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ORIGINAL RESEARCH

Association Between 2010 Medicare Reform and Inpatient Rehabilitation Access in People With Intracerebral Hemorrhage

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BACKGROUND: Evidence suggests intracerebral hemorrhage survivors have earlier recovery compared with ischemic stroke survivors. The Centers for Medicare and Medicaid Services prospective payment system instituted documentation rules for inpatient rehabilitation facilities (IRFs) in 2010, with the goal of optimizing patient selection. We investigated whether these requirements limited IRF and increased skilled nursing facility (SNF) use compared with home discharge.

METHODS AND RESULTS: Intracerebral hemorrhage discharges to IRF, SNF, or home were estimated using GWTG (Get With The Guidelines) Stroke registry data between January 1, 2008, and December 31, 2015 (n=265 444). Binary hierarchical models determined associations between the 2010 Rule and discharge setting; subgroup analyses evaluated age, geographic region, and hospital type. From January 1, 2008, to December 31, 2009, 45.5% of patients with intracerebral hemorrhage had home discharge, 22.2% went to SNF, and 32.3% went to IRF. After January 1, 2010, there was a 1.06% absolute increase in home discharge, a 0.46% increase in SNF, and a 1.52% decline in IRF. The adjusted odds of IRF versus home discharge decreased 3% after 2010 (adjusted odds ratio [aOR], 0.97; 95% CI, 0.95–1.00). Lower odds of IRF versus home discharge were observed in people aged <65 years (aOR, 0.92; 95% CI, 0.89–0.96), Western states (aOR, 0.89; 95% CI, 0.84–0.95), and nonteaching hospitals (aOR, 0.90; 95% CI, 0.86–0.95). Adjusted odds of SNF versus home discharge increased 14% after 2010 (aOR, 1.14; 95% CI, 1.11–1.18); there were significant associations in all age groups, the Northeast, the South, the Midwest, and teaching hospitals.

CONCLUSIONS: The Centers for Medicare and Medicaid Services 2010 IRF prospective payment system Rule resulted in fewer discharges to IRF and more discharges to SNF in patients with intracerebral hemorrhage. Health policy changes potentially affect access to intensive postacute rehabilitation.

Key Words: healthcare policy ■ inpatient rehabilitation facility ■ intracerebral hemorrhage ■ Medicare ■ outcome ■ rehabilitation ■ skilled nursing facility

Intracerebral hemorrhage (ICH) accounts for approximately 10% of all strokes in the United States and is a cause of significant long-term disability.[1] For some ICH survivors, recovery occurs rapidly during the first few weeks,[2] a period that overlaps with the provision of postacute rehabilitation. Treatment at an inpatient rehabilitation facility (IRF) has been associated with greater functional recovery,[3–5] higher likelihood of return to the community,[6,7] and lower rehospitalization rates,[8] compared with treatment at a skilled nursing facility (SNF). These findings are supported by several American Heart Association (AHA)/American Stroke Association guidelines, which detail the benefits of rehabilitation beginning "as early as possible" for the management of spontaneous intracerebral hemorrhage[9] and recommend IRF for qualifying stroke survivors in lieu of SNF in the Guidelines for Adult Stroke Rehabilitation and Recovery.[10]

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CLINICAL PERSPECTIVE

What Is New?

- This study evaluated whether the change to inpatient rehabilitation facility admission requirements, implemented by the Centers for Medicare and Medicaid Services in 2010, decreased postacute care access for people with intracerebral hemorrhage.

What Are the Clinical Implications?

- The American Heart Association Guidelines for the Management of Spontaneous Intracerebral Hemorrhage detail the benefits of rehabilitation beginning "as early as possible."
- It is imperative to appraise the effects of health policy changes on populations who would benefit from intensive rehabilitation therapies.

Nonstandard Abbreviations and Acronyms

AHA	American Heart Association
CMS	Centers for Medicare and Medicaid Services
GWTG	Get With The Guidelines
ICH	intracerebral hemorrhage
IRF	inpatient rehabilitation facility
PPS	prospective payment system
SNF	skilled nursing facility
tPA	tissue-type plasminogen activator

The goal of the Centers for Medicare and Medicaid Services (CMS) 2010 IRF prospective payment system (PPS) Rule was to improve the selection of a population with complex needs, expected to receive "reasonable benefit" from IRF treatment.[11] This 2010 Rule applied to all IRF patients, with and without cerebrovascular disease. Trial IRF admissions of <10 days were eliminated; patients are required to participate in 3 hours of therapy, 5 days a week (physical therapy and either occupational therapy or speech and language pathology) and have hospital-level medical acuity requiring daily physician oversight.[12] This is compared with SNF rehabilitation, a level of postacute care in which therapy services are provided 1.5 hours a day, 5 days a week, and physician management occurs 3 times a week.[13]

To facilitate compliance with IRF admission criteria, CMS requires completion of a series of documents: (1) preadmission screening within 48 hours of IRF admission, detailing the individuals' prior level of function, clinical complication risk, needed treatment combination (physical therapy, occupational therapy, or speech and language pathology), conditions that benefit from rehabilitation, expected level of improvement, and estimated length of stay; (2) postadmission physician evaluation 24 hours after IRF admission, documenting any relevant changes since the preadmission screening; and (3) the individualized overall plan of care during the first 4 days, synthesizing a customized treatment regimen and providing broad treatment goals for each discipline (nursing, therapy services, case management, and social work).[14]

The purpose of this study is to provide evidence-based data underscoring the potential influence of Medicare policy changes on access to rehabilitation care. Evaluating the consequences of health policy on patient outcomes is an important aspect of health services research. Using GWTG (Get With The Guidelines)–Stroke registry data, we hypothesized that compared with home discharge, the CMS 2010 IRF PPS Rule documentation requirements decreased IRF use, while increasing SNF use for people with ICH. The GWTG-Stroke registry has advantages over prior CMS reports[13,15] as it collects data on patients aged <65 and ≥65 years.

