Frequency and Costs of Hospital Transfers for Ambulatory Care–Sensitive Conditions

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Millions of Americans receive important, but costly, long-term and rehabilitative care in US nursing homes (NHs) each year. Approximately 1.8 million Americans live in NHs or other skilled nursing facilities, and this number is expected to double in the next 40 years.[1] In South Carolina alone, approximately 16,000 residents live in more than 170 NH facilities.[2] In addition, up to 4.9 million Medicare recipients receive rehabilitative care each year in US NHs following acute hospitalization.[3] Medicare, the largest payer for rehabilitation care, spent an estimated $288 million for post acute rehabilitation and hospice care in 2007.[4]

NH patients are frequently transferred to acute hospital emergency departments (EDs) and subsequently hospitalized.[4] Hospitalization often results in iatrogenic complications and declining health trajectories among elderly patients.[5] In a recent study, nearly one-fourth of long-term NH residents experienced at least 1 ED visit in 6 months, and more than 60% of ED visits resulted in hospitalization.[6] Overall, reported annual hospital admission rates for long-term care NH patients range from 9% to 59%.[7] Similarly, 23.5% of Medicare patients discharged to skilled nursing facilities are readmitted to acute hospitals within 30 days, resulting in an estimated $4.3 billion in excess costs.[8]

An extensive and varied literature exists describing factors associated with NH to ED transfers and hospitalizations.[9-12] Identified predictors include sociodemographic factors, such as male gender and increasing age; medical conditions including congestive heart failure, chronic respiratory disease, and dementia; provider-specific factors related to the availability of nurses, physicians, and nurse practitioners; and regulatory factors such as reimbursement rates and bed-hold policies.[7]

When surveyed, providers have indicated several factors that contribute to overhospitalization.[13] Some of these include patient and family preferences; lack of knowledge on the part of patients and families regarding end-of-life care options such as hospice care, lack of familiarity with patients by covering providers, and lack of timely (<4 hours) access to physician or nurse practitioner (NP) evaluation. Acknowledgment of concern for medico-legal liability is largely absent

ABSTRACT

Objectives

Nursing home (NH) patients are frequently transferred to emergency departments (EDs) and/or hospitalized in situations in which transfer might have been avoided. This study describes the frequency of NH transfers for ambulatory care–sensitive conditions (ACSCs) and estimates associated expenditures.

Study Design

Retrospective cohort study of 62,379 NH patients with Medicare coverage receiving care in South Carolina between 2007 and 2009.

Methods

Subjects were analyzed to determine the frequency of acute ED or hospital care for conditions. Comparison is made to similar patients transferred for acute treatment of non-ACSCs. Generalized linear models were used to estimate the costs attributable to treating ACSCs.

Results

Over 3 years, 20,867 NH subjects were transferred from NHs to acute care facilities, and 85.3% of subjects had at least 1 episode of care for an ACSC. An average of 13,317 subjects per year were transferred for an average of 17,060 episodes of ED or hospital care per year between 2007 and 2009. More ACSC patients transferred to EDs were subsequently admitted to the hospital (50.4% vs 25%; P <.0001). In adjusted analyses, mean ED costs per episode of care ($401 vs $294; P <.0001) were higher, but mean hospitalization costs per episode of care were lower ($8356 vs $10,226; P <.0001) for ACSC patients compared with non-ACSC patients.

Conclusions

A significant proportion of Medicare NH patients are treated acutely for ACSCs, which are associated with higher healthcare utilization and costs. Better access to onsite evaluation might enable significant cost savings and reduce morbidity in this population.

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Take-Away Points

Nursing home patients are frequently transferred to emergency departments (EDs) or admitted to acute care facilities for ambulatory care–sensitive conditions (ACSCs) in situations in which more timely access to onsite primary care services might have diminished the need for transfer.

- 85.3% of transferred patients had at least 1 ACSC diagnosis.
- 50.4% of ACSC patients seen in EDs were subsequently admitted to the hospital (vs 25% for patients without ACSCs, P <.0001).
- Mean ED costs per episode of care ($401 vs $294; P <.0001) were higher for ACSC patients, but mean hospitalization costs per episode of care were lower ($8356 vs $10,226; P <.0001).

from the literature, but this may still be a factor in decisions to hospitalize.

