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Restarting the Cycle: Incidence and Predictors of First Acute Care Use After Nursing Home Discharge

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Abstract

Background/Objectives—The primary objective of this study was to describe the time to first acute-care use (e.g., emergency department use without hospitalization or rehospitalization)for older adults who discharged to home after receiving post-acute care in skilled nursing facilities (SNFs). The secondary objective was to identify predictors of patients' first acute-care use.

Design—Retrospective cohort study using administrative claims data.

Setting—SNFs providing post-acute care in North and South Carolina (*N*=1,474).

Participants—A cohort of Medicare beneficiaries aged 65 years and older (*N*=55,980) who were hospitalized, then transferred to a SNF for post-acute care, and subsequently discharged home (January 1, 2010, to August 31, 2011).

Measurements—Medicare institutional claims data (Part A and Part B) and Medicare enrollment data were used; facility-level variables were obtained from CMS Nursing Home Compare. Survival from SNF discharge to first acute-care use was explored. Cox proportional

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hazards regression models were used to describe patient, home care and nursing facility-level predictors.

Results—After SNF-to-home discharge, 22.1% of older adults had an episode of acute-care use within 30 days, including 7.25% with an ED visit without hospitalization and 14.8% with a rehospitalization; 37.5 % of older adults had their first acute-care usewithin 90 days. Male gender, dual eligibility status, higher Charlson co-morbidity score, certain primary diagnoses at the index hospitalization (neoplasms and respiratory disease), and care in SNFs with for-profit ownership or fewer licensed practical nurses hours per patient day were associated with higher risk for acute-care use.

Conclusion—Medicare patients have a high use of acute-care services after discharge from SNFs, and several factors associated with acute-care use are potentially modifiable. Findings suggest the need for interventions to support patients as they transition from SNFs to home.

Keywords

care transitions; skilled nursing facilities; epidemiology

Introduction

Fee for service Medicare insures patient stays for post-acute care in skilled nursing facilities (SNF) for the first 100 days, and more than 1.7 million older adults in the U.S. receive post-acute care in SNFs after a hospitalization each year.[1] The outcomes among older adults who transfer from a hospital to a SNF for post-acute care and are subsequently discharged home are not well documented. Thus, understanding the time to first acute-care use (e.g., emergency department use without hospitalization or rehospitalization) after discharge from a SNF to home is an important public health issue.

For patients transitioning from a hospital directly to home, a high risk of re-admission or emergency department use has been clearly described;[2-4] however, the incidence and predictors of first acute-care use after patients transition from SNFs to home has not been reported. Patient demographics, primary admission diagnosis, number and nature of co-morbid conditions and use of home-care services predict additional acute-care use in hospital to home transitions.[5-8] In addition, the characteristics of SNFs (e.g., ownership, size and staffing characteristics) may also contribute to outcomes of those receiving post-acute care prior to transitioning home.

The purpose of the study was toexamine care transitions of a cohort of older adults that undergoes post-acute care in a SNF following a hospital stay and is discharged home from the SNF. The primary objective was to describe the time to the first acute-care use (e.g., a composite of ED use without hospitalization or rehospitalization) after SNF discharge. The secondary objective was to describe patient, home care and facility-level predictors of these outcomes at 30 and 90 days.

Methods

Data Sources

The study was conducted as a collaboration between investigators at The University of North Carolina at Chapel Hill, Duke University, the University of Pennsylvania and The Carolinas Center for Medical Excellence, a Medicare Quality Improvement Organization (QIO). The QIO was a partner in these analyses; the study was designed and initiated by the first and last authors who had no direct link with The Carolinas Center for Medical Excellence. This study is not part of a larger research effort in the QIO or other organizations. Medicare utilization data were provided to the QIO from the Center for Medicare & Medicaid Service (CMS) to support its community care transitions programs in North Carolina and South Carolina. These data include claims information for institutional services covered by Medicare fee-for-service Part A and Part B for services provided from September 2008 through November 2011. Institutional claims data were used to identify ED use and inpatient hospitalizations for patients in the study population. The use of institutional Part B claims enabled the identification of ED use when patients did not experience a hospital admission. Medicare enrollment data from the QIO were included to identify patient Medicare coverage and socio-demographic information. Not included in our analytic datasets was Medicare non-institutional Part B claims and Part D claims because they were not available to the QIO at the time of this study. These data were limited to Medicare beneficiaries with enrollment mailing addresses in North Carolina and South Carolina. Facility-level variables were obtained from CMS Nursing Home Compare data posted as of October 31, 2010. The Institutional Review Board at the Duke University Health System and CMS approved this study.

