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Post-acute care transitions and outcomes among Medicare beneficiaries in assisted living communities

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Abstract

BACKGROUND: Despite the rapid growth of assisted living (AL) and frequent hospitalizations among AL residents, little is known about their patterns of post-acute care transitions and outcomes. This study examined the post-acute care transitions among AL residents and their association with outcomes in the first 30 and 60 days after hospital discharge.

METHODS: This study used data from 2018 national Medicare enrollment and claims datasets, the Minimum Data Set (MDS), and Medicare Provider Analysis and Review (MedPAR) of 104,497 unique Medicare beneficiaries residing in ALs in the U.S. Post-acute care referrals, based on hospital discharge status, to skilled nursing facilities (SNF), home with home health care (HHC), home without HHC, and other settings. Outcomes included 30-day and 60-day hospital readmissions, emergency department (ED) visits, long-stay care nursing home placement, and mortality. Multinomial logistic regression analysis and logistic regression analysis were conducted.

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Author Contributions

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Specific contribution of each author on this manuscript is listed below:

- Jinjiao Wang was responsible for study concept and design, data analysis and interpretation, and preparation of manuscript, including review and approval of the final submission.
- Yunjiao Mao participated in study concept and design, data cleaning and management, data analysis and interpretation, and preparation of manuscript, including review and approval of the final submission.
- Brian McGarry participated in study design, data analysis and interpretation, and preparation of manuscript, including review and approval of the final submission.
- Helena Temkin-Greener participated in study concept and design, data analysis and interpretation, and preparation of manuscript, including review and approval of the final submission.

Conflict of Interest

The authors declare no conflicts of interest, financial, personal, or other related to this manuscript.

RESULTS: The most common post-acute care referral was to SNF (40%), followed by home without HHC (28%), home with HHC (17%), and others (15%). Compared to discharge home without HHC, discharge to SNF was associated with lower likelihood of ED visits (Odds Ratio=0.597, $p<0.01$) and hospital readmissions (OR=0.856, $p<0.001$), and higher likelihood of long-stay nursing home placement (OR=11.224, $p<0.01$) and mortality (OR=2.025, $p<0.01$). Discharge home with HHC was associated with higher likelihood of hospital readmissions (OR=1.148, $p<0.01$) and lower likelihood of long-stay nursing home placement (OR=0.737, $p<0.05$) than discharge home without HHC. The results were similar within the first 30 days as well as 60 days after hospital discharge.

CONCLUSIONS: AL residents who are discharged to different post-acute care settings tend to differ in 30-day and 60-day outcomes. At hospital discharge, clinicians and discharge planners should be provided information about the exact type and availability of services at AL to make the most appropriate discharge referrals for AL residents.

Keywords

assisted living; facility; post-acute care; home health care; skilled nursing facility; Medicare

BACKGROUND

Assisted living (AL) is an important residential care setting in the United States with an estimate of 811,500 older adults residing in 28,900 AL communities in 2016.^{1, 2} ALs provide housing, meals, some personal care and non-skilled health-related services to older adults who need supportive care.³ Over time, AL has evolved from a residential provider for relatively healthy older adults to a hybrid residential and care provider³ that has been admitting an increasing number of older adults with substantial care needs, such as Alzheimer's disease and related dementias (ADRD) and functional limitations.^{4, 5} Many of the AL residents are 85 years and over (52%),⁶ have prevalent multimorbidity (74%), polypharmacy (51%), functional and cognitive impairments (limitations in activities of daily living [ADL] 64%, ADRD 42%), depressive symptoms (28%), pain (20%),⁶⁻¹⁰ and unstable health status.¹¹

Hospitalizations and 30-day readmissions are common in the AL population.¹²⁻¹⁴ This is not only because hospitalization itself is a predictor of AL use,¹⁵ but also because of AL residents' advanced age, comorbidities, and prevalent cognitive and functional impairments, which increase hospitalization risk.^{16, 17} Therefore, it is critical to better understand post-acute care trajectories in this population, and their association with health outcomes, and to identify both un-modifiable as well as modifiable factors.¹⁸

AL residents face unique situations and challenges in the post-acute care transitions. First, AL residents have greater risk for certain outcomes in the post-acute care period, such as hospital readmissions,^{19, 20} indicating that AL residents may need more intensive post-acute care support than the general older population in the community. By virtue of staying in a structured residential setting, AL residents may have greater access to certain services (e.g., meal preparation, social interaction, and group guided exercise) than community-dwelling older adults. Yet, earlier research has suggested that ALs may not be equipped to provide

sufficient support for the residents after hospital discharge,²¹ questioning the adequacy of post-acute care support ALs can provide to residents. Moreover, there is a possibility that ALs may be cautious and/or unable to assume responsibility for post-acute care and be incentivized to advocate other referrals for their residents rather than have them discharged back to the AL. It is unclear whether hospitals take these unique dynamics into account when making discharge referral decisions for AL residents.

