

# Characteristics Associated With Mobility Limitation 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, mobility limitation in 343 residents with dementia in 45 assisted living facilities and nursing homes. Overall, 89% of residents had some degree of mobility limitation. Mobility limitation was associated with fewer behavioral symptoms, low fluid intake, professional assessment, and professional and informal treatment.

*Key Words: Mobility, Nursing home, Residential care, Assisted living*

## Background

Maintenance of mobility is an important component of quality of life for all individuals, including those in long-term care facilities; in fact, long-term care residents and staff identify mobility as pivotal to residents' quality of life (Bourret, Bernick, Cott, & Kontos, 2002; Trudeau, Biddle, & Volicer, 2003). Further, mobility limitation leads to increased health care utilization, pressure sores, muscle atrophy, bone loss, pneumonia, incontinence, constipation, and general functional decline (Jirovec & Wells, 1990; Mahoney, Sager, & Jalaluddin, 1999; Trudeau et al.).

It is no surprise that the Minimum Data Set mandates quarterly assessments of mobility among nursing home residents. Care for mobility limitation needs to reflect resident characteristics (e.g., dementia, vision, cerebrovascular condition, age, and overall functional status) and the structure and process of care, such as the availability of handrails (structure) and staff training and assessment (process). Care provided by the facility staff is an important component of maintenance and/or restoration of mobility because staff members are the ones who typically identify and assist with mobility problems (Hyatt, 1997).

Based on Donabedian's (1988) structure, process, and outcome model, this article examines components of the care environment and how they relate to mobility for residents with dementia living in nursing homes and residential care/assisted living (RC/AL) settings. Until now, the study of mobility limitation in long-term care has been largely limited to nursing home care. Little information is known about the status and mobility-related care of residents in assisted living settings. Given the growth of this form of care, this study describes the mobility of older adults with

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dementia in RC/AL and nursing homes and examines structural and process characteristics that relate to mobility limitation.

## Methods

Data for these analyses were gathered on 237 residents in 35 residential care facilities and 106 residents in 10 nursing homes in four states, as part of the Dementia Care study of the Collaborative Studies of Long-Term Care (CS-LTC). All residents had a diagnosis of dementia. Data collection was conducted on-site between September 2001 and February 2003. For each resident, data collectors conducted interviews with: (a) the direct care provider who provided hands-on care and knew the most about the resident's care, health, mood, and daily activities; (b) the supervisor (i.e., staff member above a direct care provider level) who knew the most about the resident; (c) the facility administrator; and (d) a family member. Data collectors also gathered observational data on these 343 residents during the course of a single day. This study's analyses were restricted to those residents. Observations also were conducted on the physical environment of each facility. Further details about the Dementia Care study are in the introduction to this journal.

## Measures

**Dependent variable.**—The Dementia Care study defined mobility based on observation of three characteristics: being on one's feet, changing position, and changing location. Resident-specific data on each of these characteristics were observed during 5-minute intervals between 10 and 11 a.m., 1 and 2 p.m., and 4 and 5 p.m. on one day in each study facility (for a maximum of 36 observations per resident). These times were chosen because they sample the most common activity periods (i.e., when sleep, meals, and morning personal care are least likely to occur). If a scheduled period of observation included a meal, the observation time was adjusted so as to exclude the meal. Up to three residents were observed at a time by each data collector.

Each characteristic was coded to reflect the resident's predominant activity during a 5-minute observation period. Position was noted as on feet, sitting, or lying down. On feet was coded when the resident was standing or walking with or without assistance. Location was coded as bedroom, indoor public area, outdoor public area, or off-site. A change in position was inferred if the resident was observed in two different positions in two sequential 5-minute observations; change in location was similarly defined.

Based on the three characteristics, residents were assigned to one of four levels of mobility limitation. First, if the resident was on his or her feet greater than or equal to 25% of the observations, the resident was coded as having "no mobility limitation." If the resident was on his or her feet less than 25% of obser-

vations and did not move (i.e., change position or location between consecutive observations), the resident was coded as having "high mobility limitation." If the resident was on his or her feet less than 25%, but moved between 10% or more of observations, he or she was coded as "low mobility limitation," while those who moved fewer than 10% of observations were coded as having a "moderate mobility limitation."

