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Predictors of Residential Care Admission in Community-Dwelling Older People With Dementia

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Abstract

Objectives: The objectives of this study were to identify variables associated with dementia and entry into aged residential care (ARC) and derive and validate a risk prediction model for dementia and entry into ARC.

Design: This was an observational study of prospectively collected Home Care International Residential Assessment Instrument (interRAI-HC) assessment data.

Setting and Participants: Participants included all people age ≥ 65 years who had completed an interRAI-HC assessment between July 1, 2012 and June 30, 2018. Exclusion criteria included death or entry into ARC within 30 days of assessment and not living at home at the time of the assessment.

Measures: InterRAI data from 94,202 older New Zealanders were evaluated for presence or absence of dementia. A multivariable competing-risks model for entry into ARC with death as the competing event was used to estimate subdistribution hazard ratios (SHR).

Results: In total, there were 18,672 (19.8%) persons with dementia (PWD). PWD were almost twice as likely to enter ARC as persons without dementia [42.8% vs 25.3%; difference 17.5% (95% confidence interval 16.7%–18.2%)]. PWD at highest risk of entering ARC were those where there was a desire to live elsewhere (SHR 1.44), depression (indicated, SHR 1.15), poor cognitive performance (Cognitive Performance Scale minimal SHR 1.32 and severe plus SHR 1.91), and wandering (SHR 1.19). Factors associated with reduced risks of PWD entering ARC were living with a child or relative, alcohol consumption, and comorbidities.

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The authors declare no conflicts of interest.

Ethical approval for the study was obtained from the Ministry of Health, Health and Disability Ethics Committee (REF: 14/STH/140).

Supplementary Data

Supplementary data related to this article can be found online at <https://doi.org/10.1016/j.jamda.2020.04.021>.

Conclusions and Implications: A desire to live elsewhere, social isolation, independent activities of daily living, and depression were independently associated with entry into ARC. Supporting caregivers may improve outcomes for PWD that delay entry into ARC. Future revisions of the interRAI questionnaire could provide more insight on this matter.

Keywords

Dementia; aged residential care facilities; older people; risk prediction model; ethnicity

Dementia is a common disorder in older people.¹ It was estimated in 2010 that approximately 35.6 million people around the world had dementia, with this number expected to continue to increase.² In New Zealand, there were an estimated 62,287 people with dementia in 2016, and by 2050 this number is expected to reach over 170,000.³

Individuals with dementia spend more time in aged residential care (ARC) facilities than individuals without dementia.⁴ In New Zealand, ARC facilities are permanent facilities designed to offer skilled nursing, rest home, hospital, and respite care. Reasons for early entry into ARC facilities have been extensively studied. Common risk factors include living alone, ethnicity, sex, marital status, falls risk, cognitive impairment, diabetes, and stroke.^{5,6} In the case of Alzheimer's disease, risk factors include age, ethnicity, marital status, female sex, living alone, and decline in instrumental activities of daily living (IADLs).^{6,7} Individuals who are married or live with a caregiver generally have a decreased risk of entry to ARC.⁷

New Zealand is 1 of many countries with an aging population. As the number of older people increases, so does the need for health services and ARCs. In response to this need, New Zealand health boards have developed health and social policies to help older people remain living in their own homes for as long as possible.^{8,9} To enable this, the government has developed strategies for targeted intervention programs and delivery of home health services.¹⁰ These services are particularly important in caring for persons with dementia (PWD). New Zealand has an extensive community support program that is designed to assist older people to stay at home. It is publicly funded. Services provided include medication management, domestic assistance (eg, assistance with shopping and cleaning), or personal care (which includes assistance with activities of daily living). In addition, there is the provision of respite care to help address carer stress.

