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Nothing to SNF At: Evaluating and Intervention to Reduce Skilled Nursing Home (SNF) Length of Stay

Andrea Frazier, Presence Health, Chicago, IL

ABSTRACT

Length of stay (LOS) in skilled nursing facilities (SNF) is a driver of high health care costs, particularly form Medicare patients. This study used survival analysis techniques to examine the effect of a simple intervention (educating providers and case managers on expected LOS for each patient, as determined by national benchmarks) on SNF LOS. This paper also considers techniques used to abet particular data collection challenges in the study.

INTRODUCTION

Continuity of care from a hospital encounter to a Skilled Nursing Facility (SNF) stay is crucial for patients (Herndon, Kurapati, Rutherford & Vecchioni, 2012); proper execution of the transition from hospital to SNF affects patients' health outcomes, satisfaction, and future utilization of health care (Coleman, Smith, Frank, Min, Parry & Kramer 2004). Nearly one quarter of Medicare beneficiaries discharged from hospitals to skilled nursing facilities are readmitted to an acute care setting within 30 days (Mor, Intrator, Fenz, & Grabowski, 2010). The Agency for Healthcare Research and Quality (AHRQ) estimates at least 20% of Medicare beneficiary hospitalizations end in a transfer to a SNF (AHRQ, 2017). Thus, length of stay in SNF is a strong driver of healthcare costs, particularly for patients in Medicare populations. Excess days in institutional settings also negatively impact patient satisfaction and quality of life.

In 2015, a hospital in suburban Chicago analyzed post-hospitalization SNF length of stay for Medicare members assigned to a Medicare Accountable Care Organization (ACO). Members discharged to SNF from this hospital were found to spend 30% more days in SNF than patients discharged from comparable hospitals in the region; for the most frequently utilized clinical categories, length of stay in SNF consistently exceeded Milliman Care Guidelines recommendations for the category.

Clinical Category	Average length of stay in SNF, prior to pilot program	% Excess of Clinical Category benchmark
Hip Arthroplasty	37	94.7%
Febrile Illness	39	56.0%
Pyelonephritis, Acute	39	44.4%
Knee Arthroplasty, Total	26	73.3%
Heart Failure	34	47.8%

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: Average length of stay in comparison to Milliman benchmark, Top 5 Clinical Categories, prior to launch of pilot program

In response, the hospital launched a pilot program for members of the Medicare ACO who were discharged from acute care to SNF. In this program, case managers maintained contact with the receiving SNF, explaining the Milliman Care Guideline for SNF length of stay (LOS) based on the

patient's clinical category, and reminding staff at the facility of these expectations as the stay approached the expected SNF LOS.

A preliminary analysis suggested SNF LOS was lower for patients whose case manager discussed expected length of stay with the receiving SNF; however, this analysis did not take into account patient demographic differences and clinical information such as diagnosis and severity, and could not consider stays with missing discharge information. Further analysis of this data, controlling for patient demographics and other factors, was necessary to isolate the efficacy of this intervention from other variations in the patient population. Additionally, exclusion of open stays and those with missing data limited and skewed the set of observations; a more robust analysis, with techniques that incorporated censored data, was required to understand the full impact of the pilot program.

METHODS

DATA

Data were from records maintained by Presence Health Case managers at PSJMC, as well as claims data for Medicare Value Partners members attributed to Presence Health. Approximately 8 months' worth of records were available at the time of the study; three months prior to the case management intervention and five months after establishing the protocol for case management intervention.

Case managers recorded patient demographic information, the presence or absence of several case management interactions while in hospital, the expected SNF LOS from the Milliman Care Guidelines, the receiving SNF, and the SNF admission and discharge dates. Due to lags in claims processing, we were unable to match all stays to paid claims data; information about comorbid conditions and procedures in-hospital would have enriched the study.

One SNF in the region refused to communicate with case management staff at the hospital regarding expected SNF LOS; patients discharged to that SNF were excluded from the analysis. Records with missing SNF admission dates, or missing patient information, were excluded from the analysis. SNF LOS was capped at 101 days; SNF days without a discharge date, but less than 100 days' duration as of October 31, 2015 (the end of the data collection period), were right censored.

STUDY DESIGN

The case management intervention was intended to decrease the excess length of stay in SNF. Therefore, survival analysis was used to model data describing time to SNF discharge—that is, the "event" was the discharge from SNF; the time-to-event is the SNF LOS. Because our data contained stays without a discharge date, it was necessary to choose procedures that appropriately handle censoring.

In our first analysis, we used PROC LIFETEST to stratify by pre-pilot and pilot-program phases. This test indicated that the proportion of "short" SNF stays remained about the same in both phases, but that longer stays had a shorter LOS in the pilot-program phase. We next wished to analyze whether that difference was significant, and to identify drivers for that reduction in LOS.

