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Long-Term Nursing Home Entry: A Prognostic Model for Older Adults with a Family or Unpaid Caregiver

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Abstract

Background/Objectives—We comprehensively examine factors associated with long-term nursing home entry across 6 domains of older adult and family caregiver risk from nationally representative surveys. We develop a prognostic model and a simple scoring system for use in risk stratification.

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Design, Setting, and Participants—Our sample of 2676 community living older adults receiving help with self-care disability and their primary family/unpaid caregiver was drawn from the 1999 and 2004 National Long-Term Care Surveys and 2011 National Health and Aging Trends Study and linked caregiver surveys.

Measurements—Prediction of long-term nursing home entry (episodes >100 days or ending in death) by 24 months, ascertained from Minimum Data Set assessments and dates of death from Medicare enrollment files. Risk factors were measured from survey responses.

Results—In total, 16.1% of older adults entered a nursing home. Our final model and risk scoring system includes 7 independent risk factors: older adults' age (1 point/5-years), living alone (5 points), dementia (3 points), 3–6 self-care activities (2 points), caregiver age (45–64 years: 1 point, 65–74 years: 2 points, 75+ years: 4 points), caregiver helps with money management (2 points), and caregiver reports moderate (2 points) or high (4 points) strain. Using this model, participants were assigned to risk quintiles. Long-term nursing home entry was 7.0% in the lowest quintile (0–6 points), 20.4% in the middle three quintiles (7–14 points), and 30.9% in the highest quintile (15–22 points). The model was well calibrated and demonstrated moderate discrimination with a c-statistic of 0.670 in the original data, 0.647 in bootstrapped samples, and 0.652 using the point-scoring system.

Conclusions—We developed a prognostic model and simple scoring system that may be used to stratify community-living older adults by risk of long-term nursing home entry. Our model may be useful for population health and policy applications.

Keywords

nursing home entry; disability; risk prediction

The exceedingly high financial and human costs of nursing home care has motivated sustained interest in identifying risk factors that are associated with long-term nursing home entry.^{1–3} However, most studies have been conducted in small, disease-specific, non-representative samples.^{1–6} Nationally representative studies have generally been constrained to a narrow set of individual or family caregiver factors^{7,8} or have examined nursing home use rather than entry.^{9,10} Yet nursing home entry is a multifactorial process affected by individual health and function, type and intensity of care needs, and the availability and adequacy of services and supports.¹ As more than 9 in 10 community-living older adults with disability rely on help from family and unpaid caregivers,¹¹ caregiver factors may also affect risk of nursing home entry, although evidence is mixed.^{12,13}

Having a clearer understanding of what factors affect risk for nursing home entry is particularly important and timely at this juncture due to population aging, efforts to promote community living, and the promulgation of alternative payment programs that create incentives to understand and mitigate non-medical risk factors that contribute to service utilization.¹⁴ The diffusion of risk prediction tools in clinical software and electronic medical records alongside consumer-generated electronic data capture make it increasingly possible to incorporate a broader set of factors in risk prediction, such as information reported by family caregivers.^{15,16} Although many people incur short-term post-acute care in a nursing facility, long-term nursing home entry is a relatively uncommon event that is

highly concentrated in persons with disability. The availability of a prognostic model could facilitate more effective targeting of supports to delay or avert this outcome.

Because risk prediction is usually poor when based on a narrow set of factors and support from family caregivers may be consequential to nursing home entry, we undertook a multi-stage study to assess how older adult and family caregiver factors jointly contribute to risk in a nationally-representative sample of community-living older adults with self-care disability. We expected that the ability to discriminate risk for long-term nursing home entry would involve multiple domains encompassing both older adults and family caregivers. Therefore, we first comprehensively examine factors associated with long-term nursing home entry within previously identified domains of older adult and family caregiver risk. Second, we develop a prognostic model for long-term nursing home entry. Third, we translate our model to a simple scoring system with decision-thresholds to guide use of our model in risk stratification.

