

ORIGINAL ARTICLE

Use of Rehabilitation and Other Health Care Services by Patients With Joint Replacement After Discharge From Skilled Nursing and Inpatient Rehabilitation Facilities

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ABSTRACT. DeJong G, Tian W, Smout RJ, Horn SD, Putman K, Smith P, Gassaway J, DaVanzo JE. Use of rehabilitation and other health care services by patients with joint replacement after discharge from skilled nursing and inpatient rehabilitation facilities. *Arch Phys Med Rehabil* 2009;90:1297-305.

Objective: To compare use of rehabilitation and other health services among patients with knee and hip replacement after discharge from a skilled nursing facility (SNF) or an inpatient rehabilitation facility (IRF).

Design: Follow-up interview study at 7.5 months after discharge.

Setting: Five freestanding SNFs, 1 hospital-based SNF, and 6 IRFs from across the United States.

Participants: Patients (N=856): patients with knee replacement (n=561) and patients with hip replacement (n=295).

Interventions: No interventions.

Main Outcome Measures: Number of home and outpatient therapy visits, physician visits, emergency room visits, rehospitalizations, and medical complications.

Results: After discharge from postacute care, the vast majority of patients received home rehabilitation, outpatient rehabilitation, or both. Patients with knee replacement received an average of 19 home and/or outpatient rehabilitation visits; patients with hip replacement received almost 15 visits. There were no statistically significant differences in rates of emergency room use and rehospitalization except that patients with hip replacement discharged from IRFs had higher rates of rehospitalization than those discharged from freestanding SNFs (15.8% vs 3.1%). Multivariate analyses did not find any SNF/IRF effects.

Conclusions: Patients with joint replacement from both SNFs and IRFs receive considerable amounts of follow-up rehabilitation care. Study uncovered no setting effects related to rehospitalization or medical complications. Looking only at care rendered in the initial postacute setting provides an in-

complete picture of all care received and how it may affect follow-up outcomes.

Key Words: Arthroplasty, replacement, hip; Arthroplasty, replacement, knee; Hospital readmission; Rehabilitation; Rehabilitation centers; Skilled nursing facilities; Utilization.

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THE VAST MAJORITY of beneficiaries in Medicare's traditional fee-for-service program who obtain a hip or knee replacement go on to use some form of postacute care. In 2005, about 35% used an SNF, and another 25% used an IRF.¹ While the relative merits of these 2 settings are sometimes disputed, little is known about the subsequent use of rehabilitation and other health care services after discharge from a SNF or an IRF.

This article reports the findings of a study on the use of rehabilitation and health care services among patients with hip and knee replacement in the months after their discharge from an SNF or IRF. Known formally as JOINTS II, this study was a follow-up to the original JOINTS I study that examined rehabilitation treatment and discharge outcomes in a larger cohort of 2152 patients with joint replacement discharged in 2006 and early 2007. The initial findings from JOINTS I are reported in 2 accompanying articles.^{2,3} An accompanying article, also based on JOINTS II, addresses the outcomes of care at follow-up.

This article characterizes the patterns of rehabilitative and health care use in the follow-up period and the medical complications that may be associated with such use. This article does not seek to evaluate the relative merits of SNF and IRF care. The article answers 4 main questions: how do patients

List of Abbreviations

BMI	body mass index
CMS	Center for Medicare and Medicaid Services
CSI	Comprehensive Severity Index
ER	emergency room
HMO	Health Maintenance Organization
IRF	inpatient rehabilitation facility
JOINTS I	Joint Replacement Outcomes in Inpatient Rehabilitation Facilities and Nursing Treatment Sites
JOINTS II	follow-up study to Joint Replacement Outcomes in Inpatient Rehabilitation Facilities and Nursing Treatment Sites
LOS	length of stay
OT	occupational therapy
PT	physical therapy
SNF	skilled nursing facility

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discharged from SNFs and IRFs compare in (1) their subsequent use of rehabilitation services; (2) their use of other health care services—for example, physician visits, emergency room visits, and hospital care; (3) the onset of medical complications in the first several months after discharge from postacute care; and (4) which patient and setting characteristics are most associated with the onset of medical complications and rehospitalization?

METHODS

Study Facilities

Study facilities for the follow-up study were drawn from the 22 facilities that had participated in the original JOINTS I study examining outcomes at discharge.^{2,3} When recruiting the original 22 facilities, the study team sought facilities from each of the nation's 4 major census regions, freestanding and hospital-based facilities, a mix of for-profit and not-for-profit facilities, facilities in markets with high and low managed-care penetration, and facilities that could bring at least 200 patients into the study. All of these facility recruitment goals could not be met concurrently, especially among SNFs, few of which could meet the 200-patient threshold. The most important recruitment objective was geographic diversity. Facility participation was entirely voluntary. The final sample was not intended to be a national probability sample of facilities.

Study Group

The study group consisted of patients who participated in JOINTS I and were discharged from facilities that participated in the JOINTS II follow-up study. To be included in the original JOINTS I study, patients had to be (1) 21 years or older, (2) admitted pursuant to hip or knee replacement of any type (including bilateral replacements and revisions), and (3) admitted from any source. For purposes of this article, however, we excluded patients who (1) had a hip replacement subsequent to a hip fracture; (2) died before the interview with them could be conducted, although an interview was conducted with a family member; (3) had an additional joint replacement in the follow-up period for a different joint; or (4) had a postacute care rehabilitation LOS greater than 52 days. We excluded those with hip fracture because (1) they presented a different demographic profile (older and more female subjects), (2) the etiology of the condition leading to replacement was different, and (3) the procedure was not elective. We excluded those with an LOS of 52 days or more (all SNF patients) because their LOS was markedly different from the LOS of the next nearest patient and accounted for only .025% of patients.