Many patients, providers, and policy makers feel that a significant proportion of NH-to-hospital transfers are potentially avoidable. Indeed, the preventability of such episodes of care has been the subject of much study and debate, but there is no gold standard for determining preventability.[14-17] In 1 systematic review, low-quality inpatient care was associated with a 55% increase in risk for early hospital readmission.[14] However, estimates of hospitalization preventability range from 9% to 48%.[15]

Within this context, it is appealing to analyze a set of diseases for which improvements in care might prevent hospitalization.[18] Ambulatory care–sensitive conditions (ACSCs) are those for which hospital admission could potentially be prevented by timely primary, or ambulatory, care intervention. According to the Agency for Healthcare Research and Quality (AHRQ): "Hospitalization for an ambulatory care-sensitive condition is considered to be a measure of access to appropriate primary healthcare. While not all admissions for these conditions are avoidable, it is assumed that appropriate ambulatory care could prevent the onset of this type of illness or condition, control an acute episodic illness or condition, or manage a chronic disease or condition."[19] For example, with early evaluation, a patient with cellulitis might receive oral antibiotics that could avoid a course of intravenous antibiotics for which hospitalization is necessary. Similarly, a patient with chronic heart failure receiving early dietary modification and diuretic therapy might avoid hospitalization for volume overload and pulmonary edema.

Thus, ACSC analysis represents a useful method for identifying potentially avoidable acute care utilization based on the assumption that facilities with disproportionately high rates have problems with timely access to appropriate primary care.[20-22] Several reports indicate that avoidable hospitalizations for ACSCs are common and costly.[23-25] Carter and colleagues examined an elderly Massachusetts cohort and found that 20.3% of ED visits among NH residents were for ACSCs and that NH residents had a relative risk ratio for hospital admission of 2.23 (95% CI, 1.744-2.855) compared with community-dwelling patients. In addition, acute care costs for ACSCs in NH patients are quite high, estimated, for example, at 23% of the $971 million spent on NH residents in New York state.[26]

The current literature on ACSC in NH patients has several limitations. Most studies have analyzed ED visit rates or hospitalizations, but not both.[6,25,27] Also, relatively few studies have analyzed costs of care for ACSCs among nursing home patients.[26] Finally, a greater number of robust studies are needed to more accurately analyze the actual costs attributable to ACSCs in NH patients. Such figures can be used to estimate cost savings based on the projected or actual effect sizes of different interventions designed to reduce NH transfers. The purpose of this project was to determine the frequency of ED visits and hospitalizations for ACSCs among NH patients and to determine Medicare expenditures for these patients.

METHODS

Study Population

We constructed a statewide cohort of Medicare-insured patients receiving care in South Carolina NHs during calendar years 2007 to 2009. Data sources included Medicare Provider Analysis and Review (MedPar), Medicare Outpatient Carrier, and Medicare Annual Beneficiary Summary files from CMS. Data sets were linked using a unique patient identifier code. Selection criteria included: 1) age ≥18 years; 2) enrolled in Medicare; and 3) billed for an acute hospitalization, ED visit, long-term NH stay, or inpatient rehabilitation in a South Carolina NH. Subjects were included in the present cohort if they had a NH admission and discharge date within the study time frame. We categorized subjects as having had acute ED visits or hospitalizations if they had encounters that fell during the period of a NH stay. Episodes of acute care were further categorized as ED-only visits, ED-hospitalization visits, or hospitalization-only visits. This study was reviewed and approved by our local institutional review board. All analyses were conducted using SAS version 9.3 (SAS Institute, Cary, North Carolina).