Methods

Participants and Data Collection

Our study draws on the 1999 and 2004 National Long-Term Care Survey (NLTC) and the 2011 National Health and Aging Trends Study (NHATS) with linked caregiver surveys, Minimum Data Set files, and Medicare enrollment files. The NLTC and NHATS are nationally representative surveys of adults ages 65 and older. Both surveys rely on Medicare enrollment files for their sampling frame. Both surveys collect information about a broad set of socio-demographic and health characteristics during in-person interviews. With sampling weights, both studies produce nationally representative estimates of late-life disability. The 1999 and 2004 Informal Caregiver Survey and 2011 National Study of Caregivers are nationally representative surveys of the relatives and unpaid helpers to NLTC and NHATS study participants receiving assistance with self-care, mobility, or household activities for health or function at the time of in-person interviews.

Eligibility criteria for this study were developed to maximize comparability of older adults and their family caregivers at each point in time.¹¹ We paid particular attention to survey design issues that have been identified as important in the measurement of disability,¹⁷ and by extension, family caregiving.¹⁸ We restricted our focus to community-living older adults who were receiving help with self-care activities (eating, dressing, bathing, toileting, transferring, indoor mobility) for whom nursing home entry is most common.^{1,7} Eligible caregivers were relatives or unpaid non-relatives providing help to older adults who met inclusion criteria. As the NLTC caregiver survey was only conducted with “primary” caregivers, a “primary caregiver” was identified from the 2011 National Study of Caregivers (which interviews multiple caregivers) for each NHATS study participant. The final study sample consists of 2,676 older adult-family caregiver dyads.¹¹

Measurements

Older adult and family caregiver measures were constructed from survey responses. Candidate items were grouped by six domains of risk (See Tables 1 and 2). Domains

encompassed older adult demographic characteristics (age, gender, race), social and economic resources (education, Medicaid status, marital status, living arrangement), and health (medical conditions, hospital use, functional impairment) and family caregiver demographic characteristics (age, gender, relationship to older adult), caregiving circumstances (living arrangement, health, competing responsibilities, duration, intensity, types of care, respite use), and role-related appraisal (measures of caregiving strain).

Definition of Long-Term Nursing Home Entry

Long-term nursing home entry was defined as a nursing home stay of longer than 100 days or ending in death. Episodes of nursing home care were constructed using the Minimum Data Set (MDS) assessment. Death was identified from dates of death in Medicare enrollment files. The MDS is administered to nursing home residents on admission and regular intervals thereafter, as well as after a change in status, hospitalization, or discharge. MDS assessments are mandatory for all residents of Medicare- and Medicaid-certified nursing homes, and are used in Medicare payment¹⁹ and public reporting of nursing home quality.^{20,21} We constructed episodes from chronologically ordered MDS assessments within 24 months of interview. Episodes included breaks in nursing home care of less than 30 days, so as to accommodate intervening hospitalizations which are common among nursing home residents.^{22,23} Our definition of long-term nursing home entry includes older adults who were deceased at the time of nursing home discharge or who died within 30 days of discharge, since 1 in 5 nursing home resident deaths occur in the hospital.²⁴ In total, 513 of 2,676 participants experienced long-term nursing home entry within 24 months of interview.

Model Derivation

We developed proportional hazard regression models that incorporated dates of nursing home entry and right censoring events (e.g., death, end of study interval). These models produce valid estimates of the absolute cause-specific risk for an outcome event at a point in time in the presence of competing risks, in this case, death prior to nursing home entry. In addition to survey year, a comprehensive set of older adult factors and family caregiver factors were initially considered for model-building. As items of caregiving strain were highly correlated ($p < 0.001$) they were aggregated as a composite measure (range: 0–9) for subsequent use in model-building. Variables other than older adults' age, gender, and survey year that were not associated with long-term nursing home entry in bivariate models ($p < 0.25$), were dropped. A reduced set of 28 variables were considered in model development: 16 older adult factors and 12 family caregiver factors, yielding an events-per-variable ratio of 18 which suggests adequate sample for reliable risk prediction.^{25,26}

