Please note that the Original Project Title: Comparing Length of Stay, Rehabilitation Services Utilization in Medicare Advantage versus Traditional Medicare Fee- For Service Beneficiaries with Hip Fracture in Skilled Nursing Facilities.

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Amit Kumar, a postdoc fellow, presented his research ideas and hypothesis in our regular research meeting funded by NIA.

Background
One in three Medicare enrollees received their insurance benefits through Medicare Advantage (MA) plan. After the passage of Medicare Modernization Act, there is a rapid increase in MA enrollment and use of skilled nursing facilities (SNF) for post-acute rehabilitation services compare to inpatient rehabilitation facilities. Previous studies examining utilization of rehabilitation services and the quality of care have focused either in capitated or fee-for-service payment systems. However, there is no information about the rehabilitation quantity, quality, and outcomes of care among MA patient staying in SNF. The Office of Inspector General reported that SNFs upcode the Medicare fee-for-service (FFS) patients into higher payment RUGs categories, leading to more hours of therapy without a substantial rise in case-mix (age and diagnoses at admission were largely unchanged from 2006 to 2008). It is unknown whether this inappropriate selection of higher paying RUG and therapy group in SNFs affecting MA patients or not and how it influences the outcome in these two groups. MA plans are known for treating patients with greater efficiency and coordination of care, minimizing excessive utilization.

Our group has recently published a paper about rehabilitation service utilization in patients with hip fracture among Medicare FFS beneficiaries. Jung et al. reported that there is an increase in the quantity of therapy among fee for service patient with a hip fracture without change in case mix at SNF admission. Amit Kumar decided to extend this research in MA population and comparing with traditional FFS patients.

Initially, we thought of using MDS-3 assessment completed on all Medicare- or Medicaid-certified nursing home residents irrespective of their insurance status. However, after doing more research, literature review, we found that hospitals receiving a disproportionate share or educational training payments and supplements submit claims for MA members. Therefore, we decided to use inpatient claims for retrieving hospital related information.

We would like to answer three clinically relevant questions. First, are there differences in the amount of rehabilitation therapy received by MA and FFS beneficiaries discharged from hospitals to SNF with hip fracture? Second, is there a difference in the length of SNF stay between MA and FFS beneficiaries? Third, how do health outcomes such as functional improvement, hospital readmission, and successful discharge to the community will differ between MA and FFS patients in SNF?

First Draft -Specific Aims

1. Evaluate the differences in post-acute rehabilitation services utilization (physical therapy, occupational therapy) in older patients enrolled in Medicare health maintenance organizations (HMOs) and fee-for-service (FFS) systems during a short stay in skilled nursing facilities (SNFs).
2. Compare the differences in patients centered outcome associated with amount of rehabilitation services utilization during a short stay in skilled nursing facilities (SNFs).

Working hypothesis: FFS patients will be receiving more rehabilitation care and staying longer in the SNF, and will have better outcomes.

Timeline

Activities	Year - 2016		Year - 2017									
	Nov	Dec	Jan	Feb	March	April	May	June	July	August	Sept	Oct
Research & Brainstorming	■	■										
Literature review	■	■										
Data Retrieval Analytical cohort			■	■								
Statistical analysis and interpretation					■	■						
Draft Proposal					■	■						
Discuss results with clinician and coauthors					■	■						
Present the results in Annual PO meeting							■					
Preparation of manuscript							■	■				
Submission of manuscript									■	■	■	■

Methods

Study Sample: We will select patients with a hip fracture for this study because this is an acute condition that commonly occurs in frail older adults and receives rehabilitation care in the SNF.