**Independent variables, resident.**—Cognition was assessed with the Mini-Mental State Examination (MMSE) and the Minimum Data Set Cognition Scale (MDS-COGS); functional status with the Minimum Data Set Activities of Daily Living Scale (MDS-ADL; minus the mobility items), and comorbidity through a list of 11 conditions. Further details about the independent variables can be found in the footnotes to Table 2. Behavioral symptoms were assessed with the Cohen-Mansfield Agitation Inventory; depression using the Cornell Scale for Depression in Dementia; pain with the Philadelphia Geriatric Center Pain Intensity Scale; and low food and fluid intake with the Structured Meal Observation. Family members rated their current involvement on a scale from 1 (very low) to 5 (very high). Supervisors rated resident's vision as adequate, impaired, highly impaired, or severely impaired.

**Independent variables, facility.**—Staff members, both direct care providers and supervisors, were asked how well trained they felt in identifying mobility limitation and in helping residents with their mobility limitation. Facility administrators estimated the proportion of staff who had received formal training in detecting and treating mobility limitation.

Supervisors answered several questions regarding assessment and treatment specific to the residents under study: whether the resident had been formally assessed for mobility limitation in the previous year using a written, standardized instrument and/or by a medical doctor or physical therapist; whether or not the resident had been treated for mobility limitation; whether or not the resident used any of a variety of assistive mobility devices (e.g., cane, wheelchair, walker); to what degree they felt treatment was successful; and to what extent limitation in mobility was present (perceived presence). Finally, the environment was assessed by observation and two scales were constructed: the Special Care Unit Environmental Quality Scale (SCUEQS) and the Assisted Living Environmental Quality Scale (ALEQS).

## Analysis

We computed simple descriptive statistics—means and standard deviations for continuous measures and percentages for categorical measures—by setting (nursing home vs RC/AL). We completed statistical comparison of these characteristics by setting by fitting linear or logistic (for continuous and binary characteristics, respectively) models, using generalized estimat-

ing equations (GEE; Diggle, Heagerty, Liang, & Zeger, 2002), to control for subject clustering within facility through an exchangeable correlation structure; these models have setting as the single explanatory variable. Similarly, we computed descriptive statistics for those observed to have no or low mobility limitation and for those with a moderate to high mobility limitation. We used a four-level ordinal mobility measure as the dependent variable in partial proportional odds logistic regression to estimate odds ratios and 95% confidence intervals for greater mobility limitation. This procedure estimates separate odds ratios for the three cumulative logits for independent variables for which the proportional odds assumption was not met (Stokes, Davis, & Koch, 2000). We estimated adjusted odds ratios, controlling for age, gender, race, cognitive impairment (very severe, severe, moderate, vs mild), number of comorbid conditions, and number of nonmobility related ADL dependencies. We also tested interactions of predictors with setting. Both unadjusted and adjusted models accounted for resident clustering within facility using GEE.

## Results

We coded a total of 11,842 observations, with 93% of residents having at least 30 (out of a maximum of 36) observations. The average age of the residents was 84.8 ( $SD = 7.2$ ), 80% were female, and 90% were White. The average family involvement score was 3.8 ( $SD = 1.2$ ), representing a high level of involvement.

Table 1 describes the mobility status of the sample, and compares RC/AL and nursing home residents by mobility limitation and selected facility components. There was no significant difference in the distribution of residents' mobility limitation across facility type. Overall, about 11% of residents had no mobility limitation, 39% had low limitation, 36% had moderate mobility limitation, and 14% had high mobility limitation.

However, there was a significant difference in assessment and professional treatment between the two types of facilities. Residents in nursing homes were more likely to receive professional (70% vs 41%,  $p = .022$ ) and standardized (64% vs 35%,  $p = .010$ ) assessments of mobility. Residents in nursing homes were also more likely to receive professional treatment (from a medical doctor or physical therapist) for mobility limitation (41% vs 19%,  $p = .012$ ). Residential care facilities scored higher than nursing homes on the special care unit environmental measure ( $M = 26$  vs 21,  $p = .003$ ).

