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Health Outcomes From Assisted Living Facilities: A Cohort Study of a Primary Care Practice

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Abstract

The population of older adults residing in assisted living facilities (ALF) in the United States is growing, yet health data about this population is relatively sparse. We aimed to compare health outcomes of ALF residents with those of age- and sex-matched community dwelling adults in a retrospective cohort study of 808 older adults. Linear regression analyses were conducted to describe the relationship between ALF residency and our outcomes of hospitalizations within 1 year of the index date (earliest recorded date in the ALF), 30-day rehospitalization following index hospitalization, emergency department (ED) visits, and mortality at 1 year. Hospitalizations were significantly greater for ALF residents than for controls. The odds of death for ALF residents were approximately twice that of controls. Falls and ED visits were also significantly greater for ALF residents. The ALF population requires targeted geriatric and primary care models if we are to effectively meet the needs of this growing population.

Keywords

assisted living; outcomes; primary care

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All authors approved the final version of the manuscript.

Conflict of Interest

Paul Y. Takahashi, MD, serves on the medical board for Axiall LLC.

Introduction

Assisted living facilities (ALFs) provide care for older adults who are no longer able to live in their own homes and bridge the gap between community and nursing home-level care. In Minnesota, assisted living refers to services or service packages available within a housing structure, as defined by statute. These services include having an on-call registered nurse available for staff, a protocol for daily checks of residents, a client request/staff response system, and health services from a Minnesota licensed home-care agency.^{1,2} Commonly, the time for transition to an ALF comes because of a consequential event in a person's life,³ hence establishing a vulnerable ALF population. ALFs are heterogeneous places on many levels, especially in terms of resident and facility staffing characteristics.⁴ This heterogeneity poses a challenge for providers and for health service research in this area.

We know from national survey data that ALFs are home to many of the *oldest old*, with the average age of residents being 86.9 years⁵ compared with 78.8 years for residents of nursing homes.⁶ Although some residents may live in ALFs until they die, many others will require transfer to skilled care facilities, usually because of cognitive or functional needs.⁷ Data are lacking about use of acute health care services by ALF residents because ALFs are not regulated, similar to nursing homes; however, data for ALFs is urgently needed if providers are to efficiently meet the needs of this growing high-risk population. Even less is known about rates of advance care planning (ACP) in this group.

Previous research using survey data showed that approximately 1 in 4 ALF residents had been hospitalized in the previous year. The risk was even greater across all age groups for falls and certain chronic medical conditions.⁸ In Canada, ALF residents with dementia had hospitalization rates almost 4 times that of nursing home residents with dementia⁹ as well as statistically significant higher rates of emergency department (ED) use.¹⁰ These unplanned events are unfavorable for patients, can be expensive, and may be preventable.¹¹ In addition, questions remain about health care utilization and ACP in the ALF population in the United States.

Therefore, our primary aim was to characterize the association between ALF residency and hospitalization over a year and to compare the results with those of an age- and sex-matched community cohort by using outcomes data retrieved from electronic health records (EHRs). Second, we aimed to describe the association between ALF residents and ED visits. Third, we aimed to identify mortality outcomes and to compare rates of ACP documentation.

Methods

Study Design and Population

This was a retrospective cohort study of ALF residents empaneled in Employee and Community Health (ECH) at Mayo Clinic, Rochester, Minnesota. ECH encompasses primary care providers in family medicine and primary care internal medicine and provides longitudinal primary care to patients in the greater Rochester area, including those in ALFs. All adults 60 years and older who were living in 8 different ALFs served by ECH between January 1, 2012, and June 30, 2015, were eligible for inclusion in the study. ALF addresses

and room numbers were first identified by nurse practitioners from the care transitions program¹² who were familiar with the ALFs and were confirmed by review of the EHR. The earliest EHR record of residence in an ALF was taken as the index date for each person. Patients were excluded if they refused research authorization, if they did not have a confirmed ALF address, if a control could not be identified, and if they were not empaneled at ECH.

A referent cohort was generated from patients empaneled in ECH and living independently in the community. These patients were identified from their first primary care visit after January 1, 2012, and before June 30, 2015. The referent cohort was matched to the ALF cohort for age (± 2 years), sex, and time of entry into the study (± 2 months of index visit). To match the time of entry, we used the first clinic visit closest to the ALF index date as the index date for patients in the referent cohort. The study protocol was approved by the Mayo Clinic Institutional Review Board, and only those with valid research authorization were included.