Dataset: MedPAR - Inclusion Criteria, Year: January 2011 through June 2015
Patients admitted to hospital with hip fracture
MS-DRG codes: 533, 534, 535, and 536
Primary ICD-9-CM diagnostic codes: 82000, 82021, 82022, 82023, 82024, 82026, 82027, 82028, 82029, 82030, 82031, 82032, 8208, 82080, 82009, and 8080
Age ≥ 65 years
Patients from hospital with no information on disproportionate share
Length of stay less than 15 days
Discharged to only SNF
Admitted to SNF within 3 days of discharge from hospital
Merge with American community Survey
Exclude previous nursing home stay in past twelve months
Exclude previous hospitalization in past twelve months

Dataset: MDS-3 - Inclusion Criteria
First-time SNF admissions from acute care hospitals identified on the basis of the presence of an MDS admission assessment tracking record
Include short term and long-term stay
Patients must have at least two assessments.
Patients must have first MDS assessment within 10 days of admission to SNF
Patients must have at least second or subsequent MDS (last) assessment within 10 days of discharge from SNF or any assessment.
Exclude Patients in coma
Exclude patients' with any missing information on variables
Exclude patients' with extreme therapy minutes and outliers
Exclude patients' from Hawaii, Virgin Island, and Puerto Rico

Since 2008, the MedPAR file contains claims information on MA enrollees receiving care in disproportionate share hospitals (DSH) and Indirect Medical Education or Direct Medical Education adjustments. Therefore, our study cohort will be limited to patients discharged from these hospitals.

Data Sharing: Please note that the person-level data for this study (i.e., MDS, MBSF, MedPAR, and HEDIS) are covered under the strict terms of a Data Use Agreement (DUA) with the Centers for Medicare and Medicaid Services (CMS). We are prohibited from making any person-level data file, no matter how de-identified, available. However, researchers interested in replicating the results of these analyses may enter into their own DUA with CMS. See the Research Data Assistance Center (ResDAC) at www.resdac.org for assistance. The OSCAR/CASPER provider level data and zip-code level data from the American Community Survey are available for purchase/download and links to more information are provided below.

Data Source	Variables	link
Medicare Provider and Analysis Review (MedPAR)	Types of Fracture, Hospital length of stay, ICU, HCC score, hospital acquired conditions, and fracture management using ICD-9 procedure codes.	https://www.resdac.org/cms-data/files/medpar-rif
Master Beneficiary Summary File (MBSF)	Demographic Information: age, sex, race, marital status, Enrollment information: FFS, MA, dual eligibility Date of death	https://www.resdac.org/cms-data/files/bsf
Minimum Data Set (MDS 3.0)	Admission and Discharge ADL, Admission Pain Status, Cognition, Pain, BMI	https://www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/Minimum-Data-Set-3-0-Public-Reports/index.html Long Term Care Minimum Data Set 3.0 https://www.resdac.org/cms-data/files/mds-3.0
Online Survey, Certification, and Reporting System (OSCAR)	SNF Characteristics and Staffing Pattern: Profit status, part of chain, Total RN/LPN FTE, PT-FTE, OT-FTE, MD-FTE	http://www.longtermcareinfo.com/data/casper-and-oscar.php
Healthcare Effectiveness Data and Information Set (HEDIS)	Capture readmission for MA patients 'if patients will readmit to non- DSH hospitals	https://www.resdac.org/cms-data/files/hedis-puf
American Community Survey	Zip code level median household income and education.	https://www.census.gov/programs-surveys/acs/
Residential History File (RHF)	Successful discharge to the Community	RHF create a per-person chronological history of health service utilization and location of care within a pre-specified calendar using Medicare claims and post-acute assessment data.

Primary Independent Variable
1. Measure of Rehabilitation Therapy; Physical therapy (PT) and Occupational Therapy (OT)
OT/PT Individual Minutes Number: The data in this column indicates the total number of minutes that physical therapy was administered to the resident in the last seven days.
OT/PT Concurrent Minutes Number: The data in this column indicates the total number of minutes that physical therapy was administered to the resident concurrently with one other resident in the last seven days.
OT/PT Group Minutes Number: The data in this column indicates the total number of minutes that physical therapy was administered to the resident as part of a group of residents in the last seven days.