Study Population

The study focused on a cohort of Medicare patients in North Carolina and South Carolina who transferred from a hospital to a SNF and then were discharged from the SNF to home. Patients were included if this discharge occurred between January 1, 2010 and August 31, 2011. Medicare reimburses all or part of the cost for SNF care for the first 100 days of SNF admissions; thus, a length of stay cut-off at 106 days was chosen so that all patients with 100 day Medicare reimbursement and those with last minute discharge complications could be included in the study cohort. When more than one SNF admission occurred during the study period for a single individual, the first was defined as the index SNF admission. For each included patient, Medicare claims data were examined for the duration of the study period bounded by 12 months prior to index SNF admission through 90 days post index SNF discharge. We examined Medicare Part A and Part B claims for up to 12 months prior to SNF admission to determine co-morbidity variables. Thus, Medicare claims from services as early as December 2008 were examined in these analyses. Patients were excluded if they (a) were less than 65 years of age at SNF index admission, (b) were enrolled in a Medicare managed care plan during the study period, or (c) lacked full Part A and Part B coverage during this period. Cohort selection is shown in Figure 1.

Outcomes

The primary outcome was first acute-care use, a composite of ED use without hospitalization or re-hospitalization within 30 and 90 days after SNF discharge. The time to the first outcome event was calculated as the number of days between the index SNF discharge date and the date of the first acute-care use. The proportional hazards of patients with each of these outcomes at 30 and 90 days also were calculated for acute-care use at 30 and 90 days. The rate of acute-care use after SNF discharge (per1000 patient-days) was also calculated. In addition, the frequency of ED visits without hospitalization that included observation status in the ED was also calculated.

Patient Factors, Home Care Use and Facility Characteristics

Patient factors included demographic information, race by self-report as recorded in the Medicare enrollment database, primary admission diagnosis, a measure of co-morbidity burden and a description of prior hospital use. Demographic data for each patient included age at time of index SNF admission, gender, state (North Carolina or South Carolina). We defined dual eligible status based on state buy-in flags provided in the Medicare denominator file. These indicate whether states paid for beneficiary Medicare coverage during each month of the study period. We defined dual eligible as state buy-in during any month of the observation period. Clinical data for patients included the primary discharge diagnosis of the index hospitalization; primary discharge diagnoses were categorized using seven groups of International Classification of Disease-Ninth Revision, Surveillance Diagnosis Group (SDG) codes: Neoplasms(SDG codes 03-14), Cardiovascular (SDG codes 30,31,37), Cerebrovascular (SDG code 40), Respiratory (SDG codes 44-49), Cellulitis, Abscess or Ulcer (SDG codes 72-73), Fractures (SDG codes 83-84), and Other (all remaining SDG codes).[9, 10] To incorporate information on co-morbidity burden, a previously validated modified Charlson Comorbidity Score (calculated using ICD-9 codes from claims data for the 365 days preceding the index SNF stay)[11] and hospitalizations in 90 days prior to index SNF admission (calculated with Medicare Part A institutional claims data) were identified.

Nursing facility characteristics included the index SNF length of stay, calculated by subtracting the day of SNF admission from the date of the SNF discharge. Publicly available Nursing Home Compare data[12]were used to identify other facility-level characteristics potentially associated with post-discharge acute care use, including the number of SNF beds (unknown, 0-50, 51-100, 101-150, 151 or more), ownership (unknown, for profit, government, non-profit), registered nurse (RN) hours per resident day (unknown, 0 - 0.49, 0.50 - 0.99, 1,00 - 1.99, 2.00 - 2.99, 3.00 - 3.99, 4.00 or higher) and licensed practical nurse (LPN) hours per resident day (unknown, 0 - 0.49, 0.50 - 0.99, 1.00 - 1.99, 2.00 - 2.99, 3.00 - 3.99, 4.00 or higher). A single Nursing Home Compare data set (October, 31 2010) was used, which described nursing home characteristics at the beginning of the study period. Finally, Medicare claims were used to determine whether home care was used immediately following the SNF discharge; information regarding home health care utilization was limited due to incomplete claims information in the analytic files used in this study. Patients with home hospice services were excluded because they likely have different patterns of acute care use than other beneficiaries.