METHODS

Although data sharing agreements prohibit the AHA from making the data set publicly available, researchers may submit proposals for statistical analysis of the confidential data by the Duke Clinical Research Institute, with approval from the AHA. Details of the application process are available at www.heart.org/en/professional/quality-improvement/quality-research-and-publications/national-level-program-data-research-opportunities.

Data Source

We analyzed prospectively collected clinical registry data for people diagnosed with ICH and treated at GWTG-Stroke registry participating hospitals. Started by the AHA, GWTG-Stroke registry is a continuing registry and performance improvement initiative for acute-care hospitals. Participation is voluntary; GWTG-Stroke registry centers contribute acute stroke patient data on demographic and socioeconomic characteristics, diagnostic testing results, treatments, in-hospital outcomes, and discharge disposition.[16–18] GWTG-Stroke registry participating hospitals received either a waiver of authorization and exemption from subsequent review by their respective institutional review board or human subjects' approval to enroll cases without individual consent under the common rule. The Duke Clinical Research Institute (Durham, NC) has institutional review board approval to analyze GWTG-Stroke registry aggregate data for research purposes and served as

the data analysis center. Outcome Sciences, Inc, functioned as the data collection coordination center. This study conformed to all Strengthening the Reporting of Observational Studies in Epidemiology guidelines.[19]

Study Group

We evaluated adult (aged ≥18 years) acute stroke hospital discharges, in the GWTG-Stroke registry, between January 1, 2008, and December 31, 2015 (n=2 361 126). The study cohort is defined in Figure 1. Comfort measures, hospice care, transfers to other short-term general hospital, left against medical advice, hemorrhagic stroke treated with intravenous tPA (tissue-type plasminogen activator), and missing or unknown discharge destination were excluded. Among the remaining group with documented discharge disposition (n=2 078 906), we excluded ischemic stroke (ischemic stroke discharges were analyzed separately[20]), in-hospital mortality, other discharge disposition (ie, discharge to hospice, long-term care hospital, intermediate, or other acute-care hospital), and missing specific destination. We excluded cases discharged to long-term acute care and intermediate care because the CMS 2010 IRF PPS Rule did not apply to either destination. The final study group included 265 444 ICH discharges to home, IRF rehabilitation, or SNF rehabilitation between January 1, 2008, and December 31, 2015.

Outcome of Interest/Primary Exposures and Covariates

The outcome of interest was the proportion of ICH discharges to home, IRF, or SNF.

The primary exposure variable was the CMS 2010 IRF PPS Rule, a health policy change introduced on January 1, 2010.[21] Patient-level data on sociodemographic characteristics and medical history were abstracted according to GWTG registry procedures.[18] Participating hospitals were categorized by geographic region and other hospital characteristics (Table 1). The National Institutes of Health Stroke Scale score was used to assess stroke severity. Hospital arrival off hours, mode of arrival, and time from symptom onset to arrival were analyzed. Rehabilitation outcomes, such as assessment by physical and occupational therapy, dysphagia screening, and ability to ambulate at discharge, were evaluated.

Statistical Analysis

The proportion of ICH discharges to home, SNF, and IRF was determined for each of the 8 years and during the pre–CMS 2010 IRF Rule and post–CMS 2010 IRF Rule categorization periods (pre–CMS 2010 IRF Rule, 2008 to 2009; post–CMS 2010 IRF Rule, 2010 to 2015; Figure 2). Differences in patient and hospital characteristics were compared between the 3 discharge destinations. The association of the CMS 2010 IRF PPS Rule with discharge location was assessed using 2 binary multivariable hierarchical logistic regression models (IRF versus home and SNF versus home), with hospital random effects to account for within-hospital clustering of patients. The use of this binary approach with home as the reference group is justified by the fact that discharge to home is a universal option available for patients with stroke at the end of the acute-care hospitalization. During the study period, we also created a binary multivariable hierarchical regression model of IRF versus SNF discharge for patients with ICH. Model covariates were selected on the basis of clinical relevance, as detailed in Table 2. Stroke severity, as measured by National Institutes of Health Stroke Scale, is not regularly recorded in patients with ICH and, so, was not included in the models because of the high rates of missing data (49%). For categorical data with <3% missing fields included in the multivariable models (dysphagia screening), we used single imputation to the dominant (most common) level. Insurance type (8% missing), arrival mode (6% missing), and ambulatory status at discharge (14% missing) were included in the models, but not imputed.

