Arthroplasty Today 3 (2017) 275–280

Contents lists available at ScienceDirect

Arthroplasty Today

journal homepage: http://www.arthroplastytoday.org/

Original research

Comparison of postarthroplasty functional outcomes in skilled nursing facilities among Medicare and Managed Care beneficiaries

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ARTICLE INFO

Article history:
Received 24 February 2017
Received in revised form
4 April 2017
Accepted 5 April 2017
Available online 10 May 2017

Keywords:
Total joint arthroplasty
Skilled nursing facility
Medicare
Managed Care
Physical therapy

ABSTRACT

Background: After home health care, the skilled nursing facility (SNF) is the most commonly used postacute care modality, among Medicare beneficiaries, after total joint arthroplasty. Prior studies demonstrated that a loss in postsurgical ambulatory gains is incurred in the interval between hospital discharge and arrival at the SNF. The aim of this present study is to determine the consequences of that loss in function, as well as compare SNF-related outcomes in patients with Medicare vs Managed Care (MC) insurance.

Methods: We conducted a retrospective analysis of 80 patients (54 Medicare and 26 MC) who attended an SNF after hospitalization for total joint arthroplasty. Outcomes from physical therapy records were abstracted from each patient's SNF file.

Results: There was an approximately 40% drop-off in gait achievements between hospital discharge and SNF admission. This decline in ambulation was significantly greater in Medicare patients (*Medicare*: 94.6 ± 123.2 ft, *MC*: 40.0 ± 48.9 ft, $P = .034$). Larger reductions in gait achievements between hospital discharge and SNF admission were significantly correlated with longer SNF lengths of stay and poorer gait achievements by SNF discharge. Patients with MC insurance made significant improvements in gait training at the SNF beyond that which was acquired at the hospital, whereas Medicare patients did not ($P_{Medicare} = .28$, $P_{MC} = .003$).

Conclusions: Large losses in motor function between hospital discharge and SNF admission were associated with poor functional outcomes and longer stays at the SNF. These effects were more pronounced in Medicare patients than those with MC insurance.

Introduction

Driven by growing demand and improvements in surgical technique and implant technology, the use of total joint arthroplasty (TJA) in the management of osteoarthritis and other degenerative and traumatic conditions has increased over recent decades [1]. Its excellent outcomes, however, are balanced by the need for postoperative rehabilitation, which may be protracted and demanding for some [2,3]. In the elderly or comorbid patient, use of rehabilitation care facilities, such as skilled nursing facilities (SNFs), long-term care facilities, and inpatient rehabilitation facilities (IRFs), may be warranted after surgery. Of these, the SNF is the most frequently used, second only to home health care as the most common postacute care (PAC) modality in patients with Medicare [4]. Forty-nine percent of Medicare beneficiaries attend a rehabilitation facility after TJA; of these patients, 75% attend an SNF [5]. Policymakers and clinical practitioners have consequently dedicated more attention to the clinical care and therapeutic services offered at SNFs, as well as postdischarge care for TJA patients.

Medicare's "75% rule" stipulated that, to qualify as an IRF, 75% of a facility's patient census must be admitted with 1 of 13 diagnoses, including hip fracture, polyarticular rheumatoid arthritis, and severe osteoarthritis [6]. In 2005, this was amended to a revised 60%

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.artd.2017.04.002.

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http://dx.doi.org/10.1016/j.artd.2017.04.002

Table 1
Demographic and clinical characteristics of patients discharged to an SNF after TJA.

Characteristic	Medicare	MC	Total	*P* value[a]
Age, y (±SD, range)	71.4 (±12.0, 24-89)	63.5 (±8.0, 45-80)	68.7 (±11.4, 23-89)	.004
Gender	Male: 16, Female: 38	Male: 8, Female: 18	Male: 24, Female: 56	.92
BMI, kg/m^2 (±SD, range)	30.1 (±7.1, 16.2-50.0)	34.2 (±6.0, 21.7-45.1)	31.4 (±7.0, 16.2-50.0)	.01
Race	White: 35, Asian: 4	White: 21, Asian: 1	White: 56, Asian:5	.90
	Black: 3, Other: 12	Black: 0, Other: 4	Black: 3, Other: 16	
Married	Yes: 24, No: 30	Yes: 13, No: 13	Yes: 37, No: 43	.64
Living status	Alone: 15, With others: 39	Alone: 5, With others: 21	Alone: 20, With others: 60	.41
Surgery	TKA: 34, THA: 20	TKA: 16, THA: 10	TKA: 50, THA: 30	.90
	Primary: 44, Revision: 10	Primary: 19, Revision: 7	Primary: 63, Revision: 17	.39
Preoperative diagnosis	Osteoarthritis: 43, Other: 11	Osteoarthritis: 17, Other: 9	Osteoarthritis: 60, Other: 20	.17
ASA score (±SD, range)	2.91 (±0.46, 2-4)	2.92 (±0.50, 2-4)	2.92 (±0.47, 2-4)	.99
EBL, mL (±SD, range)	257.9 (±318.1, 50-2000)	288.5 (±331.5, 50-1500)	267.8 (±320.7, 50-1500)	.69