Instruments

The JOINTS II follow-up telephone questionnaire was used to obtain follow-up data on postdischarge use of rehabilitation and health services. The questionnaire asked whether a patient had an additional joint replacement (for either the same or different joint), and asked about use of other rehabilitation services since discharge including home-based rehabilitation, outpatient rehabilitation, and additional SNF-based or IRF-based rehabilitation. Patients also were asked how many times they visited a physician, used an emergency room, or were admitted to a hospital; the number of nights spent in the hospital with each admission; and reasons for admission. Health care use included all reasons and conditions that may have precipitated a health care encounter during the follow-up period. We decided not to ask about use of dental services. Nor did we ask about use of prescription drugs given difficulties in obtaining accurate self-report information.

The questionnaire also asked about general health, living situation, social support, functional status, depression and mood, falls, community participation, employment, and post-discharge medical complications. Embedded in the follow-up questionnaire were 2 patient assessment instruments, the phone-FIM⁴ and the Short-Form 12-Item Health Survey.^{5,6}

We designed, revised, and pretested the 50-item JOINTS II questionnaire with the aid of the larger study's clinical practice team, consisting of local site coordinators, clinicians (eg, therapists, nurses, physicians, case managers), and administrators who had worked together since the larger study's inception. For purposes of the follow-up study, the clinical practice team was joined by representatives from IT HealthTrack, an independent survey organization specializing in rehabilitation follow-up surveys, and by representatives from the Lewin Group, a health services and health policy research firm.

Data Collection

Facility-level data. Data on facility characteristics came from 2 main sources: (1) provider of service files maintained and updated quarterly by CMS for each Medicare-certified provider, and (2) a brief 1-page facility characteristics questionnaire sent to each study facility to confirm and supplement data obtained from CMS provider-of-service files. From these 2 sources we obtained facility data such as geographic location, profit status, bed size, occupancy rates, availability of physician and pharmacy services, payer mix, staffing ratios, and number of beds dedicated to orthopedic patients or patients with joint replacement.

Patient-level data. We acquired patient-level data from 2 sources: the JOINTS I database and the JOINTS II follow-up survey. The JOINTS I study database consisted of data abstracted from patient charts and data collected at point of care.³ We linked JOINTS I data with follow-up survey data using study identification numbers devoid of any identifying personal information except those permitted in Health Insurance Portability and Accountability Act limited data sets. Combining these 2 data sources provided a comprehensive profile of patients who participated in both JOINTS I and II. The JOINTS I database provided data on patient characteristics, patient medical history, comorbidities, patient acuity, functional status, living situation, employment status, payers, use of durable medical equipment, use of orthotics and prosthetics, medications, and other variables related to patient status and outcome on discharge.

Follow-up telephone interviews were conducted by IT HealthTrack's trained nurse interviewers. Interviews lasted from 15 to 35 minutes depending on the number of skip patterns that applied to a given respondent. The target date for interview was 6 months from admission to SNF or an IRF. Because of challenges in locating and enrolling patients into the JOINTS II follow-up study, many patients were interviewed after the 6-month target date. We adjusted for variation in follow-up periods in the data analyses.

Dependent Variables

The main dependent variables were the various forms of postdischarge rehabilitation and health care use described earlier in the Instruments section.

Postdischarge use of rehabilitation services. We examined receipt of postdischarge rehabilitation in 3 settings: the patient's home, an outpatient setting, or a bed-service rehabilitation center such as a SNF or IRF. Postdischarge home rehabilitation and outpatient rehabilitation may be considered substitutes for one another. Thus, when we examined postdischarge

rehabilitation services, we considered rates of participation in home care and outpatient care both separately and together. We also considered the total number of home and outpatient visits both separately and together.

Physician visits. We distinguish between 2 main types of physician visits: those associated with standard follow-up care for joint replacement and those associated with other health needs.

Emergency room visits and rehospitalizations. To help categorize reasons for ER visits or hospital admissions, we asked the clinical practice team. The team classified reasons for ER visits and rehospitalization into 3 categories: (1) probably related to joint replacement, (2) possibly related to joint replacement, and (3) not related to joint replacement. This classification is inherently subjective, and a different group of clinicians may well come to a different consensus. Rehospitalization was measured as a binary variable with 0 being no hospitalization and 1 being hospitalized during the follow-up period. We did not adjust for case-mix differences between settings of care when examining rates of ER visits and rehospitalization because we were being descriptive and not trying to ascribe ER visits or rehospitalizations to the original postacute placement.

Medical complications. When examining differential rates of ER visits and rehospitalization, a closer look at more common medical complications associated with a joint replacement is warranted. Thus, we asked respondents if they had 1 or more of 8 common joint replacement-related complications since their discharge. They also could identify additional complications related or unrelated to the joint replacement.

Data Analysis

Characterizing study facilities. We divided facilities into 3 groups: SNFs, IRFs, and 1 hospital-based SNF, a hybrid facility that had features of both an SNF and IRF and exhibited very different practice patterns as described by DeJong et al.^{2,3} We also considered their geographic distribution and payer mix relative to national distributions.

