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Predictors of entry to the nursing home: Does length of follow-up matter?

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Abstract

This study examined the extent to which predictors of nursing home entry vary in their salience as a function of length of follow-up. Participants were 201 persons attending five senior day care centers. The impact of baseline assessment on nursing home entry was examined at one, two, and three-year follow-up periods. Analysis revealed that MMSE, IADL, physical non-aggressive agitated behavior, and 4 indicators of caregiver burden had significantly changing impacts on time to nursing home entry. Only depressed affect and age remained significant predictors at all three follow-up periods in the multivariate analysis. Physical and verbal aggressive agitation and declining caregiver health were significant predictors in the short term. Socializing and ethnicity became predictors at year three. We have demonstrated that while some predictors of nursing home placement are robust over varying follow-up times, the predictive value of others changes with length of the follow-up period. Length of follow-up needs to be taken into account in clarifying the processes that predict nursing home entry.

Keywords

Nursing home entry; Institutionalization; Predictors; Follow-up

1. Introduction

Much research has focused on identifying predictors of nursing home placement (Heyman et al., 1997; Chan et al., 2003; Bharucha et al., 2004; Friedman et al., 2006; Cohen-Mansfield and Wirtz, 2007). The studies utilized different variables, assessments, populations (e.g., with dementia, without dementia, or both), sample sizes, analyses, and follow-up durations in the determination of predictors of nursing home admission.

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In examining the impact of different variables on nursing home placement using varying follow-up durations, several variables emerged as consistently significant. These included diagnosis of dementia with follow-ups of 1 year (Chan et al., 2003), 3–7 years (Heyman et al., 1997; Aarsland et al., 2000; Tomiak et al., 2000; Cohen-Mansfield and Wirtz, 2007), and 10+ years (Bharucha et al., 2004); poor health with follow-ups of 1 year (Chan et al., 2003), 3–7 years (Tsuji et al., 1995; Tomiak et al., 2000), and 10+ years (Bharucha et al., 2004; Valiyeva et al., 2006); poor functioning in activities of daily living with follow-ups of 1 year (Chan et al., 2003), 2 years (Hanley et al., 1990; Liu et al., 1994), 3–7 years (Heyman et al., 1997; Aarsland et al., 2000; Tomiak et al., 2000; Hebert et al., 2001; McCann et al., 2005; Akamigbo and Wolinsky, 2006) and 10+ years (Bharucha et al., 2004; von Bonsdorff et al., 2006); and behavioral problems with follow-ups of 1 year (Chan et al., 2003), and 3–7 years (Tsuji et al., 1995; Hebert et al., 2001; von Bonsdorff et al., 2006; Cohen-Mansfield and Wirtz, 2007).

Some variables did not have results that were consistent over time. For example, age of care recipient was not a significant predictor in one year follow-up (Chan et al., 2003), but was significant with longer periods of follow-up (3–7 years) (Heyman et al., 1997; Aarsland et al., 2000; Tomiak et al., 2000; Gaugler et al., 2005; McCann et al., 2005; Akamigbo and Wolinsky, 2006; Cohen-Mansfield and Wirtz, 2007) and 10+ years (Bharucha et al., 2004). Being Caucasian was found to be a significant predictor in studies with shorter (1 year) (Chan et al., 2003) as well as longer (3–7 years) (Gaugler et al., 2005; McCann et al., 2005; Akamigbo and Wolinsky, 2006; Cohen-Mansfield and Wirtz, 2007) follow-up times. However, the study with the longest follow-up examining ethnicity (6 years) (Tsuji et al., 1995) did not find ethnicity to be significant. Inconsistent results were similarly reported for depression of the care recipient, which was found to be a significant predictor of nursing home admission by Cohen-Mansfield and Wirtz (2007) at 3+ years, but not by Aarsland et al. (2000) after 4 years or Bharucha et al. (2004) after 10-years.