From 2012, it was mandated in New Zealand that anyone living within the community and requiring publicly funded formal healthcare and support services must undergo a comprehensive standardized geriatric needs assessment. The assessment used is the Home Care International Residential Assessment Instrument (interRAIHC).¹¹ The interRAI-HC is a comprehensive assessment that collects health information across a wide variety of social and medical domains, including dementia diagnoses and cognitive function. The interRAI instrument's purpose is to obtain health information to create individual care plans for older people with complex needs. Individuals undergoing assessment can give consent for their information to be used for planning and research purposes. In the past, 93% of individuals have given consent for their data to be used for research and planning purposes.¹¹

Aged care planners in New Zealand need to understand at what point in the disease progression PWD will require ARC. This study aimed to characterize differences between older persons with and without dementia, and to identify variables associated with dementia and entry into ARC.

Methods

Design

This was an observational study of prospectively collected interRAI-HC assessment data.

Participants

Participants included all people aged 65 years who had completed an interRAI-HC assessment between July 1, 2012 and June 30, 2018, and who had consented for their data to be used for research purposes. During that period, the interRAI-HC assessment was compulsory for all people who a medical professional determined may need publicly funded ARC or other long-term support. Exclusion criteria included death or entry into ARC within 30 days of assessment, and not living at home at the time of the assessment. Only the first assessment for any individual was used. Follow-up was until death or July 30, 2018 (with a minimum of 30 days follow-up). Details of data collection methods are published elsewhere.¹²

All persons within New Zealand who have ever interacted with the public health system have a unique national health index (NHI) number. Encrypted NHI numbers linked interRAI-HC assessments with death events and entry to ARC events. Using the NHI number, the New Zealand Technical Advisory Services (<https://tas.health.nz/analytics-insights-and-strategy/interrai>) provided interRAI-HC records of all people who had consented for their data to be used for research. The Ministry of Health encrypted the NHI numbers and, using its Contracted Care Payment System database, provided dates of admission of people who had entered ARC. This database has been verified to include ~90% of all people who had entered ARC.¹¹ The other ~10% were self-funded individuals who may or may not have completed an interRAI-HC assessment. The National Mortality Collection Register provided the dates of any deaths.

Under disease diagnoses in the interRAI assessment, neurologic options for dementia are Alzheimer's disease and dementia other than Alzheimer's disease. In this study, in addition to the above choices, if dementia or Alzheimer's disease was recorded in the medical notes, then the participant was considered to have dementia. There were 3 scales included in this study. The activities of daily living (ADL) hierarchy scale was developed as a measure of an individual's capacity to undertake a combination of personal hygiene, toilet use, locomotion, and eating.¹³ The ADL scale is based on the performance of the individual in the 3 days prior to assessment. The higher scores on the ADL hierarchy denote that somebody is already assisting individuals to perform their ADL activities, reducing the need to receive assistance at an ARC. The Depression Rating Scale was developed to measure a person's mood.¹⁴ The depression scale was validated against the Cornell and Hamilton depressions scales.¹⁴ It scores people using 7 mood items over the 3 days prior to assessment. The

Cognitive Performance Scale was designed to assess an individual's decision making, comprehension, and short-term memory.¹⁵

Variables for the multivariable models were chosen a priori based on known and possible associations with ARC or death.¹⁶ How each variable was coded is shown in Supplementary Table 1.

Alcohol consumption was an example of a categorical variable and was measured as follows. Alcohol consumption was a minor observation and is related to the question "When you look back over the last 14 days, what is the highest number of drinks you had in a single sitting?" A sitting refers to any given point in time (eg, at dinner, after work, while out at a social event, watching television). The answer "None" could mean that the person never drinks or simply that they have not had a drink in the last 14 days. We aggregated into 3 categories: "None," "1," and "2 or more."

