)	1.05 (0.51, 2.17)
Physically assisted	35.8	28.9	38.4	26.8	1.35 (0.74, 2.47)	1.26 (0.66, 2.43)	1.48 (1.00, 2.18)	1.39 (0.77, 2.50)
Residents per staff	7.0 (6.9)	7.8 (7.3)	6.1 (5.1)	8.8 (8.5)	0.98 (0.95, 1.01)	0.98 (0.95, 1.01)	0.95 (0.91, 0.99)	0.95 (0.91, 0.99)
Perceived success (if intake perceived low)	60.8	65.6	55.2	76.7	0.82 (0.31, 2.19)	0.92 (0.29, 2.82)	0.35 (0.11, 1.09)	0.30 (0.09, 0.94)

(Table continues on next page)

Table 2. (Continued)

Characteristic <sup>b</sup>	Distribution of Characteristic as % or M (SD)			Relationship Between Characteristic and Presence of Low Food Intake		Relationship Between Characteristic and Presence of Low Fluid Intake	
	Food Intake			Unadjusted	Adjusted <sup>a</sup>	Unadjusted	Adjusted <sup>a</sup>
	Low (n = 176)	High (n = 159)	High (n = 159)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Environment							
Residents in dining area	90.8	98.7	98.7	0.18 (0.05, 0.62)	0.17 (0.04, 0.73)	0.18 (0.05, 0.69)	0.18 (0.06, 0.63)
Noninstitutional features	3.1 (1.6)	3.4 (1.5)	3.7 (1.4)	0.84 (0.73, 0.97)	0.84 (0.72, 0.97)	0.68 (0.58, 0.79)	0.65 (0.55, 0.77)
Low noise level	47.9	42.9	46.5	1.14 (0.68, 1.89)	1.32 (0.79, 2.20)	0.86 (0.42, 1.76)	0.92 (0.44, 1.89)
Pureed food	12.9	11.7	NA	0.87 (0.34, 2.21)	0.65 (0.23, 1.79)	NA	NA
Fluids thickened	NA	NA	5.2	NA	NA	1.06 (0.43, 2.63)	1.02 (0.38, 2.75)
No. in residents group	3.3 (3.3)	3.8 (3.3)	3.3 (1.5)	0.96 (0.88, 1.05)	0.96 (0.89, 1.05)	1.02 (0.92, 1.14)	1.03 (0.93, 1.15)
Family present	5.2	7.8	5.8	0.45 (0.14, 1.44)	0.41 (0.12, 1.35)	1.49 (0.69, 3.27)	1.22 (0.46, 3.20)
Training to Detect and Treat <sup>c</sup>							
Supervisory staff							
None in facility	8.2	20.1	28.0	1.00	1.00	1.00	1.00
Some in facility	18.8	15.4	14.7	0.89 (0.83, 0.96)	0.89 (0.84, 0.96)	1.00 (0.93, 1.07)	1.01 (0.94, 1.08)
Most in facility (≥ 75%)	72.9	64.4	57.3	0.81 (0.69, 93)	0.80 (0.70, 0.92)	1.00 (0.86, 1.16)	1.02 (0.89, 1.16)
Direct care providers							
None in facility	8.2	21.5	26.7	1.00	1.00	1.00	1.00
Some in facility	11.8	6.0	9.3	0.89 (0.84, 0.96)	0.89 (0.84, 0.96)	0.99 (0.93, 1.07)	0.99 (0.93, 1.07)
Most in facility (≥ 75%)	80.0	72.5	64.0	0.81 (0.69, 0.93)	0.80 (0.70, 0.92)	1.99 (0.86, 1.15)	0.99 (0.87, 1.14)
Staff feels trained to assess	95.4	92.8	78.4	1.28 (0.40, 4.07)	1.72 (0.53, 5.59)	1.17 (0.62, 2.18)	1.12 (0.56, 2.25)
Staff feels trained to treat	92.5	88.9	79.9	1.05 (0.43, 2.55)	1.33 (0.54, 3.28)	1.02 (0.49, 2.11)	1.12 (0.52, 2.34)

Notes: NH = nursing home; RC/AL = residential care/assisted living; SMO = structured meal observation. Low food and fluid intake were assessed by observation using the SMO and refer to ≤ 75% of food and ≤ 8 oz. of fluid consumed. Except as noted for training, all data are resident level, are of those residents for whom outcome data (i.e., food and fluid intake) and supervisor data (required for adjustment) are available and are from supervisor report. Due to missing data, *n* varies from 238 to 298, except in the case of perceived success of treatment, which is relevant only for those for whom the staff perceives low food or fluid intake and for whom there are data for 81 (24%) of residents for food and 56 (17%) for fluid.