Characterizing study patients. We divided study patients into 2 main groups: patients with knee and hip replacement. We also considered whether the patient had an original replacement or a revision and whether it was unilateral or bilateral. We further characterized the study group at admission and discharge across facility types by demographic profile, acuity as measured by the CSI,⁷⁻¹² functional status as measured by the FIM,^{13,14} presence of comorbidities, case-mix group as defined by the case-mix method used in the IRF prospective payment system, payer mix, and LOS.

Comparing respondents and nonrespondents. There are several ways in which respondents and nonrespondents can be compared. The most important comparison is how JOINTS II study participants are similar to, or different from, those who participated in the JOINTS I study only (but not in the JOINTS II follow-up study)—2 mutually exclusive groups. This comparison is not straightforward because certain exclusion criteria were applied to JOINTS II patients based on knowledge that could only be ascertained from the JOINTS II follow-up survey and therefore cannot be applied retroactively to those in the original JOINTS I cohort who did not participate in the JOINTS II follow-up study. Thus, when comparing the JOINTS II follow-up cohort for this article with the JOINTS I cohort, we included those JOINTS II patients who had been excluded (eg, those who died, or had a subsequent replacement for another joint).

Postdischarge rehabilitation services. We measured frequency of patients' use of various types of postdischarge re-

habilitation services. We then sought to determine which patients were more likely to obtain one form of postdischarge rehabilitation compared with another. Because home and outpatient rehabilitation services can be considered substitutes for one another and because both are similar in terms of therapy intensity per visit, we identified patient characteristics, facility characteristics, and amount of inpatient therapy received that might be associated with the total number of outpatient and home visits combined. To do so we constructed an ordinary least squares regression model using stepwise entry that took into account (1) patients' demographic, medical, and functional profiles (either at admission or discharge from postacute care); (2) setting type (ie, freestanding SNF, hospital-based SNF, IRF) and other characteristics of the facility from which patients were discharged; and (3) the amount of therapy patients received while in the facility. We wanted to determine whether there were any patient characteristics or other factors related to use of inpatient rehabilitation services and how they might need to be taken into account when explaining follow-up services used.

Rehospitalization. Likewise, we sought to determine the independent variables that might be associated with rehospitalizations. We developed a 3-stage logistic regression model to test which (1) patient characteristics, (2) postacute care setting and practice patterns (eg, LOS, total therapy hours, therapy intensity [therapy hours a day]), and (3) postdischarge services or events that might be associated with rehospitalization (1=yes, 0=no).

Medical complications. We first evaluated the frequency with which patients in each of the 3 settings reported different types of medical complications. We then used logistic regression to identify patient and patient care variables most strongly associated with the onset of the most frequently reported condition: swelling in the leg.

Adjusting for variation in duration of follow-up period. We considered how variation in the time until follow-up might affect our assessment of postdischarge use of rehabilitation and other health care services and onset of medical complications. First, we assumed that use of rehabilitation therapy was most likely to occur in the first few months after discharge from a freestanding SNF, hospital-based SNF, or IRF, and therefore, the duration of the follow-up period would not be material in evaluating relative use. Second, we assumed that this was not the case for use of other health care services such as physician visits, ER visits, and hospitalizations because the mere passage of time increases the chances that a person will acquire a health condition that will require professional attention. To address this, we evaluated the duration of the follow-up periods across settings and calculated how the average follow-up period varied across the 3 settings. In any multivariate analyses seeking to explain postdischarge use of rehabilitation and other health care services, we explicitly included duration of the follow-up period as an independent variable.

RESULTS

Study Facilities

Of the 22 facilities that participated in JOINTS I, 12 facilities agreed to participate in the JOINTS II study. Ten facilities chose not to take part in the follow-up study because of issues related to local institutional review board constraints, low patient volumes, facility repairs, and/or demands on staffing. The 12 participating facilities included 5 freestanding SNFs, 1 hospital-based SNF, and 6 IRFs. At least 1 SNF from each of the 4 major U.S. census regions participated in JOINTS II, but we were unable to recruit an IRF from the midwest region.

Table 1: JOINTS II Study Facility Characteristics by Type of Facility Compared With All SNFs and IRFs Nationally

Facility Characteristics	JOINTS II Study			National*	
	Fs-SNF n=5	Hb-SNF n=1	IRF n=6	All SNF n=15,027	IRF n=1219
Size (no. of beds), mean \pm SD	183.2 \pm 86.2	50.0	95.3 \pm 36.3	107.3 \pm 64.9	31.5 \pm 28.1
Has dedicated orthopedic or joint replacement unit (%)	40.0	Yes	33.3	NA	NA
Nonprofit (%)	20.0	Yes	66.7	28.8	61.8
Freestanding (%)	100.0	No	83.3	92.0	17.9
Acute hospital-based unit (%)	0.0	Yes	16.7	8.0	82.1
2006 Occupancy rate (%), mean \pm SD	87.3 \pm 13.4	85.0	83.1 \pm 5.2	NA	NA
No. of joint replacement patients in 2006, mean \pm SD	101.4 \pm 103.0	315.0	355.5 \pm 205.1	NA	163.4
24-hour onsite physician coverage (%)	0.0	Yes	100.0	NA	100.0
Onsite pharmacist coverage (%)	0.0	Yes	100.0	NA	NA
Geographic region					
Northeast	1	✓	1	2722	215
Midwest	2	X	0	4813	334
South	1	X	3	5133	466
West	1	X	2	2349	202
Payer mix [†]					
Non-HMO Medicare patients (%)	38.9	79.0	63.8	NA	63.4
HMO patients (%)	27.6	14.0	15.4	NA	NA

Source: JOINTS Study facility questionnaire and CMS Provider of Service file.