Statistical Analysis

Survival curves were constructed using a product-limit estimator of the time from SNF discharge to ED use or re-hospitalization. Subjects were censored at death or at the end of the study period; if patients died in the ED or hospital then they were considered to have experienced the event prior to censoring. Multivariable Cox proportional hazards modeling was also performed to examine the unadjusted and adjusted relationships between patient, home care use, and nursing-facility characteristics and time to ED use without hospitalization or re-hospitalization at 30 and 90 days. In the multivariable models, predictor variables were added sequentially in the following groups: patient non-clinical factors (i.e., age, gender, race, state, and dual eligibility status); patient clinical factors (i.e., primary diagnosis ICD-9 group, index SNF length of stay, the Charlson Comorbidity Score, number of hospitalizations in 90 days prior to index SNF admission); use of home care immediately after SNF discharge; and finally nursing facility-level characteristics (i.e., number of beds, type of ownership, number of RN hours per resident day, and number of LPN hours per resident day). Once added, a group was included in all subsequent models. After each group was added, the model was fitted and estimates of the relative risks were calculated. Analyses were conducted using SAS version 9.2.

Results

The study cohort for these analyses included 55,980 fee-for-service Medicare patients who were hospitalized, then transferred to one of 1,474 SNFs and then discharged to home between January 1, 2010 and August 31, 2011. A total of 11,822 patients were excluded for reasons described in Figure 1. Patient non-clinical, clinical and home care utilization characteristics are shown in Table 1. A majority of patients (73%) were more than 75 years of age, about two-thirds (68%) were female, most (86%) were white, and two-thirds (67%) received home care services after SNF discharge.Characteristics of the nursing facilities are also described in Table 1; the majority of nursing facilities (62%) had 51-150 beds, about two-thirds (66%) were for-profit facilities, just under half (49%) offered 0.50 to 0.99 RN hours per resident day, and just under half (49%) offered 0.50 to 0.99 LPN hours per resident day.

The primary objective of the study was to describe time to first acute care use after discharge from a SNF to home: 22.1% (12,349 patients) experienced their first acute-care use (e.g., ED visits without hospitalization or rehospitalization) within 30 days; 37.5 % (20,966 patients) experienced their first acute-care use within 90 days. Expressed as utilization per 1000 patient days, the rates of acute care events in the first 30 and 90 days were 8.61/1000 patient-days and 5.67/1000 patient-days respectively. Many patients used acute-care services more than once in the 30 or 90 days after discharge from a SNF; thus, within 30 days of SNF discharge to home, 10.3% (5,771 uniquepatients) had ED visits without hospitalization and 14.7% (8,303 additional unique patients) were re-hospitalized. Within 90 days after SNF discharge, 20.1% (11,302 unique patients) had ED visits without hospitalization and 25.9% (14,564 additional unique patients) were re-hospitalized. Within 30 days of SNF discharge, 3.5% (1,977 patients) died; within 90 days, 8.1% (4,538 patients) died. Among patients with ED visits without hospitalization at 30 days, 0.79% (443)

received observation level of care in the ED; among those with ED visits without hospitalization at 90 days, 1.6% (911) received observation level of care in the ED. The survival curve shown in Figure 2 reveals that for those patients still alive and at home, the first use of acute-care services after SNF discharge often occurred quickly; 12% of patients had ED visits without hospitalization or were re-hospitalized 10 days after SNF discharge.

The secondary objective of this study was to describe predictors of acute-care use after discharge from a SNF to home at 30 and 90 days. Table 2 shows the adjusted associations between patient, home care, and nursing facility characteristics and a composite of ED use or re-hospitalization at the 30 day cut point, the adjusted associations at the 90 day cut point are not shown secondary to the consistency of findings in the two models. In the multivariate analysis (Table 2), higher risk for ED use or re-hospitalization at 30 days was associated with (a) male gender, African American race and eligibility for Medicare and Medicaid and (b) higher Charlson Comorbidity Score, higher count of hospitalizations in the 90 days prior to the index SNF stay, ICD-9 diagnosis of neoplasms and respiratory disease and (c) care in a for-profit nursing facility. However, lower risk for ED use or re-hospitalization was associated with ICD-9 diagnosis of fracture, SNF treatment of longer duration or in North Carolina, and care in a nursing facility with greater licensed practical nurse hours per resident day. The predictors of acute-care use after SNF discharge at 90 days were similar except that primary diagnosis of cardiac disorder or cellulitis, abscess or ulcer, and use of home care were associated with higher risk. Similar to the 30 day model, SNF treatment of longer duration or in a SNF with greater RN hours per resident day were associated with lower risk for acute-care use.