ASA, American Society of Anesthesiologists; EBL, estimated blood loss; THA, total hip arthroplasty; TKA, total knee arthroplasty; SD, standard deviation.
[a] A *t* test or chi-squared analysis was used to compare patient demographics between Medicare and MC groups.

rule, and consequently, more of these patients were diverged from the IRF to the SNF for post-TJA care [7]. An analysis by the Medicare Payment Advisory Commission (MedPAC) revealed that, between 2006 and 2013, Medicare fee-for-service spending on SNF care increased from $19.5 billion to $26.6 billion, although the number of Medicare-covered stays and SNF facilities decreased [8]. Therapeutic services rendered by the SNF make up a large proportion of this spending, despite the fact that over one-quarter of the physical therapy (PT) modalities used at the SNF have no or minimal documented benefit [8,9].

Recent efforts have aimed to elucidate both the cost of care and functional outcomes achieved at the SNF after TJA. Toward the latter end, comparisons have been made between the functional progress accomplished with home health care vs SNF care. Home health care is associated with significantly fewer hospital readmissions, adverse events, and infectious complications compared with care at the SNF [9-11]. With respect to cost, however, care at the SNF clearly confers a much higher price tag. For instance, the total 90-day cost of care for patients discharged to an SNF after total hip arthroplasty is roughly double compared with patients discharged with home health care [12]. Although patients with home health care attain greater mobility and independence than SNF patients, these differences are confounded by the fact that home health care patients have better baseline function and less comorbidity [13]. Efforts to compare functional outcomes at SNFs and IRFs have been equally challenging, although patients at IRFs tend to have shorter lengths of stay, participate in more intensive PT, and have more favorable mobility achievements than patients at SNFs [13-22].

In a prior study, it was demonstrated that patients who attend an SNF after TJA ambulate for shorter distances on the day of and the day following admission to the SNF compared with the day of hospital discharge [23]. For instance, on the first day after hospital discharge, patients at the SNF exhibited an ability to ambulate for only half the distance compared with their last hospital PT session. A related study evaluated the association between patient insurance status and multiple outcomes at the SNF, including length of stay, discharge functional status, and goal achievements [24]. The authors found that patients with Medicare endured longer lengths of stay, slower PT progress, and poorer functional outcomes compared with patients with private, Managed Care (MC; including health maintenance organization and preferred provider organization) health insurance.

These studies inspired several unanswered inquiries. First, what consequences, if any, arise from the reduction in ambulation observed in patients who attend SNFs? Secondly, what improvements in physical function are made at the SNF beyond that which is acquired from PT on hospital discharge? The present study aims to address each of these questions. Moreover, patients in this study are subdivided into Medicare and MC groups to further characterize differences in SNF outcomes based on insurance payer. We hypothesize that large reductions in ambulation after hospital discharge will correlate with longer stays and poorer functional outcomes at the SNF, and that patients will enjoy only nominal functional improvements during their SNF stay compared with what has been achieved in the hospital. We expect these effects to be more pronounced in patients with Medicare than patients with MC.

Material and methods

Study design

This study was approved by our institutional review board (IRB). We performed a multisite retrospective review of medical and PT records obtained from 29 SNF sites representing five different counties in California. Patients were included in this study if they attended an SNF after TJA at our institution between November 2012 and July 2014. All TJAs were performed by a single surgeon. After inclusion and exclusion criteria were met, a total of 80 patients were enrolled.

Data collection

Hospital records were reviewed for each consecutive patient, from which the following elements were abstracted: age, gender,

Table 2
Comparison of distance ambulated (feet ± SD) between Medicare and MC patients at hospital discharge, SNF admission, and SNF discharge.