We will have an average mean number of minutes of therapy per week, on the basis of the 7-day retrospective period and all assessments from the entire SNF stay. We will sum total number of individual minutes, concurrent minutes, and group minutes for PT and OT services across all MDS assessment records during patients' entire SNF stay. Since most stays will be less than 40 days, we will calculate minutes of therapy received in the first 40 days of SNF stays. Further, we will compute average daily minutes per day by dividing the total number of therapy minutes from the SNF length of stay up to 40 days.

2. SNF Length of stay will be defined as calendar days from admission to discharge using MDS admission and discharge records. We will follow-up to 180 days in the SNF.

Dependent Variables
Function: Functional status will be measured using seven ADL items into a 28-point scale with 0 indicating independence and 28 indicating total dependence. Change in functional status will be computed by subtracting admission from discharge scores; negative scores will be reversed to be positive to improve understanding. The more positive score the greater the improvement.

Hospital Readmission (yes/no): We will use all-cause readmission to the hospital within 30 days following discharge from the index hospitalization. Because MA enrollees may be readmitted to a non-DSH hospital which may not submit claims to Medicare, so we will merge the MedPAR and HEDIS files to estimate the 30-day hospital readmission for MA enrollees.

Long-stay resident (yes/no): SNF patient will become a long-stay nursing home resident, if they will stay in a nursing home more than 100 days.

Successful Discharge to the community (yes/no): Successful discharge from SNF will be defined as being discharged to the community within 100 days of SNF admission and remaining alive in the community without being institutionalized in any acute and post-acute settings for at least 30 days. We will link MDS with MedPAR and HEDIS files to estimate the Successful discharge to the community.

Statistical Analysis

There are some evidence showing cherry picking of healthier beneficiaries in MA plans and sicker patients switching from MA to FFS. There might be a level of endogeneity in the selection of MA enrollees. We anticipated that MA and FFS beneficiaries might differ with respect to demographic, clinical, and socioeconomic characteristics. To account for differences in observed demographic and clinical characteristics between FFS and MA, we will generate a propensity score that will reflect the probability of individuals to be in MA versus FFS program using observable baseline characteristics. Propensity score model will include age, gender, race, marital status, length of stay in the hospital, number of days in the intensive care unit, fracture treatment, number of comorbidities, admission cognition, body mass index, hospital-acquired complications, HCC score, dual Medicare/Medicaid status, median household income, household education and state fixed effects. After that, Inverse Probability of Treatment Weighs (IPTW) will be generated from the propensity scores to balance the differences in patient demographic and clinical characteristics.

We will compare baseline characteristics between FFS and MA using chi-square tests for categorical variables and t-tests for continuous variables then weights were applied to calculate weighted rates and mean. First, we will use linear probability model without applying IPTW to compare the difference in outcomes between MA and FFS and then we will use IPTW. After that, we will use a linear probability model to compare outcomes between FFS and MA patients after applying IPTW and SNF fixed-effect.

Reviewer feedback: We will estimate logistic regression models to compare the binary outcome variables: 30-day hospital readmission, becoming a long-stay resident and successful discharge to the community.

Recommended Tables

Table 1. Characteristics of Medicare Fee-For-Service versus Medicare Advantage Patients with Hip Fracture before and after Inverse Probability of Treatment Weighting.

Variables	Unadjusted		IPTW-adjusted	
	FFS	MA	FFS	MA
Age				
Female				
Married				
Race				
White				
Black				
Hispanic				
Others				
Dual				
Safety-net Hospitals %				
Hospital Length of Stay				
Intensive Care Length of Stay				

HCC Score (Comorbidity Index)				
Hospital Acquired Conditions %				
Fracture Treatment				
Open Reduction Internal Fixation				
Close Reduction Internal Fixation				
Internal Fixation				
Partial Hip Replacement				
Total Hip Replacement				
Non-Surgical Management				
Body Mass Index				
Admission ADL				
Admission Pain Status				
Cognition				
Intact				
Mild Impairment				
Moderate Impairment				
Severe Impairment				
SNF Characteristics % and Staffing (mean ± SD)				
For Profit				
Part of Chain				
Total RN/LPN FTE				
Total PT- FTE				
Total OT-FTE				
Total MD-FTE				