Ambulatory Care–Sensitive Conditions

ACSCs have been used in numerous prior health services research studies examining access to primary care

Table 1. Ambulatory Care Condition Frequencies

Acute Preventable Conditions	Subjects Per Year, n	Episodes of Care Per Year, n
Iron-deficiency anemia [*ICD-9-CM* 280.1, 280.8, 280.9]	128	133
Bacterial pneumonia [*ICD-9-CM* 481,482.2, 482.3, 482.9, 483, 485, 486]	428	465
Cellulitis [*ICD-9-CM* 681, 682, 683, 686]	334	361
Convulsions [*ICD-9-CM* 780.3]	188	218
Dehydration/volume depletion [*ICD-9-CM* 276.5]	1159	1301
Gastroenteritis [*ICD-9-CM* 558.9]	56	57
Hypoglycemia [*ICD-9-CM* 251.2]	32	34
Kidney/urinary infection [*ICD-9-CM* 590.0, 599.0, 599.9]	2118	2614
Severe ear, nose, and throat infections [*ICD-9-CM* 382, 462, 463, 465, 472.1]	37	38
Other conditions[a]	200	212
Total	4680	5433
Chronic Conditions		
Angina [*ICD-9-CM* 411.1,411.8,413]	73	77
Asthma [*ICD-9-CM* 493]	217	258
Chronic obstructive pulmonary disease [*ICD-9-CM* 466.0, 491, 492, 494, 496]	1167	1517
Congestive heart failure [*ICD-9-CM* 402.01, 402.11, 402.91, 428, 518.4]	2020	2772
Diabetes [*ICD-9-CM* 250.0-250.3,250.8-250.9]	1927	2811
Grand mal and other epileptic conditions [*ICD-9-CM* 345]	230	294
Hypertension [*ICD-9-CM* 401.0, 401.9, 402.00, 402.10, 402.90]	3001	3895
Tuberculosis (nonpulmonary) [*ICD-9-CM* 012-018]	2	3
Total	8637	11,627
Grand total	13,317	17,060

[a]Other conditions included: dental conditions [*ICD-9-CM* 521-523, 525, 528], nutritional deficiencies [*ICD-9-CM*260-262, 268.0, 268.1], cancer of the cervix [*ICD-9-CM* 180.0-180.1, 180.8-180.9], and pelvic inflammatory disease [*ICD-9-CM* 614]. Excluded conditions were congenital syphilis [*ICD-9-CM* 090], hemophilus meningitis age 1-5 years only [*ICD-9-CM* 320.2], convulsions age <5 years [*ICD-9-CM* 780.3], and failure to thrive age <1 year [*ICD-9-CM* 783.4].

services, including studies of NH and skilled care populations.[23,28] For this study, we used a modification of the coding scheme for ACSCs recommended by the AHRQ.[29] Subjects were categorized as having been treated for ACSCs diagnoses or not. Ambulatory care-sensitive conditions and relevant *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) codes are shown in Table 1. Given the age range of our population, we excluded congenital syphilis (*ICD-9-CM* 090.x), hemophilus meningitis age 1-5 only (*ICD-9-CM* 320.2), convulsions age <5 years (*ICD-9-CM* 780.3), and failure to thrive age <1 year (*ICD-9-CM* 783.4). We further cat-

egorized ACSCs as "acute and/or preventable" versus "chronic." Finally, given the nature of our research question and in order to better characterize total hospital costs attributable to ACSCs, we examined subjects with ACSCs as either a primary or secondary diagnosis.

Outcome Measures

The primary outcomes for this study were measures of acute healthcare utilization and associated hospital costs for patients treated for ACSCs compared with those treated acutely for non-ACSCs. We determined both the number of subjects treated and episodes of care per year for each ACSC. We further determined the mean number of ED visits and hospitalizations per subject and the overall number of visits. The primary cost outcome for adjusted analyses was mean Medicare expenditures for ED visits and/or hospitalization.

In addition to treatment for ACSCs, we also examined several other covariates. Age and length of NH stay were analyzed as continuous variables. Gender (male/female) and race (white/other) were analyzed as categorical variables. Baseline comorbidity was analyzed using chronic condition flags present in the Medicare Annual Beneficiary Summary file, provided the date of first diagnosis occurred prior to the index NH stay. These comorbidities were: acute myocardial infarction/ischemic heart disease, Alzheimer's disease/dementia, atrial fibrillation, cataract, chronic kidney disease, chronic obstructive pulmonary disease (COPD), congestive heart failure, diabetes mellitus (DM), depression, osteoporosis, stroke, and cancer.