We repeated the primary multivariable models (IRF versus home and SNF versus home) in separate prespecified subgroup analyses to examine whether the effect of the CMS 2010 IRF PPS Rule on discharge disposition was modified by age (<65 and ≥65 years as a proxy for Medicare eligibility), geographic region (West, South, Midwest, or East), or hospital teaching status. Statistical differences in stratum-specific estimates were tested by generating interaction *P* values for each subgroup (Table 3). All statistical analyses were performed using SAS software (version 9.2; SAS Institute Inc, Cary, NC).

RESULTS

A total of 265 444 ICH discharges were included in the primary analysis. Among 28 361 ICH discharges between January 1, 2008, and December 31, 2009, 45.5% of patients were discharged to home directly, 22.2% were discharged to SNF, and 32.3% were discharged to IRF. After implementation of the CMS IRF PPS Rule on January 1, 2010, there was a 1.06% absolute increase in home discharge, a 0.46% increase in SNF discharge, and a concomitant 1.52% decline in IRF discharge (Figure 2).

Differences in the characteristics of patients by discharge destination are shown in Table 1. Home discharges were younger (mean age, 59 years), had higher levels of ambulation at discharge (66%), and had the shortest length of stay (5 days). Patients discharged home were also the least likely to have a history of atrial

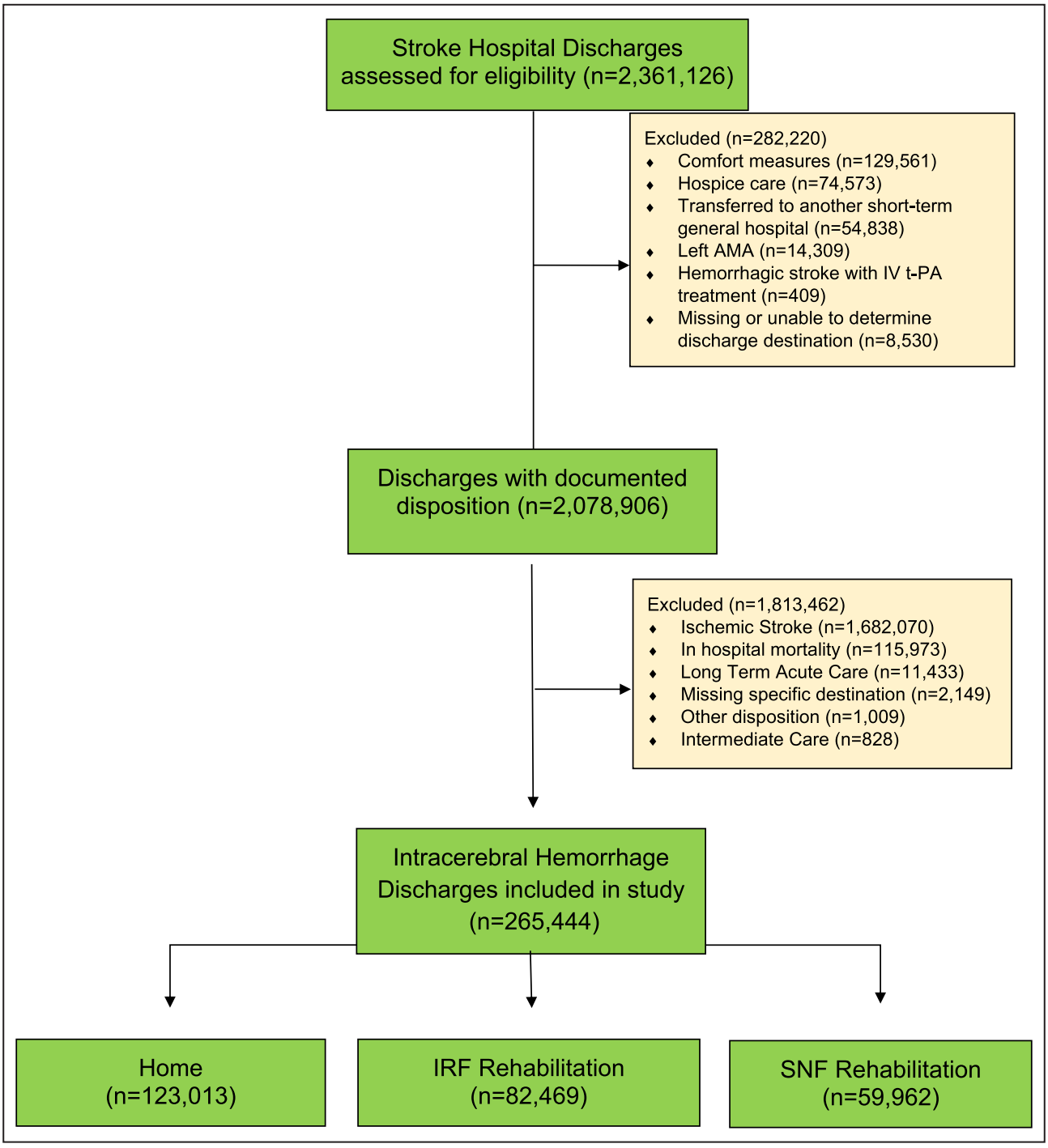

Figure 1. Flow diagram for study cohort derivation.
AMA indicates against medical advice; IRF, inpatient rehabilitation facility; IV, intravenous; SNF, skilled nursing facility; and tPA, tissue-type plasminogen activator.

fibrillation (8%), previous stroke or transient ischemic attack (16%), coronary artery disease or prior myocardial infarction (12%), diabetes mellitus (19%), peripheral vascular disease, hypertension, or heart failure. Home discharges were most likely to be uninsured (12%); however, the rates of missing data on insurance status were high in this group (10%).