Common post-acute care transitions among Medicare beneficiaries include skilled nursing facilities (SNF), home with home health care (HHC), and home without HHC.²² Previous studies have examined the use²³ and outcomes²⁴ of different post-acute care referrals among community-dwelling older adults. Indeed, much debate exists regarding whether and how transitions to post-acute care providers such as SNF and HHC may render better outcomes for patients.^{18, 24–26} In spite of the vulnerability and increased risk of hospitalization among AL residents, our knowledge is limited about these referrals among AL residents and their relationship to subsequent patient outcomes. No published study has used national data to examine the post-acute care transitions of Medicare beneficiaries residing in ALs and their subsequent outcomes.

Focusing on Medicare beneficiaries residing in ALs who had an acute hospitalization, this study had three objectives: 1) examine patterns of their post-acute care referrals; 2) identify factors associated with different post-acute care referrals, and 3) examine the association between post-acute care referrals and outcomes in the first 30 and 60 days after hospital discharge. We hypothesized that AL residents who were older and having a greater number of medical conditions were more likely to be referred to SNF and HHC after hospital discharge than going home without HHC, and that being discharged to SNF would be related to the highest risk for hospital readmissions, ED visits, long-stay nursing home placement and death in the first 30 and 60 days after hospital discharge, followed by HHC and then home without HHC.

METHODS

Data Sources

We used multiple sources of data from CY2018 including the Medicare Provider Analysis and Review (MedPAR), the Minimum Data Set (MDS), the Master Beneficiary Summary File (MBSF), Medicare outpatient claims, the Area Health Resource File (AHRF) of a national cohort of Medicare beneficiaries who resided in ALs (described below), a national inventory of AL communities, and the Provider of Services (POS) files of the discharging hospitals.

Study Sample

We used a previously validated methodology to identify Medicare beneficiaries in AL communities.²⁷ Using the 9-digit zip codes associated with the physical address of each AL, we obtained Medicare beneficiary identification numbers from the Medicare enrollment database and identified beneficiaries who resided in AL.²⁸ For this study, we separately identified CY2018 AL residents who were fee-for-service (FFS) Medicare beneficiaries and

those enrolled in Medicare Advantage (MA) plans, because Medicare claims data are only available for the FFS beneficiaries. We limited our study cohort to residents age 55+ because younger individuals do not represent the typical AL population. AL residents were linked to the Medicare data at the individual level. We then identified AL residents who had an unplanned general acute care hospitalization in CY2018 and who were not in a nursing home within 30 days prior to the index hospital admission. We identified 72,421 Medicare FFS residents and 32,076 who were enrolled in MA, residing in 17,380 ALs. The final sample included 104,497 unique AL residents.

Key Variables

Post-Acute Care Referral—Post-acute care referral was assessed by the discharge status of the index hospital stay in MedPAR. Our focus was on the following care referrals: SNF (including inpatient rehabilitation facility), home without HHC (referred to as ‘home’ hereafter), and home with HHC (referred to as ‘HHC’ hereafter). Other referrals included inpatient care (e.g., other general acute care hospitals, federal hospitals, psychiatric hospitals, long-term care hospitals, hospital-based Medicare approved swing beds, and critical assess hospitals), non-skilled long-term care (e.g., intermediate care or Medicaid-certified nursing facilities), hospice (home- or facility-based), death, leaving against medical advice and discharge back to corrective facilities.

Outcomes—Outcomes included hospital readmission, emergency department (ED) visit, long-stay nursing home placement, and mortality. Each outcome was operationalized as two binary variables, i.e., 30-day occurrence and 60-day occurrence (yes/no), as described below.

Hospital readmission was identified from MedPAR and observed in the first 30 or 60 days after discharge from the index hospitalization.

ED visit was identified from Medicare outpatient claims with a focus on visits that did not result in hospitalization. Because Medicare outpatient claims were only available for the FFS beneficiaries, this outcome (ED visit) was only counted among FFS beneficiaries.

Long-stay nursing home placement was identified as admission to nursing homes that lasted for 100 days or longer, based on the MDS.

Mortality (death) was identified based on the MBSF-validated death date.

Covariates—We included covariates at the individual, AL, hospital, county, and state levels that may influence post-acute care referrals and outcomes.

Individual covariates included resident age, gender, race, dual eligibility, Medicare Advantage (MA) enrollment, information about the index hospitalization (i.e., length of stay and binary indicator [<3 days / ≥ 3 days] diagnosis-related groups (DRG) category [medical/surgical], and DRG weight), specific diagnoses of chronic conditions (e.g., ADRD, chronic kidney disease, chronic obstructive pulmonary disease, heart failure, diabetes, and arthritis [yes/no for each]), total number of chronic conditions.

AL covariates included AL bed-size, proportion of dually eligible residents, and average resident age obtained from the national inventory of AL communities and aggregated resident-level data specific to each AL.

Hospital covariates included ownership (non-profit, for-profit, other), teaching status (major, limited, graduate, no affiliation), number of beds, and location (rural/urban) of the discharging hospital obtained from the POS file.

County covariates included the numbers of hospital beds, nursing home beds, and HHC agencies per 1000 population age 65+ obtained from AHRF.

State covariates included state dummies.