Statistical Analysis

Descriptive statistics (means, medians, and proportions) of demographic variables, length of hospital stay, chronic conditions present in beneficiary summary file prior to the index episode, and acute care utilization (eg, hospital readmission, intensive care unit [ICU] admission, etc) were calculated by ACSC status (with vs without an ACSC). We also calculated the frequency of episodes of care per year stratified by chronic and acute preventable conditions. In order to determine costs attributable to the care of ACSC adjusted for relevant covariates described above, we fitted a generalized linear model estimated via generalized estimating equations and a gamma distribution with a log link. This approach enabled us to estimate costs with robust standard error estimates for making inferences regarding expenditures. Adjusted mean costs are reported in US dollars calculated from the model-predicted costs, with all dollar values adjusted to 2009 dollars using the Consumer Price Index.

RESULTS

Subject Characteristics

This cohort represented a 100% sample of Medicare recipients treated in South Carolina NHs during calendar years 2007 to 2009. Table 2 describes characteristics of NH subjects treated in EDs or hospitalized for ACSCs compared with those treated for non-ACSCs. Overall, 17,794 of 20,867 transferred patients (85.3%) were treated for at least 1 ACSC condition as a primary or secondary diagnosis during an episode of acute care. Mean age, the proportion of female subjects, and the proportion of nonwhite subjects were similar between groups. NH length of stay and the proportion of long-stay (>30 days) NH patients were higher among subjects in the ACSC group. Both groups had significant numbers of subjects with preexisting chronic diseases, but chronic ACSCs including congestive heart failure (69.2% vs 54.7%), COPD (47.7% vs 37.6%), and DM (56.5% vs 39.9%) were higher in the ACSC group compared with the non-ACSC group.

Ambulatory Care–Sensitive Conditions

Table 1 describes the types of treated ACSCs grouped according to acute and preventable conditions or chronic conditions. Over the 3-year study period, 4680 patients were treated in the ED and/or hospital for a total of 5433 episodes of acute and preventable conditions. Dehydration/volume depletion and kidney/urinary tract infections were the most frequent acute ACSCs treated. More patients were seen for chronic ACSCs than acute/preventable, with 8637 subjects treated for a total of 11,627 episodes of care per year. Hypertension, DM, and congestive heart failure were the most frequent chronic conditions treated.

Healthcare Utilization

Table 3 displays several domains of acute ED and hospital utilization in ACSC subjects compared with non-ACSC subjects. During the 3-year study period, the 20,867 NH patients experienced 27,382 episodes of care for ACSC compared with only 7200 episodes of care without ACSC. A significantly higher proportion of NH patients seen in the ED with ACSC diagnoses were subsequently admitted to the hospital (50.4% vs 24%; P <.0001). NH-to-hospital transfers representing hospital readmissions were not significantly different between the ACSC and non-ACSC condition groups (15.1% vs 16%; P = .26). ICU admission was almost twice as common in the ACSC condition group (10.2% vs 5.6%; P <.0001). Patients treated for ACSC diagnoses had higher mean numbers of

Table 2. Characteristics of Subjects (over the 3-year study period)