Statistical Analyses

Data are presented as n (%) for categorical variables, mean and standard deviation for normally distributed quantitative variables, and median (lower quartile-upper quartile) for non-normally distributed variables. To identify which interRAI variables were most strongly associated with dementia, we compared variables by dementia status using standardized mean differences (SMDs). This enabled ranking of the differences between the variables. We interpreted SMD 0.2 to be small, >0.2 to <0.8 to be medium, and 0.8 to be large.¹⁷ The R package *tableone* v 0.9.3 (K. Yoshida, J. Bohn, and M.K. Yoshida in Vienna, Austria) was used because it incorporates extensions of SMD to binary and multinomial variables.¹⁸

A multivariable competing-risks time-to-event regression model was constructed for the outcome of entry to ARC. A competing risk model was used to account for the substantial proportion of participants who died before they could otherwise have entered ARC. This made death a competing risk. (Variables for inclusion were chosen a priori by senior physicians based on known or possible associations with either ARC entry or death.) The effects of variables on the likelihood of participants entering ARC were reported as subdistribution hazard ratios (SHRs). The Fine-Gray method was used to calculate SHR with the *cmprsk* package in R.¹⁹ A SHR greater than 1 indicated an increased risk of entering ARC for people with a risk factor relative to those without the factor. For example, an SHR of 1.5 indicated a 50% increase in risk after accounting for all the covariates in the model, whereas a SHR <1 indicated a decreased risk (eg, 0.67 indicates a 33% decrease risk. Note, the increase in risk from 0.67 to 1 is $1/0.67 = 1.5$ or 50%). To assess the relative importance of each variable, we calculated the percentage contribution of the variable to the model. We used the χ^2 statistic minus the number of degrees of freedom for that variable relative to the χ^2 minus the number of degrees of freedom for all of the model; we present these graphically.¹⁶

The competing risk model required a complete data set. Fifty-two out of 18,672 participants (0.27%) had missing data. As this is a small percentage, we deemed it unnecessary to impute their missing values.

In the case of timed walk test, those who were unable or refused to be tested were assigned to 1 of the 4 categories of timed walk [incomplete/refused/not tested; the others being fast (< 8 seconds), average (9 to 14 seconds), and slow (> 15 seconds)].

The STROBE guidelines (www.strobe-statement.org) were used to guide this report. All calculations were performed in R v 3.4.3 (R Core Team, Vienna, Austria).²⁰ Ethics approval was obtained from the New Zealand Ministry of Health: Health and Disability Ethics Committee (14/STH/140).

Results

Of 193,292 interRAI-HC assessments, 99,092 were excluded, leaving 18,672 (19.8%) PWD and 75,528 (80.2%) persons without dementia for the final analysis (Figure 1). PWD were more likely to enter ARC compared with persons without dementia [42.8% compared with 25.3%; difference 17.5% (95% confidence interval, CI 16.7%–18.2%)]. PWD were less likely to die prior to entry to ARC or end of follow-up [27.6% compared with 32.9%; difference –5.3% (95% CI –6.1% to –4.6%)]. The overall rate of death was similar [43.7% compared with 43.3%; difference 0.4% (–0.4% to 1.2%)].

Dementia vs Nondementia

PWD were slightly younger (81.1 years) than persons without dementia (81.9 years; 10 months difference in mean ages) and more likely to be male (43.8% compared with 38.6%; Supplementary Table 2). They were also physically healthier, with lower rates of chronic diseases, faster walking, less dyspnea, and less fatigue.

PWD were less likely to live alone (32.4% compared with 51.6%) and more likely to live with relatives. They were also less likely to be lonely alone (18.0% compared with 21.9%) or to have experienced a major life stressor in the 90 days before assessment alone (34.6% compared with 46.7%) (Supplementary Table 2).

PWD or their relatives were more likely than persons without dementia or their relatives to feel that they would be better off living somewhere else (20.6% compared with 15.4%).

Although many PWD remained independent, they were less likely to be independent than persons without dementia (ADL hierarchy independence; 51.8% compared with 68.6%). In contrast, PWD were more likely to have symptoms of depression (Depression Rating Scale indicated; 31.4% compared with 22.9%).

Dementia: Survival Analysis

Of 18,672 PWD within the derivation dataset, 7992 (42.8%) entered ARC, and 5147 (27.6%) died without first entering an ARC during follow-up of between 30 days and 5.9 years [median 3.3 (1.8–4.6) years]; Supplementary Table 3.