Statistical Analysis

Descriptive statistics were used to summarize sample characteristics as means (standard deviations [S.D.]) or median (interquartile range) for continuous variables and frequency (% [N]) for categorical variables. To identify factors associated with different post-acute care referrals, we conducted multinomial logistic regression analysis of post-acute care referrals as a function of the individual, AL, hospital, and county characteristics as well as state dummies as described above. To examine the associations between post-acute care referral and outcomes, we excluded individuals referred to the “other” post-acute care referral category. We then fit separate logistic regression models for each outcome (readmission, long-stay nursing home placement, ED visit [FFS beneficiaries only], and mortality; each observed in 30 days and 60 days; totaling eight models) as a function of post-acute care referral and the same individual-, AL-, hospital-, county-level controls, and state dummies. Standard errors were clustered at the level of discharging hospital. Statistical analyses were conducted using Stata 14 (Stata Corp, College Station, TX). This study has been approved by the Institutional Review Board of the University.

RESULTS

Upon discharge from an acute hospitalization, the most common post-acute care referral was SNF (40%), followed by home (28%), HHC (17%), and other referrals such as non-skilled long-term care and hospice care (15%) (Figure 1). The analytical sample included AL residents who were discharged to SNF, home, and HHC (N=89,342), excluding those with other referrals (e.g., non-skilled long-term care and hospice care). The sample had an average age of 83, were mostly female (65%), non-Hispanic white (89%) with some having dual Medicare-Medicaid eligibility (21%) and MA enrollment (31%). Overall, AL residents in the sample had multiple chronic conditions (sample mean=13), among which the most common were hypertension (65%), arthritis (56%), ischemic heart disease (49%), anxiety/depression (48%), chronic kidney disease (40%), heart failure (38%), diabetes (34%), chronic obstructive pulmonary disease (33%), and ADRD (31%). The index hospitalization was mostly for medical (79%) rather than surgical reasons. The length of stay of the index hospitalization was mostly three days or longer (75%) with an average of five days (Table 1).

Differences were noted among AL residents with different post-acute care referrals (Table 2). Compared with home, post-acute care referrals to SNF and HHC were more likely to occur for AL residents who are older (Relative Risk Ratio [RRR] of older age groups in SNF vs. home and HHC vs. home comparisons ranged from 1.116 to 2.645, all $p<0.01$), dual-eligible (SNF vs. home: RRR=1.186, $p<0.01$), MA enrollees (SNF vs. home: RRR=1.644; HHC vs. home: RRR=1.487; all $p<0.01$), having a longer hospital stay (≥ 3 days versus < 3 days; SNF vs. home: RRR=10.178, $p<0.01$; HHC vs. home: RRR=1.843, $p<0.01$), having surgical DRG (SNF vs. home: RRR=1.809, $p<0.01$), having certain diagnoses (e.g., ADRD; HHC vs. home: RRR=1.142; SNF vs. home: RRR=1.441; all $p<0.01$) and less likely for AL residents from under-represented racial/ethnic groups (e.g., non-Hispanic Black vs. non-Hispanic white in SNF vs. home [RRR=0.845, $p<0.01$] and HHC vs. home comparisons [RRR=0.908, all $p<0.1$]).

AL-level characteristics such as older average age was associated with higher relative risk of post-acute care referrals to SNF and HHC. Greater AL concentration of dually-eligible residents was associated with higher relative risk of post-acute care referrals to SNF than home (RRR=2.669, $p<0.01$). Characteristics of the discharging hospital such as rural location (RRR=0.858, $p<0.01$) and non-profit or public ownership (RRR=0.876, $p<0.01$) were associated with lower likelihood of post-acute care referrals to SNF as compared to home. Local supply of health care services such as the concentration of hospital beds (SNF vs. home: RRR=0.995, $p<0.01$; HHC vs. home: RRR=0.996, $p<0.01$) and nursing home beds (SNF vs. home: RRR=1.007, $p<0.01$) were related to post-acute care referrals in AL. Differences existed between referrals to HHC and SNF (p -values in Table 2), where older AL residents and dual eligible beneficiaries were more likely to be referred to SNF than HHC.

Adjusted logistic regression analyses (Supplementary Table S1 and Figure 2) between post-acute care referrals and outcomes showed that compared to discharge home, discharge to SNF was associated with lower likelihood of 30-day ED visit (OR=0.597, $p<0.01$), lower likelihood of 30-day hospital readmission (OR=0.856, $p<0.01$), higher likelihood of 30-day long-stay nursing home placement (OR=11.224, $p<0.01$), and higher likelihood of 30-day mortality (OR=2.025, $p<0.01$). Discharge to HHC was associated with higher likelihood of 30-day hospital readmission (OR=1.148, $p<0.01$) and lower likelihood of 30-day long-stay nursing home placement (OR=0.737, $p<0.05$), and no difference in ED visits and 30-day mortality relative to discharge home.

Results for 60-day outcomes were consistent with those for 30-day outcomes. Figure 2 illustrates the effect sizes of the association between post-acute care transitions and outcomes. The full models of these analyses are detailed in Supplementary Tables (S1–S2).