	ACSC Diagnoses[a]	No ACSC Diagnoses	*P*
Subjects (n = 20,867)	17,794 (85.3%)	3073 (14.7%)	
Age in years (mean ± SD)	80.7 ± 10.4	80.2 ± 11.2	.0245
Female (%)	64	59.6	<.0001
Race			.0108
White (%)	75	77.1	
Other (%)	25	22.9	
NH length of stay, in days (median)	50	72.0	<.0001
Short stay (%)	25	34.4	<.0001
Long stay (%)	75	65.6	
Chronic conditions[b]			
AMI/ischemic heart disease	13,027 (73.2%)	1941 (63.2%)	<.0001
Alzheimer's disease/ dementia	10,332 (58.1%)	1671 (54.4%)	.0001
Atrial fibrillation	6198 (34.8%)	925 (30.1%)	<.0001
Cancer	3090 (17.4%)	584 (19%)	.0060
Cataract	14,309 (80.4%)	2405 (78.3%)	.0283
Chronic kidney disease	10,301 (57.9%)	1471 (47.9%)	<.0001
Chronic obstructive pulmonary disease	8491 (47.7%)	1155 (37.6%)	<.0001
Congestive heart failure	12,317 (69.2%)	1682 (54.7%)	<.0001
Depression	9599 (54%)	1522 (49.5%)	<.0001
Diabetes mellitus	10,056 (56.5%)	1225 (39.9%)	<.0001
Osteoporosis	7656 (43%)	1293 (42.1%)	.3373
Stroke	7923 (44.5%)	1192 (38.8%)	<.0001

ACSC indicates ambulatory care-sensitive condition; AMI, acute myocardial infarction; NH, nursing home.
[a]One or more ACSC condition listed among discharge diagnoses for an index episode of care. Not all episodes of care for each patient included ACSC diagnoses.
[b]Chronic conditions present in beneficiary summary file prior to the index episode of care.

ED visits per subject (1.5 vs 1.2; *P* <.0001) and hospitalizations per subject (1.3 vs 1.1; *P* <.0001) than did non-ACSC subjects, with the total number of ED visits and hospital visits occurring in similar proportions.

Attributable Costs

Table 4 highlights estimated costs for ED care and hospitalization among NH subjects transferred for ED care and hospitalization for ACSCs compared with non-ACSCs after adjustment for demographic factors and comorbid chronic diseases. Adjusted mean ED costs were approximately $100 more ($401 vs $294; *P* <.0001) for episodes of ED care for ACSC patients compared with non-ACSC patients. However, adjusted mean hospitalization costs were approximately $1900 less ($8356 vs $10,226; *P* <.0001) for ACSC patients compared with non-ACSC patients. Given the markedly higher numbers of ACSC subjects, total annual expenditures for ACSCs were significantly higher in each category. Model coefficients are displayed in Table 5.

DISCUSSION

This report represents the first study to analyze ED and acute hospital utilization in a Medicare cohort at the state level while using robust methods for estimating attributable healthcare costs. Our results confirm that a majority of patients transferred from NHs to hospitals for ED care and/or hospitalization are treated for ACSCs as a primary or secondary diagnosis. ACSC patients appear more likely to be admitted to the hospital from the ED and more likely to be admitted to the ICU, based on bivariate analyses. In fully adjusted regression models, overall utilization and Medicare expenditures are higher for patients with ACSCs transferred from NHs to EDs than for patients without ACSCs. Total annual costs were significantly higher in ACSC patients compared with non-ACSC patients. This is important because prior studies have suggested that early access to primary and preventive care may obviate or diminish the need for acute care in patients with these conditions. Clearly, most acute care

Table 3. Acute Care Utilization Among Transfers From Nursing Homes (N = 34,582 Episodes of Care), 2007 to 2009

	ACSC Diagnoses	No ACSC Diagnoses	*P*
Type of transfer (n)	27,382	7200	
ED only (%)	10,060 (36.7%)	4769 (66.2%)	<.0001
ED and admission (%)	13,790 (50.4%)	1725 (24%)	<.0001
Admission only (%)	3532 (12.9%)	706 (9.8%)	<.0001
Hospital readmissions[a] (n, %)	2614 (15.1%)	388 (16%)	.2632
ICU admission[b] (n, %)	2792 (10.2%)	406 (5.6%)	<.0001
Mean number of ED visits per subject[c]	1.5	1.2	<.0001
Mean number of hospitalizations per subject[c]	1.3	1.1	<.0001
Total ED visits per year[c]	7950	2165	<.0001
Total hospital admissions per year[c]	5774	810	<.0001

ACSC indicates ambulatory care-sensitive condition; ED, emergency department; ICU, intensive care unit.
[a]Index hospital admission occurred within 30 days of a previous acute care hospital discharge.
[b]Index hospital admission included an ICU stay.
[c]Over the 3-year period.