Outcomes

Our primary outcome was hospitalizations within the first year from the index date; secondary outcomes were observation stays, 30-day rehospitalization, ED visits, and mortality within the first year. Hospitalizations and 30-day rehospitalization were determined using *International Classification of Diseases (ICD)-9* and ICD-10 hospital billing codes from the EHRs. Data for observation visits were also collected using ICD-9 and ICD-10 codes. Any observation stay that led to a hospitalization was included as a single hospitalization to avoid double counting. ED visits were determined in a similar fashion using ICD codes for ED visits. Mortality outcomes were determined from the EHR for 1 year beyond the index date. The EHR at Mayo Clinic is updated for mortality outcome from the hospital and from family notification as well as from news outlets and hospice.

Predictors

Demographic predictors of age, sex, ethnicity, and race were obtained from the EHR. Marital status at index date was obtained by our health science research department's review of records and used as a proxy measure of live-in caregiver status for the purposes of our analysis. Control patients were sex and age matched to case patients. Comorbid illness burden at index date was assessed using the Charlson Comorbidity Index (CCI).¹³ Data were obtained with ICD-9 and ICD-10 codes about the following comorbid conditions for 2 years before the person's index date: dementia, diabetes mellitus, congestive heart failure, chronic obstructive pulmonary disease, chronic kidney disease, cirrhosis, sepsis, pneumonia, myocardial infarction/coronary heart disease, stroke, Parkinson disease, anemia, cancer (non-skin), and depression. The presence of an advance directive (AD) and a provider order for life-sustaining treatment (POLST) in the EHR was noted and dated.

Statistical Analysis

Demographic and clinical variables between ALF residents and community dwelling older adults were compared using Pearson χ^2 tests designed for categorical variables and Kruskal-Wallis test for continuous variables. Patients were followed up for 1 year from the index

date. Single and multiple linear regression analyses were performed to examine the potential influence of comorbidity variables that were unequally balanced between groups (namely Parkinson disease, pneumonia, dementia, anemia, non-skin cancer, and depression). Adjustment for comorbid health conditions and marital status was done. For marital status, we dichotomized to still married or not (ie, divorced, widowed, single) for the purposes of our analysis. The odds ratio (OR) and 95% CI were computed using R software, version 3.4.0 (The R Foundation).¹⁴ *P* values <.05 were considered significant.

Results

Cohort Characteristics

We initially reviewed the records of 587 patients. This number was subsequently reduced to 404 because of exclusions for a patient's not being empaneled in ECH or not having an appointment within the specified period (n=93), identifying later that they were not in an ALF during the specified time (n=68), outside our age or date range (n=5), and not having an available control (n=17). Of the 808 people (404 ALF residents and 404 community dwelling controls) included in this study, the mean (SD) age was 86 (6.4) years, and 30.9% were women. Community dwellers were more likely to be married than their ALF counterparts (46.3% vs 29.7%, *P*<.001). The mean (SD) CCI did not differ between the 2 groups (5.94 [1.99] vs 5.70 [2.00], *P*=.09). Among individual medical conditions considered, anemia (44.3%), myocardial infarction/chronic heart disease (39.9%), dementia (33.9%), and depression (32.9%) were most prevalent in the ALF population. When compared with the community dwelling older adults, several comorbid conditions were significantly more common in ALF residents (dementia, depression, pneumonia, non-skin cancer, and Parkinson disease). Demographic and clinical characteristics of our cohort are shown in Table 1.

Outcomes

Hospitalizations—Among the ALF cohort, 195 of 404 (48.3%) had at least 1 hospitalization in the year following the ALF index date entry, compared with 127 (31.4%) community dwellers; 52 ALF residents had 2 or more hospitalizations. ALF residents were twice as likely as controls to be hospitalized one or more times in the year (OR, 2.03 [95% CI, 1.5–2.7]). Table 2 shows unadjusted and adjusted analyses (for CCI and marital status). We constructed a separate regression model to determine whether outcomes were influenced by certain comorbid conditions. Patients who had a history of pneumonia were 1.8 times more likely to be admitted regardless of where they lived (*P*=.003). Other comorbid conditions were not associated with an increased rate of hospitalization (*P* .10). No significant difference in median length of stay overall was noted between the 2 groups (*P*=.08). Numbers for readmission were small and not significantly different (Table 2).

Mortality—Over the 1-year period, 20.3% (82/404) of the ALF cohort died compared with 9.4% of the community cohort (38/404). The odds of mortality in the first year for ALF residents vs community dwellers was 2.5 (95% CI, 1.6–3.8). Including comorbid conditions in the model adjusted this OR to 1.7 (95% CI, 1.3–2.2). People with a history of anemia, dementia, and non-skin cancers were 2.8 times, 2.2 times, and 1.9 times more likely,

respectively, to have died at 1 year regardless of place of residence ($P<.001$). Other comorbid conditions were not associated with an increased risk of death in this group ($P>.10$).

