


# Hospital Care of Assisted Living Residents by an Assisted Living Based Primary Care Team

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## Abstract

The objective of this article is to characterize inpatient-related outcomes and measures of efficiency for hospitalized assisted living residents managed by an assisted living-based primary care (ALPC) team. Between 2010 and 2012, 1594 assisted living residents received ALPC. An ALPC team member served as hospital attending physician to 377 assisted living residents at three community hospitals. Several inpatient metrics were compared between the hospitalized ALPC cohort and those reported in the National Hospital Discharge Survey. Hospitalized assisted living residents who received inpatient hospital care by an ALPC team member had lower inpatient mortality, 30-day readmission rates, and shorter length of stay compared to published averages. The authors determined that an ALPC team who follows its patients in the hospital may achieve improved inpatient outcomes.

## Keywords

assisted living, readmission, house call, home care, rehospitalization, geriatrics

At present, it is estimated that there are 800 000 US seniors living in assisted living facilities.<sup>1,2</sup> Most are too frail to visit their physician when they need care. This group, which typically has multiple chronic conditions and dependencies on assistance with two or more activities of daily living (ADLs), has difficulty accessing a physician's office for care and high rates of emergency room and hospital utilization.<sup>3,4</sup> Home visits to the homebound elderly have been shown to reduce hospitalizations, rehospitalizations, and skilled nursing facility (SNF) placements and improve patient and caregiver satisfaction.<sup>5,6</sup> Analogous to the private home based house call, assisted living based primary care (ALPC) is the on-site delivery of primary care services to residents of assisted living facilities (ALFs). ALF residents have high rates of hospitalizations and rehospitalizations, due to multiple comorbidities and inadequacy of care transition planning and follow up. As such, we surmised that an ALPC team that also served as primary hospital attending may be associated with improved outcomes.

## Method

The ALPC team was led by a physician with ALPC and inpatient hospital care experience. The ALPC team consisted of a nurse practitioner, a triage/scheduling nurse, and mobile on-site diagnostics. Scheduled visits were made on a monthly

basis, and sick/urgent visits were made as needed. Between January 1, 2010, and June 2012, the ALPC team made 16 115 ALF visits to 1594 patients. Patients required an ALF visit due to dependency on ADL assistance, significant difficulty traveling to a physician's office, or both. During this period, a physician from the ALPC team served as primary hospital attending during 377 hospitalizations at three hospitals in the Cleveland, Ohio, metropolitan area (Cleveland Clinic Hillcrest Hospital, University Hospitals Ahuja Medical Center, University Hospitals Geauga Medical Center). Patients' primary hospital diagnoses were converted into major diagnostic category (MDC) codes, and those with less than 5% occurrence were lumped into category "other." Discharge medications were reconciled twice for each

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patient, once in the hospital by the discharging attending and then again upon arrival at home or at the receiving facility. A member of the same ALPC team then saw patients within 48 hours of discharge from the hospital, and again within 30 days of discharge.

### Statistical Analyses

Comparisons were made between the hospitalized ALPC cohort and the 2010 Centers for Disease Control and Prevention (CDC)-reported National Hospital Discharge Survey data for individuals older than 65 years of age.<sup>7</sup> All data were analyzed using SPSS 19.0 statistical software (SPSS Inc., Chicago, IL). Descriptive statistics including 95% confidence intervals for continuous variables were obtained using the “Explore” procedure in SPSS, whereas 30-day readmission rates (including cross-tabulation by primary diagnostic category), in-hospital mortality rate, and percentage distribution of deciles of propensity scores were estimated using the “Complex Samples” module in SPSS. Propensity scores for each patient were estimated using binary logistic regression predicting 30-day readmission from the patient’s age, sex, average length of hospital stay (ALOS), and primary MDC. Assignment of specific diagnoses into MDC categories was based on the All Patient Refined Diagnosis Related Groups Manual.<sup>8</sup> Significance testing between sample and national statistics was based on comparing 95% confidence intervals.