Candidate variables were entered into multivariable cox regression models using best-subsets selection to identify the most important predictors and guide the selection of a final model. Best subsets regression is an approach that simultaneously identifies a series of models with similar statistical properties, ranking each model using statistics of model fit and affording investigators the ability to incorporate clinical and practical considerations in selecting a final model that is most appropriate from models of equivalent statistical accuracy.²⁷ SAS 9.4 was used for regression modeling following the approach described by

Miao and applied by Cenzer.^{28,29} Final model selection was guided by the Schwarz Bayesian Information Criterion (SBIC). Relative to other measures of model fit, the SBIC imposes a greater penalty for each variable and yields a model with fewer variables, which may be advantageous with respect to clinical utility and ease of use. The authors reviewed 5 models with the highest SBIC scores and selected a 7-variable model comprising measures that are appropriate for risk stratification.

Bootstrap resampling, in which the model selection process was replicated 100 times was used to assess model performance.^{25,26} Discrimination of the prognostic model in the derivation sample was evaluated using Harrell's c-statistic. We used bootstrapped samples to compute an adjustment factor for overfitting related to variable selection and estimation.^{28,29} Calibration plots were produced to examine actual and predicted probability by risk group over time, using Stata Version 12.³⁰ Three risk groups were constructed, reflecting the lowest, middle three, and highest quintiles in our sample.

Finally, we constructed a point scoring system and decision-threshold to guide use of the model for risk stratification. Because the point scoring system is organized around categories, continuous variables were categorized using cut-points that balanced adequacy of sample and observed thresholds of elevated risk. Each point corresponds to risk associated with a 5-year increase in older adults' age after rounding the ratio of coefficients to the nearest integer.³¹ Discrimination and calibration of the point scoring system were compared to the original model using the methods previously described. As dementia is highly interrelated with functional impairment,³² family caregiving,^{33–35} and nursing home entry,^{1,4} we examined the performance of the point-based scoring system for older adults with and without dementia.

As the NLTCs and NHATS employ a complex multistage sampling strategy, descriptive estimates incorporate sampling weights and design variables.¹¹ Best subset selection methodology, bootstrap resampling, and the computation of Harrell's c-statistic do not accommodate design variables and sampling weights. Hazard ratios with and without sampling weights and design variables were similar in our cohort, as were results using the Fine and Gray method of examining the cumulative incidence function (Supplementary Tables S1–S3).

Results

In total, 16.1% of community living older adults receiving help with self-care or mobility from a family or unpaid caregiver experienced a long-term nursing home stay within 24 months of interview. The median time between interview and nursing home entry was 281 days (interquartile range: 112–486). Of the remaining participants, 20.0% died and 63.9% survived 730 days without entering a nursing home.

Older adults were on average 79 years of age and received help with 2 of 6 self-care activities; nearly 1 in 3 had dementia (Table 1). Factors that were independently associated with long-term nursing home entry encompassed each of the 3 identified domains of older adult risk, including: older age, white race, being unmarried, living alone, having incurred a

hospitalization in the prior year, and greater disability severity as measured by numbers of self-care activities. Health conditions that were independently associated with nursing home entry included dementia, hearing impairment, vision impairment, and stroke; cancer was inversely associated with nursing home entry.

Family caregivers were on average 63 years of age; nearly 3 in 4 lived with the older adult, and most were not employed (Table 2). Family caregivers provided an average of 34 hours of help per week. Family caregiver characteristics that were independently associated with older adults' nursing home entry encompassed each of the 3 identified domains of risk, including: older age, being a non-spouse, living separately, providing greater hours of care, helping with money management, respite use, and caregiving-related strain; helping with transportation was inversely associated with nursing home entry.