Abbreviations: Fs-SNF, freestanding SNF; Hb-SNF, hospital-based SNF; NA, not applicable.

*Includes all SNFs and IRFs nationally. Many SNFs and some IRFs do not serve patients who had a joint replacement. Ideally, one would want to compare study SNFs and IRFs to the subset of facilities that serve patients with joint replacement.

[†]Payer mix for all patients in study facilities, not just those in JOINTS study. See table 2 for the payer mix of patients included in the study.

The hospital-based SNF had therapy intensity (therapy hours a day) of an SNF and the LOS of an IRF, and its total hours of therapy were less than either a freestanding SNF or an IRF. It also shared other features from both settings and had some unique characteristics as outlined in an accompanying article.³ In general, the remaining study facilities represented larger freestanding SNFs and IRFs compared with the average size of SNFs and IRFs nationwide. The proportions of for-profit and nonprofit facilities in this study are consistent with the percentages seen nationally; 20% of SNFs and 66.7% of IRFs were nonprofit. The hospital-based SNF was located in a nonprofit acute care hospital, but its therapy services were rendered by a for-profit company. Apart from the hospital-based SNF, all study SNFs were freestanding compared with 92% nationally, and 83.3% of study IRFs were freestanding compared with 17.9% nationally. Thus, freestanding IRFs were overrepresented. This result was a function of study design and facility recruitment strategy that favored larger facilities that could deliver the requisite patient volumes (table 1).

Study Group

The 12 facilities participating in JOINTS II provided a total of 1326 patients to complete the JOINTS II survey. A total of 1016 patients or family members were successfully contacted and interviewed, yielding a response rate of 76.6%. When applying our exclusion criteria for this article, we excluded (1) 85 patients who had a hip replacement subsequent to a hip fracture; (2) 18 patients who died before the interview with them could be conducted, although an interview was conducted with a family member; (3) 35 patients who had an additional joint replacement in the follow-up period for a different joint; and (4) 2 patients who had an LOS greater than 52 days. In addition, we excluded 20 patients who were interviewed for the wrong rehabilitation stay. The final sample consisted of 856 patients: 561 patients with knee replacement and 295 patients with hip replacement.

Comparison with nonparticipants. There were several statistically significant differences between participants and nonparticipants—that is, between patients in JOINTS II and patients in JOINTS I who did not participate in JOINTS II (the JOINTS I-only cohort), but only a few are particularly noteworthy. Compared with nonparticipants, JOINTS II freestanding SNF patients had more medical acuity on admission as measured by the CSI (27.2 vs 21.7, $P<.001$, for patients with knee replacement; 21.0 vs 12.7, $P<.001$, for patients with hip replacement). Among patients with knee replacement, freestanding SNFs had more bilateral replacements (6.8% vs 2.3%; $P=.0469$). Compared with nonparticipants, JOINTS II IRF patients with knee replacement were more likely to be admitted with lower motor FIM scores and achieve greater FIM gains while in an IRF.

Study group characteristics. Patients with joint replacement in all 3 settings were typically women in their early 70s (table 2). About one third of patients lived alone, and about 80% participated in non-HMO (ie, fee-for-service) Medicare. In general, IRF patients had a more severe medical and functional profile on admission than did freestanding SNF and hospital-based SNF patients. IRF patients presented more medical acuity as measured by higher admission CSI, lower admission motor FIM scores, longer onset days, and more representation in more severe case-mix groups (803–806); were more likely to be represented in 1 of the more severe comorbidity tiers; and were more likely to have had a bilateral replacement or a revision. Freestanding SNF and hospital-based SNF patients with knee replacement, however, had higher BMI scores and were more likely to be morbidly obese ($\text{BMI}\geq 40$) than IRF patients. IRF patients achieved greater functional gains from admission to follow-up than freestanding SNF and hospital-based SNF patients, but still had a lower discharge motor FIM because they had lower admission motor FIM scores.