Discussion

This analysis indicates that 22.1% of older adults in the study cohort experienced their first acute-care use (e.g., ED visits without hospitalization or rehospitalization) within 30 days of discharge from SNFs; 37.5 % (20,966 patients) experienced their first acute-care use within 90 days. A previous study of complicated transitions (e.g., unexpected transition in care from lower to higher levels of care[3]) indicated that 20% of older adults discharged from hospitals to home were rehospitalized within 30 days.[2] The current study expands these findings by describing the ongoing vulnerability of older adults who receive care in SNFs to poor health outcomes during care transitions to home.[3, 4] Findings from this study do not describe what proportion of ED use and re-hospitalization after SNF stay is potentially avoidable or related to suboptimal planning and delivery oftransitional care. However, the high rates of acute-care use following SNF discharge highlights this population as needing additional research and clinical scrutiny.

Understanding patient and health system characteristics associated with higher or lower acute-care use may suggest particular populations or interventions for additional study.Several risk factors for subsequent acute care use were identified that might be amenable to intervention, including improved coordination of services for patients with specific identified ICD-Ninth Revision diagnoses (e.g., neoplasms and respiratory diseases) and characteristics of nursing facilities (e.g., nursing staffing levels). Thus, the findings indicate that health outcomes after SNF discharge are multi-factorial, related to both patient

and system characteristics, and will likely require a multi-pronged approach for future study and intervention. Some solutions may focus on developing standardized transitional care services that can be provided in SNFs for all post-acute patients, while others may address the specific needs of post-acute patients with the highest chronic disease burden and the most significant barriers to accessing care after discharge. The evidence from hospital-based studies of transitional care, e.g. The Transitional Care Model[13] and the Care Transitions Model,[14] will be important starting points for designing interventions to support older adults and family caregivers during transitions in care from SNFs to home.

Secondary data analyses have potential biases that may limit our conclusions. Our analytic databases were limited to Medicare institutional claims data and Medicare enrollment data for residents of only two states. Claims data provide a limited and potentially biased view of actual patient care and patient experiences in that they record information necessary for reimbursement, but not all information relevant to patient care decision. Reimbursement priorities may not align with clinical priorities producing bias that is difficult to predict without medical record review and patient/provider interviews. Claims from outpatient clinics, pharmacy, and home health sources were either not available or incomplete for the time of these analyses. However, the covariates and outcomes considered in our analyses were likely well ascertained, and additional claims data would not have substantially altered our findings. Available data were also limited for some key predictors of acute-care use; for example, additional data describing the level of patient function or family caregiver support following SNF discharge would be useful. Similarly the data were not sufficiently rich to explore the potential pathways linking predictor and outcome variables. For example, future research describing what occurs in patients' homes after the discharge (e.g., a post-operative complication, a missed appointment, a new medical problem, lack of caregiver support, etc.) could identify specific trigger events for ED visits and hospital admissions that might be amenable to intervention. Findings were also limited by the absence of an analysis of hospital observation stays (i.e., not formal admissions) in the description of first acute-care use. In addition, the findings use data from only two states, which limits the generalizability of the findings. Moreover, our data did not include ED visits and hospitalizations that may have occurred outside of North Carolina and South Carolina, which likely means that our findings underestimate the number of acute care events after SNF discharge. Finally, the findings were limited by use of data from the October 31, 2011 Nursing Home Compare data set; although these characteristics may have changed over the study period, data availability and the complexity of introducing time varying covariates into the model precluded updating these variables over time. The study also has several strengths, including the use of a large cohort of unique patients over 20 months in two states, regression modeling with non-clinical and clinical patient characteristics, home care use, and nursing facility covariates, and consistent findings of clinically and statistically significant associations between covariates and outcome measures across all models.

