Impact of Frontloading of Skilled Nursing Visits on the Incidence of 30-day Hospital Readmission

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Abstract

Hospitalization among older adults receiving skilled home health services continues to be prevalent. Frontloading of skilled nursing visits, defined as providing 60% of the planned skilled nursing visits within the first two weeks of home health episode, is one way home health agencies have attempted to reduce the need for readmission among this chronically ill population. This was a retrospective observational study using data from five Medicare-owned, national assessment and claim databases from 2009. An independent randomized sample of 4,500 Medicare-reimbursed home health beneficiaries was included in the analyses. Propensity score analysis was used to reduce known confounding among covariates prior to the application of logistic analysis. Although whether skilled nursing visits were frontloaded or not was not a significant predictor of 30-day hospital readmission (p=0.977), additional research is needed to refine frontloading and determine the type of patients who are most likely to benefit from it.

Introduction

Hospitalization among older adults receiving skilled home health services continues to be prevalent. Nationally, 27% of Medicare-reimbursed home health recipients are hospitalized at some point while receiving home health services.[1] Hospitalization costs in 2010 for fee-for-service Medicare beneficiaries rose to $116 billion from $113 billion in 2009 and $106 billion in 2005.[2] It has been estimated that unplanned, and possibly preventable, hospitalizations costs $12 billion a year and that eliminating just 5.2% of preventable Medicare readmissions could save an estimated $5 billion annually.[3]

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While in its infancy, a growing body of evidence indicates that hospitalization among geriatric skilled home health recipients is most likely to occur within the first two weeks of the home health episode.[4-6] Specifically, the Home Health Quality Improvement Organization Support Center found, as reported by Vasquez, that among those hospitalized during the home health episode, 25% of patients are hospitalized within 7 days of admission to home health services[6]; 50.1% by 14 days[5]; and 58% by 21 days (cumulative).[6] These findings indicate the need to target services immediately following a hospital discharge and in the very beginning of the home health episode in order to reduce preventable readmissions.[7]

Like many other health care organizations in the United States, home health agencies and advocacy groups throughout the country have focused their efforts on reducing the need for 30-day hospital readmissions among Medicare beneficiaries. Frontloading of skilled nursing visits is one way home health agencies have attempted to reduce the need for readmission among this chronically ill population. Frontloading has been defined as providing 60% of the planned skilled nursing visits within the first 2 weeks of the home health episode.[8] Frontloading of skilled nursing visits is thought to allow clinicians to identify issues early-on and intervene before a readmission is needed. Results on the benefits of frontloading are particularly beneficial for those with heart failure decreasing readmission rates from 39.4% to 16%.[8] Conversely, the impact of frontloading was not effective for patients with diabetes.[8]

Despite limited evidence, frontloading for all diagnoses has been encouraged as one of 12 best practices aimed at reducing readmission among skilled home health recipients by the 2007 Home Health Quality Campaign (HHQC) and frontloading was also endorsed by the West Virginia Medical Institute.[4,9] The West Virginia Medical Institute is the Quality Improvement Organization, under contract with CMS, was charged with assisting health care providers in improving quality and safety and in developing innovative solutions that assure the quality and necessity of health care services.[10] To gain a better understanding of the benefits of frontloading, the purpose of this study was to evaluate the impact frontloading skilled home health nursing visits has on the incidence of 30-day hospital readmission among older adults receiving Medicare-reimbursed skilled home health services over a one-year period.

Frontloading of skilled nursing visits was operationalized by considering the findings of Bowles and colleagues who reported that, on average, skilled home health patients received nine skilled nursing visits during the home health episode.[11] Thus, five skilled nursing visits within the first 14 days of the home health episode was considered 60% of the total number of skilled nursing visits. We hypothesized that Medicare-reimbursed skilled home health recipients with frontloaded skilled nursing visits (5 or more skilled nursing visits in the first 14 days of the home health episode) would have a lower incidence of hospital readmission within 30-days of hospital discharge compared to those who received less than five skilled nursing visits within the first 14 days of the home health episode. It was hypothesized that client characteristics, including the hospitalization risk factors identified in the literature, home health agency tax identification status (for-profit vs. not-for-profit), and the intervention of frontloaded skilled home health nursing visits would impact 30-day

readmissions to the hospital (Table 1). The covariates employed in this study were derived from a review of the literature as being associated with risk of readmission among skilled home health recipients.[7]

Theoretical Framework

Mitchell and colleagues' Quality Health Outcomes Model (QHOM) guided this study (Figure 1).[12] The QHOM is a theoretical framework that relates multiple factors affecting quality of care to desired outcomes and consists of four components: system, client, interventions, and outcomes. Given the heterogeneity of the Medicare-reimbursed skilled home health population, the model suggests that health interventions, specifically frontloaded skilled nursing following a hospitalization, influence and are affected by the client (hospitalization risk factors), to produce positive or negative outcomes (readmission within 30 days of hospital discharge). This study was grounded in the QHOM by conceptualizing and examining the relationships between system components and the impact these factors had on 30-day readmission.

Methods

Study Design

This was a retrospective observational study using data from five Medicare-owned, national assessment and claim databases from 2009. Propensity score analysis was used to reduce known confounding among covariates. This study was approved using the expedited review procedure by the University's Institutional Review Board, Office of Regulatory Affairs.