Table 2 shows the association between selected resident and facility characteristics and mobility limitation. Residents who had behavioral symptoms had lower odds of being in the high mobility impairment group than those without behavioral symptoms (adjusted OR = .40, 95% CI .17–.91). Residents with low fluid intake were more likely to have a higher level of mobility impairment than residents with adequate fluid intake (adjusted OR = 1.73, 95% CI 1.08–2.79). There was no significant association between other

**Table 1. Prevalence of Mobility Limitation and Relevant Components of Care in Dementia Care Study Sample, by Setting**

Mobility Limitation	RC/AL	NH	$p^a$
	( $N = 237$ ) % or $M$ ( $SD$ )	( $N = 106$ ) % or $M$ ( $SD$ )	
Prevalence <sup>b</sup>			
No mobility limitation	11.0	12.3	.880
Low mobility limitation	40.5	34.9	
Moderate mobility limitation	33.8	40.6	
High mobility limitation	14.7	12.2	
Assessment			
Professional	40.7	70.2	.022
Written or standardized	35.2	64.3	.010
Perceived presence, current	29.3	44.0	.090
Treatment			
Professional	19.4	40.5	.012
Informal	28.1	36.9	.205
Use of assistive mobility device	49.2	51.8	.716
Perceived success (if perceived mobility limitation)	60.0	57.1	.765
Training to detect and treat <sup>c</sup>			
Supervisory staff			
None in facility	12.2	0	.791
Some in facility	13.1	34.9	
Most in facility (> 75%)	74.7	65.1	
Direct care providers			
None in facility	15.3	0	.407
Some in facility	11.4	13.2	
Most in facility (> 75%)	73.4	86.8	
Staff feels adequately trained to assess	93.5	90.6	.536
Staff feels adequately trained to treat	87.9	89.6	.843
Environmental characteristics <sup>c</sup>			
SCUEQS	26.2 (5.6)	20.7 (2.8)	.003
ALEQS	13.9 (4.1)	11.1 (2.6)	.061

Notes: RC/AL = residential care/assisted living; NH = nursing home; SCUEQS = Special Care Unit Environmental Quality Scale; ALEQS = Assisted Living Environmental Quality Scale. Mobility was defined on the basis of three observed characteristics: being on one's feet, changing position, and changing location. Except as noted for "training," all data are resident-level and from those residents for whom outcome data (i.e., mobility) were available. Due to missing data,  $N$  varies from 182 to 237 (RC/AL) and 84 to 106 (NH), except in the case of "perceived success" of treatment, which was relevant only for those with mobility limitations and for whom there were data for 151 (44%) of subjects.

<sup>a</sup>Adjusted for facility-level clustering using generalized estimating equations (exchangeable correlation matrix);  $p$  values are based on score statistics.

<sup>b</sup>See text for explanation of cutpoints.

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

resident characteristics measured in this study and mobility limitation.

In terms of structural facility characteristics, residents of RC/AL facilities with fewer than 16 beds had higher levels of mobility limitation than nursing home residents (adjusted OR = 2.23, 95% CI 1.03–4.82),

Table 2. Characteristics Associated With Observed Mobility Limitation, Unadjusted and Adjusted