Patients discharged to IRF had a mean age of 65 years, were slightly more likely to be men (51%), to have Medicare (48%) or Medicaid (12%) insurance, and to originate from the Northeast (27%) or Midwest (22%).

Patients discharged to SNF were older (mean age, 73 years) and more likely to be women (55.6%) with Medicare insurance (48%). They had the longest

Table 1. Patient and Hospital Characteristics by Discharge Disposition: 2008 to 2015 (n=265 444)

Characteristics	Home	SNF	IRF
No. (%) of intracerebral hemorrhages	123 013 (46.3)	59 962 (22.6)	82 469 (31.1)
Age, mean (SD), y	59.4 (15.7)	73.1 (13.6)	64.8 (14.7)
Male sex, %	49.8	44.4	51.2
Race/ethnicity, %			
Black	17.8	16.9	18.8
Hispanic	11.1	7.5	7.7
Asian	4.4	5.1	4.5
White	60.5	65.3	63.8
Other, UTD	5.9	5	5.1
Missing	0.3	0.2	0.2
Stroke severity			
NIHSS score, median (IQR)	1 (0–4)	9 (3–17)	7 (3–14)
NIHSS score, mean (SD)	3.3(5.5)	10.9 (9)	9.3 (7.9)
NIHSS score missing, %	54	49.3	46.3
Length of stay (days), median (IQR)	5 (3–10)	9 (5–18)	8 (5–16)
Insurance, %			
Medicare	24.5	47.6	34.5
Medicaid	9.9	11.7	9.5
Private/VA	43.4	32.6	42.1
No insurance	12.2	3.9	6.8
Missing	10	4.2	7.1
Medical history, %			
Atrial fibrillation	7.7	18.2	11.9
Prosthetic heart valve	1	1.3	1.2
Previous stroke/TIA	16.5	29.3	19.8
CAD/prior MI	12.4	20.1	15.7
Carotid stenosis	1.4	2.1	1.6
Diabetes mellitus	19.1	27.8	22.9
Peripheral vascular disease	2	3.8	2.5
Hypertension	61	76.8	71.4
Tobacco use	21.7	12.6	17.5
Dyslipidemia	27.8	35.4	31
Heart failure	3.5	8.1	4.7
Medical history missing	1.3	0.9	1
Arrival and admission			
Arrived off hours, %	52.6	52	54.8
Time from onset to arrival, median (IQR), min	923 (256–2331)	725 (174–1904)	521 (129–1448)
EMS arrival, %	25.9	49	42.8
Able to ambulate independently at discharge, %	66.5	10.2	13.8
Dysphagia screening, %	69.9	73.7	80.1
Rehabilitation assessed or received, %	93.3	98.9	100
Hospital characteristics			
No. of hospital beds, median (IQR)	465 (328–670)	429 (305–635)	472 (337–690)
AIS stroke discharges per year, median (IQR)	293.7 (198.2–409.8)	276.1 (187.3–399.9)	302.4 (205.6–409.8)
Annual intravenous tPA cases, mean (SD)	28.9 (19.1)	27.2 (18.6)	29.4 (18.7)
Geographic region, %			
West	21.5	24.2	17.1

(*Continued*)

Table 1. Continued

Characteristics	Home	SNF	IRF
South	39.7	33.1	34.1
Midwest	18.6	19.9	21.8
Northeast	20.2	22.9	27.1
Hospital type and location, %			
Primary stroke center	40.5	42.9	39.6
Rural location	2.2	2.8	1.9
Teaching or academic hospital	75.3	71.6	77

AIS indicates acute ischemic stroke; CAD, coronary artery disease; EMS, emergency medical services; IQR, interquartile range; IRF, inpatient rehabilitation facility; MI, myocardial infarction; NIHSS, National Institutes of Health Stroke Scale; SNF, skilled nursing facility; TIA, transient ischemic attack; tPA, tissue-type plasminogen activator; UTD, unable to determine; and VA, Veterans Affairs.

hospital stay (9 days). SNF discharges were most likely to arrive at the hospital via emergency medical services (49%) and have a history of atrial fibrillation (18%), previous stroke or transient ischemic attack (29%), coronary artery disease or prior myocardial infarction (20%), diabetes mellitus (28%), peripheral vascular disease, hypertension, or heart failure. The rate of missing National Institutes of Health Stroke Scale was highest in the home group (54%) and lowest in the IRF discharge group (46%) (Table 1).