Data Sets—The 2009 assessment and claims data sets were obtained from CMS, through the Research Data Assistance Center (ResDAC). Data originated from a five-percent sample of the Outcome Assessment Information Set (OASIS), the home health assessment required for CMS beneficiaries, then cross-referenced to the home health and hospital claims, eligibility and provider files. The data sets were comprised of the following: OASIS-B1[13]; Home Health Standard Analytic File (HHSAF)[14]; Medicare Provider and Analysis Review File (MedPAR) (short stay/long stay/skilled nursing facility)[15]; Denominator/Eligibility File[16]; Provider of Services File (POS).[17] The data sets contained the covariates, independent and dependent variables, related to skilled Medicare home health beneficiaries and home health agencies essential to address the study aims. Table 1 contains the specific variables supplied by each data set.

Sample—Beneficiaries were eligible for the study if they were admitted to home health within 30 days of a hospital discharge. After applying the first seven of eight exclusions, 50,160 beneficiaries remained. Of these beneficiaries, 15.4% (n=7,740) experienced a 30-day hospital readmission. However, beneficiaries who were readmitted to the hospital within the first 14 days of home health (n=5,268) were excluded from the analysis because frontloading was not possible. After removing those readmitted within the first 14 days, 44,892 eligible home health beneficiaries remained in the data set. Overall there were eight exclusion criteria applied to the data sets (Figure 2).The remaining home health beneficiaries

were divided into two groups, those who received 5 or more skilled nursing visits within the first 14 days (frontloaded) and those who received less than 5 (not frontloaded).

Managed-Medicare beneficiaries were excluded from the data set as home health claims data are not available for this population. The OASIS data set was the anchor data set to prepare the data files since having received home health during 2009 was required. Figure 2 depicts the preparation of the final analytic data file.

Power Analysis—Because the use of all eligible subjects in the analytic data file would lead to an overpowered study, a random sample of all eligible subjects was selected for this analysis. An adequately powered study is designed to detect both statistically and clinically meaningful differences in outcome between groups. The estimated sample size was based on a logistic regression model of rehospitalization on frontloading. Accordingly, a logistic regression of a binary response variable (Y=rehospitalization within 30 days of hospital discharge) on a binary independent variable (X=frontloading dichotomized) with a sample size of 4,468 subjects (of which 50% are assumed to be frontloaded, and 50% are assumed to not be frontloaded) achieves 80% power at a 0.01 significance level to detect a change in the probability of being hospitalized within 30 days of hospital discharge from the baseline value of 0.27 (27% hospitalized among subjects who were frontloaded) to 0.357 (~36% among subjects who were not frontloaded). This change corresponds to an odds ratio of 1.5. An adjustment was made assuming that a multiple regression of the independent variable of interest, frontloading, on the other independent variables in the logistic regression will obtain an R-Squared of 0.80 yielding a necessary sample size of 4,468 beneficiaries. Simple random selection of 4,500 eligible beneficiaries was accomplished using SAS™ version 9.3.

Variables

All variables employed in this study and their sources are listed in Table 1. The unweighted and weighted means, standard deviations, percentages and categories for all study variables are listed in Table 2. Statistics are shown for beneficiaries in both groups (frontloaded [FL] and not frontloaded [Not FL]).

Dependent Variable—The MedPAR file provided the dependent variable, the occurrence of 30-day hospital readmission measured as a hospitalization (yes/no) within 30 days of the initial hospital discharge.

Independent Variable—Frontloading of skilled nursing visits was operationalized as having five skilled nursing visits within the first 14 days of the home health episode as this was considered 60% of the total number of skilled nursing visits. Frontloading of skilled nursing visits was the dichotomous, independent variable and was defined as receiving 5 or more skilled nursing visits within the first 14 days of the home health episode.

Covariates (Matching Variables)—The OASIS, HHSAF or Provider of Services Summary contained the covariates included when deriving the propensity score. Several of the variables derived from the OASIS have a category of "unknown". This is not missing data, but is an option on the OASIS assessment where the clinician was unable to accurately

determine the appropriate answer at the time the tool was completed and is therefore considered an acceptable response (Table 2).[13]

Statistical Analysis

Propensity Score Analysis—In this type of study, random assignment to study group is not possible. Therefore, propensity score analysis[18] and matching methods[19] were conducted to control for differences between beneficiaries in the frontloaded and not frontloaded groups.[20]

Propensity score analysis is the conditional probability of receiving treatment, given the distribution of observed covariates.[19] It is a rigorous analytic method that controls for observed confounders that might influence group assignment[18] by reducing the confounding covariates into a single variable, the propensity score. The propensity scores were created using the covariates found in Table 2. Beneficiaries in each group were matched on these scores using the full-matching technique.[21] During propensity score analysis, frontloaded (treated) beneficiaries received a weight of 1 and non-frontloaded (control) beneficiaries received a weight proportional to the number of treated individuals in the matched set divided by the number of control beneficiaries in the set.[21, 22] These weights were then used in the logistic regression model in the statistical analyses.