Characteristic	Distribution of Characteristic as % or M (SD)		Relationship Between Characteristic and Higher Levels of Mobility Limitation	
	No or Low Mobility Limitation (n = 147)	Moderate to High Mobility Limitation (n = 135)	Unadjusted OR (95% CI) <sup>b</sup>	Adjusted <sup>a</sup> OR (95% CI) <sup>b</sup>
<b>Resident<sup>c</sup></b>				
Severe to very severe cognitive deficit	57.5	65.2		
High, moderate, or low limitation (vs none)			0.50 (0.22, 1.11)	0.40 (0.16, 1.00)
High to moderate limitation (vs none or low)			1.40 (0.87, 2.27)	1.16 (0.68, 1.99)
High limitation (vs none, low, or moderate)			1.26 (0.60, 2.65)	1.05 (0.49, 2.24)
Depressed	23.9	21.3	0.85 (0.56, 1.30)	0.93 (0.59, 1.46)
Behavioral symptoms	57.7	60.6		
High, moderate, or low limitation (vs none)			0.40 (0.17, 0.92)	0.47 (0.21, 1.07)
High to moderate limitation (vs none or low)			1.13 (0.69, 1.84)	0.99 (0.57, 1.70)
High limitation (vs none, low, or moderate)			0.46 (0.22, 0.97)	0.40 (0.17, 0.91)
Low activity	41.7	53.1	1.39 (0.91, 2.12)	1.30 (0.80, 2.10)
High pain	17.0	25.4	1.75 (0.99, 3.07)	1.42 (0.83, 2.44)
Low food intake	51.0	57.1	1.42 (0.98, 2.04)	1.36 (0.93, 1.98)
Low fluid intake	42.9	62.3	1.79 (1.13, 2.83)	1.73 (1.08, 2.79)
Impaired vision	39.7	44.4	1.09 (0.70, 1.70)	0.85 (0.49, 1.47)
Family involvement	3.6 (1.3)	3.6 (1.3)	1.09 (0.90, 1.33)	1.04 (0.85, 1.28)
<b>Facility</b>				
Facility type				
NH	27.9	33.3	1.0	1.0
RC/AL, < 16 beds	15.6	17.0	2.16 (0.93, 5.06)	2.23 (1.03, 4.82)
RC/AL, Traditional	20.4	20.7	1.07 (0.54, 2.14)	1.54 (0.80, 2.94)
RC/AL, New-model	36.1	28.9	0.95 (0.42, 2.11)	1.15 (0.51, 2.60)
Facility size (OR per 10 beds)	76.4 (50.3)	83.6 (55.3)	0.98 (0.93, 1.04)	0.98 (0.93, 1.03)
For-profit ownership	75.7	60.7		
High, moderate, or low limitation (vs none)			0.33 (0.12, 0.88)	0.28 (0.10, 0.82)
High to moderate limitation (vs none or low)			0.48 (0.29, 0.81)	0.57 (0.33, 1.00)
High limitation (vs none, low, or moderate)			1.62 (0.70, 3.72)	1.95 (0.86, 4.43)
Assessment of mobility limitation				
Professional	39.7	62.1	2.28 (1.59, 3.28)	2.20 (1.47, 3.30)
Written or standardized	39.7	50.8	1.45 (0.98, 2.14)	1.43 (0.92, 2.20)
Perceived presence, current	16.9	48.8	4.74 (2.64, 8.52)	4.67 (2.43, 9.00)
Treatment of mobility limitation				
Professional	15.6	37.1	2.58 (1.60, 4.16)	2.11 (1.24, 3.61)
Informal	20.9	41.6	2.37 (1.49, 3.75)	1.82 (1.03, 3.22)
Use of assistive mobility device	43.0	57.1		
High, moderate, or low limitation (vs none)			5.54 (2.21, 13.88)	3.34 (1.28, 8.74)
High to moderate limitation (vs none or low)			1.77 (1.09, 2.87)	1.23 (0.69, 2.20)
High limitation (vs none, low, or moderate)			1.25 (0.60, 2.60)	0.96 (0.43, 2.13)
Perceived success (if perceived mobility limitation)	68.5	53.6	0.51 (0.24, 1.08)	0.51 (0.24, 1.10)
Training to detect and treat mobility limitation <sup>d</sup>				
Supervisory staff				
None in facility	12.2	8.1	1.0	1.0
Some in facility	21.1	20.0	0.58 (0.19, 1.78)	0.55 (0.17, 1.73)
Most in facility (> 75%)	66.7	71.9	0.84 (0.28, 2.50)	0.93 (0.32, 2.68)
Direct care providers				
None in facility	15.0	10.4	1.0	1.0
Some in facility	8.2	14.1	0.92 (0.28, 2.96)	0.65 (0.20, 2.17)
Most in facility (> 75%)	76.9	75.6	0.68 (0.28, 1.68)	0.63 (0.24, 1.65)
Staff feels adequately trained to assess	91.8	92.6	1.26 (0.60, 2.65)	1.08 (0.47, 2.50)
Staff feels adequately trained to treat	87.0	86.7	0.87 (0.48, 1.57)	0.90 (0.49, 1.65)

(Table continues on next page)

while those in for-profit facilities have lower odds of having any mobility limitation compared to residents in not-for-profit facilities (adjusted OR = 0.28, 95% CI 0.10–0.82). Process facility characteristics such as

professional assessment (adjusted OR = 2.20, 95% CI 1.47–3.30) and perceived presence of mobility limitation (adjusted OR = 4.67, 95% CI 2.43–9.00) were associated with higher levels of mobility limitation.