Insurance	Hospital discharge	*P* value[a]	SNF admission	*P* value[a]	SNF discharge	*P* value[a]
All	118.05 ± 121.1		41.2 ± 41.5		173.1 ± 119.3	
Medicare	133.3 ± 140.4	.65	38.6 ± 37.2	.29	157.2 ± 94.2	.46
MC	86.5 ± 55.0	.91[b]	46.5 ± 49.7	.20[b]	204.2 ± 154.9	.10[b]

SD, standard deviation.
[a] Medicare vs MC.
[b] One-way analysis of covariance was used to adjust for between-groups differences in age and body mass index.

Table 3
Comparison of distance ambulated (feet ± SD) between hospital discharge vs SNF admission and hospital discharge vs SNF discharge.

Insurance	Hospital discharge	SNF admission	SNF discharge	*P* value,[a] hospital discharge vs SNF admission	*P* value,[a] hospital discharge vs SNF discharge
All	118.05 ± 121.1	41.2 ± 41.5	173.1 ± 119.3	<.001	<.001
Medicare	133.3 ± 140.4	38.6 ± 37.2	157.2 ± 94.2	<.001	.28
MC	86.5 ± 55.0	46.5 ± 49.7	204.2 ± 154.9	<.001	.003

SD, standard deviation.
[a] Two-way, paired *t* test.

body mass index (BMI), surgery type (total knee arthroplasty vs total hip arthroplasty; primary vs revision surgery), race, marital status, living status (alone vs with others), preoperative diagnosis, American Society of Anesthesiologists score. In addition, we recorded the total distance ambulated during the final hospital PT session, which generally took place the day of or the day preceding hospital discharge.

The corresponding medical and PT records were requested from each patient's SNF. If there was no response from the SNF, or if the requested file was incomplete, two additional attempts were made to collect the missing records or missing data. To be considered complete, the SNF file needed to contain the following items relevant to the study's primary outcomes: total distance ambulated on initial PT evaluation at the SNF, total distance ambulated on final PT evaluation at discharge from the SNF, length of stay at the SNF, and the primary insurance payer for the SNF visit. If after two attempts, any element remained missing from the record, the patient was then excluded from the study. Four patients were also excluded for the following reasons: (1) the patient was discharged from the SNF without having participated in any PT (3 patients) and (2) the patient was readmitted to the hospital before any PT took place (1 patient).

Study outcomes

We analyzed four primary outcomes in this study. (1) We measured the total distance ambulated at three different time points in the post-TJA journey: hospital discharge, SNF admission, and SNF discharge. Comparisons were made between Medicare and MC patients at each time point to determine if there were differences based on insurance payer. (2) Comparisons were then made between the distance ambulated at hospital discharge vs SNF admission, as well as hospital discharge vs SNF discharge. The purpose of this analysis was twofold: first, to demonstrate if patients exhibited significant reductions in gait training achievements between hospital discharge and SNF admission, and secondly to demonstrate if they made significant improvements in gait training during the SNF visit beyond that which was acquired by hospital discharge. (3) The average decline in distance ambulated in the interval between hospital discharge and SNF admission was then calculated, and again comparisons were made based on insurance payer. (4) Regression analysis was then performed between two different SNF outcomes (SNF length of stay, distance ambulated on SNF discharge) and the percent decline in distance ambulated during the hospital discharge-SNF admission interval. This was performed to determine if greater declines in gait training achievements were correlated with poorer functional outcomes during the SNF visit.

Table 4
Comparison of average decline in distance ambulated (feet ± SD) between Medicare and MC groups in the interval between hospital discharge and SNF admission.

Insurance	Average decline	*P* value[a]
All	76.9 ± 107.7	
Medicare	94.6 ± 123.2	.011
MC	40.0 ± 48.9	.034[b]

SD, standard deviation.
[a] Medicare vs MC.
[b] One-way analysis of covariance was used to adjust for between-groups differences in age, body mass index, and distance ambulated at hospital discharge.

Statistical analysis

A 1-way analysis of covariance was used to measure the association between insurance status (Medicare vs MC) and the following outcomes: total distance ambulated on hospital discharge, SNF admission, and SNF discharge; average decline in distance ambulated between hospital discharge and SNF admission. Because older age and obesity are previously-reported factors known to influence rehabilitation after TJA, statistical adjustments were made when necessary using age and BMI as covariates in the analysis of covariance [25-27]. A 2-tailed, paired samples *t* test was used to compare the distance ambulated between hospital discharge vs SNF admission, and hospital discharge vs SNF discharge. Each analysis was carried out with the full complement of the study's sample size ($n = 80$). Data were analyzed using IBM SPSS Statistics 23 (International Business Machine Corporation, Armonk, NY).