ED Visits and Falls—ED visits were significantly higher for ALF residents (OR, 2.25 [95% CI, 1.7–3.0]). Similarly, the number of falls was significantly higher for ALF residents (OR, 2.42 [95% CI, 1.6–3.7]). This significance remained for both ED visits and falls after correction for comorbid conditions (Table 2). People with dementia were 2.1 times more likely to fall regardless of place of residence ($P=.001$). Other comorbid conditions were not associated with an increased risk of falls ($P>.10$).

Advance Care Planning—ALF residents were more likely to have an AD (n=281, 69.6%) or POLST (n=246, 60.9%) on file than controls (AD: n=164, 40.6%; POLST: n=107, 26.5%) ($P<.01$).

Discussion

In this retrospective cohort study, we found that those living in ALFs had 2-fold higher rates of hospitalization and death within the first year than age- and sex-matched community dwellers, even when adjusting for comorbid health and marital status. Almost half (48.3%) of those in our ALF cohort were hospitalized within 1 year. Gimm and Kisantas⁸ previously examined data from a national survey of residential care facilities and found that almost a quarter of residents were hospitalized in a year and that risk was greater for those with higher levels of debility, fall-related injuries, and chronic medical conditions but not for those with Alzheimer disease dementia. Their study was based on survey data collected from facility administrators and facility records and not, as in our study, on data identified directly from EHRs, which might explain our higher rate of hospitalization. Zimmerman et al¹⁵ found a hospitalization rate of 12.7% over a 100-day quarter per 100 residents in ALF facilities across 4 states. However, medical outcome data in this study was collected by surveying staff caregivers at the facilities. Hedrick et al¹⁶ identified a hospitalization rate of 40% in their predominantly male Veterans Affairs cohort included in an assisted living pilot program. In a Canadian cohort, the cumulative incidence of hospital admission over 1 year was 38.9%, which was determined with data from the Alberta Inpatient Discharge Database.¹⁷ These variations reflect the diversity in ALFs and the different methods of collecting outcome data. We previously showed high rates of multiple comorbid conditions and ED use, especially for ALF residents,¹⁸ and the current study results expand on this data. Our finding that 48.3% of the ALF cohort was hospitalized in the first year and 33.9% had dementia agrees with or is greater than findings from the above-mentioned studies. Importantly, our outcomes data were obtained from the EHR, which is a more objective means of data collection; and we also included a community-living control cohort for comparison data.

Our secondary outcomes showed that ALF residents were at higher risk for ED use, falls, and mortality. We found that 20% of our ALF cohort died within the year, a rate similar to that of other cohorts,^{16,19} but in our study, the rate was 2-fold higher than that of matched community dwellers. Although ACP data was more likely to be recorded for ALF residents,

which is in keeping with the few earlier, small studies,^{20,21} notably over 30% of ALF residents did not have any AD. There were over 500 ED visits in our ALF cohort during the time period. Our rates of 30-day rehospitalization and observation visits were low overall and not significantly different, which may in part be due to our established care transitions program.¹² Many ALF residents are in poor health,²² and many will have nursing home-level care needs,²³ thus prompting frequent ED visits that may not necessarily alter their treatment.²⁴

Although we did not identify a difference from the CCI in our cohort, certain medical conditions had significantly higher rates in our ALF population. Of ALF residents, 1 in 3 had a dementia diagnosis compared with less than 1 in 10 community dwellers. However, dementia did not increase the risk of hospitalization. An earlier study showed greater hospitalization rates for ALF residents with dementia who had greater medical needs than nursing home residents.¹⁹ Because we relied on the EHR for documentation of a dementia diagnosis, even more people in our community and ALF cohorts likely had as yet unspecified cognitive impairment. Pneumonia increased the likelihood of hospitalization, and dementia increased the risk of falls and death in our cohort. These findings have important implications for health care service planning in our area.

Because of the diversity in ALFs,²⁵ providing medical care poses a challenge.²⁶ Traditional models of care, such as outpatient office visits, may not be suited for ALF residents. We know from a Canadian study that potentially modifiable patient factors (health instability, recurrent admissions, and polypharmacy) and facility factors (facility size, nurse staffing) play an important part in influencing hospitalizations.¹⁷ Although altering facility factors may be difficult, patient factors may be more easily addressed. For example, geriatric care models that incorporate disease-specific care may be more optimal. One disease state that lends itself to a specific care model is dementia; the behavioral symptoms and physical debility that ensue from dementia frequently require acute care visits. Innovative dementia care models have shown promise in terms of quality indicators for dementia care and caregiver outcomes.²⁷⁻³⁰ At the center of these care models is a dementia care manager (geriatric nurse practitioner, nurse, or social worker) who coordinates care and supports caregivers, working alongside primary care providers and with community resources. Such models could be applied to ALFs with a high prevalence of patients with dementia. At our institution, the palliative care homebound program targets frail elders with functional impairment and serious illness with goals to manage symptoms, maximize quality of life, and facilitate advance care planning in the home. This program has been effective in reducing hospitalizations and length of hospital stay, and it is cost saving.^{31,32} Adapting programs such as this to specifically target the high-risk and frail population living in ALFs is likely to have similar outcomes and a positive impact.