Matching methods balance the distribution of observed covariates in the comparison groups (frontloaded vs. not frontloaded) imitating what would have occurred in a randomized control trial.[19] This controls for the observed confounders between the groups. Therefore, within the sample of frontloaded and non-frontloaded beneficiaries with similar propensity scores, both groups will have similar distributions of the observed covariates included in the propensity score (Table 1).[21]

Data Analysis—Following the propensity score analysis, propensity score weighted bivariate logistic regression models were used to regress 30-day hospital readmission on each individual variable using the SAS Proc Logistic procedure. Other than the primary predictor of interest, dichotomized frontloading, only covariates demonstrating significance at the p 0.05 level in the bivariate analyses were included in the final multivariate analyses.[23] Table 2 provides a comprehensive list of the independent variables considered in the simple logistic regression models. Correlation coefficients were generated to assess multicollinearity, and variables demonstrating collinearity were chosen for inclusion on the basis of clinical importance. Using Bonferroni's correction, statistical significance in the final multivariate analyses was set at p 0.01. Odds ratios are provided for intervention and covariates in addition to their 99% confidence intervals.

Results

An independent randomized sample of 4,500 Medicare-reimbursed home health beneficiaries was included in the analyses. Beneficiaries were predominantly female (60.17%), white (82.64%), and not frontloaded (60%) (Table 2). Overall, 207 (4.6%) readmissions occurred between 15 and 30 days of home health admission with more occurring in the not frontloaded group (n= 124; 2.75%) compared to the frontloaded group

(n=83; 1.84%). However, this was not statistically significant (p=0.972) (Table 3). The final regression model included variables significant at the 0.05 level in the bivariate model as predictors and their proportional weights as generated by the propensity score analysis.

Bivariate logistic regression modeling of frontloading on 30-day readmission showed 12 variables to be significant at the 0.05 level (Table 4). However, five variables were removed due to collinearity. Frontloading of skilled nursing visits was not significant (p=0.972) but was included in the multivariate model as it was the predictor of interest. Multivariate modeling (Table 5) indicated that depressed patients compared to those not depressed, increased the odds of a 30-day readmission by 94% (odds ratio [OR]=1.94; 99% confidence interval [CI]=1.27-2.98; p<.001). The odds of a 30-day readmission were increased by 51% among home health beneficiaries with a guarded rehabilitation prognosis (OR=1.51; 99% CI=1.01-2.28; p=0.009). In addition, with each unit increase in the number of high-risk diagnoses, the odds of a 30-day readmission increased by 17% (OR=1.17; 99% CI=1.01-1.37; p=0.008). Finally, with every unit increase in bathing dependence the odds of a 30-day readmission decreased by 17% (OR=1.17; 99% CI=1.01-1.37; p=0.008). Similar to the bivariate model, frontloading was not a significant predictor of 30-day hospital readmission (p=0.977).

Discussion

While more 30-day readmissions occurred among the group not frontloaded, the hypothesis that frontloading skilled home health nursing visits would impact 30-day readmissions was not supported by the results of this study. Prior to excluding beneficiaries who were readmitted within the first 14 days of home health, it was found that 15.4% (n=7,740) of Medicare-reimbursed home health beneficiaries experienced a 30-day hospital readmission. Prior research has shown that among the home health beneficiaries readmitted, approximately 50% of them are readmitted within the first 14 days of admission to home health.[4-6] Similarly, our findings indicate that of those readmitted, 68% (n=5,268) were readmitted within the first 14 days of home health but were excluded from this analysis as frontloading (five or more skilled nursing visits within 14 days), defined a priori, was not possible. This left only 32% (n=2,472) of the 30-days readmissions, those readmitted between 15 to 30 days, eligible for analysis.

These findings suggest that it may be critically important to provide intense and targeted home health services to Medicare-reimbursed beneficiaries within the first 14 days of skilled home health. As this study and prior research has shown, stretching out the services over the first 30 days of skilled home health is often too late and readmission has already occurred. However, intense and targeted interventions within the first 14 days of skilled home health remain a gap in knowledge and therefore must be designed and tested to determine their impact on reducing 30-day readmission. Equally important, is the need to admit Medicare beneficiaries at high risk for readmission, to home health soon after hospital discharge. At present, Medicare's Conditions of Participation mandate that beneficiaries are evaluated for skilled home health services within 48 hours of referral, within 48 hours of the patient's return home, or on the physician-ordered start of care date.[24] Future research must evaluate

home health agency compliance with this Condition of Participation in evaluating patients with 48 hours of hospital discharge and its relationship to readmission.

Prior research suggests that frontloading reduced the need for readmission among skilled home health patients.[8, 25] However, samples for both studies were not randomly selected, lacked methodological rigor and considered frontloading of skilled nursing visits only. Frontloading remains one of 12 best practices endorsed by the West Virginia Medical Institute aimed at reducing readmission among skilled home health recipients.[4, 9] However, additional research is essential to refine the practice of frontloading, perhaps to place greater emphasis on the first 7 days of home health admission as 14 days is clearly too late to meet the needs of this unique and vulnerable population. The refinement of frontloading could also include additional home health disciplines such as physical and occupational therapy. Admission to home health within 24 hours of hospital discharge, especially among those at high risk for readmission, might also be an important component of refining how frontloading is operationalized. As a part of the refinement of frontloading, we must determine the types of patients who are most likely to benefit from it. Finally, in order to build upon our knowledge we must closely examine the Medicare beneficiaries who are readmitted within the first 14 days of home health. It will be essential to determine this group's unique characteristics and to identify the unmet needs that may underlie their 30-day readmission.