Results

A total of 80 patients were enrolled; 54 of them used Medicare and 26 of them used MC as the primary payer for the SNF visit. Table 1 reports the demographic, clinical, and operative features of the patients included in the study. Medicare patients were significantly older than MC patients (*Medicare*: 71.4 ± 12.0 years, *MC*: 63.5 ± 8.0 years, $P = .004$). However, MC patients had significantly greater BMIs (*Medicare*: 30.1 ± 7.1 kg/m^2, *MC*: 34.2 ± 6.0 kg/m^2, $P = .01$). To account for these differences, all subsequent comparisons between Medicare and MC patients were performed with adjustments made for age and BMI as noted. The two groups did not significantly differ with respect to gender, race, marital status, living status, surgery type, preoperative diagnosis, American Society of Anesthesiologists score, or estimated blood loss (Table 1).

The average distance ambulated was recorded at three time points after TJA: hospital discharge, SNF admission, and SNF discharge (Table 2). Comparisons were then made between

Table 5
Correlation between SNF LOS (days ± SD) and percent decline (percent ± SD) in distance ambulated between hospital discharge and SNF admission.

Insurance	SNF LOS	Average percent decline	Pearson *r*	*P* value[a]
All	18.4 ± 15.3	52.9 ± 47.6	0.24	.03
Medicare	21.2 ± 17.4	60.5 ± 34.3	0.27	.05
MC	12.3 ± 6.6	36.9 ± 65.4	0.08	.72

LOS, length of stay; SD, standard deviation.
[a] Significance of correlation.

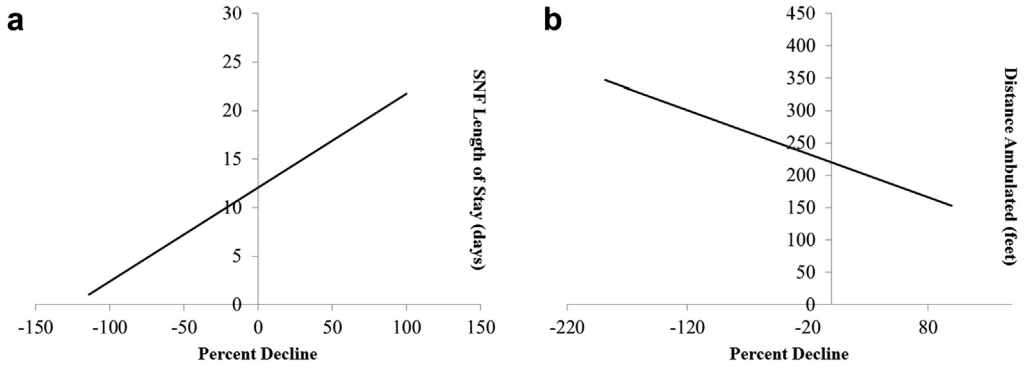

Figure 1. Linear regression comparing percent decline in distance ambulated between hospital discharge and SNF admission with (a) SNF length of stay and (b) distance ambulated at SNF discharge.

Medicare and MC patients. There was no significant difference between the groups at any of these time points, including after adjustment for age and BMI. The average length of stay in the hospital did not significantly differ between groups (*Medicare*: 3.3 ± 1.3 days, *MC*: 2.9 ± 0.8 days, $P = .18$). Notably, however, there was a significant difference in SNF length of stay between Medicare and MC patients (*Medicare*: 21.2 ± 17.4 days, *MC*: 12.3 ± 6.6 days, $P = .01$), consistent with prior studies [24]. Differences in early postoperative ambulation could conceivably account for some difference in distance ambulated at future time points [28]. For this reason, subsequent comparisons between Medicare and MC groups also adjusted for distance ambulated at hospital discharge where appropriate.

In Table 3, a comparison was made between the average distance ambulated at hospital discharge and SNF admission, then between hospital discharge and SNF discharge. Patients were found to exhibit significant reductions in distance ambulated between hospital discharge and SNF admission in both groups ($P < .001$). However, only the MC group made significant improvements in average distance ambulated between hospital discharge and SNF discharge, whereas the Medicare group did not ($P_{Medicare} = .28$, $P_{MC} = .003$).