Table 2: JOINTS II Follow-Up Study Patient Characteristics*

Characteristic or Outcome	Knee Replacement				Hip Replacement			
	Fs-SNF (n=127)	Hb-SNF [§] (n=140)	IRF (n=294)	P	Fs-SNF (n=65)	Hb-SNF [§] (n=59)	IRF (n=171)	P
Demographics								
Age (y)	71.1±9.8	72.5±7.1	71.5±9.5	.399	72.4±11.7	74.3±6.1	70.0±11.7	.022
Sex (% female)	78.7	71.4	72.5	.322	73.9	67.8	68.4	.686
Race (% white)	58.3 [#]	98.6	74.2	<.001	40.0 [#]	100.0	84.8	<.001
Lived alone (%)	37.8	33.6	30.3	.312	41.5	28.8	33.9	.318
Payer mix (% non-HMO Medicare)	78.7	79.3	81.0	.845	89.2	93.2	74.9	.002
Admission status, mean								
Admission CSI [†]	27.2	28.9	31.4	.005	20.8±7.7	15.8±9.2	20.4±12.6	.015
BMI	34.0±8.0	34.5±7.8	31.5±6.6	<.001	31.0±5.7	30.6±6.6	30.2±6.2	.635
Admission motor FIM	50.3±8.7	46.9±8.3	40.9±7.6	<.001	48.4±7.4	46.3±8.6	38.4±7.6	<.001
Admission cognitive FIM	34.4±2.9	30.5±4.4	30.1±5.2	<.001	34.6±1.5	29.9±3.2	29.1±5.3	<.001
Onset days [‡]	3.7±2.3	3.6±1.7	4.2±3.6	.073	3.2±2.0	3.6±1.5	3.9±1.5	.015
Case-mix group (%)								
801–802	71.7	70.7	39.8		63.1	67.8	28.1	
803–804	22.1	22.1	40.5	<.001	30.8	18.6	40.9	<.001
805–806	6.3	7.1	19.7		6.2	13.6	31.0	
Comorbidities (%)								
Bilateral replacement	7.1	1.4	18.4	<.001	0.0	0.0	2.9	.158
Revision	2.4	4.3	5.4	.370	7.7	8.5	15.2	.179
Morbid obesity (BMI≥40)	19.7	19.3	10.9	.017	9.2	6.8	4.7	.414
Hypertension	74.8	81.4	74.8	.280	76.9	72.9	63.7	.108
Diabetes	26.8	27.1	23.5	.633	16.9	20.3	18.1	.883
Ischemic heart disease	11.8	21.4	16.7	.110	10.8	23.7	18.1	.161
Tier 1 (most severe)	0.0	0.0	0.0		0.0	0.0	0.0	
Tier 2 (more severe)	0.0	2.9	2.4	<.001	0.0	0.0	0.6	.463
Tier 3 (moderate)	7.1	15.7	28.9		7.7	11.9	15.8	
Tier 0 (none on list of comorbidities)	92.9	81.4	68.7		92.3	88.1	83.6	
Discharge status								
Discharge to community (%) [¶]	97.6	99.3	96.3	.183	100.0	96.6	94.7	.161
Discharge motor FIM	70.6±7.5	69.8±6.7	68.0±6.5	.001	70.2±7.5	69.3±6.5	67.3±6.2	.001
Change in motor FIM	20.2±7.3	22.9±8.0	27.2±6.9	<.001	21.7±6.7	23.0±7.8	29.0±6.5	<.001
LOS	13.7±6.5	8.6±3.1	9.7±3.3	<.001	13.3±8.6	9.0±3.6	10.1±4.1	<.001

Source: JOINTS II study.

NOTE. Values are mean ± SD, unless otherwise noted.

Abbreviations: Fs-SNF, freestanding SNF; Hb-SNF, hospital-based SNF.

*Data in this table are not case-mix-adjusted. Excluded from this table are surrogate responders for patients who died and responders who had additional replacements of a different joint.

[†]CSI: one of the JOINTS study's principal severity adjusters.

[‡]Onset days are the number of days from surgery to rehabilitation admission. In the case of joint replacement, this number is almost always the length of acute care immediately prior to the rehabilitation admission.

[§]Hb-SNF: the JOINTS study's hospital-based facility was classified as a high-volume facility based on the volume of patients served by the Hb-SNF in 2006.

^{||}Comorbidity tier based on comorbidity tiers used in Medicare's IRF prospective payment system.

[¶]Discharge to community is defined as discharge to home or assisted living.

[#]Twenty-eight of 127 Fs-SNF knee patients are missing race, and 12 of 65 Fs-SNF hip patients are missing race.

Duration of Follow-Up Period

The average follow-up period was 7.8 months, with the average follow-up period longest for IRF patients (8.1mo). The largest differences in average follow-up periods across post-acute settings were 18 days for patients with knee replacement and 27 days for patients with hip replacement. If there was any bias in the relative use of health services (unadjusted for duration and case mix), the results would tend to favor free-standing SNF-based and hospital-based SNF-level care over IRF-level care because they had shorter follow-up periods.

Use of Rehabilitation Services in the Follow-Up Period

Patients with joint replacement from all 3 settings used considerable amounts of rehabilitation services during the follow-up period (table 3). Only a small percentage of patients

with knee replacement used no rehabilitation services during the follow-up period, and only a small percentage were admitted to another SNF or an IRF during the follow-up period. Freestanding SNF patients were more likely to use home-based rehabilitation services (freestanding SNF knee patients=73.2%; freestanding SNF hip patients=83.1%) than their hospital-based SNF and IRF counterparts. Hospital-based SNF and IRF patients were more likely to use outpatient rehabilitation services.

Freestanding SNF patients also were more likely to use both home and outpatient rehabilitation services. About half of freestanding SNF patients with knee replacement received both, and 29.2% of freestanding SNF patients with hip replacement received both. We did not ascertain the sequence of rehabilitation settings used, although other evidence suggests

Table 3: Postdischarge Use of Rehabilitation Services in Follow-Up Period (Not Case-Mix Adjusted)