Methodological issues other than follow-up period also affect the results, such as sample size and the operationalization of the variables under study. For example, with the exception of McCann et al. (2005), prior service use was not found to be a significant predictor irrespective of follow-up time when sample sizes were smaller than 1500 (Tsuji et al., 1995; Chan et al., 2003; Bharucha et al., 2004; Cohen-Mansfield and Wirtz, 2007), but was significant with larger samples over all follow-up lengths (Tomiak et al., 2000; Akamigbo and Wolinsky, 2006). The importance of the way a predictor is operationalized can be seen in the case of service use, such as adult day care utilization (Gaugler et al., 2005; McCann et al., 2005; Cohen-Mansfield and Wirtz, 2007) nursing home use (Akamigbo and Wolinsky, 2006), community service use (Chan et al., 2003) or prior hospital use (Tomiak et al., 2000; McCann et al., 2005; Akamigbo and Wolinsky, 2006). When comparing the results of different studies, it is impossible to discern whether differences in results are due to different follow-up periods, or to different samples, sample sizes, or methodologies.

For the most part, research investigating time-to-event outcomes such as nursing home entry has focused on the main effects of patient and caregiver characteristics. A main effects model assumes that the influence of any given baseline characteristic on the hazard (or, more precisely, the log of the hazard) of the outcome remains relatively stable across the duration of the period of study. However, that assumption cannot be taken for granted (particularly with respect to health-related outcomes).

Comparatively little is known about which characteristics associated with the timing of nursing home entry remain relatively stable across time, and which characteristics change in their salience across time. It is to a further explication of that question that the current study is addressed. Specifically, following Meinow et al.'s 2004 observation that some variables

are better short-term predictors of mortality and others are better at predicting long-term outcomes, we hypothesize that the same will be true of predictors of nursing home entry even in comparisons that differ by only one year. Additionally, since the data included independent ratings of the participants by adult day care center staff and by family members on some variables, we will examine the consistency in findings based on these different informants.

2. Subjects and methods

2.1. Participants

Two hundred and one community-residing participants from five senior day care centers in Maryland were included. Participants had been attending day care for an average of 1.24 years, with a range of less than two months to 13.3 years. The median day care attendance was once or twice per week during the two weeks preceding the initial interview. The average age of participants was 79.96 years, 68 were male and 133 were female. Most (177, 88.1%) were Caucasian. Participants' demographic data were generally similar to those of participants in a national survey of day care users, although a greater proportion of the participants in this study were Caucasian and a greater proportion was disabled in the performance of ADL (Weissert et al., 1990; NADSA, 2008). The Institutional Review Board approved this study for the Research Institute on Aging, and informed consent was obtained for all participants. For those who were unable to provide informed consent (as judged by a day care staff member who was well acquainted with the participant), a close relative was asked for consent. Additional information on the process of obtaining informed consent is available elsewhere (Cohen-Mansfield et al., 1988).

2.1.1. Day care centers—Five senior adult day care centers serving overlapping areas in Montgomery County, Maryland were included. All facilities involved in this study had structured activities and social programs as well as medical support staff.

2.2. Procedure

Participants were recruited throughout the study. At each six-month interval, all attendees of the adult day care centers above the age of 60 were approached for participation in the study. Overall, 351 were approached, with 116 refusing to participate and 235 consenting. After 34 were excluded before data collection due to passing away or discontinuing the daycare program, 201 participants were enrolled in the study.

Participants were assessed at baseline, and their status was verified every six months and recorded as: alive in the community, entered a nursing home, or deceased. Medical examinations by a geriatric physician were performed at baseline for 183 participants.

Activity directors in the adult day care centers provided information about the cognitive, affective, and behavioral status of participants (through questionnaires administered by a research assistant) because of their regular and close contact with participants. Family members provided information concerning the participants via a mailed questionnaire. When a participant was in a nursing home at follow-up, the closest relative was interviewed over the telephone regarding the reasons for nursing home entry.

2.3. Assessments

Data were collected through chart review, interviews, and questionnaires.