DISCUSSION

This study is the first to examine post-acute care referrals among AL residents in the U.S. using national datasets and the associations between post-acute care referrals and outcomes in the 30 and 60 days after hospital discharge, with three principal findings. First, similar to the overall Medicare population,²⁹ SNF is the most common post-acute care

referral in the AL population, followed by home and HHC. Second, referrals to different post-acute care settings were associated with multiple characteristics of the individual, the AL, the discharging hospital, and the region, highlighting the complexity of post-acute care transitions. Third, adjusting for multilevel covariates, post-acute care referrals were associated with differences in outcomes, emphasizing the importance of providing appropriate post-acute care services to AL residents. AL residents discharged to HHC had the highest probability of having hospital readmissions and ED visits, followed by AL residents discharged home, and then by those discharged to SNF.

Findings should be interpreted with consideration of the complexity in hospital discharge decision making, which often involves multiple stakeholders including the patient, his/her caregivers, the hospitalists, discharge planners, post-acute care providers, and the AL.³⁰ The post-acute care referrals are decided based on not only the patient's needs and preferences, but also the post-acute care that is available at hospital discharge.^{31, 32} Findings about individual variables associated with post-acute care referrals indicate a general trend that AL residents who are older, having more chronic conditions (e.g., ADRD), and more complex admission diagnoses leading to the index hospitalization, and a longer hospital stay tend to be discharged to more intense post-acute care options (i.e., SNF), which are consistent with studies with community-dwelling older adults.^{24, 26} There was a consistent decrease in the likelihood of referrals to receive additional post-acute care (HHC and SNF versus home) among under-represented racial/ethnic groups. We also noted increased likelihood of SNF referrals among dually eligible beneficiaries and increased likelihood of HHC referrals among MA enrollees. Together, these findings suggest systematic differences in post-acute care^{33–36} that may be related to the patient's ability to finance additional personal care and his/her healthcare plans. Dual-eligible beneficiaries may be unable to afford additional privately paid support that is needed at AL after hospital discharge, and thus have to be referred to SNF. The different reimbursement rates for post-acute care service across healthcare plans (e.g., MA vs. FFS) may also play a role in one's post-acute care destinations³⁷ and services³⁸ received. Adding to such complexity is that even though AL and nursing home are substantially different in their services³ and target populations (e.g., diagnoses, prognosis, and care needs³⁹), clinicians and discharge planners in the hospital are often unfamiliar with these differences, urging deeper understanding of the residential care landscape among hospital-based professionals to optimize post-acute care referrals and outcomes for AL residents.

Findings about acute care admissions (including hospital readmission and ED visits) among AL residents in this study are consistent with prior studies with community-dwelling older adults, where discharge to SNF is associated with lower risk of readmission and discharge to HHC is associated with higher risk of hospital readmissions and ED visits.²⁴ There are, however, also studies that reported discharge to home (including HHC and home without HHC) to be related to lower risk of hospital readmissions,⁴⁰ which may be due to the differences in the patient population and categorization of post-acute care referrals. Several potential reasons may exist for why discharge to SNF is associated with lower rates of acute care admissions in AL than discharge home (with or without HHC). The 24/7 monitoring and emergency services available at SNF represent a more intensive level of care than what is typically available in ALs.⁴¹ Therefore, at the onset of symptom changes, the on-call

clinicians in SNFs may be able to provide emergent care for patients and prevent some of the acute care admissions. Furthermore, because SNFs themselves represent an inpatient level of care, conditions that might require a hospitalization if acquired at home (e.g., a urinary tract infection) may be successfully treated in the SNFs without the need for hospitalization. SNFs also provide more intensive rehabilitation services than ALs, and thus may be able to facilitate greater functional improvement to reduce the risk of acute care admissions, particularly those caused by falls.

This study is descriptive, because we were unable to determine the extent to which differences in patient outcomes across discharge destinations are due to differences in the quality and adequacy of care or patient case-mix. Although we controlled for numerous measures of health status, there are likely a number of unobservable characteristics that may vary across discharge referrals and could influence the risk of outcomes. Therefore, though prior evidence has suggested unmet needs of AL residents after hospital discharge (e.g., medication administration and symptom monitoring¹⁹), this study is unable to ascertain the specific reasons of differences in acute care readmissions across the different post-acute care settings.

We noted large effect sizes ($OR > 10$) in the association between post-acute care referral to SNF and long-stay nursing home placement in the first 30 and 60 days after hospital discharge, and that HHC referral being related to the lowest likelihood of long-stay nursing home placement. The lower risk of long-stay nursing home placement related to HHC referral may be that for relatively healthier older adults with fewer ADL limitations, HHC delays long-stay nursing home placement.⁴² Yet for AL residents with more intensive care needs, HHC – being an intermittent skilled care provider – may be insufficient to meet their needs. Rather, for AL residents who acquired new care needs that the AL cannot provide, long-stay nursing home placement may be more reasonable than staying in AL. Indeed, hospitalizations among vulnerable older adults such as AL residents often trigger the transition to long-stay nursing homes. Also contributing to this finding is the fact that SNFs are often located within the same facilities that also provide long-term care, making it easier for SNF patients to transition to long-stay nursing homes than patients in other post-acute care settings.