Our final model included 7 factors representing each of the 6 older adult and family caregiver domains of risk (Table 3). Older adults' age in years (HR: 1.02; 1.01–1.04), living alone (HR: 1.81; 1.47–2.23), having dementia (HR: 1.45; 1.20–1.75), and receiving help with greater numbers of self-care activities (HR: 1.07; 1.02–1.12) were associated with 24-month nursing home entry - as was having a family caregiver who was older (HR: 1.02; 1.01–1.02), helped with money management (HR: 1.29; 1.05–1.58), and reported greater caregiving-related strain (HR: 1.06; 1.03–1.10). The c-statistic for the final model was 0.670. From bootstrapped samples, an over-optimism penalty of 0.023 due to overfitting was estimated, resulting in an adjusted c-statistic of 0.647.

Finally, to assess the ability of the final model to discriminate risk, participants were stratified into three risk groups differentiating the highest and lowest quintiles from moderate risk. Observed 24-month nursing home entry was 6.9% in the lowest risk group, 19.3% in the moderate risk group, and 31.0% in the highest risk group (top panel of Table 4). Calibration plots indicated close correspondence between observed and predicted risk in each group. The point scoring system led to modest loss in model discrimination, yielding a c-statistic of 0.652. Using the point-scoring system, long-term nursing home entry was 7.0% in the lowest quintile (0–6 points), 20.4% in the middle three quintiles (7–14 points), and 30.9% in the highest quintile (15–22 points). In stratified analyses by dementia status, the point-based scoring system was found to generally discriminate well in each of the three risk groups (bottom panel of Table 4; Figure).

Discussion

We systematically evaluated a broad range of older adult and family caregiver factors from nationally-representative surveys to develop a prognostic model that may be used to stratify community-living older adults receiving help with self-care or mobility from family or unpaid caregivers into higher, moderate, and lower risk of 24-month nursing home entry. Our final prognostic model includes 7 factors encompassing multiple domains of older adult and family caregiver risk. This finding emphasizes that factors affecting nursing home entry extend beyond individual characteristics to their social context – including family caregiver demographics, circumstances, and experiences. Our prognostic model was successfully able to stratify older adults into risk groups with marked differences in nursing home entry,

ranging from 7% in the quintile at lowest risk, to 31% in the highest-risk quintile. The model appears to be robust with limited loss of discrimination in bootstrapped samples. Finally, we were able to translate our prognostic model to a point-based scoring index with decision thresholds corresponding to the high and low risk groups.

The model that we have developed has potential for use in care delivery, policy, and research settings. Organizations such as Accountable Care Communities and state Medicaid Home and Community-Based Programs that are responsible for delivering appropriate services to older adults with disabilities could use such a model for risk stratification to more effectively target interventions to those at high risk for nursing home entry. This model could also be used for risk adjustment in comparing rates of nursing home entry in different environments or populations. The model could prove useful to researchers in the design of observational studies in which nursing home entry is an outcome, or in establishing eligibility criteria and/or study measures in interventional studies that seek to reduce nursing home entry as a primary endpoint.

This is the first application of nationally representative data to comprehensively assess how older adult and family caregiver factors jointly contribute to risk for nursing home entry among community-living older adults receiving help from a family caregiver. Study results confirm the importance of comprehensively assessing a broad range of factors to understanding risk of nursing home entry. We find that it is not only older adults' demographic factors and function that affect nursing home risk, but that characteristics of family caregivers, caregiving circumstances, and perceptions of their role are also informative. Importantly, several of the factors identified in our model are potentially modifiable through targeted community-based supports: most notably, living alone,³⁶ functional disability,³⁷ and caregiving-related strain.^{35,38}

To our knowledge, just one other prognostic model has been developed for nursing home entry. The model developed by Yaffe and colleagues focused on persons with advanced dementia and predicted 30-day nursing home episodes between 1989 and 1994.⁴ The Yaffe model has many similarities to the model that we have developed despite differences in study populations, definitions of nursing home entry, and time period. The c-statistic in each of the two models were on the order of 0.67 at 24-months, suggesting considerable remaining unexplained variation, as is generally the case when predicting services utilization.³⁹ Stratified results by dementia status are reassuring and suggest that our model has broad application to community-living older adults with significant disability, regardless of dementia status.