This study has limitations, including its retrospective design. Because we relied on data already collected, we did not have a measure for activities of daily living or falls or a standardized cognitive assessment. Our cohort was identified manually; therefore, we have not been able to capture data for all ALF residents in the Rochester area, although we believe our sample is representative and, importantly, includes a comparison group still living in the community. Most of those studied were white, which is typical of the

population in our area.³³ Also, we did not have a measure of socioeconomic status or caregiver status. Instead, we used marital status as a proxy measure for caregiver status. Despite these limitations, our study adds to a sparse literature about the ALF population. We believe we offer an important insight and have identified a need to prioritize the ALF population in plans for practice change in primary care and geriatric medicine.

Conclusion

Our study showed that ALF residents have many complex medical conditions and are significantly higher users of acute medical care with higher odds of death at 1 year than age-matched, community-dwelling older adults. This study highlights the need to provide targeted geriatric care for this growing population to have an impact on outcomes and to better plan for the years ahead.

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Abbreviations

ACP	advance care planning
AD	advance directive
ALF	assisted living facility
CCI	Charlson Comorbidity Index
ED	emergency department
EHR	electronic health record
ICD	<i>International Classification of Diseases</i>
OR	odds ratio
POLST	provider order for life-sustaining treatment

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Table 1.Demographic and Clinical Characteristics^a

Variable	ALF Residents (n=404)	Community Dwellers (n=404)	P Value
Age, mean (SD), y	86.8 (6.4)	86.8 (6.4)	.97
Sex, female	125 (30.9)	125 (30.9)	
Race			.06
White	399 (98.8)	386 (95.5)	
Other	5 (1.2)	18 (4.5)	
Marital status			<.001
Married	120 (29.7)	187 (46.3)	
Widowed	242 (59.9)	182 (45.0)	
Single	16 (4.0)	13 (3.2)	
Divorced	25 (6.2)	21 (5.2)	
Other	1 (0.2)	0	
Charlson Comorbidity Index, mean (SD)	5.94 (1.99)	5.70 (2.00)	.09
Comorbid conditions			
Anemia	179 (44.3)	138 (34.2)	<.01
CHF	108 (26.7)	87 (21.5)	.08
Cirrhosis	2 (0.5)	3 (0.7)	.65
CKD	102 (25.2)	90 (22.3)	.32
COPD	66 (16.3)	69 (17.1)	.78
Dementia	137 (33.9)	34 (8.4)	<.001
Depression	133 (32.9)	62 (15.3)	<.001
Diabetes mellitus	105 (26.0)	99 (24.5)	.63
MI/CHD	161 (39.9)	148 (36.6)	.35
Non-skin cancer	56 (13.9)	12 (3.0)	<.001
Parkinson disease	29 (7.2)	7 (1.7)	<.001
Pneumonia	84 (20.8)	48 (11.9)	<.001
Sepsis	32 (7.9)	12 (3.0)	.002
Stroke	40 (9.9)	31 (7.7)	.26

Abbreviations: ALF, assisted living facility; CHD, coronary heart disease; CHF, congestive heart failure; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; MI, myocardial infarction.

^aData presented as No. (%) unless otherwise specified.

Table 2.

Hospitalizations, Mortality, ED Visits, and Falls in 1 Year

Variable	ALF Residents (n=404)	Community Dwellers (n=404)	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio ^a	P Value
LOS, median (IQR), d	5 (3–8)	4 (2–7)	08
Died, No. (%)	82 (20.3)	38 (9.4)	2.5 (1.6–3.8)	2.4	<.001
Hospitalized (1), No. (%)	195 (48.3)	127 (31.4)	2.03 (1.5–2.7)	2.0	<.001
30-day rehospitalization, No.	29	21	1.4 (0.8–2.7)		.31
Observation stays, No.	56	44	1.3 (0.8–2.1)		.24
ED visits, No. patients (%)	263 (65.0)	183 (45.3)	2.25 (1.7–3.0)	2.0	<.001
Total ED visits	507	338			<.001
Falls, No. (%)	94 (23.3)	45 (11.1)	2.42 (1.6–3.7)	2.4	<.001

Abbreviations: ALF, assisted living facility; ED, emergency department; IQR, interquartile range; LOS, length of stay.

^aAdjusted for CCI and marital status.