Table 2. (Continued)

Characteristic	Distribution of Characteristic as % or M (SD)		Relationship Between Characteristic and Higher Levels of Mobility Limitation	
	No or Low Mobility Limitation ( <i>n</i> = 147)	Moderate to High Mobility Limitation ( <i>n</i> = 135)	Unadjusted OR (95% CI) <sup>b</sup>	Adjusted <sup>a</sup> OR (95% CI) <sup>b</sup>
Environmental Characteristics				
SCUEQS	24.2 (5.1)	24.1 (5.7)		
High, moderate, or low limitation (vs none)			1.11 (1.03, 1.19)	1.11 (1.02, 1.20)
High to moderate limitation (vs none)			1.00 (0.96, 1.04)	1.02 (0.97, 1.07)
High limitation (vs none, low, or moderate)			0.99 (0.92, 1.07)	1.02 (0.94, 1.11)
ALEQS	12.8 (4.0)	12.6 (4.0)		
High, moderate, or low limitation (vs none)			1.14 (1.04, 1.25)	1.18 (1.06, 1.31)
High to moderate limitation (vs none)			0.98 (0.93, 1.04)	1.03 (0.96, 1.10)
High limitation (vs none, low, or moderate)			0.94 (0.84, 1.05)	0.99 (0.88, 1.12)

Notes: NH = nursing home; RC/AL = residential care/assisted living; SCUEQS = Special Care Unit Environmental Quality Scale; ALEQS = Assisted Living environmental Quality Scale. Mobility limitation was defined on the basis of three characteristics: being on one's feet, changing position, and changing location. See text for explanation of cutpoints. Except as noted for "training," all data are resident level, and from those residents for whom outcome data (i.e., mobility) and supervisor data (required for adjustment) were available and from supervisor report. Due to missing data, *N* varies from 264 to 282, except in the case of "perceived success" of treatment, which was relevant only for those with mobility limitations and for whom there were data for 138 (48.9%) of subjects.

<sup>a</sup>Adjusted for male gender, non-White race, age, cognitive status, number of eleven 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 four activities of daily living (dressing, eating, toilet use, hygiene).

<sup>b</sup>Based on a partial proportional odds logistic regression model for the four-level ordinal mobility limitation measure. The OR is interpreted as the relative odds of having greater versus lesser mobility limitation compared to the reference group (or per unit for continuous characteristics). CIs are based on robust variance estimation using generalized estimating equations with an exchangeable working correlation to control for within-facility clustering.

<sup>c</sup>Cognitive status is based on Mini-Mental State Examination (MMSE) or Minimum Data Set–Cognition (MDS-COGS) scores, if the MMSE is missing (*N* = 17). MMSE cutpoints for mild, moderate, severe, and very severe are:  $\geq 17$ , 10–16, 3–9, 0–2; respective MDS-COGS cutpoints are: 0–1, 2–4, 5–6, 7–10. Depressed:  $\geq 7$  on the Cornell Scale for Depression in Dementia; behavioral symptoms: any behaviors at least weekly on the Cohen-Mansfield Agitation Inventory; low activity:  $< 9$  (median) on the Albert Patient Activity Scale; pain:  $\geq 2$  points on the Philadelphia Geriatric Center Pain Intensity Scale; low food and fluid intake: consumed  $\leq \frac{3}{4}$  of meal and drank  $\leq 8$  oz on Structured Meal Observation. Depression, behavioral symptoms, and pain were taken from supervisor report, activity was taken from care provider report, and intake was based on direct observation.

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

Similarly, the process facility characteristic of treatment, both professional (adjusted OR = 2.11, 95% CI 1.24–3.61) and informal (adjusted OR = 1.82, 95% CI 1.03–3.22), was associated with higher levels of mobility limitation than that found in residents who did not receive treatment for mobility limitation. Residents using an assistive mobility device also had greater odds of having some mobility impairment (adjusted OR = 3.34, 95% CI 1.28–8.74) than those not using such devices. Finally, the structural variable of a higher environmental quality score was associated with having some degree (high, moderate, or low) of mobility limitation versus having no mobility limitation.

## Discussion

Direct observation of 343 residents with dementia in RC/AL facilities and nursing homes revealed that 89% of the residents had some level of mobility limitation, as defined in this study. Residents with high mobility limitation (14%) did not change position or location

during 3 hours of observation. Those with moderate limitation (36%) were on their feet fewer than 25% of observations, but changed position and or location at least once but fewer than 10% of observations. An additional 39% of the residents had low mobility limitation (on feet fewer than 25% of observations, but changed location 10% or more of observations), and the other 11% percent had no mobility limitation (i.e., were on their feet 25% or more of observations). Proportions were similar in RC/AL facilities and nursing homes.