Primary Analysis

Within the 1.52% absolute decline in IRF discharge for people with ICH, the unadjusted odds of IRF rehabilitation (compared with home) were 6% lower post–CMS 2010 IRF Rule (odds ratio [OR], 0.94; 95% CI, 0.92–0.97; *P*<0.0001; Table 2). This difference attenuated to 3% lower odds in the adjusted analysis (adjusted odds ratio [aOR], 0.97; 95% CI, 0.95–1.00; *P*=0.0263; Table 2). The unadjusted odds of SNF rehabilitation, compared with home, post–CMS 2010 IRF Rule was not significant in the unadjusted analyses (OR, 1.02; 95% CI, 0.99–1.04; *P*=0.2455); however, the adjusted odds of SNF rehabilitation compared with home post–CMS 2010 IRF Rule increased to 14% higher and became statistically significant (aOR, 1.14; 95% CI, 1.11–1.18; *P*<0.0001; Table 2). The odds of IRF compared with SNF rehabilitation discharge post–CMS 2010 IRF Rule decreased 7% in the unadjusted analyses (OR, 0.93; 95% CI, 0.91–0.96; *P*<0.0001) and 15% in the adjusted analyses (aOR, 0.85; 95% CI, 0.83–0.88; *P*<0.0001; Table 2).

Prespecified Multivariable Subgroup Analyses

Age significantly modified the association between IRF rehabilitation (compared with home) post–CMS Rule

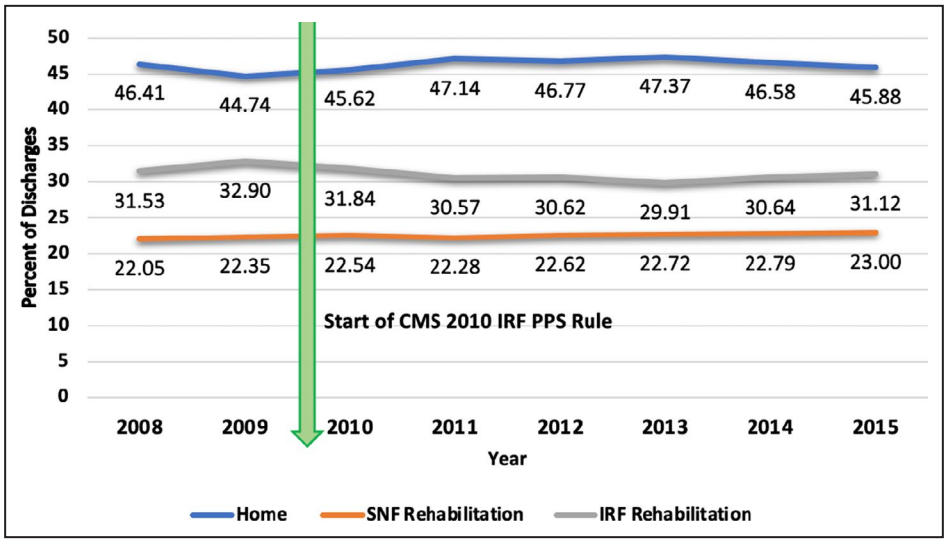

Figure 2. Percentage of acute intracerebral hemorrhage visits with discharge disposition of home, skilled nursing facility (SNF) rehabilitation, and inpatient rehabilitation facility (IRF) rehabilitation by year.
CMS indicates Centers for Medicare and Medicaid Services; and PPS, prospective payment system.

Table 2. Unadjusted and Adjusted Association of the CMS 2010 IRF PPS Rule With IRF Versus Home, SNF Versus Home, and IRF Versus SNF in ICH Discharges

Outcome	Variable	Unadjusted OR (95% CI)	Unadjusted *P* Value	Adjusted OR (95% CI)*	Adjusted *P* Value
IRF vs home	After CMS 2010 IRF PPS Rule vs before	0.94 (0.92–0.97)	<0.0001	0.97 (0.95–1.00)	0.0263
SNF vs home	After CMS 2010 IRF PPS Rule vs before	1.02 (0.99–1.04)	0.25	1.14 (1.11–1.18)	<0.0001
IRF vs SNF	After CMS 2010 IRF PPS Rule vs before	0.93 (0.91–0.96)	<0.0001	0.85 (0.83–0.88)	<0.0001

CMS indicates Centers for Medicare and Medicaid Services; ICH, intracerebral hemorrhage; IRF, inpatient rehabilitation facility; OR, odds ratio; PPS, prospective payment system; and SNF, skilled nursing facility.

*Variables included in the model were age (per 10 years), female sex, race-ethnicity (Black, Hispanic, or other race-ethnicity [Other race-ethnicity in this context would be defined as Not Black, Not Hispanic, Not White] vs White race), insurance type (Medicaid, Medicare, or other insurance vs none), medical history of atrial fibrillation/flutter, prosthetic heart valve, previous stroke/transient ischemic attack (TIA), coronary artery disease, prior myocardial infarction, carotid stenosis, diabetes mellitus, peripheral vascular disease, hypertension, dyslipidemia, heart failure, or smoking, arrived off hours, emergency medical services arrival, dysphagia screening, ambulation at discharge, rehabilitation assessment, annual number of ischemic stroke/TIA cases (101–300 or ≥301 vs 0–100), intravenous tPA (tissue-type plasminogen activator) use, number of annual tPA cases (11–20 or ≥20 vs 0–10), geographic region (South, West, and Midwest vs Northeast; rural vs urban), teaching hospital, primary stroke center, and number of hospital beds (per 50).

