Factors Influencing Time to Nursing Home Placement in Persons with Probable Alzheimer's Disease

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BACKGROUND

- Between 30-50% of people with dementia (PWD) from high income countries reside in resource and cost-intensive residential or nursing home care facilities.
- However, the majority of PWD report a preference to reside in their own homes regardless of disease stage.
- Thus, there is a need 1) to better identify those at risk for early placement; and 2) to identify effective interventions aimed at mitigating/reducing time to placement.

AIMS

The aims of this study were:

1) To examine the influence of pre-progression rate (PPR) on time to nursing home placement (NHP)
2) To determine if disease severity at which home care and respite services (HCRS) are introduced makes a difference in delaying time to NHP

METHODS

- **Participants**: Prospectively collected longitudinal data were obtained from the Baylor College of Medicine ADMDC, Houston, TX.
  - ***Inclusion***: a) NINCDS-ADRDA criteria for probable AD; b) no confounding secondary diagnoses; and c) at least one yearly follow-up visit (n = 1210).
  - ***Exclusion***: a) onset of symptoms greater than 3 years prior to baseline visit; and b) NHP between baseline and the first yearly follow-up visit.

METHODS

- **Measures**:
  - ***Independent variables:***
    - Severity stage at time of HCRS use. – HCRS use was assessed with a questionnaire distributed prior to the initial visit and then again at each annual follow-up visit. Severity of AD at time of first HCRS use was defined based on MMSE score (mild [20-30], moderate [11-19], or severe [1-10]). I

      In this study, HCRS is broadly defined and includes:
      - Home-based care -paid worker providing respite, companion, homemaker/ home-health aid, or nursing services in the PWDs home
      - Adult day care—respite services provided outside the home setting which include therapeutic activities, social activities, and health monitoring
    - Preprogression rate (PPR). – Disease progression rate (PRR) was calculated using the following formula: (30–baseline MMSE)/estimated duration of symptoms in years). Participants were categorized as slow (0-1.9 MMSE points/year), intermediate (2-4.9 MMSE points/year), and rapid progressors (5 or more MMSE points/year).
  - *Dependent variable:*
    - Time to NHP. – was calculated as the time in months from physician-estimated onset of symptoms to the NHP date.
  - *Covariates:*
    - Age, sex, years of education, baseline severity of dementia (mild, moderate, severe based on Mini Mental Status Examination score [MMSE]), functional status (based on Physical Self-Maintenance Scale [PSMS] and Instrumental Activities of Daily Living [IADL] scores), caregiver age, caregiver relationship to participant, and level of caregiver stress (measured by asking caregivers to rate their level of stress in caring for their partner with AD on a 4-point Likert scale (1=lowest stress; 4=highest stress).
- **Analysis:**
  - All demographic and clinical variables were compared based on the disease stage at which HCRS was first introduced using chi-squared tests (discrete variables) or ANOVA (continuous variables).
  - A univariate Cox proportional hazards regression model and log rank test were used to determine the unadjusted effect of 1) severity stage at first use of HCRS, 2) PPR, and 3) the interaction between severity stage at first use of HCBS and PPR on time to NHP (Table 2). Kaplan-Meier curves were presented to compare time to NHP between 1) participants who first used HCBS in the mild, moderate, or severe stages of AD (Figure 1) and 2) participants with slow, intermediate, or rapid PPRs (Figure 2).
  - A multivariate Cox proportional hazards regression model was further used to determine these associations while controlling for covariates (Figure 3).

RESULTS

Table 1. Key baseline demographic and predictive characteristics by severity at HCBS introduction

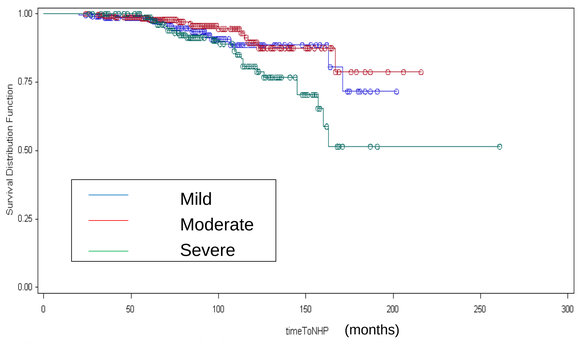
Baseline Variable	HCRS introduced in mild stage (n = 381)	HCRS introduced in moderate stage (n = 414)	HCRS introduced in severe stage (n = 356)
Participant age, y, mean*	74	75	71
Participant female*	38.6%	30.4%	27.3%
MMSE* - Mild (20-30) - Moderate (11-19) - Severe (0-10)	 95.0% 5.0% 0.0%	 48.3% 51.5% 0.3%	 30.5% 33.6% 35.9%
IADL, mean*	12.62	16.17	18.87
PSMS, mean*	6.99	8.15	9.36
PPR* (MMSE points/year) - Slow (0-1.9) - Intermediate (2-4.9) - Rapid (≥5)	 49.0% 39.2% 11.8%	 30.7% 49.5% 31.9%	 14.7% 49.2% 36.2%
Duration of symptoms, y, mean*	3.21	3.92	4.12
Caregiver age, y	63	62	61.57
Caregiver relationship to participant (spouse), % - Spouse - Adult-child - Other	 55.0% 31.4% 13.6%	 45.3% 38.8% 16.0%	 49.7% 33.8% 16.6%
Caregiver stress level, mean	2.71	2.79	2.86
NHP, n, %*	31 (9.69%)	48 (12.87%)	77 (24.29%)