The findings suggest important areas for research. First, replication of this study using data from a cohort of older adults from multiple states in different regions of the country is necessary to confirm the generalizability of the findings. Second, the reasons for repeat acute-care use in this population are not well documented and it is not known what proportion is related to the index condition or conditions treated in the SNF, and therefore

are potentially amenable to interventions there. Third, study is needed to examine elements of community health care that follows SNF discharge (e.g., follow-up with primary care physicians and the intensity or duration of home care) and to describe the relationship between community healthcare and first use of acute-care services. For example, research is needed that combines Medicare Claims data with Outcome Assessment and Information Set (OASIS) home care data to study associations between home care intensity or duration and outcomes after SNF discharge. Fourth, research is needed to develop services that will engage or prepare family caregivers to assist SNF patients after discharge, for example, follow-up studies based on existing models, such as the "Providing Assistance to Caregivers in Transition"[15] and "Project Home"[16] interventions. Fifth, prior research has not explored the relationship between code status, the use of palliative care or hospice services and health outcomes after SNF discharge; studies of these services are needed to explore alternatives to acute-care use for patients with late-staged illnesses. Further research is also needed to explore state level predictors of patient outcomes after discharge from SNFs; the finding that treatment in a SNF in North Carolina versus South Carolina was associated with lower risk for use of acute-care services after SNF discharge is not consistent with findings that identify similar 30-day re-utilization rates after hospital discharge from these two states.[17]

This study implies the need for interventions to improve transitions of patient care from SNF to home. A large body of studies supports the value of transitional care interventions in reducing the risk for re-utilization of acute-care services after hospital discharge.[18, 19] Patients in the cohort of patients studied were treated in 1,474 SNFs in North Carolina and South Carolina; this finding indicates that services to improve patient support during transitions from SNFs to home are needed in numerous and widely dispersed nursing homes. Owing to financial constraints in nursing homes, cost-neutral strategies such as use of existing SNF staff to deliver elements of transitional care may be needed to improve patient and caregiver preparation for care transitions to home.[15, 16] Findings from a set of case studies of transitional care in SNFs, for example, show that frontline nursing home staff are frequently unaware of the basic components of transition planning and are thus unlikely to provide critical services such as medication reconciliation, written discharge and follow-up instructions, or clinical summaries of the nursing home stay to the next care provider. [20] Among patients with greatest vulnerability, for example those with multiple co-morbidities, a diagnosis of neoplasms or respiratory disease, and dual eligibility status, interventions such as the Transitional Care Model[13] may be useful.

In conclusion, older Medicare patients have a high use of acute care services beginning soon after discharge from SNFs; associations between patient, homecare and facility level characteristics and re-utilization of hospital services after discharge suggest that designing and testing strategies to support older adults as they transition home after SNF careshould be a high priority.