### Results

An ALPC physician served as inpatient attending during 377 ALF resident hospitalizations in January 2010 and June 2012. The majority of the patients were women (63%) and were on average 85 years old. Circulatory and pulmonary diseases accounted for the greatest percentage of inpatient admissions. The ALOS was 4.04 days (SD, 3.06). The 30-day readmission rate was 7.4% (SE, 1.3) and the in-hospital mortality rate was less than 1%. Table 1 summarizes these sample characteristics.

Comparisons were made between ALOS means for each primary MDC diagnosis for our hospital sample and the 2010 CDC-reported National Hospital Discharge Survey data for individuals older than 65 years of age.<sup>7</sup> Comparisons of the 95% confidence intervals showed that, overall, the ALOS was significantly shorter for our patient cohort (mean, 4.04 days) compared to the national sample (mean, 5.7 days). Within the MDC categories, significantly lower ALOSs in our sample were noted for the diagnoses of renal and urological diseases and disorders, mental disorders, infectious diseases, and those of the respiratory system. These results are summarized in Table 2.

The overall in-hospital mortality rate for our cohort (over all 377 patients) was only 0.8% (SE, 0.5; 95% CI, 0.3–2.4) compared to the CDC-reported National Hospital Discharge

**Table 1.** Characteristics of Hospitalized Patients (2010–2012) Receiving Inpatient Care by Assisted Living Based Primary Care Team

Patients, n	377
Age, y	
Mean (SD)	85.30 (0.54)
Median (25th, 75th percentile)	87.00 (81, 92)
Sex, %	
Male	37.0
Female	63.0
Medical diagnosis, % (95% CI)	
Neurological	8.1 (5.7–11.3)
Pulmonary	14.8 (11.5–18.8)
Circulatory	15.4 (12.0–19.4)
Gastroenterology	8.9 (6.4–12.3)
Endocrine and metabolic	6.5 (4.4–9.5)
Renal and urinary	10.5 (7.8–14.1)
Infectious	8.6 (6.2–12.0)
Other	14.0 (10.8–18.0)
Average length of stay, mean (95% CI)	4.04 (3.70–4.38)
30-day readmission rate, % (95% CI)	7.4 (5.2–10.5)
In-hospital mortality rate, % (95% CI)	0.8 (0.3–2.4)

rate for adults older than 65 years of age (per 100 discharges) of 3.9% (95% CI, 3.12–4.68).

The overall rate of 30-day readmission was 7.4% (95% CI, 5.2–10.5). Kuo and Goodwin<sup>9</sup> reported a 19.0% (95% CI, 18.41–19.59) readmission rate for Medicare patients cared for by hospitalists and a 17.4% (95% CI, 17.01–17.79) rate for patients cared for by their primary care physicians (PCPs; see Figure 1). Comparisons of 95% confidence intervals show a significantly lower readmission rate for the ALPC patient cohort compared to both of the above rates.

Furthermore, using logistic regression, we estimated propensity scores for 30-day readmission in our hospital sample while controlling for the patient’s age, sex, ALOS, and primary MDC. The analysis showed that the average probability of re-hospitalization was 0.05 (range, 0.0–0.32; SD, 0.06). The majority of the scores (81.9%) fell within the first three deciles of the propensity scores (0.0–0.1), suggesting a less than 10% chance of 30-day hospital readmission for more than 75% of the sample.

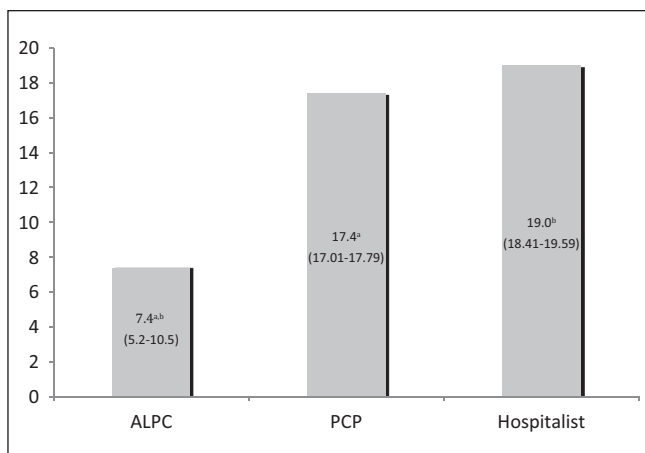
The logistic regression also showed that some diagnostic categories were associated with significantly greater odds of 30-day re-hospitalization than others. Consistent with the results of the above reported frequency analyses, individuals with metabolic, endocrine, and nutritional diagnoses were considerably more likely to be readmitted within 30 days than were patients with other diagnoses (see Table 3). The odds of re-hospitalization were also significantly higher for those with diagnoses of infections (systemic or unspecified sites; odds ratio, 7.90).