Cognition categories: Measured by the Cognitive Function Scale (CFS) using Cognitive Performance Scale (CPS) and Brief Interview for Mental Status (BIMS) from MDS admission assessment. Pain categories: If patient is having pain that affects sleep and functional activity in last 5 days Admission ADL score ranges from 0 - 28 (higher scores indicate more impairment). Full-time equivalent (FTE): 35 hours'/ week work in the SNF as a staff or on contract.
Abbreviation: FFS- Fee-for-Service; MA- Medicare Advantage; SNF- Skilled Nursing Facilities; HCC- Hierarchical Condition   Category; ADL- Activities of Daily Living; SD- Standard Deviation; IPTW- Inverse Probability of Treatment Weighting; FTE- Full-Time Equivalent; Total RN/LPN FTE- Total number of full-time equivalent Registered Nurse and Licensed Practical Nurse; Total PT- FTE- Total number of full-time equivalent Physical Therapist; Total OT- FTE- Total number of full-time equivalent Occupational Therapist; Total MD- FTE- Total number of Full-time Physician.
**p<0.01, *p<0.05

Table 2: Length of Stay and Amount of Rehabilitation Care in Medicare Fee-For-Service versus Medicare Advantage Patients

	Unadjusted			Adjusted	
	FFS	MA	Differences based on linear probability model (95% CI) [p-value]	Differences after IPTW-Adjusted based on linear probability model (95% CI) [p-value]	Differences after IPTW-Adjusted SNF Fixed Effect (95% CI) [p-value]
SNF Length of Stay Mean (SD) [median]					
Rehabilitation Therapy (Minutes) Mean (SD) [median]					
Total Physical Therapy					
Total Occupational Therapy					
Total Rehabilitation Therapy					
Rehabilitation Therapy/Day					

Note: SNF Length of Stay: follow-up to 180 days. Total Therapy: Sum of therapy minutes (Independent + Concurrent + Group) administered to the resident up to 40 days. Total Rehabilitation Therapy: Combined Occupational therapy + Physical therapy minutes. Rehabilitation Therapy/day: Total Rehabilitation therapy divided by length of stay up to 40 days.

Table 3: Patients Outcomes in Medicare Fee-For-Service versus Medicare Advantage Patients before and after Inverse Probability of Treatment Weighting and SNF Fixed Effect.

			Unadjusted		Adjusted		
	FFS	MA	Differences based on linear probability model (95% CI) [p-value]	Odds Ratio based on logit model (95% CI) [p-value]	Differences after IPTW Adjusted based on linear probability model (95% CI) [p-value]	Odds Ratio based on logit model (95% CI) [p-value]	Differences after IPTW-Adjusted SNF Fixed Effect [p-value]
Change in ADL							
30-Day Hospital Readmission %							
Became Long-Stay Resident %							
Successful Discharge to Community %							

Notes: Change in ADL: (Discharge ADL - Admission ADL) and the score was reversed in positive for better understanding. Higher score in ADL change indicates greater improvement in functional status. Long Stay Resident: Stayed more than 100 days. Successful Discharge to the Community: Discharge to community within 100 days in SNF followed by uninterrupted 30 days stay in Community/home/home health.