2.3.1. Demographic information—Basic demographic information on age, gender, ethnicity, marital status, number of regular income sources (i.e., social security, pension,

interest, and support from relatives) and length of time in day care at initial testing was recorded from day care records. Participants (or relatives when participants were unable) provided information on how many living children they had, as well as how many years of education they had received. Day care staff reported participants' attendance over the previous two weeks.

2.3.2. Other measures

Cognitive functioning: A trained research assistant administered the Mini-Mental State Examination (MMSE) (Folstein et al., 1975) to each participant.

Functional status: Functional status was measured by having the family caregiver fill out Lawton and Brody's IADL (Instrumental Activities of Daily Living) assessment (Lawton and Brody, 1969; Mangen and Peterson, 1984).

Delusions and hallucinations: Family caregivers reported whether participants experienced delusions using the BEHAVE-AD (Reisberg et al., 1987; American Psychiatric Association, 2000).

Depressed affect: Family caregivers rated the participants' severity of depression using the Raskin depression scale (Paykel et al., 1980; Knight et al., 1983; Raskin, 1988).

Agitation: Agitation may be defined as physical (non-aggressive or aggressive) or verbal (non-aggressive or aggressive). Physical non-aggressive agitation includes unusual physical behavior that is non-threatening, (e.g., pacing), physical aggressive agitation involves aggression toward self or others, and verbal non-aggressive agitation includes unusual verbal communication that is non-threatening. Verbal aggressive agitation includes unusual verbal communication that is threatening, such as cursing or screaming. Family caregivers rated agitation using the Cohen-Mansfield Agitation Inventory for Community (CMAI-C) (Cohen-Mansfield et al., 1995). Based on prior work (Paykel et al., 1980), the agitation scores were converted to 4 indicators: physical aggressive and non-aggressive behaviors and verbal aggressive and non-aggressive behaviors.

Pain: Family caregivers were asked to rate the severity of the participant's physical pain using the short form McGill pain questionnaire (Melzack, 1987; Werner et al., 1988).

Social network: The social network of participants was evaluated by the activity staff members using the Hebrew home social network scale (HHSNS) (Cohen-Mansfield and Marx, 1992).

Medical information: Physical examinations of participants provided information on the number of medical categories with diagnoses (e.g., cardiovascular, respiratory, etc.), number of psychiatric diagnostic categories (e.g., major affective disorders, anxiety disorders, etc.), and diagnosis of dementia. Relatives rated the participants' appetite for the previous two weeks on a scale from 1-extremely low to 6-extremely high.

Caregiver burden: The Zarit burden interview (Zarit et al., 1985) was used to assess the primary caregiver's burden.

2.4. Analytic approach

The standard form of the Cox proportional hazards model assumes that

$$\lambda_i(t) = \lambda_0(t)e^{\beta x}$$

Under this model, the effect of each covariate is assumed to be constant over time. A convenient alternative lies with the time-dependent coefficient model:

$$\lambda_i(t) = \lambda_0(t)e^{\beta(t)x}$$

Under this model, the effect of each covariate is permitted to vary across time, and the constancy of (t) (i.e., the proportionality assumption) is tested.

The proportionality assumption is typically tested using either or both of two complementary analytical strategies: (1) testing the statistical significance of a covariate-by-time interaction term which augments the standard proportional hazards model, and (2) testing the statistical significance of the relationship between the Schoenfeld residuals and time, which is typically assumed to be linear (Schoenfeld, 1982; Allison, 1995; Therneau and Grambsch, 2000; Vittinghoff et al., 2005). While the covariate-by-time approach directly models the log of the hazard, the Schoenfeld approach is based on the deviations of each covariate from its expected value. Because of the centrality of the proportionality assumption to the primary question being addressed in this research, we employed both of these analytical strategies. All analyses were conducted using SAS Version 9.