implementation (interaction *P* value=0.0053). The adjusted odds of IRF rehabilitation (compared with home) post–CMS 2010 IRF Rule were lower for people aged ≥65 years (aOR, 0.92; 95% CI, 0.89–0.96; Table 3), whereas the adjusted odds of IRF rehabilitation were not statistically significant for people aged <65 years (aOR, 0.99). Region did not significantly modify the association between IRF rehabilitation (compared with home) post–CMS Rule implementation (interaction *P* value=0.74). The adjusted odds of IRF rehabilitation compared with home were lower for those located in the West (aOR, 0.89; 95% CI, 0.84–0.95; Table 3), but none of the other region-specific estimates were significantly different from 1.0. Hospital teaching status significantly modified the association between IRF rehabilitation (compared with home) post–CMS Rule implementation (interaction *P* value=0.0045). The adjusted odds of IRF rehabilitation (compared with home) post–CMS 2010 IRF Rule were lower for those treated at nonteaching hospitals (aOR, 0.90; 95% CI, 0.86–0.95; Table 3), whereas there was no association for those treated at teaching hospitals (aOR, 0.99).

With respect to comparing SNF rehabilitation with discharge home, age also modified the observed association post–CMS 2010 IRF Rule (interaction *P* value=0.0004). The adjusted odds of SNF rehabilitation (compared with home) post–CMS 2010 IRF Rule were elevated in both age groups, but the adjusted odds were higher for those aged <65 years (aOR, 1.20; 95% CI, 1.15–1.26) compared with those aged ≥65 years (aOR, 1.08; 95% CI, 1.04–1.12; Table 3). Region did not significantly modify the association between SNF rehabilitation (compared with home) post–CMS Rule implementation (interaction *P* value=0.54), indicating the adjusted odds of SNF rehabilitation did not vary by region. However, the odds of SNF rehabilitation were significantly higher in the Northeast (aOR, 1.12; 95% CI, 1.06–1.2), South (aOR, 1.15; 95% CI, 1.1–1.21), and Midwest (aOR, 1.21; 95% CI, 1.13–1.30; Table 3), but the adjusted odds were closer to the null and only marginally significant in the West (aOR, 1.06; 95% CI, 1.00–1.13). Hospital teaching status significantly modified the association between SNF rehabilitation (compared with home) post–CMS Rule implementation (interaction *P* value=0.0023). The adjusted odds of SNF rehabilitation (compared with home) post–CMS 2010 IRF Rule were higher for those treated at teaching hospitals (aOR, 1.16; 95% CI, 1.12–1.21; Table 3), whereas the adjusted odds were not significantly different from the null for people treated at nonteaching hospitals (aOR, 1.05).

DISCUSSION

Quantifying the clinical relevance of health policy changes is an important addition to the field of outcomes research. In this evaluation of postacute rehabilitation trends, we found a small absolute decline in IRF discharge after the CMS 2010 IRF PPS Rule for people with acute ICH. In the setting of this decline, the odds of IRF discharge compared with home decreased by 3% in the adjusted analyses, and the odds of IRF discharge compared with SNF decreased by 15%. The odds of IRF discharge decreased for people aged >65 years, location in the Western United States, and at nonteaching hospitals, whereas there was no decline observed in older Medicare-eligible age group, other regions, or at teaching hospitals. Interaction *P* values were statistically significant in the age category, indicating differences between people aged <65 and ≥65 years. Although the odds of IRF discharge did not significantly change after the CMS 2010 IRF PPS Rule for people aged <65 years, age significantly modified the association, with a greater effect in those aged ≥65 years. Hospital teaching status also significantly modified the association between IRF and home discharge after the CMS 2010 IRF PPS Rule; the decline in IRF rehabilitation discharge in nonteaching hospitals was significantly greater than the decline seen at teaching hospitals.

Table 3. Subgroup Analysis: Adjusted Association of CMS 2010 IRF PPS Rule With IRF Versus Home and SNF Versus Home in ICH Discharges