The limitations of this study relate mostly to the design as it was a secondary data analysis. The analysis included only one year of data previously collected in 2009. Also, only traditional, fee-for-service Medicare beneficiaries were included because managed-Medicare beneficiary claims are not available. However, despite the limitations, national Medicare-owned data sets represent the largest and most robust source of information available to address the study's hypothesis.

Conclusion

Reducing 30-day readmission among Medicare-reimbursed skilled home health beneficiaries remains a national priority and is still an elusive goal. While frontloading was not found to be significantly associated with a reduction in 30-day readmission among Medicare-reimbursed home health beneficiaries in this study, additional research is needed to refine frontloading, determine the type of patients who are most likely to benefit from it and further evaluate these findings. In moving the science forward, it will be critical to examine the Medicare beneficiaries who are readmitted within the first 14 days of home health to determine this group's unique characteristics and to identify their unmet needs that may underlie their 30-day readmission.

Acknowledgments

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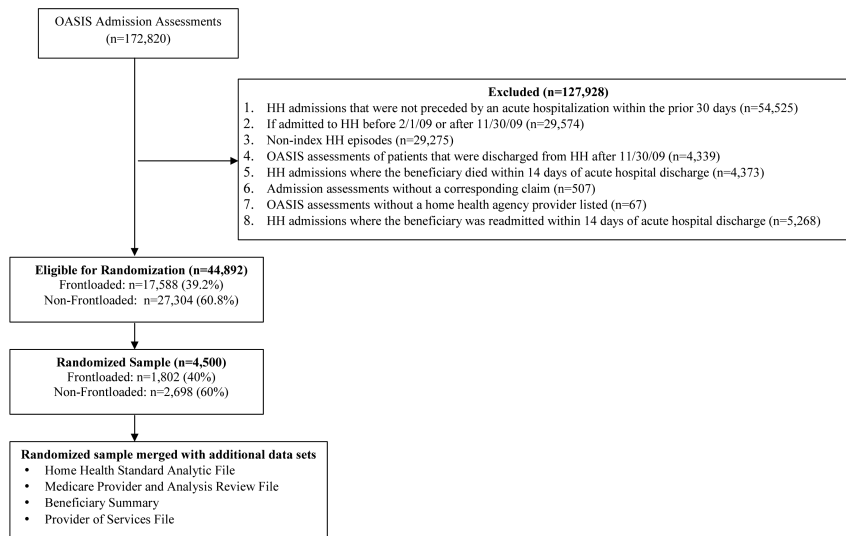8. Rogers J, Perlic M, Madigan EA. The effect of frontloading visits on patient outcomes. Home Healthcare Nurse. 2007; 25(2):103–109. [PubMed: 17285038]

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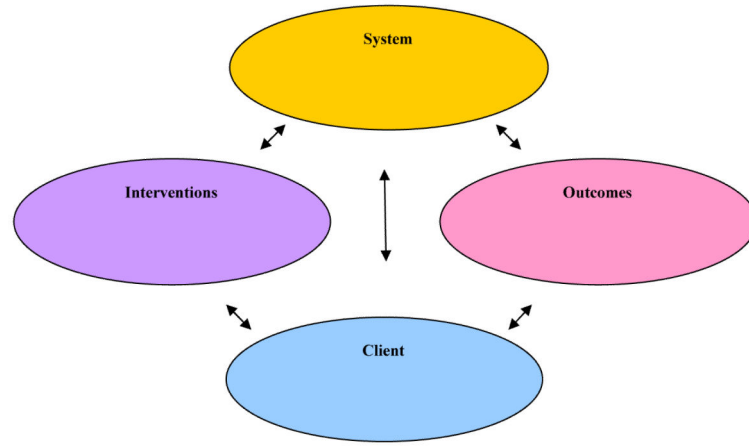
Figure 1.
Quality Health Outcomes Model

OASIS Admission Assessments
(n=172,820)

Excluded (n=127,928)
1. HH admissions that were not preceded by an acute hospitalization within the prior 30 days (n=54,525)
2. If admitted to HH before 2/1/09 or after 11/30/09 (n=29,574)
3. Non-index HH episodes (n=29,275)
4. OASIS assessments of patients that were discharged from HH after 11/30/09 (n=4,339)
5. HH admissions where the beneficiary died within 14 days of acute hospital discharge (n=4,373)
6. Admission assessments without a corresponding claim (n=507)
7. OASIS assessments without a home health agency provider listed (n=67)
8. HH admissions where the beneficiary was readmitted within 14 days of acute hospital discharge (n=5,268)

Eligible for Randomization (n=44,892)
Frontloaded: n=17,588 (39.2%)
Non-Frontloaded: n=27,304 (60.8%)

Randomized Sample (n=4,500)
Frontloaded: n=1,802 (40%)
Non-Frontloaded: n=2,698 (60%)

Randomized sample merged with additional data sets
• Home Health Standard Analytic File
• Medicare Provider and Analysis Review File
• Beneficiary Summary
• Provider of Services File

Figure 2.
Consort Diagram: Sample of Medicare Beneficiaries Receiving Skilled Home Health