Results from this study are timely in light of recent deliberation regarding whether and how to account for social factors in Medicare payment policy^{40,41} and awareness of the potential value to be derived from more systematic recognition and effective support of family in care delivery.^{42,43} The enduring commitment and intensity of family help is widely recognized: in this study family caregivers were providing nearly 34 hours of care per week on average. Our finding that caregiver factors contribute to risk for long-term nursing home entry raises the possibility that investing in services that better support family caregivers may yield dividends through reductions in long-stay nursing home use.

Limitations of our study include the inability to generalize findings to older adults with less severe disability, those living in residential care settings such as assisted living, and the 2–6% of older adults exclusively assisted by a paid caregiver.⁴⁴ Measures were carefully constructed to maximize comparability across the NLTCS and NHATS, but not all cross-year differences could be fully reconciled.¹¹ Data constraints preclude our ability to differentiate planned from unplanned nursing home entry, and limited our focus to a single “primary” caregiver as opposed to measures that characterize the broader helping network. Likewise, data limitations impede our ability to assess regional variability in long-term services and supports delivery environment as well as use of post-acute care and home and community-based services and supports. Strengths of our study include reliance on a national sample of community-living older adults, comprehensive information on multiple domains of older adult and family caregiver risk, and complete and objective ascertainment of both nursing home entry and mortality. Our model performs well across identified dimensions of prognostic model quality⁴⁵ with respect to being relatively free of bias, generalizable, and well-calibrated.

In summary, we developed a prognostic model for long-term nursing home entry; an event of public health, human, and economic consequence. As the annual cost of semi-private nursing home care exceeds \$85,000⁴⁶ and few Americans hold long-term care insurance, nursing home entry is often a financial challenge for older adults and families who must pay out of pocket.⁴⁷ Because publicly-financed programs are the primary payers of nursing home care, identifying and mitigating risk is of fiscal consequence to federal and state policy-makers. Americans have strong preferences for community living and broader availability of community-based services and supportive programs make respecting these preference increasingly possible.^{36,37,48} The 7-item prognostic model that we have developed may be of use to policy-makers, payers, and care delivery organizations by enabling more effective targeting of community-based supportive services to at-risk older adults with disability and the family members involved in their care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Impact Statement

We certify that this work is novel. This is the first prognostic model of long-term nursing home entry that has been developed in a nationally representative sample of community living older adults with and without dementia receiving help from a family caregiver.

Figure.

Long-Term Nursing Home Entry Among Community-Living Older Adults with a Family or Unpaid Caregiver, Points-Based Risk Score Stratified by Dementia Status

Y Axis: Nursing Home Entry (%)

X Axis: Points-Based Risk Score

—●— No Dementia —◆— Dementia

Table 1

Characteristics of Community-Living Older Adults Receiving Help with Self-Care or Mobility from Family or Unpaid Caregivers, Stratified by Long-Term Nursing Home Entry