Regarding mortality, we want to emphasize that the higher mortality risk noted among AL residents referred to SNF likely reflects unobserved differences in the case mix of AL residents referred to SNF as opposed to other settings. This includes unmeasured factors, such as frailty, which isn't available in the current datasets but is a predominant predictor of mortality among community-dwelling older adults.⁴³

Findings have important clinical and policy implications for AL and post-acute care. Part of the challenge in providing the right type and amount of post-acute care for AL residents lies in the complexity and variation of services provided within AL. AL communities with more licensed staff have lower rates of hospitalization and long-stay nursing home placement.^{44, 45} Yet most AL communities in the U.S. do not provide medical or skilled nursing services.⁴⁶ Further, the majority (83.3%) of AL staff are unlicensed personnel (e.g., personal care aides) and only 16% are licensed personnel (e.g., registered nurses [6.1%

and licensed practical nurses [9.9%]).² The need for more skilled post-acute care among AL residents after hospital discharge may not be met on site¹⁹ and necessitates additional support. Moreover, because AL communities are regulated at the state level, much variation exists in the availability and type of services provided in the AL.⁴⁶ Due to the unfamiliarity with AL settings, complexity and variation in AL services,^{5, 47} clinicians who discharge AL residents from the hospital are often unaware of the specific type and amount of support patients will have once they return to AL and thus find it challenging to make informed decisions. Information regarding the level of support available in the AL is critical yet often unavailable to hospitalists and discharge planners when they are trying to decide on the most suitable post-acute care referral for AL residents. In light of recent reforms that may affect post-acute care providers' ability and willingness to offer certain care to patients,²⁵ more work is needed to ensure that those who are the most vulnerable (e.g., racial/ethnic minorities and persons with ADRD) have access to the right type of post-acute care.

This study has several limitations. First, we measured post-acute care referrals, not the actual use of post-acute care that may be different from the referral. Second, though we controlled for a comprehensive set of individual-, hospital-, AL- and regional variables, there may be residual confounding, e.g., in variation in disease severity, functionality, caregivers and AL policies.

CONCLUSION

Post-acute care referrals for AL residents in the U.S. are related to multi-level variables that speak to both the needs of the patient and the availability of care. AL residents with different post-acute care referrals tend to differ in 30-day and 60-day outcomes. At hospital discharge, clinicians and discharge planners should be provided information about the exact type and availability of services at AL to make the most appropriate discharge referrals for AL residents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Points:

1. In assisted living (AL) communities in the U.S., skilled nursing facility is the most common post-acute care referral, followed by home without home health care (HHC) and home with HHC.
2. Post-acute care referrals made for AL residents in the U.S. are related to multi-level variables that speak to both the needs of the patient and the availability of care.
3. AL residents who are discharged to different post-acute care referrals tend to differ in 30-day and 60-day outcomes.

Why does this matter?

Because the AL is the fastest growing residential care provider in the United States, it is important for clinicians and discharge planners to be provided information about the exact type and availability of services at AL to make the most appropriate discharge referrals for AL residents.

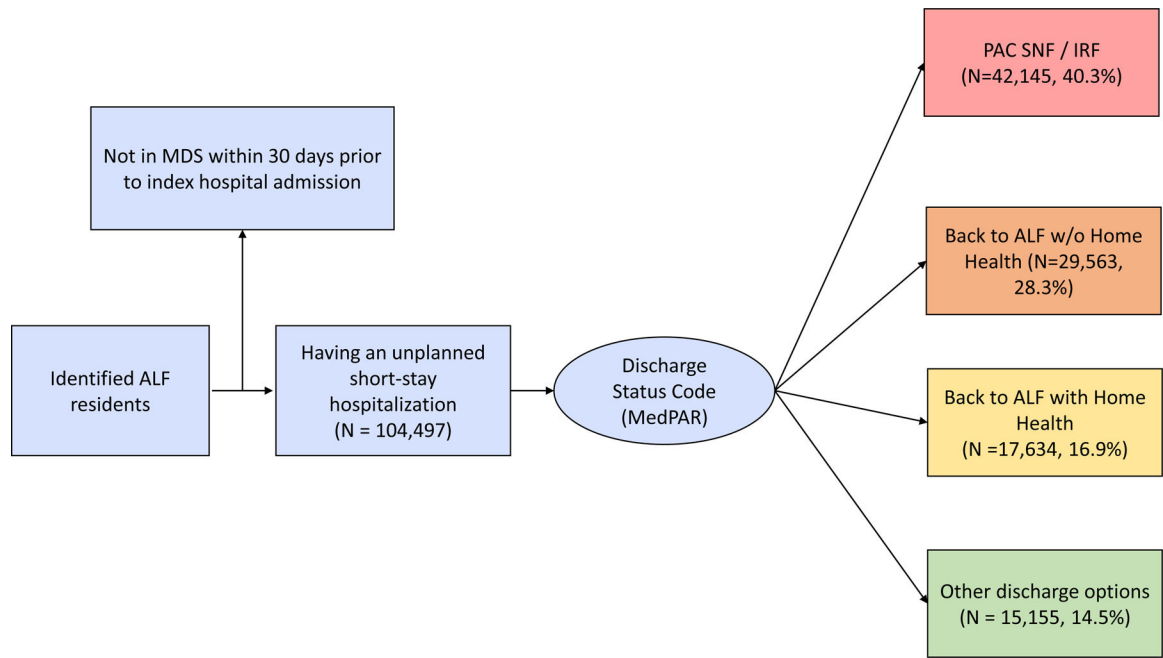


Figure 1. Discharge Transitions After An Acute Care Hospital Stay In Assisted Living