Table 1

Data Sources

Variable Type (QHOM Concept)	Variable	Variable Definition	Variable Source
Independent (Intervention)	Presence of Front-Loaded Skilled Nursing Visits	5 or more skilled nursing visits in the first 14 days of the home health episode	HH Agency Standard Analytic File (HHSAF)
Dependent (Outcome)	30-day Hospital Readmission	The occurrence of a hospital readmission within 30-days of a hospital discharge for CMS-reimbursed patients receiving HH services	Medicare Provider and Analysis Review File (MedPAR)
Covariates (Client)	Female, White, Hispanic, severity of illness, living alone, guarded rehabilitation prognosis, pressure ulcer, stasis ulcer, dyspnea, urinary incontinence, lacking an informal caregiver, needing assistance with bathing, ambulation, eating or taking medications	Hospitalization risk factors	Outcome Assessment Information Set (OASIS)
Covariates (Client)	Diagnosis of DM, Depression, ischemic heart disease, HIV/AIDS, renal failure, HF, COPD; cardiomypathy, dysrythmia, CAD, Alzheimer's disease, personality/anxiety disorders, osteoporosis, MI; presence of 4 or more diagnoses	Hospitalization risk factors	HH Agency Standard Analytic File (HHSAF)
Covariate (System)	Seen by a for-profit home health agency	Hospitalization risk factor	Provider of Services File

Table 2

Means and Standard Deviations of Study Variables Pre and Post-Matching

	PRE-MATCHED (UNWEIGHTED)			AFTER MATCHING (WEIGHTED)		
Frontloaded (FL) n=1,802 (40%) **Not Frontloaded (Not FL) n=2,698 (60%)**	**FL**	**Not FL**	**Total (n=4,500)**	**FL**	**Not FL**	**Total (n=4,500)**
Variable	**Mean (±SD)**	**Mean (±SD)**	**Mean (±SD)**	**Mean (±SD)**	**Mean (±SD)**	**Mean (±SD)**
Age	76.09 (11.21)	76.22 (11.01)	76.17 (11.09)	76.09 (11.21)	75.87 (11.11)	75.96 (11.15)
Number of Diagnoses	5.79 (1.68)	5.62 (1.63)	5.69 (1.65)	5.79 (1.68)	5.77 (1.65)	5.78 (1.67)
Severity of Illness	2.58 (0.67)	2.49 (0.63)	2.52 (0.65)	2.58 (0.67)	2.59 (0.67)	2.59 (0.67)
Number of High Risk Diagnoses	1.41 (1.15)	1.19 (1.12)	1.28 (1.14)	1.41 (1.15)	1.42 (1.23)	1.42 (1.20)
Variable	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Confusion						
Never	1,059 (23.53)	1,630 (36.22)	2,689 (59.76)	1,059 (23.53)	1,616 (35.92)	2,675 (59.45)
In new or complex situations only	594 (13.20)	812 (18.04)	1,406 (31.24)	594 (13.20)	857 (19.05)	1,451 (32.25)
On awakening or at night only	22 (0.49)	27 (0.60)	49 (1.09)	22 (0.49)	25 (0.56)	47 (1.05)
During the day and evening, not constantly	108 (2.40)	204 (4.53)	312 (6.93)	108 (0.24)	181 (4.02)	289 (6.42)
Constantly	19 (0.42)	25 (0.56)	44 (.98)	19 (0.42)	19 (0.41)	38 (0.83)
Cognitive Function						
Alert/oriented, able to focus and shift attention, comprehends and recalls task directions independently	1,227 (27.27)	1,836 (40.80)	3,063 (68.07)	1,227 (27.27)	1,841 (40.91)	3,068 (68.18)
Requires prompting (cueing, repetition, reminders) only under stressful or unfamiliar conditions	413 (9.18)	610 (13.56)	1,023 (22.73)	413 (9.18)	619 (13.76)	1,032 (22.94)
Requires assistance and some direction in specific situations or consistently requires low stimulus environment due to distractibility	132 (2.93)	192 (4.27)	324 (7.20)	132 (2.93)	192 (4.26)	324 (7.19)
Requires considerable assistance in routine situations. Is not alert and oriented or is unable to shift attention and recall directions more than half the time	27 (0.60)	51 (1.13)	78 (1.73)	27 (0.60)	38 (0.84)	65 (1.44)
Totally dependent due to disturbances such as constant disorientation, coma, persistent vegetative state, or delirium	3 (0.07)	9 (0.20)	12 (0.27)	3 (0.07)	8 (0.19)	11 (0.25)
Bathing Ability						
Able to bathe self in shower or tub independently	102 (2.27)	141 (3.13)	543 (5.40)	102 (2.27)	132 (2.92)	234 (5.19)
With the use of devices, is able to bathe self in shower or tub independently	227 (5.04)	354 (7.87)	581 (12.81)	227 (5.04)	353 (7.84)	580 (12.88)