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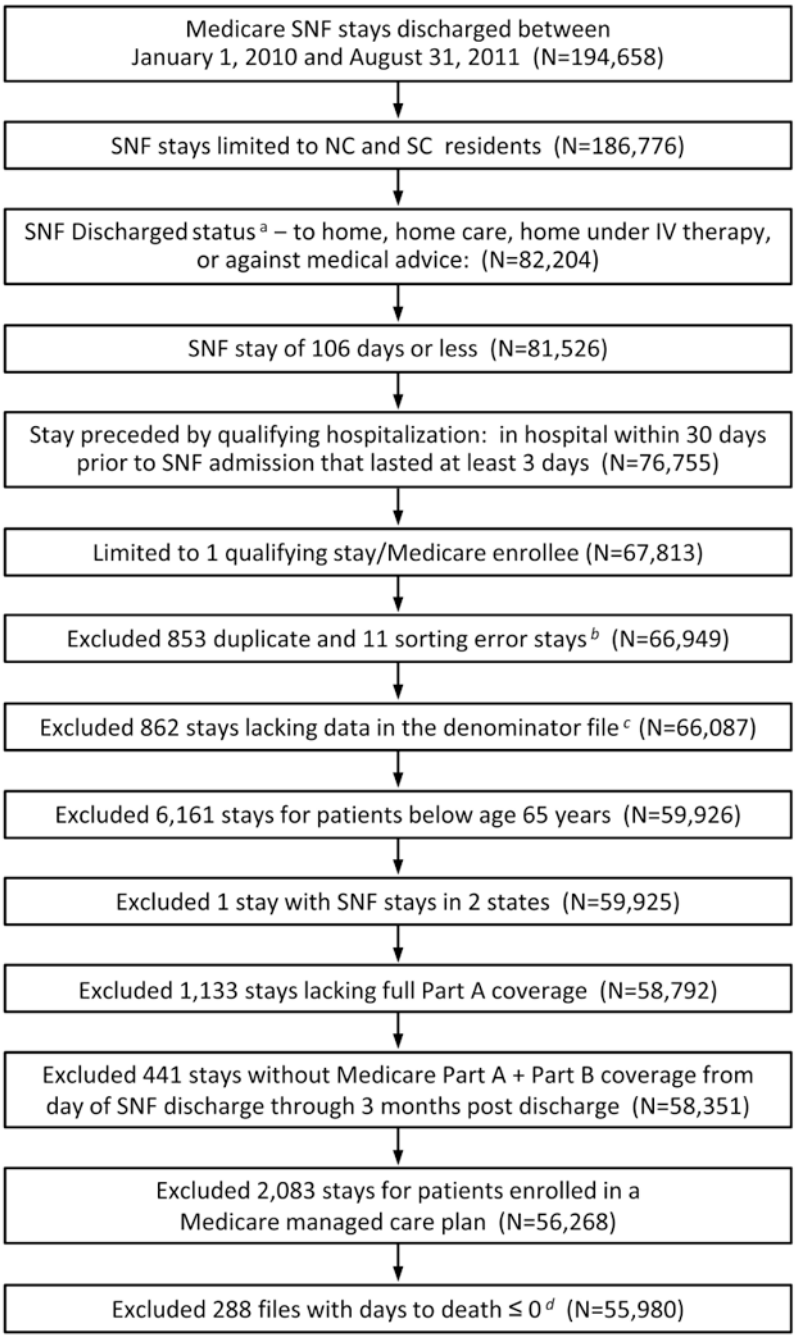

Figure 1. Cohort Flow

[a]SNF stays included in the analysis were for patients discharged to home. This included patients with and without home care andhome with IV therapy. It also included those who were discharged against medical advice.

[b]Duplicate stays that were present across both states data files.

[c]Patient identifier not in the denominator files for either NC or SC. No patient data available for those patients.