The analysis proceeded in several stages. Each covariate was initially separately entered into a Cox Model (with time to nursing home entry or censoring as the outcome) in which the proportionality assumption was relaxed, with the objective of identifying those baseline measures for which either the interaction with time or the Schoenfeld Test was statistically significant. In order to obtain hazard estimates under the least restrictive conditions, for each such variable, a discrete time (1 year, 2 year, or 3 year entry into nursing home) life table analysis was conducted, stratified by a dichotomized (at the median) form of the characteristic/assessment measure. The resulting hazard estimates were then plotted against time, separately for the two dichotomized groups, in order to visually determine the differential pattern of change. In order to identify which characteristics were salient in the prediction of time to nursing home entry in each of the three years from baseline, separate Cox models were tested for each year. Three multivariable Cox analyses were then conducted (one for each year) in order to determine which characteristics/assessments contributed an independent effect to the prediction of nursing home entry timing.

3. Results

As shown in Table 1, the proportionality assumption was found to be untenable under one or both of the analytical approaches for eight baseline variables: (1) MMSE score, (2) relative's assessment of physical non-aggressive agitated behavior, (3) number of medical categories, (4) IADL, (5) caregiver stress between caring and other responsibilities, (6) caregiver perception that social life has suffered, (7) caregiver inability of being able to care much longer, and (8) caregiver feeling of being overburdened as a caretaker. An appreciation for the nature and approximate magnitudes of changes over time is provided in Figure 1.

As Figure 1 demonstrates, the statistical significance of MMSE reported in Table 1 reflects the stronger effect of MMSE on the hazard of nursing home entry in the first year than in the third year. Approximately 21% of those with lower baseline MMSE scores (i.e., those who were more cognitively impaired and whose baseline MMSE scores were below the median) entered a nursing home during the first year, compared to a 6% hazard rate among those

with higher (i.e., above the median) baseline MMSE scores -- a relative risk of 3.3. In contrast, the third-year hazard rates of both groups were similar at approximately 0.15. Collectively, these results reflect an almost 150% increase in the hazard rate of the higher-MMSE group and a 33% decrease in the hazard rate of the lower-MMSE group between the first and third year.

The frequency of physical non-aggressive (PNA) behaviors reported at baseline by the relatives was found to reflect a similar pattern. In the first year, approximately 25% of those who reflected above-the-median baseline PNA scores entered a nursing home in the first year, compared to only approximately 5% of those who reflected below-the-median baseline PNA scores -- a relative risk of approximately 5.0. In the third year, the hazard of nursing home entry was much more similar for these two groups (approximately 0.20 and 0.15, respectively). Collectively, these results suggest that, while higher baseline PNA scores are associated with a greater hazard of nursing home entry in years 1 and 3, by year 3 the hazard rate among the lower baseline PNA group increased by 200%, while the hazard rate among the higher baseline PNA group decreased by 20%. The IADL results show higher IADL impairment levels to have proximal association with a higher risk of institutionalization, and distal association with a lower risk of institutionalization.

The four significant caregiver baseline stress measures reported in Table 1 were found to reflect similar covariate by time interaction patterns: for all four measures, the higher first-year hazard rates among subjects whose relatives reported more stress were found to dissipate (and, in some cases, reverse in direction) by the third year. Using caregiver's report of feeling overburdened as an example, first year hazard rates among participants whose relatives reported above-the-median stress on this measure were 3-times more likely to enter a nursing home during the first year than those subjects whose relatives reported below-the-median stress on this measure (hazard rates of approximately 0.261 compared to approximately 0.087 (Table 1). By year 3, the hazard rate associated with the higher-relative-stress group had dropped to 0.11 (i.e., more than a 50% reduction) while the hazard rate of the lower-relative-stress group had increased to 0.175 (i.e., more than a 100% increase). These results identify variables which reflect the most change in salience across time. However, it is equally important to identify those variables which are salient predictors of nursing home entry at each time point. As Table 2 shows, when examining predictor variables for nursing home entry during the first year after the baseline evaluation, the following variables emerged as significant: older age, low cognitive functioning (as measured by the MMSE), depressed affect (as rated by relatives and by staff), and all 4 syndromes of agitated behavior (as rated by relatives), and physical non-aggressive agitation (as rated by staff). Caregiver burden was also a significant predictor, as were several of its components.