Older Adult Characteristics	Sample Size (weighted%) ^a			Cause-Specific Hazard Ratio ^a	
	Study Sample	Nursing Home Entry			
		No	Yes ^b	(95% CI)	P-Value
	2676	2163 (83.9)	513 (16.1)		
Demographic factors					
Mean age (SD), years	79.2(8.2)	78.7(8.2)	82.1(7.6)	1.05 (1.04,1.07)	< 0.0001
Gender					
Male	894 (35.3)	730 (35.4)	164 (34.9)	reference	
Female	1782 (64.7)	1433 (64.6)	349 (65.1)	0.96 (0.75,1.23)	0.759
Race					
Black or other race	557 (19.4)	483 (20.3)	74 (14.6)	reference	
White	2119 (80.6)	1680 (79.7)	439 (85.4)	1.50 (1.10, 2.10)	0.020
Social and economic factors					
Educational attainment					
Less than 12 years	1318 (43.6)	1061 (43.1)	257 (46.4)	reference	
12 or more years	1358 (56.4)	1102 (56.9)	256 (53.6)	0.88 (0.70, 1.10)	0.252
Medicaid status					
Not enrolled	1857 (71.8)	1516 (72.7)	341 (67.0)	reference	
Enrolled	819 (28.2)	647 (27.3)	172 (33.0)	1.26 (0.99, 1.60)	0.063
Marital status					
Married	1146 (51.7)	960 (53.5)	186 (42.0)	reference	
Not married	1530 (48.3)	1203 (46.5)	327 (58.0)	1.57 (1.25, 1.95)	< 0.0001
Living arrangement					
Lives with others	2174 (84.8)	1799 (86.5)	375 (75.8)	reference	
Lives alone	502 (15.2)	364 (13.5)	138 (24.2)	1.86 (1.45, 2.38)	< 0.0001
Health and function					
Medical conditions					
Dementia	944 (31.9)	705 (28.8)	239 (47.9)	2.23 (1.81, 2.75)	< 0.0001
Hearing impairment	350 (10.1)	261 (9.0)	89 (15.5)	1.91 (1.46, 2.50)	< 0.0001
Vision impairment	737 (21.8)	556 (20.3)	181 (29.7)	1.66 (1.32, 2.10)	< 0.0001
Stroke	460 (18.4)	356 (17.5)	104 (23.2)	1.35 (1.03, 1.78)	0.032
Hip fracture	169 (7.5)	134 (7.2)	35 (9.5)	1.29 (0.90, 1.86)	0.165
Depressive symptoms	625 (27.4)	511 (27.1)	114 (28.6)	1.06 (0.83, 1.38)	0.628
Lung disease	614 (24.5)	510 (24.9)	104 (22.6)	0.93 (0.69, 1.26)	0.631
Diabetes	744 (32.5)	605 (32.8)	139 (31.1)	0.92 (0.69, 1.22)	0.554

Older Adult Characteristics	Sample Size (weighted%) ^a			Cause-Specific Hazard Ratio ^a	
	Study Sample	Nursing Home Entry			
			No	Yes ^b	
	2676	2163 (83.9)	513 (16.1)	(95% CI)	P-Value
Hypertension	1603 (64.3)	1313 (64.7)	290 (62.7)	0.88 (0.70, 1.11)	0.286
Heart disease	283 (12.8)	237 (13.1)	46 (11.0)	0.84 (0.56, 1.25)	0.374
Arthritis	1904 (70.9)	1551 (71.5)	353 (68.2)	0.83 (0.66, 1.05)	0.116
Cancer	412 (20.3)	360 (21.4)	52 (14.4)	0.69 (0.51, 0.94)	0.018
Hospitalized in prior year					
Not hospitalized	1577 (57.3)	1289 (58.8)	288 (49.6)	Reference	
Hospitalized	1099 (42.7)	874 (41.2)	225 (50.4)	1.49 (1.18, 1.87)	0.001
Mean no. self-care tasks (SD) ^c	2.2 (1.8)	2.2 (1.8)	2.6 (1.9)	1.16 (1.10, 1.23)	< 0.0001

^a Estimates are weighted to account for the complex sampling design of the National Long-Term Care Survey and the National Health and Aging Trends Study.

^b N=350 quarterly MDS assessments or nursing home episodes exceeding 100 days (n=123 in 1999, 165 in 2004, and 62 in 2011) and 163 in which participants did not survive to 100 days (n=53 in 1999, 69 in 2004, and 41 in 2011 within 24 months of interview).

^c Mean number of self-care activities from: eating, dressing, bathing, toileting, transferring, getting around inside.