Table 4. Estimated Acute Care Costs Attributable to Ambulatory Care–Sensitive Conditions[a]

	ACSC Diagnoses	No ACSC Diagnoses	*P*
ED costs per episode ($)[b]	401	294	<.0001
Total ED costs per year ($)[b]	1,344,687	467,362	
Inpatient costs per episode ($)[b]	8356	10,226	<.0001
Total inpatient costs per year ($)[b]	48,247,544	8,286,469	

ACSC indicates ambulatory care–sensitive condition; ED, emergency department.
[a]Cost estimates adjusted for patient age, gender, race, chronic comorbid conditions, and ACSC as primary or secondary diagnosis.
[b]Mean averaged over the 3-year period.

transfers are likely appropriate, especially in instances of critical illness. However, our results suggest that additional measures to improve onsite management of ACSCs might prevent avoidable NH-to-acute care transfers among stable patients and/or decrease the severity of illness among patients destined to require acute care transfers. Both of these phenomena could have favorable effects on healthcare utilization and expenditures.

Previously successful strategies to reduce NH-to-ED transfers and hospitalizations have focused on improving access to care through innovative payment policies, improving care quality for specific diseases, and increasing referrals for hospice care.[30-32] For example, Casarett and colleagues (2005) introduced a simple communication intervention to identify NH patients and families whose care preferences were congruent with palliative approaches to care.[32] Patients randomized to this intervention had higher hospice enrollment rates, half as many acute hospitalizations, and fewer days spent in acute care hospitals. Kane and colleagues (2004) described the effects of an innovative Medicare payment program that increased the availability of NPs to NH residents.[30,33] Intervention patients had half as many hospitalizations (2.43 per 100 patients per month vs 4.67 per 100 patients per month; *P* <.001) compared with control patients at other facilities, as well as 9% lower hazard for mortality compared with non-intervention patients at the same facilities. The program was estimated to save $103,000 per year per NP.

Regarding clinical management interventions, Loeb and colleagues (2006) demonstrated in a cluster-randomized trial that early initiation of a clinical pathway for onsite treatment of pneumonia resulted in a 12% absolute reduction in hospitalizations (95% CI, 5%-18%; *P* <.001) and a trend toward decreased mortality. This intervention was also evaluated to be cost-effective, estimated to save $1016 per resident (95% CI, $207-$1824).[31]

Unfortunately, the innovations described here have not been widely disseminated, and many NH professionals still regard access to timely, well-informed evaluations for acutely ill residents as a significant limitation in most nursing homes.[13] Many have called for new and effective strategies to reduce NH transfers and hospitalizations giv-

■ **Table 5.** Regression Model Estimating Adjusted Mean Costs Attributable to Ambulatory Care-Sensitive Conditions

	Estimate	95% CI		*P*
Intercept	9.0514	8.9414	9.1613	<.0001
Age	–0.0024	–0.0036	–0.0013	<.0001
Race				
(white = referent)	0.0519	0.0275	0.0762	<.0001
Gender				
(male = referent)	–0.0078	–0.0304	0.0147	.4957
ACSC				
(ACSC as principal diagnosis)	0.2250	0.2038	0.2463	<.0001
Acute myocardial infarction	0.2021	0.1546	0.2495	<.0001
Alzheimer's disease/dementia	0.0639	0.0424	0.0855	<.0001
AMI/ischemic heart disease	–0.0073	-0.0312	0.0166	.5512
Arthritis	0.0103	–0.0109	0.0315	.3392
Atrial fibrillation	–0.0118	–0.0330	0.0094	.2742
Cancer	–0.0076	–0.0329	0.0177	.5571
Cataract	0.0020	–0.0247	0.0287	.8832
Congestive heart failure	–0.0160	–0.0396	0.0075	.1824
Chronic obstructive pulmonary disease	0.0047	–0.0152	0.0245	.6446
Chronic kidney disease	–0.0169	–0.0370	0.0031	.0978
Depression	0.0021	–0.0190	0.0232	.8446
Diabetes mellitus	0.0134	–0.0068	0.0337	.1930
Hip fracture	0.0217	–0.0005	0.0440	.0556
Osteoporosis	–0.0069	–0.0290	0.0152	.5402
Stroke	0.0213	0.0020	0.0405	.0302
Visit type (ED or admission)	–3.0359	–3.0572	–3.0146	<.0001
Visit type[a] ACSC	–0.5140	–0.5720	–0.4560	<.0001