An examination of the two and three year follow-ups shows that age, cognitive functioning, depressed affect, and caregiver burden remained significant predictors for both terms (Table 2). Some of the syndromes of agitated behavior (physical non-aggressive behavior as reported by both relatives and staff, and verbal non-aggressive behavior rated by relatives) also remained significant predictors. However, the risk ratio for the agitated behaviors became lower, and physical aggressive agitation and verbal aggressive agitation (both as rated by relatives) were no longer significant when viewed over the three year period. Among the caregiver burden items, declining health of caregiver was not significant past year one follow-up. Several variables emerged as significant at two years and remained significant for the three year follow-up, including living alone, resident mental health variables of dementia diagnosis and number of psychiatric diagnoses, and some of the components of caregiver burden. Being Caucasian and frequency of social interaction became significant predictors only at the three year follow-up.

Multivariate Cox regressions were performed to determine which predictor variables independently influenced time to entry (Table 3). Caregiver burden, physical non-aggressive behavior (relative), depression (staff) and age were significant at year 1 and, of those, depression (staff), and age were significant at years 2 and 3. Caregiver burden was not an independent predictor of placement at 3 years of follow-up. Depression (as rated by relative) and number of psychiatric diagnoses were significant only at follow-up longer than 1 year (3 years for depression according to relative, and both 2 and 3 years for number of psychiatric diagnoses).

4. Discussion

In this paper we focused on the question of whether predictors vary in their salience across time. Identifying what predicts nursing home entry over short versus long term periods has several implications. In particular, this would allow professionals to better assess an older person's risk of entry into a nursing facility as well as to develop strategies to prolong community dwelling. This study is innovative in that it found different predictors of nursing home entry at different follow-up periods. In the bi-variate analysis, variables such as age, MMSE scores, depressed affect, syndromes of agitation, and caregiver burden were found to be consistently significant predictors of institutionalization at all three years following baseline. Only depressed affect and age remained significant predictors at all three follow-up periods in the multivariate analysis. The contention that length of follow-up is a critical determinant in understanding predictors of nursing home entry is strengthened by the finding that there is a significant change in the salience and direction of specific predictors when examined by the Schoenfeld Test of the assumption that the effect of each covariate is assumed to be constant over time.

The findings of change in the potency of predictors have potential implications for understanding past research findings. For example, as stated above, Figure 1 and Table 1 show that, at year one, those with lower levels of cognitive functioning were more than three times more likely to enter a nursing home than those with higher levels of cognitive function, but this difference disappeared in the third year. These results are particularly interesting in the context of Miller and Weissert's (2007) summary analysis results, where lower cognitive functioning was associated with higher probability of institutionalization in 25 of 33 studies, and no relationship was found in the remaining eight studies.

Also congruent with Miller and Weissert's (2007) summary was our finding that for physical non-aggressive behaviors, persons exhibiting high levels of those behaviors were five times more likely to enter a nursing home in comparison to those manifesting low levels, but that difference disappeared by the third year. Although several forms of agitation remained significant at all three years of follow-up (bivariate analysis, physical non-aggressive behavior (relative and staff), verbal non-aggressive behavior, relative), and others (physical and verbal aggression according to relatives; verbal non-aggressive behavior according to staff) were significant predictors at only years one or two. Physical aggressive agitation and verbal aggressive agitation (both as rated by relative) were found to be significant predictors only in the first year after baseline. As both types of agitation were rated by a relative and were aggressive in nature, it is possible that relatives felt more threatened by these behaviors and therefore admitted their relative into a nursing facility sooner.

Regarding IADLs, we found higher impairment levels to have proximal association with a higher risk of institutionalization, and distal association with a lower risk of institutionalization, are particularly instructive in the context of Miller and Weissert's (2007) summary analysis, which revealed that higher IADL impairments levels were associated

with (1) higher levels of institutionalization risk in twelve analyses, (2) lower levels of institutionalization risk in one analysis, and (3) no relationship with institutionalization risk in six analyses. The results of our study suggest that these different relationships may be attributable in part to varying effects of IADL across time.