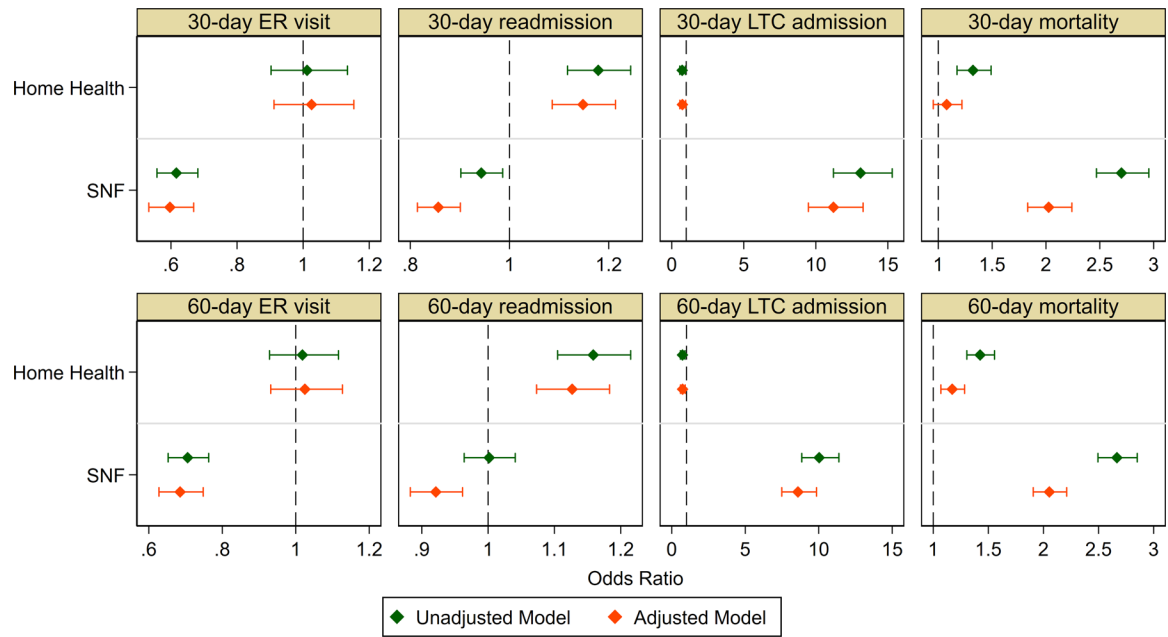


Figure 2. Effect Sizes of the Relationships Between Post-Acute Care Transitions and 30-Day and 60-Day Outcomes

Table 1.

Sample Characteristics of Assisted Living Medicare Beneficiary Residents with A Discharge from Short-Stay Hospitalization

Characteristics	Home (N=29563, 28.3%)	HHC (N=17634, 16.9%)	SNF (N=42145, 40.3%)	Total (N=89,342)
Outcomes				
Having 30-day ED visit ¹	4.6%	4.7%	2.9%	3.8%
Having 60-day ED visits ¹	7.2%	7.3%	5.2%	6.3%
Having 30-day readmission	15.0%	17.3%	14.3%	15.1%
Having 60-day readmission	22.0%	24.7%	22.1%	22.6%
Having 30-day LTC admission	0.7%	0.5%	8.1%	4.1%
Having 60-day LTC admission	1.0%	0.7%	9.2%	4.8%
Having 30-day mortality	2.3%	3.0%	6.0%	4.2%
Having 60-day mortality	4.1%	5.7%	10.1%	7.2%
Age - Mean (SD)	79.9 (12.7)	83.7 (10.3)	84.6 (9.8)	82.8 (11.1)
Pct. <65	11.1%	4.9%	4.1%	6.6%
65–74	19.1%	13.9%	11.9%	14.7%
75–84	24.8%	24.5%	24.0%	24.4%
85–94	38.6%	46.5%	48.5%	44.8%
95 and over	6.5%	10.1%	11.5%	9.6%
Gender - Female	60.4%	65.4%	67.4%	64.7%
Race				
Non-Hispanic White	85.7%	90.4%	91.0%	89.1%
Non-Hispanic Black	6.8%	4.1%	4.3%	5.1%
Hispanic	4.4%	3.1%	2.6%	3.3%
Asian/Pacific Islander	1.9%	1.4%	1.2%	1.4%
Other	1.2%	1.0%	0.9%	1.0%
Dual eligibility	23.3%	16.9%	21.8%	21.3%
Index admission Length of Stay, Mean (SD)	3.9 (5.2)	4.4 (4.2)	6.0 (5.4)	5.0 (5.2)
Index Admission LOS >= 3 days	55.1%	68.3%	92.6%	75.4%
DRG weights, Mean (SD)	1.3 (0.9)	1.4 (0.9)	1.6 (1.1)	1.5 (1.0)
DRG type				
Medical	84.9%	84.1%	73.1%	79.2%
Surgical	14.4%	14.4%	25.9%	19.8%
Missing	0.8%	1.5%	1.0%	1.0%
Medicare Advantage enrollees	31.3%	32.5%	29.8%	30.8%
Number of Chronic Conditions (Medicare fee-for-service only) ²				
Mean (SD)	13.0 (7.57)	13.3 (7.32)	13.7 (7.08)	13.4 (7.30)
<=10	15.1%	11.2%	11.2%	12.5%
11–19	37.5%	38.9%	41.3%	39.6%
>=20	16.2%	17.5%	17.7%	17.1%