These numbers are similar to other findings that document high levels of mobility limitation (75–85%) in long-term care facilities (Horn et al., 2002; Pope & Tarlov, 1991). Despite the fact that nursing homes typically have residents with higher levels of functional limitations than RC/AL facilities (Zimmerman et al., 2003), there was no significant difference in mobility limitation across the two settings among residents with dementia in this study. However, a more detailed analysis of the type of facility found higher levels of mobility limitation in RC/AL facilities with fewer than 16 beds compared to nursing homes. It may be that

smaller facilities offer less opportunity for mobility, and/or that there is less access to mobility assistive devices in these less resource-intensive settings. Also, facilities with higher environmental scores (e.g., better lighting contrast, handrails) may enable or facilitate management of residents with higher levels of mobility limitation.

Residents who exhibit behavioral symptoms were less likely to have high mobility limitation than those who did not; the association of behavioral symptoms with wandering may account for this relationship. Residents who used assistive mobility devices were more likely to have higher mobility limitation, and this relationship has been noted in other studies (Verbrugge & Sevak, 2002). Low fluid intake (observed during one meal) also remained positively associated with mobility limitation after adjustment for age, gender, race, cognitive impairment, ADLs, and comorbidities. Thus, there is a group of residents who maybe at risk for both mobility-related morbidity (e.g., pressure ulcers) and dehydration. Analysis of this group indicates that only 45% of these residents are very severely cognitively impaired (and may be end-stage dementia); hence, efforts may be indicated to focus care on this vulnerable population.

In terms of process variables, higher levels of assessment and treatment also were associated with having a higher level of mobility limitation. Since assessment and treatment were obtained from supervisor report and mobility was obtained by observation, it is unlikely that the association between assessment and treatment and mobility is due to measurement bias. More likely, this finding reflects that RC/AL and nursing home staff are attentive to residents and intervene when mobility problems occur. However,

38% to 63% of those with moderate to high limitation were not professionally assessed or treated, perhaps indicating the need for more attention for some of these more impaired residents.

## References

- Bourret, E. M., Bernick, L. G., Cott, C. A., & Kontos, P. (2002). The meaning of mobility for residents and staff in long-term care facilities. *Journal of Advanced Nursing*, 37, 338–345.
- Diggle, P. J., Heagerty, P., Liang, K. Y., & Zeger, S. L. (2002). *The analysis of longitudinal data*. Oxford, UK: Oxford University Press.
- Donabedian, A. (1988). The quality of care. How can it be assessed? *Journal of the American Medical Association*, 260, 1743–1748.
- Horn, S. D., Bender, S. A., Bergstrom, N., Cook, A. S., Ferguson, M. L., Rimmach, H. L., et al. (2002). Description of the national pressure ulcer long-term care study. *Journal of the American Geriatrics Society*, 50, 1816–1825.
- Hyatt, L. (1997). Focus on mobility. *Nursing Homes Long Term Care Management*, 46, 18–19.
- Jirovec, M. M., & Wells, T. J. (1990). Urinary incontinence in nursing home residents with dementia: The mobility-cognition paradigm. *Applied Nursing Research*, 3, 112–117.
- Mahoney, J. E., Sager, M. A., & Jalaluddin, M. (1999). Use of an ambulation assistive device predicts functional decline associated with hospitalization. *Journal of Gerontology: Medical Sciences*, 54A, M83–M88.
- Pope, A. M., & Tarlov, A. R. (1991). *Disability in America: Toward a national agenda for prevention*. Washington, DC: Institute of Medicine.
- Stokes, M. E., Davis, C. S., & Koch, G. G. (2000). *Categorical data analysis using the SAS system, 2nd ed.* Cary, NC: SAS Institute Inc.
- Trudeau, S. A., Biddle, S., & Volicer, L. (2003). Enhanced ambulation and quality of life in advanced Alzheimer's disease. *Journal of the American Geriatrics Society*, 51, 429–431.
- Verbrugge, L., & Sevak, P. (2002). Use, type, and efficacy of assistance for disability. *Journal of Gerontology: Social Sciences*, 57B, S366–S279.
- Zimmerman, S., Gruber-Baldini, A. L., Sloane, P. D., Eckert, J. K., Hebel, R., Morgan, L. A., et al. (2003). Assisted living and nursing homes: Apples and oranges? *The Gerontologist*, 43, 107–117.

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