Table Number	Analytical Code: Program - STATA

/Outcomes	
Table 2 - SNF Length of Stay	reg nhlos hmo_nhadm, cluster(accpt_id) reg nhlos hmo_nhadm [w=iptw], cluster(accpt_id) areg nhlos hmo_nhadm [w=iptw], absorb(accpt_id) cluster(accpt_id)
Table 2 - Total Physical Therapy Minutes	reg cth_ptmin hmo_nhadm, cluster(accpt_id) reg cth_ptmin hmo_nhadm [w=iptw], cluster(accpt_id) areg cth_ptmin hmo_nhadm [w=iptw], absorb(accpt_id) cluster(accpt_id)
Table 2 - Total Occupational Therapy Minutes	reg cth_otmin hmo_nhadm, cluster(accpt_id) reg cth_otmin hmo_nhadm [w=iptw], cluster(accpt_id) areg cth_otmin hmo_nhadm [w=iptw], absorb(accpt_id) cluster(accpt_id)
Table 2 - Total Rehabilitation Therapy Minutes	reg cth_min hmo_nhadm, cluster(accpt_id) reg cth_min hmo_nhadm [w=iptw], cluster(accpt_id) areg cth_min hmo_nhadm [w=iptw], absorb(accpt_id) cluster(accpt_id)
Table 2 - Rehabilitation Therapy/Day	reg tmday hmo_nhadm, cluster(accpt_id) reg tmday hmo_nhadm [w=iptw], cluster(accpt_id) areg tmday hmo_nhadm [w=iptw], absorb(accpt_id) cluster(accpt_id)
Table 3 - Change in Function ADL	reg adlgain hmo_nhadm, cluster(accpt_id) reg adlgain hmo_nhadm [w=iptw], cluster(accpt_id) areg adlgain hmo_nhadm [w=iptw], absorb(accpt_id) cluster(accpt_id)
Table 3 30-day hospital readmission	reg all_readmit30 hmo_nhadm if Death30==0, cluster(accpt_id) reg all_readmit30 hmo_nhadm [w=iptw] if Death30==0, cluster(accpt_id) areg all_readmit30 hmo_nhadm [w=iptw] if Death30==0, absorb(accpt_id) cluster(accpt_id) **Odds Ratio for 30-day readmission** logit all_readmit30 hmo_nhadm if Death30==0, cluster(accpt_id) or logit all_readmit30 hmo_nhadm [pw=iptw] if Death30==0, cluster(accpt_id) or
Table 3 Becoming longstay resident	reg longstay hmo_nhadm, cluster(accpt_id) reg longstay hmo_nhadm [w=iptw], cluster(accpt_id) areg longstay hmo_nhadm [w=iptw], absorb(accpt_id) cluster(accpt_id) **Odds Ratio for longstay resident** logit longstay hmo_nhadm, cluster(accpt_id) or logit longstay hmo_nhadm [pw=iptw], cluster(accpt_id) or
Successful Discharge to Community	reg sucomunity30 hmo_nhadm, cluster(accpt_id) reg sucomunity30 hmo_nhadm [w=iptw], cluster(accpt_id) areg sucomunity30 hmo_nhadm [w=iptw], absorb(accpt_id) cluster(accpt_id) **Odds Ratio for Successful Discharge to Community** logit sucomunity30 hmo_nhadm, cluster(accpt_id) or logit sucomunity30 hmo_nhadm [pw=iptw], cluster(accpt_id) o

Supporting Information- S1	
Six-Month Mortality	reg sixmortality hmo_nhadm, cluster(accpt_id)
	reg sixmortality hmo_nhadm [w=iptw], cluster(accpt_id)
	Odds Ratio for Six-Month Mortality
	logit sixmortality hmo_nhadm, cluster(accpt_id) or
	logit sixmortality hmo_nhadm [pw=iptw], cluster(accpt_id) or
One-year Mortality	reg onemortality hmo_nhadm, cluster(accpt_id)
	reg onemortality hmo_nhadm [w=iptw], cluster(accpt_id)
	Odds Ratio for One-year Mortality
	logit onemortality hmo_nhadm, cluster(accpt_id) or
	logit onemortality hmo_nhadm [pw=iptw], cluster(accpt_id) or

Programming Variables	Label
nhlos	SNF Length of Stay
hmo_nhadm	Insurance status (FFS versus MA)
accpt_id	SNF Provider number
ptmin hmo	Total Physical Therapy
cth_otmin	Total Occupational Therapy
cth_min	Rehabilitation Therapy/Day
adlgain	Change in ADL
all_readmit30	30-Day Hospital Readmission
longstay	Became Long-Stay Resident
sucomunity30	Successful Discharge to Community
sixmortality	Six-Month Mortality
onemortality	One-Year Mortality
iptw	Inverse Probability of Treatment Weighs