<sup>a</sup>Adjusted for male gender, non-White race, age, marital status, cognitive status, number of 11 comorbidities (congestive heart failure; high blood pressure or hypertension; myocardial infarction, heart attack, angina, arrhythmias, or other heart problem; diabetes; kidney disease or renal insufficiency; arthritis, rheumatism, degenerative joint disease, lupus, erythematosis, or scleroderma; fractured bones or osteoporosis; cerebrovascular disease, stroke, TIA, or CVA; hemiplegia or paraplegia; asthma, emphysema, bronchitis, or COPD; schizophrenia, manic-depressive disorder, or mental retardation), and impairments in seven activities of daily living (bed mobility, transfer, locomotion, dressing, eating, toilet use, hygiene).

<sup>b</sup>Cognitive status was based on Mini-Mental State Examination (MMSE) or Minimum Data Set-Cognition Scale (MDS-COGS) scores if the MMSE is missing (*n* = 51). MMSE cutpoints for mild, moderate, severe, and very severe are ≥ 18, 11–17, 3–10, 0–2, respectively; MDS-COGS cutpoints are 0–1, 2–3, 5–8, 9–10, respectively; depressed: ≥ 7 on the Cornell Scale for Depression in Dementia; low activity: < 9 (median) on the Albert Patient Activity Scale; high pain: ≥ 2 on the Philadelphia Geriatric Center Pain Intensity Scale; immobile: no position or location changes observed during 3 hours of observation; behavioral symptoms: any behavior at least weekly on the Cohen-Mansfield Agitation Inventory. Depression and behavioral symptoms are taken from supervisor report, activity is taken from care provider report, pain is taken from resident report, and immobility is based on direct observation.

<sup>c</sup>Data regarding supervisory staff training and direct care provider training are facility level and reported by administrators. Staff feelings of training adequacy are reported by the one supervisor (or direct care provider if supervisor data are missing) who is most involved in the resident's care; adequately is quite or extremely well trained.

95% CI = .55, .77). No differences were discovered in analyses of the interactions of these characteristics with facility type (RC/AL vs nursing home).

## Discussion

As found by others (Kayser-Jones, Schell, Porter, Barbaccia, & Shaw, 1999; Keller, 1993), this study shows that prevalence of low food intake (54%) and low fluid intake (51%) is high among residents of long-term care, specifically among those with cognitive impairment. While these figures are lower in RC/AL facilities than in nursing homes, they still average approximately 50% overall. There are, however, noticeable differences between this observed prevalence and facility staff-reported prevalence of eating difficulties (13.7%) and drinking difficulties (6.9%). This discrepancy may exist because of underrecognition of problems or because the threshold of concern applied by facility staff is higher than that captured by the observation of one meal or using these cut points. However, the prevalence of low intake found through this study's observations are comparable to other observations of intake during a meal that used a similar indicator of inadequacy (Kayser-Jones et al.; Keller), suggesting the difference is one of underrecognition.

While nursing homes are more likely to assess and treat residents, residents in small RC/AL facilities have better food outcomes, and those in new-model RC/AL facilities have better fluid outcomes. Differences in staff assistance during meals and in the mealtime environment may contribute to disparate outcomes across facility settings. Residents monitored by staff during mealtimes are significantly less likely to have low food and fluid intake. Similarly, even after adjustment, residents having their meals in public dining areas are much less likely to have low intake relative to those in their bedrooms. Also, residents in dining areas with more noninstitutional features are less likely to have low food and fluid intake. Each of these beneficial staff and environmental conditions are more common in RC/AL settings.

Two aspects of this research should be noted. First, this is a study of food and fluid intake, not nutritional content. Thus, no nutritional information was used to evaluate food quality or food appropriateness relative to residents' nutritional needs. However, assessing the quantity consumed does provide an indicator that can be extrapolated into a measure of potential undernutrition and dehydration. Second, food and fluid intake during a single meal was recorded instead of overall resident intake levels throughout the day.

This study shows that across RC/AL facilities and nursing homes, there is a high prevalence of low food and fluid intake among cognitively impaired residents and a discrepancy between observed low intake and that reported by staff. While nursing homes report more assessment and treatment, outcomes do not relate to these, but instead are improved for RC/AL residents, who are more likely to be monitored during the meal, be in a public dining area, and be in

a non-institutional-like setting. This research uncovers a potentially problematic care area in long-term care and highlights modifiable conditions that could be addressed through intervention. Staff who are more vigilant to low intake and facilities that attend to resident need and attempt to enhance the mealtime experience may improve nutrition and hydration among residents with dementia.

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