The average decline in distance ambulated between hospital discharge and SNF admission was subsequently calculated for Medicare and MC groups (Table 4). Medicare patients exhibited a significantly greater decline in distance ambulated than MC patients, even after adjustments were made for potential differences in baseline ambulation at hospital discharge (*Medicare*: 94.6 ± 123.2 ft, *MC*: 40.0 ± 48.9 ft, $P = .034$). A post-hoc analysis was then carried out to compare the decline in distance ambulated in patients who first received SNF PT on the same day as hospital discharge ("SNF Day 0") vs the day following hospital discharge ("SNF Day 1"). Twenty-two patients first ambulated on SNF Day 0, 49 on SNF Day 1, and the remainder on SNF Days 2 or 3. Patients who ambulated on SNF Day 0 experienced a significantly greater loss in distance ambulated compared with those who did first PT on SNF Day 1 (*Day 0*: 89.1 ± 88.8 ft, *Day 1*: 50.6 ± 56.5 ft, $P = .03$).

Table 6
Correlation between distance ambulated at SNF discharge (feet ± SD) and percent decline (percent ± SD) in distance ambulated between hospital discharge and SNF admission.

Insurance	Distance ambulated	Average percent decline	Pearson *r*	*P* value[a]
All	173.1 ± 119.3	52.9 ± 47.6	0.26	.03
Medicare	157.2 ± 94.2	60.5 ± 34.3	0.10	.47
MC	204.2 ± 154.9	36.9 ± 65.4	0.31	.15

SD, standard deviation.
[a] Significance of correlation.

A correlation was measured between SNF length of stay and the average percent decline in distance ambulated between hospital discharge and SNF admission (Table 5). There was a significant correlation between greater declines in distance ambulated and longer lengths of stay at the SNF ($r = 0.24$, $r^2 = 0.06$, $P = .03$, $n = 80$). When patients were subdivided by insurance payer, this correlation approached significance ($r = 0.27$, $r^2 = 0.07$, $P = .05$, $n = 54$) for the Medicare group and failed to reach significance in the MC group. The corresponding linear regression for all patients is depicted in Figure 1a.

A separate correlation was measured between the average distance ambulated on SNF discharge and the average percent decline in the hospital discharge-SNF admission interval (Table 6). Again, there was a significant correlation between greater declines in distance ambulated and shorter distances ambulated on SNF discharge ($r = 0.26$, $r^2 = 0.07$, $P = .03$, $n = 80$). When patients were subdivided by insurance type, the correlation was not significant in either group. The corresponding linear regression for all patients is depicted in Figure 1b.

Discussion

This study set out to determine the long-term consequences of the loss in functional skill exhibited by post-TJA patients between hospital discharge and admission to the SNF. We first affirmed that patients experience an approximately 40% drop-off in gait training achievements between the last hospital PT session and the first SNF PT session, consistent with prior studies [23]. The present study also demonstrated that the decline in ambulation was significantly greater in patients with Medicare than patients with MC, even after adjustments were made for differences in patient factors and baseline ambulation. Moreover, while patients with MC made significant improvements in gait performance by SNF discharge as compared with hospital discharge, Medicare patients did not despite their significantly longer lengths of stay. Greater reductions in distance ambulated between hospital discharge and SNF admission were also found to significantly correlate with longer lengths of stay at the SNF and poorer gait training achievements on SNF discharge. While this finding did not apply when patients were subdivided by insurance type, it may be that the subgroups were underpowered to find a significant correlation. The low *R*-squared values encountered in these correlations similarly suggest that linear regression may be inappropriate to fully account for the variability in SNF outcomes resulting from early functional deficits. Finally, there was no significant difference in distance ambulated at SNF discharge between Medicare and MC groups, although Medicare patients enjoyed a significantly longer average length of stay at the SNF (approximately 9 additional days).