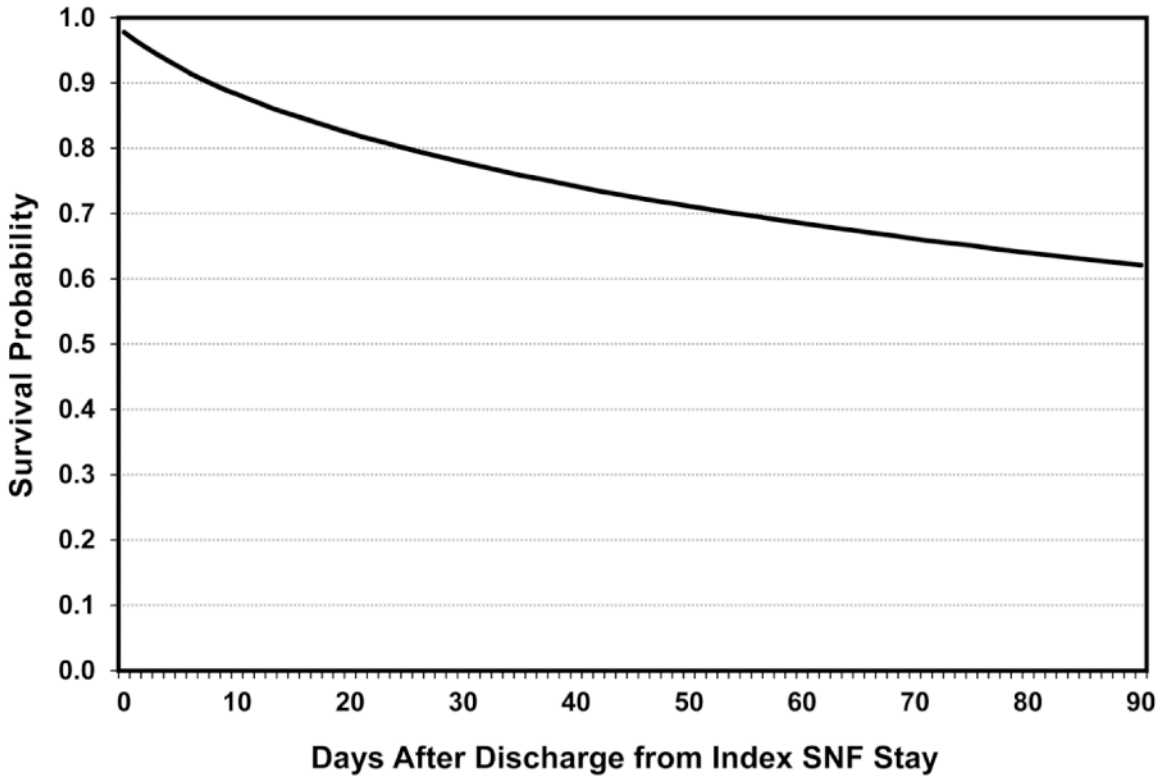

Figure 2. Survival Curve from Day of SNF Discharge until Day of ED Use or Re-hospitalization

[a] SNF – skilled nursing facility

[b] ED – emergency department

Table 1

Sample Characteristics for Patients, Use of Home Care, (N= 55,980) and Skilled Nursing Facilities (N=1,474).

Patient Characteristics	n	%
Patient Characteristics: Demographic		
Age (years) at index SNF [a] discharge		
65 – 74	15,071	26.9
75 – 84	24,239	43.3
85 or older	16,670	29.8
Gender		
Female	38,274	68.4
Race		
White	47,986	85.7
African American	7,511	13.4
Other	483	0.9
State		
NC	38,118	68.1
Dual eligibility status (Medicare and Medicaid)		
Yes	11,167	20.0

Patient Characteristics	n	%
Patient Characteristics: Clinical		
Surveillance Diagnostic Group (SDG)		
1. Neoplasms	1,247	2.2
2. Cardiovascular	1,375	2.5
3. Cerebrovascular	2,735	4.9
4. Respiratory	5,092	9.1
5. Cellulitis, Abscess or Ulcer	761	1.4
6. Fractures	9,048	16.2
7. Other SDGs	35,722	63.8
Index SNF length of stay (days)		
0 – 15	18,074	32.3
16 – 30	20,553	36.7
31 – 60	12,469	22.3
> 60	4,884	8.7
Charlson Comorbidity Score		
0	15,579	27.8
1	14,489	25.9
2	10,040	17.9
3	6,838	12.2
4	4,459	8.0
5 or more	4,575	8.2

Patient Characteristics	n	%
Number of hospitalizations in 90 days prior to index SNF admission		
0	39,472	70.5
1	12,110	21.6
2	3,220	5.8
3 or more	1,178	2.1
Patient Characteristics: Use of Home Care		
Evidence of home care use post-discharge		
Yes	37,735	67.4

Skilled Nursing Facility Characteristics	n	%
Number of beds		
0-50	181	12.3
51-100	391	26.5
101-150	525	35.6
151 or more	297	20.2
Unknown	80	5.4
Ownership		
Non profit	379	25.7
For profit	977	66.3
Government	38	2.6
Unknown	80	5.4

Skilled Nursing Facility Characteristics	n	%
RN hours per resident per day		
0 - 0.49	413	28.0
0.50 - 0.99	720	48.9
1.00 - 1.99	146	9.9
2.00 or higher	75	5.1
Unknown	120	8.1
LPN hours per resident per day		
0 - 0.49	92	6.2
0.50 - 0.99	728	49.4
1.00 - 1.99	504	34.2
2.00 or higher	30	2.0
Unknown	120	8.1

[a] SNF – Skilled Nursing Facility.

Table 2

Associations of Patient Non-Clinical, Clinical Variables, Home Care Use, and Skilled Nursing Facility Variables with a Composite of Emergency Department Use or Rehospitalization within 30 Days.