Caregiver baseline stress measures were found to have an immediate relationship with risk of nursing home entry which dissipated with time. Although several items under caregiver burden were significant predictors at all three years following baseline, caregiver's declining health emerged as significant only at year one follow-up, suggesting that it was a stronger predictor of earlier institutionalization. Miller and Weissert's (2007) summary analysis found that greater caregiver burden was associated with a lower risk of institutionalization in four out of six analyses, which fits with our finding of proximal rather than distal effects. The increased proximal risk is consistent with a theory-based association between caregiver stress and increased risk of institutionalization. However, it does not take into account the possibility that cumulative levels of caregiver stress may result in other resources (e.g., additional family members) sharing the burden across time, and thus the associated waning influence of a caregiver in the risk of institutionalization across time. Such potential use of other resources is suggested in studies such as Gaugler et al.'s (2000), which found that caregivers were far less likely to institutionalize their relatives when family members provided overnight help and assisted with activities of daily living care.

Socializing and ethnicity became predictors only at year three. These findings can be compared to those of Meinow et al. (2004), who reported different temporal patterns of predictors of mortality as previously mentioned. For example, in our study ethnicity is certainly a stable characteristic and it was a late predictor of placement, while aggressive behavior and caregiver health are factors that prompt immediate action and were predictive in the short term only.

In summary, as suggested by Meinow et al. (2004) these results indicate that when predictors are studied over a longer follow-up, "insignificant results may hide significant effects during a part of the follow-up." Meinow et al. (2004) fail to note that this deficiency can cut both ways: when average risk is studied over a comparatively long follow-up, the dominance of a significant effect during the period may lead to an incorrect conclusion that the effect prevails throughout the entire period.

Many studies examine predictors of nursing home institutionalization from the perspective of the Andersen behavior model, which posits that health behaviors are a function of predisposing (e.g., demographics and social support), enabling (e.g., indicators of familiar and community resources), and need (e.g., indicators of health) characteristics (Andersen and Newman, 1973; Andersen, 1995). This model posits that individuals' use of health services is a function of their predisposition to use services, their ability to secure those services, and their state of illness. These effects are typically assumed to have a constant effect on risk of institutionalization across time. Our findings show need variables and enabling variables to vary with follow-up time, which makes clinical sense. For example, the disruption caused by agitated behavior could propel relatives to institutionalize. Over time, however, the level of behavior may change with the progression of the disease (e.g., a person who paces will stop doing so when mobility is lost), or the relative who has not institutionalized the older person found ways to accommodate the behavior.

Another methodological issue that arises in studies that include persons with dementia involves the informant used and the effect of the informant on the results. Studies that have compared ratings of staff and family caregivers have frequently reported comparable outcomes. For example, moderate congruence (Werner et al., 1988; Cohen-Mansfield, 2002)

has been reported for pain assessment. More recently, McCallion et al. (2005) found no significant differences between traditional staff and foster family caregivers in reports of subjective or objective caregiver burden with respect to a sample of adults with intellectual disabilities and/or Alzheimer's disease living in a foster family setting. Another study comparing staff and family ratings of the resident's unmet need in a sample of adults diagnosed with dementia and living in an assisted living facility, found no differences in the perceptions of these informants (Milke et al., 2006). Similarly, congruence between relatives and adult day care staff was found in the measures used in this study. This consistency is remarkable in that different data collection methodologies were used (i.e., interviews were used with staff members and questionnaires were mailed to relatives). Taken together, the different studies provide evidence to demonstrate a consistency in reporting between informants, thus supporting the construct validity of the methodology.

In general, relatives' ratings of agitated behavior were more strongly associated with nursing home placement. Despite the potential impact of relatives' involvement on the strength of their rating as a predictor, their rating of physical nonaggressive behavior remained significant only for a one or two-year follow-up and their rating of depression was significant only at year three in the multivariate analyses. This illustrates the main finding of this paper. Whereas some predictors of nursing home placement are robust over varying periods of follow-up, the predictive value of others changes with length of follow-up period. Both researchers and practitioners need to take this into account in developing an understanding of processes that predict nursing home entry and in assessing risk and planning interventions for specific individuals.