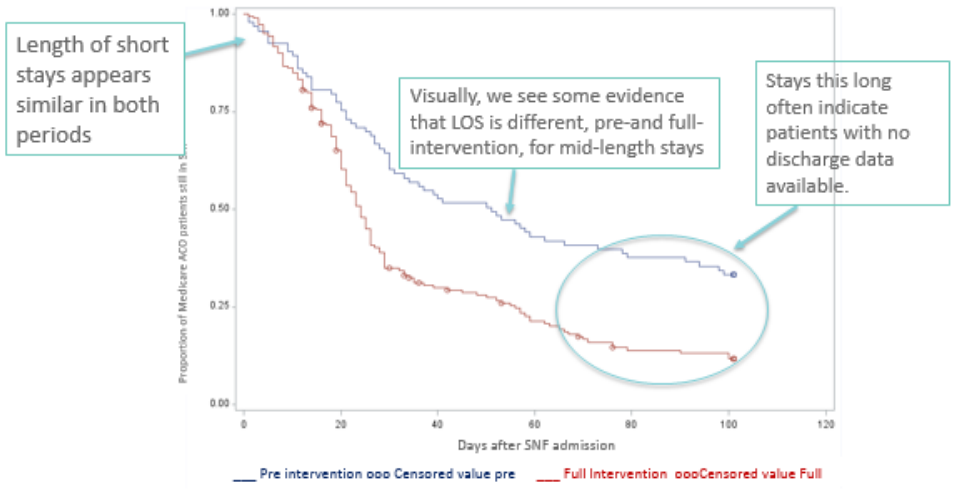
Cox proportional hazards regression models are a type of survival analysis that allows for stratification of subsets data, such as patients discharged to the same Skilled Nursing Facility or with diagnoses in the same clinical class; Cox models also allow for the inclusion of multiple covariates; covariates may be either continuous or categorical. For our second analysis, we used PROC PHREG to perform a regression analysis of survival data based on the Cox proportional hazards model, which allows for the inclusion of additional covariates.

ANALYSIS AND RESULTS

First, we investigated whether the censored data continued to indicate difference in LOS, pre-pilot and during the pilot program:

```
proc lifetest data=SNF_Tracker plots=(s, h, ls, lls);
outsurv=A_Intervals;
  time snf_los1*censored(1);
```

```
    strata snf_admit_mo (6);
run;
```



Display 1. Length of Stay in SNF, stratified pre-intervention (before pilot program) and post-intervention (during pilot program)

Our findings indicated that SNF stays terminated earlier in pilot program period, particularly for mid-length stays. Seeing evidence of a difference in the two periods, we wished to understand the drivers for that change; we considered several models, but concluded that the only drivers of potential significance were participation in the pilot program, age, and gender (note that not all models indicated that gender was a significant factor):

```
proc phreg data=SNF_Tracker;
class snf_admit_post;
  MODEL snf_los1*censored(1) = snf_admit_post age female /ties=exact;
    strata snf_admit_mo (6);
run;
```

We considered reducing the 100-day cap on SNF LOS (while Medicare's 100-day rule allows for the possibility of stays of this length, stays in SNF are generally of shorter duration), but models with caps at *x*=30,45, 60, and 100 days all indicated that the hazard of remaining in SNF past day *x* during the pilot program period was roughly half the hazard for those in SNF during the period prior to the pilot program. By contrast, in these models, each year of age increased the hazard by 1-3%; female gender reduced the hazard by modest amounts.

Variable	Parameter Estimate	SE	p-value	Hazard Ratio
Pilot Program Participation	-0.679	0.155	<.0001	0.057
Age	0.020	0.008	0.0151	1.020
Gender	-0.274	0.142	0.0545	0.760

Table 2: Parameter estimates for estimated effects

DISCUSSION AND LIMITATIONS

Data for this study was obtained from spreadsheets manually maintained by case management staff. Such data is prone to entry errors, though we attempted to validate information when claims data was available. In addition, SNF discharge information could only be obtained from SNFs willing to participate in the pilot program—one SNF in the region consistently refused to cooperate with hospital case management staff and was dropped from the study.

In studies of medical data, seasonality is often a concern. Because of the limited time frame of the pilot program, we could not control for seasonal variations in length of stay. Age and gender were included among the covariates to control for severity of cases; ideally DRG or similar condition grouping could be used to more robustly include severity.

Finally, the models used do account for the presence of censored data, but in this model censoring has two potential causes in the pilot program period, and only one cause in the period prior to the pilot program.

CONCLUSION

Survival analysis techniques suggest a reduction in SNF LOS when the case management protocol was followed, even after controlling for patient differences.

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CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the author at:

Andrea Frazier
Presence Health
andrea.frazier@presencehealth.org