Outcome	Variable	Adjusted OR (95% CI)*	Adjusted *P* Value	Interaction *P* Value
Age (<65 y before CMS 2010 IRF PPS Rule: n=25390; ≥65 y before CMS 2010 IRF PPS Rule: n=26 642) (<65 y after CMS 2010 IRF PPS Rule: n=107 366; ≥65 y after CMS 2010 IRF PPS Rule: n=106 046)				
IRF vs home	After vs before CMS 2010 IRF PPS Rule, aged <65 y	0.99 (0.96–1.02)	0.52	…
	After vs before CMS 2010 IRF PPS Rule, aged ≥65 y	0.92 (0.89–0.96)	<0.0001	0.0053
SNF vs home	After vs before CMS 2010 IRF PPS Rule, aged <65 y	1.20 (1.15–1.26)	<0.0001	…
	After vs before CMS 2010 IRF PPS Rule, aged ≥65 y	1.08 (1.04–1.12)	<0.0001	0.0004
Geographic region (West before CMS 2010 IRF PPS Rule: n=10 155; West after CMS 2010 IRF PPS Rule: n=44 927) (Northeast before CMS 2010 IRF PPS Rule: n=12 027; Northeast after CMS 2010 IRF PPS Rule: n=48 901) (South before CMS 2010 IRF PPS Rule: n=19 444; South after CMS 2010 IRF PPS Rule: n=77 311) (Midwest before CMS 2010 IRF PPS Rule: n=10 406; Midwest after CMS 2010 IRF PPS Rule: n=42 273)				
IRF vs home	After vs before CMS 2010 IRF PPS Rule, Northeast	0.98 (0.93–1.03)	0.38	…
	After vs before CMS 2021 IRF PPS Rule, West	0.89 (0.84–0.95)	0.0002	…
	After vs before CMS 2010 IRF PPS Rule, South	0.97 (0.93–1.01)	0.11	0.7476
	After vs before CMS 2010 IRF PPS Rule, Midwest	1.05 (0.99–1.11)	0.1	…
SNF vs home	After vs before CMS 2010 IRF PPS Rule, Northeast	1.12 (1.06–1.20)	0.0002	…
	After vs before CMS 2010 IRF PPS Rule, South	1.15 (1.10–1.21)	<0.0001	0.5404
	After vs before CMS 2010 IRF PPS Rule, Midwest	1.21 (1.13–1.30)	<0.0001	…
	After vs before CMS 2010 IRF PPS Rule, West	1.06 (1.00–1.13)	0.07	…
Teaching and nonteaching hospitals (teaching hospital before CMS 2010 IRF PPS Rule: n=38 948; teaching hospital after CMS 2010 IRF PPS Rule: n=160 115) (nonteaching hospital before CMS 2010 IRF PPS Rule: n=12 926; nonteaching hospital after CMS 2010 IRF PPS Rule: n=50 824)				
IRF vs home	After vs before CMS 2010 IRF PPS Rule, teaching	0.99 (0.96–1.02)	0.35	0.0045
	After vs before CMS 2010 IRF PPS Rule, nonteaching	0.90 (0.86–0.95)	0.0002	…
SNF vs home	After vs before CMS 2010 IRF PPS Rule, teaching	1.16 (1.12–1.21)	<0.0001	0.0023
	After vs before CMS 2010 IRF PPS Rule, nonteaching	1.05 (0.99–1.11)	0.12	…

CMS indicates Centers for Medicare and Medicaid Services; ICH, intracerebral hemorrhage; IRF, inpatient rehabilitation facility; OR, odds ratio; PPS, prospective payment system; and SNF, skilled nursing facility.

*Variables included in the model were female sex, race-ethnicity (Black, Hispanic, or other race-ethnicity [Other race-ethnicity in this context would be defined as Not Black, Not Hispanic, Not White] vs White race), insurance type (Medicaid, Medicare, or other insurance vs none), medical history of atrial fibrillation/flutter, prosthetic heart valve, previous stroke/transient ischemic attack (TIA), coronary artery disease or prior myocardial infarction, carotid stenosis, diabetes mellitus, peripheral vascular disease, hypertension, dyslipidemia, heart failure, or smoking, arrived off hours, emergency medical services arrival, dysphagia screening, ambulation at discharge, rehabilitation assessment, annual number of ischemic stroke/TIA cases (101–300 or ≥301 vs 0–100), intravenous tPA (tissue-type plasminogen activator) use, number of annual tPA cases (11–20 or ≥20 vs 0–10), primary stroke center, and number of hospital beds (per 50).

We found a smaller absolute increase in SNF discharges after the CMS 2010 IRF PPS Rule; within this increase, the odds of SNF discharge increased by 14% in the adjusted analysis. The odds of SNF discharge increased across all age groups, in the Northeast, South, and Midwest, and at teaching hospitals. Interaction *P* values were again significant in the age and teaching status categories, signifying the increase in SNF discharge at teaching hospitals after the CMS 2010 IRF PPS Rule is significantly greater than the increase seen at nonteaching hospitals. Interaction tests also indicated that geographic region did not modify the association under investigation, despite the Western region achieving statistical significance in the IRF analyses and the Northeast, South, and Midwest regions achieving statistical significance in the SNF analyses.

Approximately 81 600 stroke cases at IRFs were reimbursed by Medicare fee for service in 2018.[15] Given the 1.52% absolute decrease in IRF discharges during the study period and the proportion of ICH survivors, we estimate that this translates to 124 Medicare fewer fee-for-service ICH cases treated at IRF per year.

Should clinicians be concerned? On the basis of the finding from this study, documentation requirements that justify IRF admission have not made a clinically relevant impact on referral patterns for people with ICH. Unfortunately, there is a divergence between clinical referral patterns and insurance coverage for IRF care. As of 2010, the Centers for Medicare and Medicaid Services considers IRF stay of <10 days as "trial admissions," rendering them inappropriate and subject to Medicare audit.[22] Therefore, it is imperative that hospital-based clinicians consider not just the need for IRF care, but the duration of said need (ie, >10 days) when identifying populations who would benefit.