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Figure 1.
Differential hazard patterns across time for low levels vs. high levels of selected variables.
Phys Non Agg Rel = Physically non-aggressive behaviors as rated by relatives

Table 1

Hazard, log (hazard), effective sample size, and level of significance, by dichotomized participant characteristic, significant results

	Hazard		Log (hazard)			Effective sample size				χ^2	Schoenfeld-test
	T(0,1)	T(1,2)	T(2,3)	T(0,1)	T(1,2)	T(2,3)	T(0,1)	T(1,2)	T(2,3)		
MMSE score											
Low	0.208	0.264	0.139	-1.57	-1.33	-1.97	85	60	39	3.59	0.28*
High	0.063	0.192	0.154	-2.76	-1.65	-1.87	82	69	49		
Physical non-aggressive (Relative)											
Low	0.061	0.220	0.130	-2.79	-1.51	-2.04	84	71	49	6.82*	-0.36**
High	0.234	0.224	0.179	-1.45	-1.49	-1.72	81	55	37		
Number of medical categories with medical diagnoses											
Low	0.068	0.261	0.116	-2.68	-1.34	-2.15	76	65	46	4.21*	-0.27*
High	0.161	0.176	0.176	-1.82	-1.73	-1.74	101	74	50		
IADL											
Low	0.088	0.274	0.213	-2.43	-1.30	-1.54	83	67	42	4.77*	-0.29*
High	0.204	0.179	0.093	-1.59	-1.72	-2.37	87	61	45		
Stress between caring and other responsibilities											
No	0.084	0.197	0.137	-2.48	-1.62	-1.99	100	84	63	4.21*	-0.23
Yes	0.273	0.314	0.200	-1.30	-1.16	-1.61	63	41	22		
Social life has suffered											
No	0.113	0.188	0.147	-2.18	-1.67	-1.92	103	82	59	4.28*	-0.24
Yes	0.233	0.314	0.128	-1.46	-1.16	-2.06	58	41	25		
Unable to care much longer											
No	0.067	0.207	0.190	-2.71	-1.58	-1.66	78	64	46	8.98**	-0.37**
Yes	0.248	0.257	0.116	-1.39	-1.36	-2.15	82	57	37		
Do you feel overburdened as caretaker?											
No	0.087	0.211	0.175	-2.44	-1.55	-1.74	96	79	56	5.15*	-0.30*
Yes	0.261	0.253	0.111	-1.34	-1.37	-2.20	65	45	29		

Notes: All non-demographic variables were dichotomized at the median. The hazard, log (hazard), and effective sample size columns are based on lifeable estimates from 1, 2, and 3 years until nursing home entry. The χ^2 column reflects the significance of the interaction between the undichotomized assessment/characteristic variable and time:

100.0 > d
**
50.0 > d
*

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Table 2

Results of bi-variate Cox regressions for predictors of nursing home (NH) entry within 1, 2, and 3 years after baseline