* p <0.05

Table 2. Unadjusted effects of disease severity at first use of HCBS, PPR, and their interaction on time to NHP

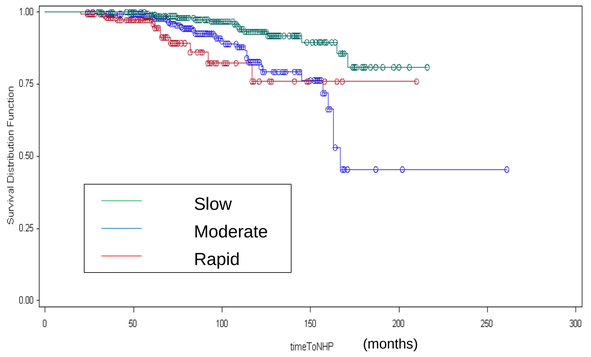
Variable	HR	CI	p Value
o **Severity stage at first use of HCRS**			**0.03**
▪ Mild vs. severe	0.60	0.32, 1.16	
▪ Moderate vs. severe	0.44	0.23, 0.83	
o **Preprogression rate**			**<0.001**
▪ Intermediate vs. Slow	3.04	1.58, 5.85	
▪ Rapid vs. Slow	6.00	2.53, 14.23	
- **Interaction (Severity at HCBS first use x PPR)**			**0.21**
Severe stage			
▪ Intermediate vs. Slow	1.38	0.68, 2.79	
▪ Rapid vs. Slow	2.31	0.97, 5.52	
▪ Intermediate vs. Rapid	0.60	0.29, 1.22	
Moderate stage			
▪ Intermediate vs. Slow	4.53	1.48, 13.84	
▪ Rapid vs. Slow	11.80	3.30, 42.26	
▪ Intermediate vs. Rapid	0.38	0.15, 1.01	
Mild stage			
▪ Intermediate vs. Slow	3.05	1.14, 8.18	
▪ Rapid vs. Slow	7.85	2.05, 30.04	
▪ Intermediate vs. Rapid	0.39	0.10, 1.47	

Figure 1. Kaplan-Meier survival curves for time to NHP by disease severity when HCRS was introduced



Those who first utilized HCRS in the severe stage of disease experienced shorter times to NHP than those who first utilized HCBS in the mild stage of disease (HR for mild vs. severe = 0.60, HR for moderate vs. severe = 0.44, $X^2 = 7.19$, $p = 0.027$)

Figure 2. Kaplan-Meier illustrating time to NHP by preprogression rate



Those with a rapid PPR experienced shorter times to NHP than those with a slow PPR (HR for intermediate vs. slow = 2.64, HR for rapid vs. slow = 5.47, $X^2 = 17.41$, $p = 0.0002$).

Table 3. Adjusted effects of disease severity at first use of HCBS, PPR on time to NHP

Variable	HR	CI	p Value
- Participant variables:			
o **Severity stage at first use of HCBS**			**0.39**
▪ Mild vs. Severe	1.30	0.38, 4.40	
▪ Moderate vs. Severe	0.66	0.24, 1.78	
▪ Mild vs. Moderate	1.98	0.70, 5.60	
o **PPR**			**<0.01**
▪ Intermediate vs. rapid	0.49	0.17, 1.44	
▪ Intermediate vs. slow	4.3	1.53, 11.88	
▪ Rapid vs. slow	8.6	2.04, 36.28	
o Age	0.95	0.90, 1.0	0.05
o Sex (male vs. female)	1.91	0.78, 4.70	0.16
o Education	0.95	0.85, 1.06	0.38
o Baseline MMSE score	1.11	1.02, 1.21	0.01
o Baseline IADL score	1.08	0.98, 1.19	0.14
o Baseline PSMS score	1.12	1.0, 1.25	0.05
- Caregiver variables:			
o Age	0.98	.94, 1.02	0.31
o Relationship to participant			0.05
▪ Spouse vs. Adult-Child	0.2	0.05, 0.74	
▪ Spouse vs. Other	0.37	0.09, 1.47	
▪ Adult-Child vs. Other	1.84	0.55, 6.11	
o Baseline stress			0.56
▪ "just a little" vs. "extreme"	1.28	0.47, 3.53	
▪ "moderate" vs. "extreme"	0.79	0.34, 1.87	
▪ "just a little" vs. "moderate"	1.62	0.66, 3.98	

PRIMARY FINDINGS

1) In this sample, we demonstrated that slower PPR was associated with longer delays in NHP even after adjusting for covariates (p<0.01).
2) Disease severity at which HCRS is introduced is associated with longer delays to NHP in an unadjusted model (p=.03)
3) However, when other variables are accounted for (e.g. caregiver stress, functional status, and gross cognitive functioning, this finding does not hold (p=.39).

LIMITATIONS

- Participants were followed at a single site, which may have limited the generalizability of the study.
- Recall error may have contributed to inaccurate reporting of HCRS.
- Since data collected regarding service utilization was based on a binary measure of use versus non-use, we were unable to examine the association between amount of HCRS use and time to NHP.

IMPLICATIONS

- PPR is a simple measure that can be used by clinicians to identify people with AD who are at higher risk for NHP (e.g. rapid progressors).
- Once identified, strategies aimed at mitigating or reducing time to NHP, such as HCRS, can be employed and more informed long-term planning can occur.
- Barriers to utilizing HCRS, especially early in the disease process, should be addressed in order to promote their use, particularly by persons who have a more rapid rate of decline, in hopes of prolonging time to NHP.