In the multivariable competing risks model for ARC, the most influential variable, contributing nearly 25% to the model, was the answer to the question that the person or relative feels that the person would be better off living elsewhere (Figure 2; SHR for 10 most

influential variables are in Table 1, SHR for all variables in Supplementary Table 4. Those who answered “Yes” were 44% more likely to enter ARC than those who answered “No” (ie, SHR 1.44; 95% CI 1.35–1.53). The ADL hierarchy scale indicated that compared with those who are independent, those needing the highest levels of assistance were less likely to enter ARC. This is because somebody is already helping the individual, so they do not need to go into ARC. Providing help can reduce the need for entry into ARC. Participants with dementia were 25%–44% less likely to enter ARC if they were living with someone in addition to their spouse or lived with a child or other relatives, compared with living alone (Table 1). Depression, mild or indicated, was associated with increased likelihood of entering ARC of 12% to 15%, as did Cognitive Performance Scale rating (32% to 91%; dose-response) and any wandering not within the last 3 days (19%). Of the comorbidities, none were associated with a greater likelihood of entering ARC; to the contrary, they were all associated with reduced likelihood of entering ARC (by 5% to 17%; ie, SHR 0.95 to 0.83; Supplementary Table 4), with congestive heart failure (17%) having the largest reduction. Male individuals were 9% less likely to enter ARC than female individuals. PWD with minimal to severe fatigue were 5% to 19% less likely to enter ARC. Similarly, recent hospitalization was associated with reduced likelihood of entry into ARC (17% to 24%). Although not a major contributor to the model, alcohol consumption over the previous 14 days was also associated with a reduced likelihood of entry to ARC (Supplementary Table 4). Compared with having no drink in the previous 14 days, those who consumed 1 drink at least once (at 1 sitting) were 6% less likely to enter ARC, whereas those whose maximum was 2 or more drinks at any 1 sitting were 8% less likely to enter ARC. Age was not a contributor.

Discussion

This study confirmed significant health and social characteristic differences between persons with and without dementia. PWD were more likely to enter ARC than participants without dementia. A systematic review by Cepoiu-Martin et al⁷ identified ethnicity, greater dementia severity, and older age to be the strongest predictors for PWD entering aged-care facilities. Although the relationship between dementia and depression inside and outside residential care facilities is well documented,^{21–29} a study on the risk of institutionalization found that caregiver burden and depression are important factors.³⁰ In our study, individuals who exhibited depression were more likely to enter ARC. This finding is consistent with a study that found that PWD who had a history of depression were more likely to enter long-term care.³¹

An association between loss of cognitive function and poor performance in ADL and IADL tests has been frequently reported in persons with dementia.^{32–37} We found moderate or worse cognitive impairment was the highest risk factor for PWD entering ARC. As cognitive function deteriorated, the likelihood of entering ARC increased. A meta-analysis found 3 or more ADL dependencies, cognitive impairment, and prior nursing home use as the strongest predictors of nursing home admission.³⁸ This suggests that interventions which aid a person to be more independent could delay the need for residential care. Unexpectedly, in our study, PWD with the most dependency in ADL Hierarchy subgroups had the lowest risk of entering ARC. This reflects a higher death rate among the most dependent in the cohort.

Endorsing the question “Person or relative feels the person would be better off living elsewhere” had the most influence on whether a PWD entered ARC. The interRAI dataset did not capture whether the participant or family member answered this question nor was it an assessment of living environment. Numerous studies have reported caregiver burden, fatigue, and depression leading to ARC admissions.^{39,40} A longitudinal follow-up study of 3875 older Americans found high risk of entering ARC associated with non-Hispanic white, living alone, low education, and more caregivers.⁴¹ In that study, older adults who had a partner caregiver were less likely to enter residential nursing care, whereas those who had a medical-supportive caregiver were more likely to be admitted. Possibly, support or respite for caregivers could delay PWD entering ARC. To help inform health planners on where best to direct resources, future revisions of the interRAI questionnaire could include a question on who (participant/relative/other with a choice of reasons, eg, clinical needs, carer strain) answered the “better living elsewhere question.”