Rehabilitation Use After Discharge	Patients With Knee Replacement				Patients With Hip Replacement			
	Fs-SNF (n=127)	Hb-SNF (n=140)	IRF (n=294)	P	Fs-SNF (n=65)	Hb-SNF (n=59)	IRF (n=171)	P
Rehabilitation service (%)								
Home rehabilitation	73.2	33.6	44.2	<.001	83.1	37.3	54.4	<.001
Outpatient rehabilitation	72.4	84.3	76.2	.055	38.5	33.9	52.6	.018
Fs-SNF, Hb-SNF, or IRF	3.2	2.9	3.1	.989	0.0	6.8	2.3	.061
Combinations (%)								
Home rehabilitation only	22.1	11.4	18.0		53.9	25.4	33.9	
Outpatient rehabilitation only	19.7	61.4	50.3		9.2	23.7	34.5	
Home rehabilitation and outpatient rehabilitation	50.4	20.7	24.8		29.2	10.2	18.1	
Another Fs-SNF, Hb-SNF, or IRF only	0.8	0.7	1.4		0.0	5.1	0.6	
Fs-SNF/Hb-SNF/IRF and home rehabilitation	0.0	0.0	0.7	<.001	0.0	1.7	2.3	<.001
Fs-SNF/Hb-SNF/IRF and outpatient rehabilitation	1.6	0.7	0.3		0.0	0.0	0.0	
Fs-SNF/Hb-SNF/IRF and home rehabilitation and outpatient rehabilitation	0.8	1.4	0.7		0.0	0.0	0.0	
None	4.7	3.6	3.7		7.7	33.9	10.5	
Total therapy visits (home and outpatient visits combined)								
Mean \pm SD	19.0 \pm 14.0	19.0 \pm 11.6	19.5 \pm 15.2		14.6 \pm 11.6	10.2 \pm 14.1	14.9 \pm 12.6	
Median	16.0	18.0	16.0		12.0	6.0	15.0	
Maximum	78.0	66.0	102.0		48.0	84.0	63.0	

Abbreviations: Fs-SNF, freestanding SNF; Hb-SNF, hospital-based SNF.

that if patients received both home-based and outpatient rehabilitation, they more than likely received home care prior to outpatient care.

A different picture emerges when one considers the total number of home and outpatient therapy visits combined (see bottom of table 3). While there were large differences in the percentages of patients who used home and outpatient therapy in the follow-up period, the average number of actual therapy visits, home and outpatient therapy visits combined, is remarkably similar among patients with knee replacement discharged from all 3 postacute settings. Patients with knee replacement averaged about 19 visits (including the few who had no visits). Patients with hip replacement discharged from freestanding SNFs and IRFs averaged nearly 15 visits; hospital-based SNF patients with hip replacement averaged about 10 visits because about one third of hospital-based SNF patients with hip replacement received no follow-up rehabilitation therapy. These findings are not case-mix-adjusted.

There was, nonetheless, significant patient-level variation in the amount of therapy used. Accordingly, we sought to determine whether there were any factors (eg, patient characteristics, type of initial postacute setting, practice patterns) that might be associated with number of therapy visits made in the follow-up period. We ran separate regressions for patients with knee and hip replacement where total number of postdischarge therapy visits was the dependent variable. We were able to explain only 6% to 8% of the variation in amount of postdischarge therapy. There was only 1 consistent predictor across regressions: patients who participated in non-HMO Medicare (fee-for-service Medicare) received fewer postdischarge therapy services.

Finally, we evaluated the total amount of therapy patients received over the course of their inpatient stay and during their follow-up period. Patients who went on to 1 other setting (home care or outpatient care) received an amount roughly double the amount received by those who did not go on to another setting. Patients who went on to 2 other settings (both home and outpatient care) received roughly triple the amount of those who did not go on to another setting.

Use of Other Health Services in the Follow-Up Period

Physician visits. Nearly all patients had a standard follow-up visit with a physician for their joint replacement, and for almost 60% of the study group, this was the only reason for seeing a physician in the follow-up period. The other 40% also saw physicians for other reasons. There were no real differences between patients with knee and hip replacement, or between patients discharged from each of the 3 settings (table 4).

Emergency room visits. The use of ER services was quite variable across patient types and the postacute setting from which the patient was discharged. Some 18.9% of freestanding SNF patients with knee replacement, 15.7% of IRF patients with knee replacement, and 14% of IRF patients with hip replacement visited an ER. Hospital-based SNF patients, especially patients with hip replacement, rarely used ER visits. These results are not adjusted for case mix or duration of the follow-up period, nor do they take into account the geographic variation in availability of after-hours care from non-ED sources.

Rehospitalization. About 13% of all study patients with knee replacement were hospitalized during the follow-up period. There were no real differences across settings of care among patients with knee replacement. About half of the rehospitalizations were deemed probably related to the patient's joint replacement. We observed larger differences across settings of care among patients with hip replacement where IRF patients were more likely to be rehospitalized in the follow-up period. Again, these results are not adjusted for case mix or duration of the follow-up period (see table 4).

When attempting to identify factors associated with rehospitalization, a logistic regression model identified only 1 variable associated with rehospitalization in the follow-up period among patients with knee replacement: LOS was negatively associated with rehospitalization—that is, a shorter LOS increased the likelihood that the patient would be rehospitalized. We were not able to identify any setting effects among patients with knee replacement. We found that our model was overspecified for patients with hip replacement because

Table 4: Physician Visits, Emergency Room Visits, and Rehospitalizations in the Postdischarge Follow-Up Period*