Variables	Within <= 1 year		Within <= 2 yrs		Within= 3 yrs	
	RR	Pr > χ^2	RR	Pr > χ^2	RR	Pr > χ^2
Participant characteristics						
<i>Demographic</i>						
Age, in 5-year steps	2.262	0.051	1.904	0.023	1.835	0.017
Ethnicity *			3.034	0.062	3.856	0.022
Lives alone	2.308	0.071	2.009	0.047	2.098	0.021
<i>Cognitive functioning</i> , MMSE score	0.944	0.022	0.963	0.021	0.969	0.038
<i>Mental health</i>						
Dementia diagnosis	2.616	0.12	2.248	0.036	2.035	0.033
No of psychiatric diagnoses	1.21	0.407	1.477	0.009	1.47	0.006
<i>DEPRESSION</i>						
Total depression, reported by relative	1.513	0.033	1.698	0.001	1.794	0.001
Total depression, reported by staff	1.669	0.001	1.639	0.001	1.563	0.001
<i>AGITATED BEHAVIOR</i>						
Physical non-aggressive (Relative)	1.581	0.001	1.292	0.005	1.235	0.012
Physical non-aggressive (Staff)	1.428	0.013	1.268	0.031	1.227	0.045
Physical aggressive mean (Relative)	2.081	0.008	1.319	0.345	1.314	0.303
Physical aggression (Staff)	1.876	0.088	1.725	0.121	1.678	0.134
Verbal non-aggressive (Relative)	1.442	0.005	1.334	0.003	1.324	0.002
Verbal non-aggressive (Staff)	1.225	0.223	1.28	0.032	1.233	0.054
Verbal aggressive (Relative)	1.359	0.029	1.151	0.272	1.109	0.397
Verbal aggressive (Staff)	1.498	0.098	1.215	0.371	1.131	0.565
<i>SOCIAL FUNCTIONING</i>						
Frequency of socializing with relatives and friends.	0.903	0.44	0.837	0.063	0.839	0.046
Caregiver Burden (mean)	2.148	0.0131	2.013	0.0019	1.962	0.0013
Not enough time for yourself	1.697	0.018	1.604	0.003	1.5	0.005
Stress between caring and other responsibilities	1.652	0.022	1.409	0.028	1.323	0.051
Embarrassed by relative's behavior	1.138	0.515	1.342	0.039	1.337	0.027

Variables	Within <= 1 year		Within <= 2 yrs		Within= 3 yrs	
	RR	Pt > χ^2	RR	Pt > χ^2	RR	Pt > χ^2
Relative negatively affects relationship	1.342	0.09	1.351	0.017	1.336	0.012
Your health suffered because of caring	1.406	0.034	1.249	0.053	1.213	0.064
Social life has suffered	1.463	0.035	1.331	0.025	1.274	0.038
Uncomfortable having friends over because of relative	1.094	0.586	1.267	0.041	1.25	0.038
Relative treats you as only caretaker	1.496	0.025	1.423	0.004	1.382	0.003
Unable to care much longer	1.777	0.001	1.481	0.002	1.34	0.013
Wish to leave care to others	1.402	0.07	1.439	0.008	1.271	0.054
Uncertain about what to do	1.378	0.083	1.47	0.004	1.481	0.001
Don't have enough privacy	1.363	0.03	1.277	0.018	1.257	0.017
Do you feel overburdened as caretaker?	1.695	0.009	1.451	0.009	1.353	0.019

Notes:

* Ethnicity is empty in year one because only Caucasian participants entered the nursing home during the first year after baseline. Results were not significant for any of the years for: *Psychotic symptoms*: at least one delusion (by relative and by staff) and hallucinations (by relatives and by staff), *Health and function variables*: Number of medical categories with diagnoses, IADL, Appetite, Pain (according to relatives and staff); *Social function variables*: Quality of relationship with relative, relationship with staff and other residents, *Caregiver burden variables*: Relative asks more help than he/she needs, Angry when around relative, Afraid about the future of your relative, Relative is dependent on you, Feel strained when around your relative, Lost control of your life, You should be doing more, Could do a better job, How long have you cared for your relative?

Table 3

Multivariate regression (only significant relationships are shown)

	Year 1	p <	Year 2	p <	Year 3	p <
Caregiver Burden	1.97	0.03	1.54	0.03	1.31	0.12
Physical, non-aggressive (relative)	1.64	0.02	1.35	0.05	1.17	0.27
Depression according to relative	1.04	0.91	1.28	0.26	1.53	0.03
Depression according to staff	1.85	0.05	1.86	0.001	1.64	0.01
Number of psychiatric diagnoses	1.47	0.2	1.71	0.001	1.64	0.001
Dementia diagnosis	1.82	0.54	3.28	0.09	2.71	0.09
Age in 5 year steps	3.51	0.05	2.35	0.04	2.37	0.02

Notes: Physical non-aggressive behavior according to staff, physical aggressive behavior according to relative, were not significant in any of the analyses.