Geographic variations in relation to stroke rehabilitation access are an important consideration, specifically, the increased odds of discharge to SNF in the South, also known as the "Stroke Belt." In our study, the odds of discharge to SNF rehabilitation increased 15% in the Southern United States during the period after the CMS 2010 IRF PPS Rule compared with home discharge. The paradox of increased SNF admissions, in a region with high stroke prevalence and stroke mortality, can potentially be attributed to known health disparities in the South (namely, Black race, rural location, and lower regional and individual-level socioeconomic status).[23–25] IRF care is expensive; a cost analysis of postacute stroke rehabilitation revealed a 58% higher median Medicare payment per patient for IRF compared with SNF (ie, $23 219 versus $14 098 per stay).[26] A 2018 analysis from the Department of Health and Human Services estimated an annual Medicare overpayment of $5.7 billion to IRFs, for care that was not "reasonable and necessary" based on noncompliance with coverage and documentation requirements.[27] Decreased access to intensive postacute rehabilitation, however subtle, in this region, has the capacity to further widen the disability gap between minority and nonminority populations.

The effect of hospital type on IRF and SNF discharge warrants discussion. Although the facilitation of the academic mission at teaching hospitals has been credited as a contributor to decreased stroke mortality from 1950 to 2015,[28,29] better acute stroke treatment, and lower 30-day readmissions,[30] a recent study found significant variation in IRF versus SNF discharge across all acute care hospital types, both teaching and nonteaching.[31] The 2019 AHA Stroke System of Care recommendations include a standardized screening evaluation to determine whether rehabilitation services are needed and the type, timing, location, and frequency of this intervention.[32] At large academic medical centers, this screening is completed by physical medicine and rehabilitation or rehabilitation medicine clinicians, who have received training in disability mitigation.[24] Although rehabilitation remains the primary means by which stroke survivors recover, there is a lack of formal scholastic paradigms that incorporate postacute rehabilitation knowledge into acute care–based cerebrovascular training programs. Educational efforts that bridge the Stroke Continuum of Care are an important part of patient-centered continuity.

The purpose of the CMS 2010 IRF PPS Rule was to allow for better identification of people most likely to benefit from inpatient rehabilitation. Indeed, the small decrease in discharge to IRF and the small increase in both home and SNF discharge after acute care makes it difficult to determine whether the CMS 2010 IRF reform achieved its aim (ie, more efficient selection) or if the reform served as a barrier to appropriate postacute rehabilitation. CMS 2010 IRF reform effectiveness was called into question *by CMS* during the ongoing COVID-19 pandemic. In an effort to prioritize "patients over paperwork,"[33] the Coronavirus Aid, Relief, and Economic Security Act temporarily waived both the 3-hour therapy rule and the postacute physician evaluation at IRFs until December 31, 2020.[34] In August of 2020, the CMS 2021 IRF PPS Rule went one step further, permanently discontinuing the postacute physician evaluation.[35] CMS's acknowledgment that some criteria used to determine IRF access are redundant, and possibly unnecessary, marks a major step in increasing clinician autonomy during the postacute rehabilitation screening process.

LIMITATIONS

The decision to discharge a patient with stroke to postacute rehabilitation involves a complex set of demographic, socioeconomic (ie, health insurance), and environmental factors, which were controlled in our analyses. We recognize that there may be many other factors that influence changes in access to poststroke rehabilitation that are not available through the GWTG-Stroke registry; for example, we could not measure interrater reliability between both physicians and therapists during the "rehabilitation assessment" process. The GWTG-Stroke registry appears to have an appropriate demographic representation of the overall US population; however, hospitals that chose to participate in GWTG-Stroke registry are often large, teaching hospitals, or located in urban centers. The exclusion of patients at intermediate-care and long-term acute-care facilities may have removed patients receiving intensive rehabilitation therapies, although the frequency of use of these setting was low (0.6% of excluded patients). The frequency and intensity of therapy services have not been quantified by CMS at these levels of postacute care; therefore, we are unable to determine the potential impact of these legislative changes on changes in the quality/intensity of therapy services. In this data set, >40% of SNF discharges and 50% of IRF discharges had non-Medicare insurance (Medicaid, private, or

Veterans' Affairs). Although these discharges were not directly affected by the CMS 2010 Rule change, studies have shown Medicare legislative changes have a significant influence on private insurance practices, which might mask our ability to identify changes over time. Clements et al showed payment rates set by Medicare are implemented by private insurers within 1 year.[36] The year-long uptake of Medicare changes by private insurers is likely reflected in our data; between 2010 and 2011, home discharge increased 1.52%, IRF discharged decreased 1.27%, and SNF discharges decreased 0.26%. This is compared with more immediate effects for Medicare beneficiaries; between 2009 and 2010, home discharges increased 0.88%, IRF discharges decreased 1.06%, and SNF discharges actually increased 0.19%. We were unable to examine the impact of IRF or SNF rehabilitation care on disability rates, use of outpatient therapy services, or the overall cost of poststroke care. Last, 49% of individuals had missing National Institutes of Health Stroke Scale data, which precluded inclusion of this stroke severity measure in our primary model.

CONCLUSIONS

This study identified a small but significant decrease in discharge to IRFs, with a concomitant increase in discharge to SNFs for acute ICH survivors during the period following the CMS 2010 IRF PPS Rule. Effect modification was noted by age and teaching status in both the IRF and SNF analyses, with a lack of effect modification by geographic region. As the number of Medicare beneficiaries will increase by 10 000 a day for the next decade, studies that evaluate the impact of health legislative changes on access to care should continue to develop health policies that will maximally benefit patients with stroke.

ARTICLE INFORMATION

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