Our findings are consistent with recent investigations that have scrutinized the cost-effectiveness, outcomes, and safety of PAC in the SNF. Up to 40% of the cost of a single episode of TJA is attributed to post-hospital discharge care, with SNFs receiving a 45% share of the postdischarge bundle [5]. With the growing use of TJA and an increasingly elderly and obese national demographic, PAC has put a significant strain on the Medicare program. Fifteen percent of the Medicare budget is now allocated to PAC, of which SNFs receive 29 billion dollars annually [29,30]. The substantial cost burden of PAC in the SNF prompted MedPAC in 2016 to advise that the US Congress freeze payments to SNFs for the next 2 years [29]. In prior iterations, MedPAC's annual reports included a recommendation that therapeutic services at SNFs be reimbursed based on patient characteristics rather than the quantity of services provided [8,29]. This was done out of a recognition that therapy-related services at the SNF were unnecessarily being provided to Medicare patients, and as a result, the facility's revenue was disproportionately generated by patients covered by Medicare [8]. The cost concerns associated with SNF care, however, are secondary to patient safety and wellness. In that regard, the US Department of Health and Human Services recently demonstrated a 22% adverse event rate for Medicare beneficiaries at the SNF, of which nearly 60% were preventable [31].

Several patient-sided and SNF-sided factors may contribute to the loss in functional performance observed between hospital discharge and SNF arrival, along with its association with longer SNF lengths of stay and poorer functional outcomes. The transition between the hospital and SNF environments may be a challenge for many patients, resulting in a delay of acclimation to the new staff, facility, and resources. Patients in this study who participated in SNF PT on the same day they were discharged from the hospital exhibited a greater loss in motor function as those who participated in PT on the day following hospital discharge. A day of rest following hospital discharge may therefore alleviate a portion of the fatigue and weariness incurred by travel to a new setting. In addition, lower therapy intensity after TJA is associated with worse functional outcomes and longer lengths of stay [32]. A study by DeJong et al. showed that post-TJA patients at SNFs receive less intense PT compared with patients who attend IRFs [14]. Other factors may include fewer medical and therapeutic resources in the SNF, less nursing supervision, and less physician involvement than in the inpatient setting [19,22,33,34]. However, taken together these explanations fail to adequately address the variations observed in this study between patients covered by Medicare vs MC. We raise the possibility that differences in reimbursement policy and resource utilization management by the insurance carriers may instead be primary factors involved in long-term SNF outcomes.

This study had several limitations. First, the study sample was limited to 80 patients who attended SNFs in the state of California. Medicare reimburses rural and urban facilities at different rates, suggesting that facility practices may differ across various geographic settings [35]. Future efforts may therefore aim to enroll a larger sample population with greater geographic diversity than that included here. In addition, functional performance in our patients was represented by a single parameter, distance ambulated, which was the PT outcome most consistently reported by the different SNF sites. Although achievement in gait training likely correlates well with other physical and occupational measures, it does not serve as a substitute for a patient's comprehensive and global rehabilitation. We therefore encourage Medicare to require the reporting of Functional Independence Measure (FIM) scores by SNFs as it does for IRFs [22]. In addition, the accuracy of gait training achievements in SNF documentation has, to our knowledge, not been verified in academic literature. These data were, therefore, taken at face value when reported by SNFs, allowing the potential for institutional measurement bias. However, the large number of SNFs included in this study (29 sites) may ameliorate biases introduced by different institutional recording practices. Finally, our study failed to measure a difference in comorbidity status between Medicare and MC patients. Given the Medicare group's older age, differences in functional outcomes could in part be attributed to debilitations resulting from concomitant medical illness.

Conclusions

Care at SNFs after TJA is appropriate for many patients, particularly for the elderly who live alone or suffer medical comorbidities. SNFs fulfill a variety of extended patient requirements including medical, skilled nursing, occupational, and physical needs, and as such will maintain a prominent position within the evolving paradigm of value-based payment strategies (ie, bundled payments). The purpose of this study was to critically assess functional achievements of PT in the SNF, comparing the influence of insurance payer on outcomes. Early and progressive ambulation is a mainstay of post-TJA rehabilitation [36]. In this study of post-TJA patients admitted to SNFs, greater losses in functional performance between hospital discharge and SNF admission were associated with worse outcomes at the SNF. These losses may have a lasting adverse impact on a patient's therapeutic progress at the SNF, as extra time may be needed to regain and improve on the patient's prior level of performance. Moreover, these losses were more pronounced in Medicare patients, and appeared to have a greater impact on long-term performance, as Medicare patients failed to make significant improvements in gait training during their SNF visit compared with what was achieved in the hospital. Taken together, these results challenge the quality of therapeutic achievements made by SNF patients, particularly those with Medicare, in the days and weeks following TJA. Further larger scale studies are needed to evaluate the true functional benefits of prolonged stays at SNFs after TJA surgery.

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