Frontloaded (FL) n=1,802 (40%) Not Frontloaded (Not FL) n=2,698 (60%)	PRE-MATCHED (UNWEIGHTED)			AFTER MATCHING (WEIGHTED)		
	FL	Not FL	Total (n=4,500)	FL	Not FL	Total (n=4,500)
Variable	Mean (±SD)	Mean (±SD)	Mean (±SD)	Mean (±SD)	Mean (±SD)	Mean (±SD)
Able to bathe in shower or tub with the assistance of another person:(a) for intermittent supervision or encouragement or reminders, OR (b) to get in and out of the shower/tub, OR (c) for washing difficult to reach areas	479 (10.64)	8.05 (17.89)	1,284 (28.53)	479 (10.64)	773 (17.18)	1,252 (27.83)
Participates in bathing self in shower or tub, but required presence of another person throughout in the bath for assistance or supervision	512 (11.38)	741 (16.47)	1,253 (27.84)	512 (11.38)	736 (16.35)	1,248 (27.73)
Unable to use the shower or tub and is bathed in bed or bedside chair	422 (9.38)	591 (13.13)	1,013 (22.51)	422 (9.38)	638 (14.19)	1,060 (23.57)
Unable to effectively participate in bathing and is totally bathed by another person	60 (1.33)	66 (1.47)	126 (2.80)	60 (1.33)	66 (1.47)	126 (2.80)
Ambulation Ability						
Able to independently walk on even and uneven surfaces and climb stairs with or without railings (needs no human assistance or assistive device)	187 (4.16)	201 (4.47)	388 (8.62)	187 (4.16)	265 (5.89)	452 (10.05)
Requires use of a device to walk alone or Requires human supervision or assistance to negotiate stairs or steps or uneven surfaces	1,013 (22.51)	1,503 (33.40)	2,516 (55.91)	1,013 (22.51)	1,524 (33.88)	2,537 (56.39)
Able to walk only with the supervision or Assistance of another person at all times	499 (11.09)	835 (18.56)	1,334 (29.64)	499 (11.09)	794 (17.64)	1,293 (28.72)
Chairfast, unable to ambulate but is able to Wheel self independently	47 (1.04)	76 (1.69)	123 (2.73)	47 (1.04)	55 (1.23)	102 (2.27)
Chairfast, unable to ambulate and is unable to wheel self	45 (1.00)	71 (1.58)	116 (2.58)	45 (1.00)	53 (1.17)	98 (2.17)
Bedfast, unable to ambulate or be up in a chair	11 (0.24)	12 (0.27)	23 (0.51)	11 (0.24)	7 (0.16)	18 (0.40)
Presence of Dyspnea						
Never, patient is not short of breath	470 (10.44)	863 (19.18)	1,333 (29.62)	470 (10.44)	695 (15.43)	1,165 (25.88)
When walking more than 20 feet, climbing stairs	485 (10.78)	823 (18.29)	1,308 (29.07)	485 (10.78)	840 (18.68)	1,325 (29.45)
With moderate exertion (e.g., while dressing, using commode or bedpan, walking distances less than 20 feet)	541 (12.02)	667 (14.82)	1,208 (26.84)	541 (12.02)	728 (16.18)	1,269 (28.20)
With minimal exertion (e.g., while eating, talking, ADLs) or with agitation	261 (5.80)	281 (6.24)	542 (12.04)	261 (5.80)	332 (7.39)	593 (13.19)

Frontloaded (FL) n=1,802 (40%) Not Frontloaded (Not FL) n=2,698 (60%)	PRE-MATCHED (UNWEIGHTED)			AFTER MATCHING (WEIGHTED)		
	FL	Not FL	Total (n=4,500)	FL	Not FL	Total (n=4,500)
Variable	Mean (±SD)	Mean (±SD)	Mean (±SD)	Mean (±SD)	Mean (±SD)	Mean (±SD)
At rest (during day or night)	45 (1.00)	64 (1.42)	109 (2.42)	45 (1.00)	103 (2.28)	148 (3.28)
Presence of Anxiety						
None of the time	1,017 (22.60)	1,643 (36.51)	2,660 (59.11)	1,017 (22.60)	1,568 (34.85)	2,585 (57.45)
Less often than daily	448 (9.96)	605 (13.44)	1,053 (23.40)	448 (9.96)	623 (13.84)	1,071 (23.80)
Daily, but not constantly	316 (7.02)	411 (9.13)	727 (16.16)	316 (7.02)	462 (10.26)	778 (17.29)
All of the time	21 (0.47)	39 (0.87)	60 (1.33)	21 (0.47)	45 (1.00)	66 (1.46)
All of the time	21 (0.47)	39 (0.87)	60 (1.33)	21 (0.47)	45 (1.00)	66 (1.46)
Transfer Ability						
Able to independently transfer	370 (8.22)	446 (9.91)	816 (18.13)	370 (8.22)	505 (11.23)	875 (19.45)
Transfers with minimal human assistance or with use of an assistive device	1,152 (25.60)	1,834 (40.76)	2,986 (66.36)	1,152 (25.60)	1,835 (40.77)	2,987 (66.37)
Unable to transfer self but is able to bear weight and pivot during the transfer	218 (4.84)	333 (7.40)	551 (12.21)	218 (4.84)	289 (6.43)	507 (11.27)
Unable to transfer self and is unable to bear weight or pivot when transferred by another person	38 (0.84)	59 (1.31)	97 (2.16)	38 (0.84)	50 (1.12)	88 (1.97)
Bedfast, unable to transfer but is able to turn and position self in bed	11 (0.24)	10 (0.22)	21 (0.47)	11 (0.24)	6 (0.14)	17 (0.38)
Bedfast, unable to transfer and is unable to turn and position self	13 (0.29)	16 (0.36)	29 (0.64)	13 (0.29)	12 (0.26)	25 (0.55)
Feeding Ability						
Able to independently feed self	1,068 (23.73)	1,700 (37.78)	2,768 (61.51)	1,068 (23.73)	1,606 (35.70)	2,674 (59.43)
Able to feed self independently but requires: (a). meal set-up; OR (b) intermittent assistance or supervision from another person; OR (c) a liquid, pureed or ground meat diet	671 (14.91)	920 (20.44)	1,591 (35.36)	671 (14.91)	1,012 (22.49)	1,683 (37.40)
Unable to feed self and must be assisted or supervised throughout the meal/snack	45 (1.00)	59 (1.31)	104 (2.31)	45 (1.00)	57 (1.27)	102 (2.27)
Able to take in nutrients orally and receives supplemental nutrients through a nasogastric tube or gastrostomy	7 (0.16)	3 (0.07)	10 (0.22)	7 (0.16)	5 (0.11)	12 (0.27)
Unable to take in nutrients orally and is fed nutrients through a nasogastric tube or gastrostomy	8 (0.18)	14 (0.31)	11 (0.49)	8 (0.18)	16 (0.35)	24 (0.53)
Unable to take in nutrients orally or by tube feeding	2 (0.04)	3 (0.07)	5 (0.11)	3 (0.07)	2 (0.04)	5 (0.10)
Living Alone	487 (10.82)	687 (15.27)	1,174 (26.09)	487 (10.82)	743 (16.51)	1,230 (27.33)