Table 2

Characteristics of Family or Unpaid Caregivers to Community-Living Older Adults Receiving Help with Self-Care or Mobility, Stratified by Long-Term Nursing Home Entry

	Study Sample ^a	Nursing Home Entry ^a		Cause-Specific Hazard Ratio ^a	
		No	Yes ^b	(95% CI)	P-Value
Family Caregiver Characteristics	2676	2163 (83.9)	513 (16.1)		
Demographic factors					
Mean age (SD), y	62.6 (14.0)	62.2 (14.0)	64.5 (13.4)	1.01 (1.00, 1.02)	0.0107
Gender				reference	
Male	846 (35.6)	674 (35.7)	172 (34.8)		
Female	1830 (64.4)	1489 (64.3)	341 (65.2)	1.07 (0.85, 1.36)	0.5520
Relationship To Older Adult				reference	
Spousal caregiver	941 (42.3)	787 (43.8)	154 (34.8)		
Nonspousal caregiver	1735 (57.7)	1736 (56.3)	359 (65.2)	1.46 (1.16, 1.82)	0.0011
Caregiving circumstances					
Living arrangement					
Lives with older adult	1943 (75.1)	1605 (76.5)	338 (67.9)	reference	
Lives separately	733 (24.9)	558 (23.5)	175 (32.1)	1.46 (1.15, 1.86)	0.002
Duration of caregiving				reference	
< 4 Years	1332 (50.5)	1069 (50.3)	263 (51.1)		
4+ Years	1344 (49.5)	1094 (49.7)	250 (48.9)	0.92 (0.74, 1.14)	0.425
Self-rated health				reference	
Excellent or very good	755 (31.6)	616 (32.4)	139 (27.5)		
Good	1153 (39.6)	928 (39.2)	225 (41.8)	1.04 (0.90, 1.20)	0.624
Fair or poor health	768 (28.8)	619 (28.5)	149 (30.6)	1.01 (0.86, 1.18)	0.945
Employed for pay				reference	
Not employed	1849 (70.2)	1484 (69.6)	365 (73.2)		
Employed	827 (29.8)	679 (30.4)	148 (26.8)	0.85 (0.67, 1.07)	0.155
Co-resident child < 18 years	290 (10.6)	249 (10.9)	41 (9.0)	0.84 (0.57, 1.20)	0.315
Mean hours help per week (SD)	33.8 (37.4)	32.6 (36.4)	40.4 (41.6)	1.01 (1.00, 1.01)	0.000
Types of help provided					
Managing money	1652 (64.5)	1297 (63.5)	355 (69.8)	1.33 (1.04, 1.72)	0.026
Self-care	1776 (67.4)	1435 (66.9)	341 (70.2)	1.23 (0.98, 1.54)	0.072
Mobility	1881 (72.4)	1517 (71.8)	364 (75.4)	1.21 (0.95, 1.54)	0.117
Medications/wound care	1567 (62.0)	1263 (61.5)	304 (64.6)	1.18 (0.96, 1.44)	0.110
Household tasks	2290 (88.2)	1865 (88.4)	425 (86.9)	0.89 (0.67, 1.18)	0.404
Transportation	1801 (74.1)	1478 (74.8)	323 (70.0)	0.76 (0.60, 0.96)	0.019
Respite care use	355 (12.7)	279 (12.2)	76 (15.6)	1.34 (1.01, 1.77)	0.042
Caregiving role appraisal					

	Study Sample ^a	Nursing Home Entry ^a		Cause-Specific Hazard Ratio ^a	
		No	Yes ^b		
Family Caregiver Characteristics	2676	2163 (83.9)	513 (16.1)	(95% CI)	P-Value
Physical strain					
None (0–1) - 0 points	1384 (55.5)	1166 (57.9)	218 (43.2)	reference	
Some (2–3) - 1 point	902 (31.1)	714 (29.9)	188 (37.3)	1.65 (1.29, 2.11)	0.000
A Lot (4–5) - 2 points	390 (13.4)	283 (12.2)	107 (19.5)	2.15 (1.61, 2.87)	<0.0001
Emotional strain					
None (0–1) - 0 points	1119 (43.1)	948 (45.0)	171 (33.1)	reference	
Some (2–3) - 1 point	989 (36.4)	790 (35.9)	199 (38.9)	1.46 (1.16, 1.82)	0.001
A Lot (4–5) - 2 points	568 (20.5)	425 (19.0)	143 (28.0)	2.02 (1.51, 2.69)	<0.0001
Financial strain					
None (0–1) - 0 points	1702 (65.0)	1398 (65.9)	304 (60.3)	reference	
Some (2–3) - 1 point	651 (23.4)	519 (22.9)	132 (25.9)	1.22 (0.94, 1.57)	0.133
A Lot (4–5) - 2 points	323 (11.6)	246 (11.2)	77 (13.9)	1.38 (1.01, 1.90)	0.045
Exhausted at night – 1 point	727 (25.4)	554 (24.2)	173 (31.7)	1.47 (1.18, 1.84)	0.001
More than can handle–1 point	573 (20.8)	448 (20.1)	125 (24.3)	1.30 (0.99, 1.69)	0.057
No time for themselves -1 point	632 (21.2)	480 (19.9)	152 (28.1)	1.58 (1.25, 1.99)	0.000
Composite strain, mean (SD)	2.5 (2.5)	2.4 (2.4)	3.1 (2.5)	1.12 (1.08, 1.16)	< 0.0001