**Table 2.** Average Length of Stay Means, in Days (95% CIs), by Primary Major Diagnostic Category (MDC) for the 2010–2012 Assisted Living Based Primary Care (ALPC) Cohort and 2009 Short-Stay Hospital Cohort for Individuals 65 Years of Age and Older

MDC Category (65+)	ALPC Cohort	National Hospital Cohort
<b>All conditions</b>	<b>4.04 (3.70–4.38)</b>	<b>5.7 (5.37–6.03)*</b>
Diseases and disorders of the nervous system	3.20 (1.58–4.82)	7.1 (4.51–9.68)
Endocrine, nutritional, and metabolic diseases and disorders	3.46 (2.59–4.33)	4.5 (3.79–5.21)
Diseases and disorders of the kidney and urinary tract	3.72 (2.91–4.53)	5.1 (4.75–5.45)*
Diseases and disorders of the female reproductive system	2.50 (-3.85–8.85)	5.1 (4.75–5.45)
Diseases and disorders of blood forming organs and immunological disorders	4.12 (3.04–5.19)	4.7 (3.76–5.64)
Infections and parasitic diseases, systemic or unspecified sites	4.88 (3.56–6.19)	7.9 (7.33–8.47)*
Mental diseases and disorders	2.67 (0.99–4.34)	8.8 (6.70–10.90)*
Ear, nose, mouth, throat, and craniofacial disorders	3.78 (1.90–5.65)	N/A
Diseases and disorders of the respiratory system	3.87 (2.98–4.77)	6.00 (5.67–6.43)*
Diseases and disorders of the circulatory system	3.58 (2.64–4.52)	4.9 (4.47–5.33)
Diseases and disorders of the digestive system	4.52 (3.18–5.85)	5.2 (4.95–5.45)
Diseases and disorders of the hepatobiliary system	3.25 (-0.28–6.78)	N/A
Diseases and disorders of the musculoskeletal system and connective tissues	4.35 (3.83–4.86)	4.95 (4.52–5.38)
Diseases and disorders of the skin, subcutaneous tissue, and breast	4.45 (2.67–6.24)	5.7 (5.03–6.37)

Note: 95% confidence intervals for the national hospital cohort were determined from standard errors (SE) using the formula Upper:  $M + 1.96 \times SE$ ; Lower:  $M - 1.96 \times SE$ .

\* $P < .05$ .



**Figure 1.** 30-day readmission rate (%) and 95% confidence intervals for the present assisted living based primary care cohort and primary care physician and hospitalist cohorts reported by Kuo and Goodwin (2011).

Note: Rates sharing subscripts are significantly different at  $\alpha = .05$ .

## Discussion

ALF residents are hospitalized at high rates and, when hospitalized, incur frequent hospital-related problems such as delirium, infections, falls, and deconditioning. The frequency of these problems increases as length of stay increases.<sup>10</sup> Furthermore, the hospitalized elderly have a significant risk of long-term institutionalization following hospitalization.<sup>11</sup> As such, it is prudent to focus on keeping hospitalization rates of ALF residents low, and aiming for a low ALOS when hospitalization is required.

We found that having an ALPC team member serve as inpatient hospital attending was associated with a low relative average length of stay and low inpatient mortality rate. Upon admission, ALPC attendings focused on keeping length of stay short by seeing the patient promptly, by establishing goals of the hospitalization up front with patients and family, by using discretion when ordering diagnostic tests, and by using consultants judiciously. Our inpatient mortality rate of less than 1% in an advanced elderly population with multiple comorbidities was also influenced by allowing ALPC palliative and hospice patients to die at home, rather than in the hospital.