Health Care Use	Knee Replacement				Hip Replacement			
	Fs-SNF (n=127)	Hb-SNF (n=140)	IRF (n=294)	P	Fs-SNF (n=65)	Hb-SNF (n=59)	IRF (n=171)	P
Months from admission to follow-up interview	7.8±1.2	7.4±1.5	8.0±1.7	<.001	7.6±0.8	7.3±1.2	8.2±1.9	<.001
Physician visits (%)								
Had a standard follow-up visit	99.2	97.9	98.6	.641	100.0	94.9	98.8	.065
Physician visits (%)								
Only reason for visit was standard follow-up	59.1	55.7	54.4	.680	66.2	59.3	54.4	.255
Physician visits (%)								
Other reasons for visit	40.9	42.1	44.2	.803	33.9	37.3	44.4	.280
Physician visits								
No. of visits for those who had at least 1 visit	4.0±1.9	3.6±1.8	4.1±2.0	.023	3.5±1.9	3.6±2.0	4.0±2.0	.216
ER visit rate (%)								
reasons probably related to JR	3.9	1.4	5.1	.183	1.5	0.0	5.3	.101
ER visit rate (%)								
Reasons possibly related to JR	7.1	5.0	6.1	.774	0.0	0.0	5.9	.023
ER visits								
No. of visits for those who had at least 1 visit	1.2±0.6	1.2±0.4	1.3±0.5	.775	1.0±1.0	NA	1.6±0.9	.392
Rehospitalization rate (%)								
Reasons probably related to JR	9.5	7.9	6.1	.465	3.1	1.7	7.6	.144
Rehospitalization rate (%)								
Reasons possibly related to JR	2.4	0.0	1.0	.172	0.0	0.0	1.8	.333
Rehospitalization rate (%)								
Reasons probably not related to JR	2.4	3.6	5.8	.249	0.0	1.7	6.4	.045
Rehospitalizations								
No. of hospitalizations for those who had at least 1 hospital admission	1.3±0.8	1.2±0.4	1.2±0.5	.724	1.0±0.0	1.0±0.0	1.6±1.2	.063

Source: JOINTS II study.

NOTE. Values are mean ± SD or as otherwise indicated.

Abbreviations: Fs-SNF, freestanding SNF; Hb-SNF, hospital-based SNF; JR, joint replacement; NA, not applicable.

*Data in this table are not case-mix-adjusted. Excluded from this table are responders who died and responders who had additional replacements of a different joint.

there were too few patients with hip replacement who were rehospitalized.

Medical Complications

Use of health care services in the postdischarge period may be provoked by the onset of medical conditions that may or

may not be related to the joint replacement for which the patient received postacute rehabilitation.

Table 5 lists the most common medical complications in the follow-up period as reported by patients in the follow-up interview. Both hospital-based SNF and IRF patients reported more swelling in the legs than SNF patients. Swelling com-

Table 5: Most Common Complications in the Postdischarge Follow-Up Period

Complication	Patients With Knee Replacement				Patients With Hip Replacement			
	Fs-SNF (n=127)	Hb-SNF (n=140)	IRF (n=294)	P	Fs-SNF (n=65)	Hb-SNF (n=59)	IRF (n=171)	P
Swelling in the legs	15.0	30.7	32.7	.002	13.9	18.6	21.1	.450
Other conditions								
Broken bone	2.4	0.0	1.4	.215	0.0	0.0	2.9	.158
Blood clot	3.2	4.3	2.7	.518	1.5	0.0	1.2	.663
Urinary tract infection	7.1	6.4	5.8	.874	0.0	5.1	7.0	.091
Bleeding problems	0.8	1.4	1.0	.986	0.0	0	2.3	.230
Pneumonia	0.8	5.0	2.4	.093	0.0	1.7	1.2	.614
Wound infection	1.6	2.1	3.1	.637	0.0	3.4	3.5	.224
Pulmonary embolism	0.8	0.0	1.4	.367	0.0	0.0	0.6	.695
Subtotal other conditions*	12.6	16.4	14.0	.654	1.5	10.2	14.0	.020
Total†	23.6	38.6	38.1	.010	15.4	27.1	29.8	.077

NOTE. Values are percentages or as otherwise indicated.

Abbreviations: Fs-SNF, freestanding SNF; Hb-SNF, hospital-based SNF.

*Percent of patients who have at least 1 of the conditions listed on the table. Some patients reported more than 1 condition. The total is not the mere addition of conditions listed.

†Percent of patients who have at least 1 of the above listed other conditions. Some patients reported more than 1 condition. The subtotal is not the mere addition of conditions listed.

monly occurs initially at the site of the surgical incision, and thus, proximity to the time of surgery is an important consideration. Both hospital-based SNF and IRF patients had shorter LOSs and thus would be expected to report more swelling during the postdischarge period. On closer examination, however, we found no clear relationship between LOS and leg swelling. We also conducted a logistic regression analysis (1=swelling; 0=no swelling) and found no patient characteristics or setting effects associated with self-reported leg swelling. There is also a question of whether swelling should be considered a medical complication or part of the natural healing and recovery process after a surgery such as a joint replacement. We also considered other clinical conditions during the postacute stay that might be associated with more swelling—for example, low protein, congestive heart failure, venous insufficiency, anemia, and obesity—but found no associations (findings in table 5 are not case-mix adjusted).

Apart from swelling in the legs reported by patients with knee replacement, there were no statistically significant differences between settings of care for individual medical conditions. When we combined all nonswelling conditions reported, we observed no differences between postacute settings for patients with knee replacement but did observe a higher rate of nonswelling medical complications among IRF patients with hip replacement.