Frontloaded (FL) n=1,802 (40%) Not Frontloaded (Not FL) n=2,698 (60%)	PRE-MATCHED (UNWEIGHTED)			AFTER MATCHING (WEIGHTED)		
	FL	Not FL	Total (n=4,500)	FL	Not FL	Total (n=4,500)
Variable	Mean (±SD)	Mean (±SD)	Mean (±SD)	Mean (±SD)	Mean (±SD)	Mean (±SD)
Urinary Incontinence	740 (16.44)	1,068 (23.73)	1,808 (40.18)	740 (16.44)	1,091 (24.24)	1,831 (40.69)
Depressed Mood	352 (4.82)	461 (10.24)	813 (18.07)	352 (7.82)	502 (11.16)	854 (18.98)
Memory Deficits	201 (4.47)	337 (7.49)	538 (11.96)	201 (4.47)	296 (6.58)	497 (11.05)
Female	1,084 (24.09)	1,729 (38.42)	2,813 (62.51)	1,084 (24.09)	1,624 (36.08)	2,708 (60.17)
Hispanic	102 (2.27)	116 (2.58)	218 (4.84)	102 (2.27)	142 (3.16)	244 (5.43)
White	1,488 (33.07)	2,207 (49.04)	3,695 (82.11)	1,488 (33.07)	2,230 (49.57)	3,718 (82.64)
Serviced by a For-Profit Home Health Agency	920 (20.44)	1,290 (28.67)	2,210 (49.11)	920 (20.44)	1,330 (29.57)	2,250 (50.01)
Presence of a Primary Caregiver	1,577 (35.04)	2,343 (52.07)	3,920 (87.11)	1,577 (35.04)	2,340 (52.01)	3,917 (87.05)
Guarded Rehabilitation Prognosis	435 (9.67)	562 (12.49)	997 (22.16)	435 (9.67)	610 (13.55)	1,045 (23.22)
Requires Assistance with ADLs						
Yes	1,032 (22.93)	1,559 (34.64)	2,591 (57.58)	1,032 (22.93)	1,539 (34.21)	2,571 (57.14)
No	505 (11.02)	727 (16.16)	1,232 (27.38)	505 (11.22)	749 (16.64)	1,254 (27.86)
Unknown	265 (5.89)	412 (9.16)	677 (15.04)	265 (5.89)	410 (9.11)	675 (14.99)
Requires Assistance with IADLs						
Yes	1,434 (31.87)	21.55 (47.89)	3,589 (79.76)	1,434 (31.87)	2,136 (47.47)	3,570 (79.34)
No	103 (2.29)	1,434 (31.87)	2,155 (47.89)	103 (2.29)	152 (3.38)	255 (5.67)
Unknown	265 (5.89)	412 (9.16)	677 (15.04)	265 (5.89)	410 (9.11)	675 (14.99)
Presence of a Pressure Ulcer						
Yes	110 (2.44)	98 (2.18)	208 (4.62)	110 (2.44)	154 (3.42)	264 (5.87)
No	1,446 (32.13)	2,172 (48.27)	3,618 (80.40)	1,446 (32.13)	2,154 (47.87)	3,600 (80.00)
Unknown	246 (5.47)	428 (9.51)	674 (14.98)	246 (5.47)	390 (8.67)	636 (14.13)
Presence of a Stasis Ulcer						
Yes	16 (0.36)	11 (0.24)	27 (0.60)	16 (0.36)	5 (0.10)	21 (0.46)
No	1,540 (34.22)	2,259 (50.20)	3,799 (84.42)	1,540 (34.22)	2,303 (51.19)	3,843 (85.41)
Unknown	246 (5.47)	428 (9.51)	674 (14.98)	246 (5.47)	390 (8.67)	636 (14.13)
Requires Assistance with Oral Medications						
Yes	759 (16.87)	1,013 (22.51)	1,772 (39.38)	759 (16.87)	1,097 (24.38)	1,856 (41.25)
No	687 (15.27)	1,172 (26.04)	1,859 (41.31)	687 (15.27)	1,050 (23.34)	1,737 (38.60)
Unknown	356 (7.91)	513 (11.40)	869 (19.31)	356 (7.91)	551 (12.23)	907 (20.15)