This study had significant limitations. The lack of a matched control group to compare against our ALPC sample stemmed from the lack of previous historical data collection at ALFs and the fact that many of our ALPC patients did not live in ALFs before move-in when our team assumed their care. Our use of the National Hospital Discharge Survey allowed for basic statistical comparisons but did not enable a true “before and after” ALPC management outcome assessment. Despite these limitations, we believe that our outcomes provide a useful baseline evaluation of the potential efficacy of an ALPC team’s positive effect on hospital outcomes, including readmission rates. Our ALPC team approach achieved low relative 30-day readmission rates, likely because of a strong focus on avoidance of lengthy hospital stays, hospital discharge planning (daily communication with family and caregivers and by arranging appropriate ancillary services such as physical therapy, home health, private duty caregivers), emphasis on medication reconciliation, and early post-hospital discharge follow-up by the ALPC team. We believe that although

**Table 3.** Logistic Regression Predicting 30-Day Readmission

Predictor		SE	Odds Ratio	95% CI
Sex (male)	-0.28	0.51	0.75	0.27–2.06
Age	0.01	0.02	1.013	0.96–1.06
ALOS	-0.04	0.08	0.96	0.82–1.13
MDC nervous system	0.65	1.45	1.92	0.11–32.83
MDC respiratory system	0.10	1.44	1.10	0.07–18.54
MDC circulatory system	1.11	1.15	3.04	0.32–28.76
MDC digestive system	1.52	1.19	4.55	0.44–46.59
MDC musculoskeletal	-17.54	6187.25	0.00	0.00
MDC endocrine, metabolic, nutritional	2.63	1.15	13.89*	1.45–133.24
MDC kidney and urinary tract	0.92	1.26	2.52	0.21–29.67
MDC infections	2.07	1.13	7.90*	0.86–72.58

Note: ALOS, average length of hospital stay; MDC, major diagnostic category.

\* $P < .05$ .

programs such as the Care Transitions Intervention<sup>12</sup> and remote monitoring are likely to be valuable tools to help reduce readmission rates in the general population, in isolation, these will be insufficient to deal with the readmission problem in the ALF setting. ALF residents have a high prevalence of cognitive and hearing impairment and frequently are reliant on caregivers to assist with such well-meaning post-discharge initiatives, and many have a preference for in-person visits. As such, it is likely that “hands-on” ALPC teams will assume an important role in post-discharge management, and hospitals, nursing facilities, and insurers may choose to engage such teams as a remedy to the national readmission problem, which is especially prevalent in the advanced elderly.

The present study shows that having an ALPC team member serve as inpatient hospital attending may be associated with improved hospital outcomes. The potential advantages of ALPC, especially to the advanced elderly, are numerous. “House calls” are widely viewed as a “friendly” way to receive convenient care, in stark contrast to the manner in which most segments and places of service of health care delivery are perceived by consumers. Beyond this, there may be significant financial cost savings associated with enrolling the advanced elderly in ALPC programs, although this study did not investigate this. In this regard, Centers for Medicare & Medicaid Services has recently announced the start of the “Independence at Home” Pilot, after a decade-long advocacy effort by the American Academy of Home Care Physicians. If participating programs can achieve the prescribed quality measures and reduce costs to Medicare by keeping expensive utilization rates low by promoting high-quality, home- and ALF-based primary care, the scope of ALPC and house calls may be significantly broadened.

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### Author Contributions

Mills (study concept and design, acquisition of subjects and data, analysis and interpretation of data, preparation of manuscript); Robertson (acquisition of subjects and data, preparation of manuscript); Ogard (acquisition of subjects and data, preparation of manuscript); Musni (acquisition of subjects and data, preparation of manuscript); Tran (acquisition of subjects and data, preparation of manuscript); Poltavski (analysis and interpretation of data, preparation of manuscript); Kendis (acquisition of subjects and data, preparation of manuscript).

### Declaration of Conflicting Interests

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