DISCUSSION

Except in 1 instance, we found no differences across initial postacute settings in amounts of rehabilitative care patients obtained during the follow-up period. Only patients with hip replacement who went to the hospital-based SNF obtained considerably less, mainly because one third received no rehabilitative care in the follow-up period. We also found no differences between settings with respect to use of physician services during the follow-up period.

Apart from swelling in the legs, we found no statistically significant differences between settings of care in the incidence of medical complications among patients with knee replacement. Among patients with hip replacement, however, IRF patients reported more medical complications, but again, we found no setting effects in the multivariate analyses. We also found no differences in ER visits and rehospitalization rates among patients with knee replacement. In the descriptive analysis, we found that IRF patients with hip replacement had more ER visits and rehospitalizations than did patients discharged from the other 2 settings of care. In the multivariate analysis, we could not uncover any setting effects that might explain these differences.

Overall, and more importantly perhaps, the study uncovered much more postdischarge use of rehabilitation services than had been anticipated at the outset of the study. Patients with knee replacement received about as much therapy during the follow-up period as they did in the initial postacute setting. Patients with knee replacement received about 17.5 hours of PT and OT during their initial postacute stay and had an average of 19 home or outpatient visits during follow-up. Patients with hip replacement received about 18 hours of PT and OT during their initial postacute stay and had an average of almost 15 visits during the follow-up period. Practice patterns were somewhat different for hospital-based SNF patients, but the amount of follow-up therapy nonetheless rivaled the amount of inpatient therapy.

These high rates of postdischarge use of rehabilitation services dovetail with recent findings by Gage et al,¹ who used a 5% sample of Medicare claims data from 2005 to examine use of care after an admission to an SNF or an IRF. Among those

in diagnosis-related group 209, Major Joint and Limb Reattachments for Lower Extremity, 67.0% of SNF patients and 74.7% of IRF patients went on to use home health or outpatient therapy. Of the 52.7% of SNF patients who obtained home health care, 21.1% later also obtained outpatient therapy. Of the 50.3% of IRF patients who obtained home health care, 22.3% later also obtained outpatient therapy.

Use of rehabilitation services in the follow-up period may obscure the effects of the original postacute setting on medical complications, ER visits, rehospitalization, and other follow-up outcomes. Receipt of additional rehabilitation services makes it more difficult to determine how much of the outcome at follow-up can or should be attributed to (1) the original surgical procedure and implant, (2) the initial postacute setting, or (3) follow-up rehabilitation services that can at times far exceed what is obtained in the initial postacute setting.

These findings suggest that we need to look at the entire episode of care, not just the freestanding SNF, hospital-based SNF, or IRF in which the patient was placed initially. This also has potential implications for how we pay for postacute care services. Should the entire episode be seen as a single package of services that can be customized based on patient need or as discrete and independent units of services that should be paid for individually? The answer to this question is beyond the scope of this article, but the findings here raise fundamental questions about the organization and payment of services across an array of settings that reach well beyond the initial postacute placement.

These findings lead to 2 suggestions for further study. First, more needs to be learned about the prescription patterns for follow-up care. Who prescribes this care, and how is the amount of care determined? How much is prescribed by the orthopedic surgeon who did the original joint replacement, the physician in the postacute setting, or the patient's primary care physician to whom care of the patient may have been entrusted on discharge from the postacute setting? To what extent is the type of follow-up care determined by the geographic availability of rehabilitation services? Second, for those who received both home and outpatient therapy services, more needs to be learned about the sequence in which these follow-up services were received. Did the patient receive these services sequentially or concurrently? Did patients receive home therapy and then outpatient therapy as is commonly assumed? We did not anticipate the need to ask.

Study Limitations

This study had 3 noteworthy limitations. First, this study carries forward the limitations of the larger JOINTS I study, particularly the selection of facilities.² Facility participation in the study was voluntary, and self-selected facilities in all probability bring with them unknown characteristics that may set them apart from others. The study team attempted to obtain a mix of facilities from different areas of the nation. Small IRF units located in acute care hospitals were definitely underrepresented, and given the diversity of practice patterns among SNFs in the larger study, the study also could have benefited from more SNFs and SNF patients.

Second, the hospital-based SNF represented only 1 facility, and caution is needed in generalizing to all hospital-based SNFs, although we know that hospital-based SNFs do have practice patterns that differ from freestanding SNFs.

Third, the study did not collect data on the sequence of postdischarge rehabilitation that could have enhanced our understanding of the various rehabilitation pathways in the follow-up period.

CONCLUSIONS

Findings from this study underscore the fact that a patient's rehabilitation does not end on discharge from an SNF or IRF but continues for several weeks thereafter either at home and/or in an outpatient setting and sometimes, but rarely, in another SNF or IRF. In fact, as much as half or more of the total amount of PT or OT may be acquired after the patient leaves the initial rehabilitation setting.

Patients with knee replacement across all 3 settings report similar amounts of rehospitalization in the follow-up period. IRF patients with hip replacement report more rehospitalization than freestanding SNF and hospital-based SNF patients. IRF patients with knee and hip replacement report more medical complications mainly because of the incidence of swelling in the legs. Multivariate analyses were unable to isolate a setting effect that might be associated with the onset of rehospitalization or medical complications. Some of the observed differences may be obscured by the additional rehabilitation and health care services that patients received in the postacute period. Future research needs to look beyond the initial postacute setting to the entire episode of postacute care. Merely looking at the initial postacute setting provides an incomplete picture of the patterns of care and how they may affect outcomes at follow-up.

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