Characteristics	Home (N=29563, 28.3%)	HHC (N=17634, 16.9%)	SNF (N=42145, 40.3%)	Total (N=89,342)
Alzheimer's Disease and Related Dementias ²	26.0%	29.7%	35.9%	31.4%
Acute Myocardial Infarction ²	6.5%	7.5%	6.9%	6.9%
Atrial Fibrillation ²	21.7%	25.5%	24.2%	23.6%
Chronic Kidney Disease ²	38.0%	40.5%	41.1%	39.9%
Chronic Obstructive Pulmonary Disease ²	31.9%	33.2%	32.6%	32.5%
Heart Failure ²	35.1%	39.1%	39.0%	37.8%
Diabetes ²	33.4%	34.1%	34.5%	34.0%
Ischemic Heart Disease ²	47.4%	49.6%	50.8%	49.4%
Osteoporosis ²	24.8%	29.3%	32.4%	29.3%
Rheumatoid Arthritis/Osteoarthritis ²	52.7%	55.7%	58.7%	56.1%
Asthma ²	17.4%	17.3%	16.0%	16.7%
Hypertension ²	62.8%	63.7%	66.7%	64.8%
Sensory - Deafness and Hearing Impairment ²	18.5%	20.7%	21.7%	20.5%
Mobility Impairments ²	7.3%	9.0%	9.5%	8.6%
Multiple Sclerosis and Transverse Myelitis ²	1.0%	1.1%	1.0%	1.0%
Obesity ²	21.4%	20.2%	19.8%	20.4%
Sensory - Blindness and Visual Impairment ²	2.8%	3.5%	3.4%	3.2%
Cancer ^{2,3}	14.7%	16.1%	15.9%	15.5%
Anxiety/Depression ²	45.8%	46.3%	49.2%	47.5%
Mental Illness ⁴	17.6%	14.2%	17.0%	16.7%
Hip/Pelvic Fracture in 2018 ²	1.6%	2.5%	10.2%	5.9%
Stroke/Transient Ischemic Attack in 2018 ²	9.3%	10.6%	12.3%	11.0%
Pressure Ulcers and Chronic Ulcers in 2018 ²	10.3%	15.3%	18.5%	15.1%
Drug Use Disorder ²	8.7%	6.7%	6.5%	7.3%

Notes:

¹The information about ED visits was only available for Medicare Fee-For-Service beneficiaries;

²The information about chronic conditions and specific diagnoses was only available for Medicare Fee-For-Service beneficiaries;

³Cancer includes breast cancer, colorectal cancer, endometrial cancer, lung cancer, and prostate cancer;

⁴Mental illness includes bipolar disorder, personality disorders, schizophrenia, schizophrenia and other psychotic disorders;

HHC = home health care; SNF = skilled nursing facility

Table 2.
Factors Associated with Post-Acute Care Discharge Transitions

Reference group	Relative Risk Ratios ¹ (S.E.)		p-value ²
	HHC vs. Home ³	SNF vs. Home ⁴	(SNF vs. HHC)
	Home	HHC	
Individual-level variables			
Age (ref: 65–75)			
<65	0.750 *** (0.038)	0.634 *** (0.028)	0.003
75–84	1.116 *** (0.040)	1.415 *** (0.045)	0.000
85–94	1.283 *** (0.046)	1.897 *** (0.063)	0.000
>=95	1.581 *** (0.076)	2.645 *** (0.118)	0.000
Gender (ref: Male)			
Female	1.126 *** (0.026)	1.145 *** (0.023)	0.448
Race (ref: Non-Hispanic White)			
Non-Hispanic Black	0.908 * (0.048)	0.845 *** (0.038)	0.192
Hispanic	0.779 *** (0.068)	0.603 *** (0.055)	0.001
Asian/Pacific Islander	0.921 (0.091)	0.767 *** (0.061)	0.088
Other	1.047 (0.098)	0.994 (0.087)	0.599
Dual eligibility (ref: Non-dual)	1.042 (0.039)	1.186 *** (0.040)	0.000
MA enrollees (ref: FFS enrollees)	1.487 *** (0.086)	1.644 *** (0.083)	0.098
Index Admission LOS >= 3 days (ref: <3 days)	1.843 *** (0.043)	10.178 *** (0.303)	0.000
DRG type (ref: Medical)			
Surgical	0.976 (0.040)	1.809 *** (0.061)	0.000
DRG weights	1.115 *** (0.020)	1.148 *** (0.018)	0.027
Number of Chronic Conditions (ref: <=10)			
11–19	1.020 (0.046)	1.053 (0.041)	0.475
>=20	1.060 (0.069)	1.024 (0.059)	0.588
Presence of Chronic Conditions (Medicare fee-for-service only)			
Alzheimer's Disease and Related Dementias	1.142 *** (0.031)	1.441 *** (0.034)	0.000
Acute Myocardial Infarction	1.050 (0.042)	0.942 (0.034)	0.006
Atrial Fibrillation	1.022 (0.028)	0.917 *** (0.023)	0.000
Chronic Kidney Disease	1.033 (0.029)	1.004 (0.023)	0.288
Chronic Obstructive Pulmonary Disease	1.031 (0.029)	0.935 *** (0.023)	0.000
Heart Failure	1.067 ** (0.031)	0.986 (0.024)	0.004
Diabetes	1.073 *** (0.029)	1.005 (0.024)	0.010
Ischemic Heart Disease	0.921 ** (0.030)	0.896 *** (0.024)	0.367
Osteoporosis	1.025 (0.028)	1.071 *** (0.026)	0.098
Rheumatoid Arthritis/Osteoarthritis	1.021 (0.036)	1.067 ** (0.032)	0.198