We found several factors associated with a lower risk of PWD entering ARC; many of these were in agreement with previous literature. Although living with a child or relatives reduced the risk of entering ARC, self-identified loneliness was not a factor. This highlights the importance of addressing social isolation as distinct from loneliness.⁴² Drinking alcohol was also associated with a slightly reduced likelihood of entering ARC and reduced mortality.⁴³ Possibly, those who do not drink are frailer and, therefore, more likely to enter ARC or die.⁴⁴ In contrast to published research,⁴⁵ age was not an indicator of likelihood of individuals with dementia entering ARC. Although other studies have found that PWD have high rates of comorbidities,⁴⁶ our results show a lower incidence for PWD compared with those without dementia (Supplementary Table 2).

Strengths and Limitations

Results from this study were limited to community-dwelling older people with complex healthcare needs and may not be generalizable to a wider audience of older community-dwelling people. There are 2 issues related to data completeness. The first of these is that approximately 7% of the interRAI participants did not consent to have their interRAI information used for research purposes. In addition, the data source provided by the Ministry of Health includes the approximately 90% of individuals who qualify for an ARC subsidy. It is unclear how this impacted the study results, as there may be some characteristics that are specific to the groups whose information is unavailable. In interpreting the results, it is important to recognize that causality cannot be inferred even when there is a strong SHR, as there may be additional explanatory risk factors missing from the models.

Although the data was comprehensive and the rates of entry to ARC during the study period were high, the study was cross-sectional and, therefore, further insights into what influenced ARC would likely require a longitudinal study and analysis.

In the case of alcohol consumption, there was no way to distinguish between people who were life-time abstainers and those who were not. We collapsed the categories ‘2–4 drinks’ and ‘5 or more drinks’ into ‘2 or more’. This was due to the small numbers of participants who responded 5 or more (299 out of 18,672). With subgroups of small numbers and 2

outcomes of interest (death and entry to ARC), competing risk models often fail to converge; hence, the need to aggregate them.

Conclusion and Implications

Twice as many PWD as persons without dementia entered ARC. The main risk factors were endorsing the statement that “Person or relative feels the person would be better off living elsewhere,” living arrangements, lower cognitive performance, recent hospitalization, female sex, and depression. In New Zealand, reducing social isolation and targeting interventions that reduce depression may delay the need for ARC.

Health planners and policy makers need to know if support needs to be given to caregivers. Future revisions of the interRAI questionnaire have been developed that focus on carer needs. This could provide data for researchers to determine if supporting caregivers improves outcomes for PWD and delays entry into ARC.

Factors associated with reduced risks of PWD entering ARC were living with a spouse, child, or other, alcohol consumption, and comorbidities. These suggest that family who look after relatives with dementia may be providing nurturing environments where the affected individual receives close medical supervision. More information on who answered the “better living elsewhere” question will provide further insight as to why these factors reduce risk of entering ARC.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Fig. 1.
Patient recruitment and outcome diagram. DOD, date of death; DOA, date of assessment.

Fig. 2.

Relative contributions of dependent variables within the multivariable competing risks model for entry into ARC as the outcome of interest and death as the competing risks outcome. A high variable contribution to the model does not mean there is a high SHR (compare with Table 1). BMI, body mass index; CHD, coronary heart disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; CPS, Cognitive Performance Scale; DM, delirium; DRS, Depression Rating Scale; Stroke/CVA, stroke/cerebrovascular accident.

Table 1

Within the Dementia Cohort, the SHRs for Entry to ARC (Competing Risk Model; Selected Variables Only)