Table 3

Participant Hospitalization between days 15-30 (n=4,500)

	N	%of Sample
Total Hospitalizations	207	4.59%
Hospitalizations among the frontloaded group	83	1.84%
Hospitalizations among the non-frontloaded group	124	2.75%

Table 4

Bivariate Logistic Regression Analysis of Frontloading on Hospitalization

Parameter	Parameter Estimate	SE	P value	Odds Ratio	95% Hazard Ratio CI	
Frontloaded	0.01	0.145	0.972	1.01	0.76	1.34
Age	−0.01	0.006	0.076	0.989	0.97	1.00
Number of Diagnoses	0.07	0.043	0.099	1.07	0.99	1.17
Severity of Illness	−0.05	0.107	0.673	0.96	0.77	1.18
High Risk Diagnosis Frequency	0.26	0.055	**<.001***	1.30	1.17	1.45
Confusion	0.16	0.074	**0.031**[!]	1.17	1.02	1.35
Cognitive Function	0.11	0.095	0.261	1.11	0.92	1.34
Difficulty Bathing	−0.14	0.058	**0.014***	0.87	0.77	0.97
Difficulty Ambulating	0.02	0.088	0.796	1.02	0.86	1.22
Dyspnea	0.27	0.063	**<.001***	1.31	1.16	1.48
Anxiety	0.27	0.081	**0.001***	1.32	1.12	1.54
Difficulty Transferring	0.02	0.099	0.838	1.02	0.84	1.24
Difficulty Feeding	0.02	0.113	0.867	1.02	0.82	1.27
Living Alone	0.19	0.154	0.211	1.21	0.90	1.64
Urinary Incontinence	0.12	0.144	0.417	1.12	0.85	1.49
Depressed Mood	0.84	0.152	**<.001***	2.3	1.72	3.11
Memory Deficit	0.04	0.224	0.845	1.05	0.67	1.62
Female	−0.30	0.143	**0.034***	0.74	0.56	0.98
Hispanic	−0.16	0.330	0.726	0.89	0.47	1.70
White	0.22	0.201	0.281	1.24	0.84	1.84
For-Profit Agency	−0.10	0.143	0.501	0.91	0.69	1.20
Presence of a Primary Caregiver	−0.05	0.208	0.797	0.95	0.63	1.43
Guarded Rehabilitation Prognosis	0.62	0.150	**<.001***	1.86	1.39	2.50
Requiring Assistance with ADLs (0 vs. 2)	0.27	0.105	**0.010**[!]	1.36	0.89	2.08
Requiring Assistance with ADLs (1 vs. 2)	−0.23	0.010	**0.020**[!]	0.823	0.55	1.24
Requiring Assistance with IADLs (0 vs. 2)	0.47	0.163	**0.004**[!]	1.95	1.11	3.44
Requiring Assistance with IADLs (1 vs. 2)	−0.27	0.111	**0.015**[!]	0.93	0.63	1.38
Presence of a Pressure Ulcer (0 vs. 2)	0.02	0.127	0.891	1.15	0.76	1.76
Presence of a Pressure Ulcer (1 vs. 2)	0.11	0.200	0.591	1.26	0.64	2.48
Presence of a Stasis Ulcer (0 vs. 2)	−0.03	0.323	0.918	1.16	0.76	1.77
Presence of a Stasis Ulcer (1 vs. 2)	0.21	0.628	0.734	1.48	0.23	9.67
Requiring Assistance with Oral Medications (0 vs. 2)	−0.20	0.103	0.0512	0.70	0.48	1.02
Requiring Assistance with Oral Medications (1 vs. 2)	0.04	0.096	0.654	0.89	0.62	1.27

SE: Standard Error

CI: Confidence Interval

*significant at the 0.05 level, included in the final model

not included in final model due to multiplicity

Table 5

Multivariate Logistic Regression Analysis of Frontloading on Hospitalization

Parameter	Parameter Estimate	SE	P value	Odds Ratio	99% Hazard Ratio CI	
Frontloaded	0.01	0.147	0.977	1.01	0.68	1.47
High Risk Diagnosis Frequency	0.16	0.060	**0.008**[*]	1.17	1.01	1.37
Difficulty Bathing	−0.16	0.060	**0.008**[*]	0.85	0.73	0.99
Dyspnea	0.14	0.070	0.052	1.15	0.96	1.37
Anxiety	0.08	0.090	0.380	1.08	0.86	1.37
Depressed Mood	0.66	0.166	**<.001**[*]	1.94	1.27	2.98
Female	−0.33	0.146	0.024	0.72	0.50	1.05
Guarded Rehab Prognosis	0.41	0.159	**0.009**[*]	1.51	1.01	2.28

SE: Standard Error

CI: Confidence Interval

[*] significant at the 0.01 level