^aEstimates are weighted to account for the complex sampling design of the National Long-Term Care Survey and the National Health and Aging Trends Study.

^bN=350 quarterly MDS assessments or nursing home episodes >100 days (n=123 in 1999, 165 in 2004, 62 in 2011), 163 in which older adult did not survive to 100 days (n=53 in 1999, 69 in 2004, 41 in 2011) within 24 months of interview.

Table 3

Predictors of Long-Term Nursing Home Entry Among Community-Living Older Adults Receiving Help with Self-Care or Mobility from Family or Unpaid Caregivers

Older Adult Characteristics	Adjusted Hazard Ratio (95% CI)		
	Hazard Model	Points-Based Model	Points
Age ^a			
65–69 years	1.02 (1.01, 1.04)	1.03 (1.02, 1.04)	REF
70–74 years			1
75–79 years			2
80–84 years			3
85–89 years			4
90+ years			5
Lives alone	1.81 (1.47, 2.23)	1.85 (1.49, 2.30)	5
Dementia	1.45 (1.20, 1.75)	1.45 (1.19, 1.76)	3
Self-Care Help ^a			
1–2 activities	1.07 (1.02, 1.12)	REF	REF
3–4 activities		1.29 (1.02, 1.63)	2
5–6 activities		1.35 (1.06, 1.72)	2
Caregiver Characteristics			
Age ^a			
<45 years	1.02 (1.01, 1.02)	REF	REF
45–64 years		1.11 (0.77, 1.59)	1
65–74 years		1.35 (0.92, 2.00)	2
75+ years		1.60 (1.09, 2.35)	4
Helps manage money	1.29 (1.05, 1.58)	1.29 (1.06, 1.58)	2
Strain ^a			
None or Little (1)	1.06 (1.03, 1.10)	REF	REF
Moderate (2–6)		1.33 (1.09, 1.64)	2
High (7–9)		1.60 (1.18, 2.16)	4

^aContinuous measures of older adults self-care help (1–6 activities), family caregiver age, and caregiver strain (0–9) in hazard model were categorized as specified for points-based model.

Table 4

Comparison of Final Prognostic Model and Point-Based Scoring System for Long-Term Nursing Home Entry Among Community-Living Older Adults Receiving Help with Self-Care or Mobility from Family or Unpaid Caregivers

Risk Quintile	Hazard Model		Point-Based Scoring System ^a	
	# Events / # At Risk	Rate	# Events / # At Risk	Rate
Lowest	37 / 534	6.9%	41 / 588	7.0%
Moderate	310/1606	19.3%	335 / 1644	20.4%
High	166 / 536	31.0%	137 / 444	30.9%
Comparison of Point-Based Scoring System Stratified by Dementia Status^a				
	No Dementia		Dementia	
Lowest	40 / 576	6.9%	18/ 97	18.6%
Moderate	203 / 1070	19.0%	185/ 760	24.3%
Highest	31 / 86	36.0%	36/87	41.4%

^aRisk quintile using points-based system: low=0–6 points, moderate=7–14 points, high=15–22 points.