	Survive (n = 5533)	ARC (n = 7992)	Death (n = 5147)	SHR (95% CI)
Better live elsewhere, %				
Yes	628 (11.4)	1981 (24.8)	1242 (24.1)	1.44 (1.35–1.53)
Living arrangements, %				
Alone	1558 (28.2)	2989 (37.4)	1497 (29.1)	1 (Reference)
With spouse or partner only	2624 (47.4)	3566 (44.6)	2311 (44.9)	0.94 (0.83–1.06)
With spouse or partner and others	351 (6.3)	336 (4.2)	334 (6.5)	0.75 (0.64–0.88)
With child	764 (13.8)	836 (10.5)	802 (15.6)	0.68 (0.63–0.75)
With siblings	39 (0.7)	47 (0.6)	23 (0.4)	0.88 (0.66–1.18)
With other relatives	150 (2.7)	116 (1.5)	117 (2.3)	0.56 (0.46–0.68)
With nonrelatives	47 (0.8)	102 (1.3)	63 (1.2)	1.03 (0.83–1.27)
CPS, %				
None	114 (2.1)	79 (1.0)	73 (1.4)	1 (Reference)
Minimal	548 (9.9)	553 (6.9)	338 (6.6)	1.32 (1.05–1.66)
Moderate	3291 (59.5)	4011 (50.2)	2221 (43.2)	1.55 (1.25–1.93)
Severe	1177 (21.3)	2261 (28.3)	1477 (28.7)	1.76 (1.4–2.2)
Severe plus	403 (7.3)	1087 (13.6)	1038 (20.2)	1.91 (1.51–2.42)
Recent hospitalization, %				
None	4151 (75.0)	5879 (73.6)	3090 (60.0)	1 (Reference)
From 31 to 90 d	562 (10.2)	640 (8.0)	578 (11.2)	0.83 (0.77–0.91)
From 8 to 30 d	376 (6.8)	462 (5.8)	386 (7.5)	0.91 (0.83–1.01)
From 0 to 7 d	444 (8.0)	1011 (12.7)	1093 (21.2)	0.76 (0.69–0.83)
Sex, %				
Female	3089 (55.8)	4793 (60.0)	2615 (50.8)	1 (Reference)
Male	2444 (44.2)	3199 (40.0)	2531 (49.2)	0.91 (0.86–0.95)
DRS, %				
None	3034 (54.8)	4029 (50.4)	2837 (55.1)	1 (Reference)
Mild	888 (16.0)	1283 (16.1)	730 (14.2)	1.12 (1.05–1.19)

	Survive (n = 5533)	ARC (n = 7992)	Death (n = 5147)	SHR (95% CI)
Indicated	1611 (29.1)	2679 (33.5)	1580 (30.7)	1.15 (1.09–1.22)
ADL hierarchy, %				
Independence	3564 (64.4)	4210 (52.7)	1906 (37.0)	1 (Reference)
Supervision	1126 (20.4)	2052 (25.7)	1296 (25.2)	1.03 (0.97–1.1)
Limited	431 (7.8)	874 (10.9)	730 (14.2)	1.04 (0.95–1.13)
Extensive	248 (4.5)	587 (7.3)	619 (12.0)	0.93 (0.83–1.04)
Maximal	73 (1.3)	149 (1.9)	269 (5.2)	0.76 (0.62–0.92)
Dependent plus	91 (1.6)	119 (1.5)	327 (6.4)	0.61 (0.48–0.77)
CHF, %				
Diagnosed	402 (7.3)	625 (7.8)	797 (15.5)	0.83 (0.76–0.9)
Fatigue, %				
None	2603 (47.0)	3865 (48.4)	1901 (36.9)	1 (Reference)
Minimal	1863 (33.7)	2547 (31.9)	1606 (31.2)	0.95 (0.9–1)
Moderate	807 (14.6)	1207 (15.1)	1113 (21.6)	0.91 (0.84–0.97)
Severe plus	260 (4.7)	373 (4.7)	527 (10.2)	0.81 (0.71–0.91)
Wandering, %				
None	5089 (92.0)	6874 (86.0)	4435 (86.2)	1 (Reference)
Present not last 3 d	288 (5.2)	622 (7.8)	350 (6.8)	1.19 (1.09–1.31)
Exhibited last 3 d	156 (2.8)	496 (6.2)	361 (7.0)	1.08 (0.97–1.2)

CHF, congestive heart failure; CPS, Cognitive Performance Scale; DRS, Depression Rating Scale; SHR, subdistribution hazard ratios.