Reference group	Relative Risk Ratios ¹ (S.E.)		p-value ²
	HHC vs. Home ³	SNF vs. Home ⁴	(SNF vs. HHC)
	Home	HHC	
Asthma	0.983 (0.030)	0.902 ^{***} (0.024)	0.004
Hypertension	1.011 (0.056)	1.076 (0.052)	0.280
Sensory - Deafness and Hearing Impairment	0.970 (0.028)	0.965 (0.023)	0.827
Mobility Impairments	1.246 ^{***} (0.047)	1.282 ^{***} (0.045)	0.438
Multiple Sclerosis and Transverse Myelitis	1.163 (0.113)	1.096 (0.095)	0.527
Obesity	0.974 (0.029)	1.019 (0.025)	0.102
Sensory - Blindness and Visual Impairment	1.142 ^{**} (0.070)	1.074 (0.061)	0.249
Cancer	0.993 (0.029)	0.937 ^{**} (0.024)	0.043
Anxiety/Depression	1.060 ^{**} (0.032)	1.069 ^{**} (0.029)	0.781
Mental Illness	0.915 ^{***} (0.032)	1.069 ^{**} (0.032)	0.000
Hip/Pelvic Fracture in 2018	1.314 ^{***} (0.095)	4.154 ^{***} (0.229)	0.000
Stroke / Transient Ischemic Attack in 2018	1.161 ^{***} (0.041)	1.504 ^{***} (0.044)	0.000
Pressure Ulcers and Chronic Ulcers in 2018	1.500 ^{***} (0.047)	1.767 ^{***} (0.049)	0.000
Drug Use Disorder	0.964 (0.042)	0.917 ^{**} (0.035)	0.252
AL-level variables			
AL beds	1.000 (0.000)	1.001 ^{***} (0.000)	0.000
Proportion of duals in AL	1.008 (0.070)	2.669 ^{***} (0.165)	0.000
Average age in AL	1.029 ^{***} (0.003)	1.050 ^{***} (0.002)	0.000
Hospital-level variables			
Hospital Ownership (ref: for-profit)			
Nonprofit/Public	1.044 (0.050)	0.876 ^{***} (0.040)	0.000
Other	1.140 ^{**} (0.076)	0.890 ^{**} (0.053)	0.000
Teaching Status (ref: Major)			
Limited	1.119 ^{**} (0.064)	1.043 (0.049)	0.194
Graduate	0.999 (0.089)	1.026 (0.072)	0.709
No Affiliation	1.038 (0.055)	0.977 (0.044)	0.211
Hospital Beds	1.000 (0.000)	1.000 (0.000)	0.393
Location (ref: Urban)			
Rural	0.982 (0.072)	0.858 ^{**} (0.054)	0.035
County-level variables			
Hospital beds per 1000 people 65+	0.996 ^{***} (0.001)	0.995 ^{***} (0.001)	0.753
Nursing home beds per 1000 people 65+	0.997 (0.002)	1.007 ^{***} (0.002)	0.000
Home health agencies per 1000 people 65+	0.911 (0.078)	0.940 (0.068)	0.674
State dummies			
Not shown	Not shown	Not shown	Not shown
Observations	87,856	87,856	87,856
Clustered SE	Yes	Yes	

Note:

1. Relative risk ratios estimated in multinomial logistic regression models between post-acute care referral (reference group = home without HHC) and outcomes;

2. p-values generated in another set of multinomial logistic regression models between post-acute care referral (reference group = home with HHC) and outcomes;

3. HHC=Home health care;

4. SNF= skilled nursing facilities; standard errors are clustered at the level of the discharging hospital (in parentheses);

p<0.01,

**
p<0.05,

*
p<0.1;

HHC = home health care; SNF = skilled nursing facility

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