Predictor Variables	Cox Proportional Hazard Models: Adjusted Hazard Ratios (95% Confidence Intervals)			
	Model 1[a] (N = 55,980)	Model 2[a] (N = 55,980)	Model 3[a] (N = 55,980)	Model 4[a] (N = 51,744) [b]
Patient Demographic Variables				
Age (yrs) at index SNF discharge	1.01 (1.00, 1.01)	1.01 (1.01, 1.01)	1.01 (1.01, 1.01)	1.01 (1.01, 1.01)
Gender (Reference: Female)				
Male	1.26 (1.21, 1.31)	1.12 (1.08, 1.17)	1.11 (1.07, 1.16)	1.11 (1.07, 1.16)
Race (Reference: White)				
Black	1.25 (1.19, 1.31)	1.17 (1.11, 1.23)	1.17 (1.11, 1.23)	1.16 (1.10, 1.22)
Other	0.84 (0.69, 1.02)	0.83 (0.68, 1.01)	0.83 (0.68, 1.01)	0.81 (0.66, 0.99)
State (Reference: SC)				
State: NC	0.98 (0.94, 1.01)	0.97 (0.93, 1.01)	0.97 (0.93, 1.01)	0.95 (0.91, 0.99)
Dual eligibility (Reference: No)				
Dual eligibility: Yes	1.63 (1.57, 1.70)	1.48 (1.42, 1.55)	1.48 (1.42, 1.55)	1.45 (1.39, 1.52)
Patient Clinical Variables				
SDG [c] Group (Reference: 7 Other)				
1. Neoplasms		1.34 (1.19, 1.49)	1.34 (1.19, 1.49)	1.33 (1.18, 1.49)
2. Cardiovascular		1.08 (0.97, 1.19)	1.08 (0.97, 1.19)	1.07 (0.96, 1.19)
3. Cerebrovascular		0.99 (0.91, 1.07)	0.99 (0.91, 1.07)	0.99 (0.91, 1.07)
4. Respiratory		1.26 (1.19, 1.33)	1.26 (1.19, 1.33)	1.24 (1.18, 1.32)
5. Cellulitis, Abscess or Ulcer		1.10 (0.95, 1.27)	1.10 (0.95, 1.27)	1.04 (0.89, 1.21)
6. Fractures		0.78 (0.74, 0.83)	0.78 (0.74, 0.83)	0.78 (0.73, 0.83)
Index SNF length of stay		1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Charlson Comorbidity Score		1.13 (1.12, 1.14)	1.13 (1.12, 1.14)	1.12 (1.11, 1.14)
Number of hospital discharges in 90 days before index SNF admission		1.22 (1.19, 1.24)	1.22 (1.19, 1.24)	1.22 (1.19, 1.24)
Home Care and SNF Variables				
Home Care use post-discharge (Reference: No)				
Home Care use: Yes			1.00 (0.96, 1.04)	0.99 (0.95, 1.03)
SNF size (reference: 0-50 beds)				
51-100 beds				1.01 (0.94, 1.10)

Predictor Variables	Cox Proportional Hazard Models: Adjusted Hazard Ratios (95% Confidence Intervals)			
	Model 1[a] (N = 55,980)	Model 2[a] (N = 55,980)	Model 3[a] (N = 55,980)	Model 4[a] (N = 51,744) [b]
101-150 beds				1.05 (0.97, 1.13)
> 150 beds				0.96 (0.88, 1.05)

Predictor Variables	Cox Proportional Hazard Models: Adjusted Hazard Ratios (95% Confidence Intervals)			
	Model 1[a] (N = 55,980)	Model 2[a] (N = 55,980)	Model 3[a] (N = 55,980)	Model 4[a] (N = 51,744) [b]
Facility ownership				
(Reference: Non-profit)				
For-profit				1.21 (1.15, 1.27)
Government				1.05 (0.93, 1.17)
Staffing measures				
RN hours per resident per day				0.99 (0.96, 1.02)
LPN hours per resident per day				0.91 (0.87, 0.96)

[a] Model 1: Non-Clinical Variables; Model 2: Non-Clinical + Clinical Variables; Model 3: Non-Clinical + Clinical + Home Care Use Variables; Model 4: Non-Clinical + Clinical + Home Care Use + Skilled Nursing Facility Variables

[b] Not all SNF characteristics were available for all SNFs in the study. Those stays in those SNFs were automatically excluded from the modeling (due to missing values) when the SNF characteristics were included in the model.

[c] SDG = Surveillance Diagnosis Groups