ACSC indicates ambulatory care–sensitive condition; AMI, acute myocardial infarction; ED, emergency department.
[a]ED only or hospitalization.

en that prior efforts at NH regulation and market-based incentives have had only modest effects on quality metrics.[34]

Limitations and Strengths

This report should be evaluated in light of its limitations. First, our analysis involves a single state, South Carolina, and the observed frequencies and costs of acute care for ACSCs may not be generalizable nationally. However, based on 2006-2007 data from the Commonwealth Fund, South Carolina ranked 28th in the nation in Medicare hospital admissions per 100,000 beneficiaries, near the median national rate.[35] Second, our data set did not include information on costs related to ambulance transportation. Grunier and colleagues reported that in 1 cohort of long-term care patients, more than 90% of patients transferred to the ED-required ambulance transport.[6] Thus, our results may underestimate total costs associated with ED and hospital transfers, especially for Medicare patients. We analyzed costs in aggregate without breaking them down into relevant cost centers. Thus, we are unable to comment on, for example, the relative contribution of radiographic tests versus laboratory testing or pharmacy costs. Finally, there were baseline differences in the prevalence of several chronic conditions between patients in the ACSC condition group and the non-ACSC condition group. It is possible that differences in severity of illness influenced patients' clinical conditions and/or provider decision making during episodes of acute illness. Nevertheless, non-ACSC subjects had high levels of chronic disease, including heart disease, dementia, chronic kidney disease, depression, stroke, and cancer.

This study has relative strengths as well. We were able to examine a large cohort and to outline frequency and attributable costs for the acute care of ACSCs in Medi-

care. Our cost estimates include both ED and inpatient costs and represent actual payments received by Medicare, preferable to examining hospital charges as has been done in previous reports.[26]

CONCLUSIONS

Our findings have several implications for healthcare policy makers and intervention developers. CMS, in provisions related to the Affordable Care Act (ACA), has recently encouraged the development of community-based care transitions programs, as well as pilot initiatives, specifically focused on reducing avoidable NH transfers.[36,37] Section 3025 of the ACA established penalties for hospitals with higher-than-expected risk-adjusted hospital readmission rates for congestive heart failure, an ACSC, and COPD was added to this list in 2014.[38] Finally, several bundled care demonstration projects are under way for posthospital care that aim to improve care transitions for Medicare enrollees.[39] All of these endeavors can benefit from reliable estimates of cost attributable to ACSCs among NH residents.

In considering potential interventions to reduce acute care transfers, it is plausible to hypothesize that real-time video teleconferencing might overcome barriers that restrict access to onsite physician and NP providers in NH settings. This redesign of the delivery system could be easily coupled with decision support similar to successful clinical management pathways for ACSC conditions as in prior clinical trials.[31] Wade and colleagues (2010) reviewed 36 trials utilizing real-time video telehealth interventions in a variety of settings, and the majority of these interventions offered health outcomes superior or equivalent to those handled in person, and they were deemed cost-saving or cost-neutral.[40] Real-time video telehealth has been used successfully in rural settings to increase subspecialty physician access, as well as in the home setting to improve chronic disease management.[40,41] Daly and colleagues (2005) demonstrated the feasibility of establishing real-time videoconferencing in NHs, but no trial to date has assessed the effectiveness of this type of intervention.[42] One barrier to implementation of telehealth and other interventions relates to expected cost outlays and estimating potential cost savings. Our analysis should prove useful to intervention developers in this respect.

In conclusion, we observed that a majority of Medicare patients transferred from NH to acute-care settings had at least 1 ACSC, and associated costs were substantial.

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