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Intensified rehabilitation therapy and transitions to skilled nursing facilities in community-living seniors with acute medical illnesses

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Aim: To examine whether rehabilitation therapy type would be associated with transitions to skilled nursing facilities (SNF) in community-living seniors with acute medical illnesses.

Methods: Using administrative and clinical data, multivariate regression analysis examined the relationship between the extent of rehabilitation therapy and transitions to SNF in all participants, as well as participants by physical function at admission.

Results: In all participants ($n = 929$), the intensified rehabilitation therapy was associated with a lower probability of transitions to SNF (14% *vs* 21%; odds ratio [OR] 0.59; 95% confidence intervals [CI] 0.22–0.96; $P = 0.02$). In participants with mild physical limitations ($n = 270$), less frequent transitions to SNF occurred when patients received intensified rehabilitation therapy [16% *vs* 23%; OR 0.46; 95% CI 0.17–0.94; $P = 0.01$]. In participants with moderate to severe physical limitations ($n = 265$), the decreased frequency of transitions to SNF associated with rehabilitation therapy became more pronounced (18% *vs* 28%; OR 0.34; 95% CI 0.07–0.89; $P = 0.004$). By contrast, in participants without physical limitation ($n = 394$), the number of transitions to SNF did not change significantly when they received intensified rehabilitation therapy ($P = 0.53$).

Conclusions: We found a significant relationship between intensified rehabilitation therapy and the decrease of transitions to SNF in community-living seniors with acute medical illness. The magnitude of this relationship increased in participants with more physical limitations, but not in participants without physical limitations at admission. **Geriatr Gerontol Int 2013; 13: 547–554.**

Keywords: frail older adults, geriatric medicine, hospital units, rehabilitation outcome, skilled nursing facility.

Introduction

More than three-quarters of nursing home admissions in the USA are preceded by an acute care hospitalization in the prior 120 days.[1] Previous studies provide evidence that acute illnesses requiring hospitalization result in catastrophic or progressive disability in older adults.[2,3] Furthermore, older adults recently disabled as a result of acute illness are vulnerable to nursing home placement regardless of the level of physical activity before hospitalization.[4–6] Numerous studies have found that more than one-third of hospitalized older adults experience decrements in physical function and more than one-quarter of them experience the transition to a nursing home.[7,8]

A skilled nursing facility (SNF) is a gateway for community-dwelling older adults to enter a nursing home setting. Transitions from hospital to SNF account for more than three-quarters of the nursing home entries by community-living seniors.[5,9–11] Once admitted to a nursing home, the length of stay can be difficult to predict. For both hospitalized older adults and their families, preventing or deferring nursing home entries hold substantial implications for their psychosocial stability; thus, it might promote their quality of life to defer, as found in prior health survey studies.[12,13]

Rehabilitation therapy for older adults has been examined as a possible preventive measure to reduce

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the progress of physical disability in older adults at post-acute or intermediate care settings across diverse health systems.[8,14–16] A number of previous studies examined the impact of a geriatric rehabilitation unit (also known as a geriatric evaluation and management [GEM] unit) in post-acute care on restoring or preventing decline of physical function.[17–20] These studies identified the dose-dependent benefits of rehabilitation therapy: restoring physical function and reducing nursing home admission.[21,22] The strongest evidence of improving the hospital outcomes of older adults, including the reductions in hospital stays and nursing home admissions, stems from geriatric inpatient units (acute care of elders [ACE] or post-acute care [PAC] units).[23–28] Either ACE or PAC units are interdisciplinary care units for frail older adults with protocol for prevention of disability. In contrast to ACE and GEM units, the inpatient geriatric consultative model has failed to show an improvement of the same outcomes in hospitalized older adults.[29,30] Isolated geriatric assessment and management service without intensified rehabilitation therapy was reported to be less effective than an integrative care model including intensified rehabilitation as a core health service.[25–29]

The USA hospital Medicare margin has been negative since 2003. In addition, since the collapse of the USA bond and stock markets in 2008, operating hospital margins fell dramatically.[31–33] Financial pressure on USA hospitals is expected to be more remarkable than ever before. The Patient Protection and Affordable Care Act (PPACA) attempts to cut current hospital operating margin deficits by reducing hospital length of stay, thus meeting diagnosis-related group (DRG) standards.[32,33] This situation might have facilitated the rapid growth in use of SNF after hospital discharge.[1,32,34] Therefore, hiring a geriatric care specialist or establishing a geriatric unit or team, either of which would require significant financial investment, might meet with resistance from those who manage hospital budgets.

Yet, relatively little is known about the outcomes of intensified rehabilitation therapy for older adults during their acute hospital stays. Despite the high transition rate to SNF for this population, to our knowledge, no prior study has evaluated the potential role of intensified rehabilitation therapy for community-living seniors with acute medical illness to impede or precipitate these transitions.[1,32,34] A lack of studies might possibly stem from the assumption that rehabilitation therapy for older adults with acute medical illness might be challenged by the patients' unstable medical conditions and busy schedules for frequent diagnostic/therapeutic procedures.[7,8,17,18] The present study determines the relationship between rehabilitation therapy type (intensified *vs* usual) and transitions to SNF in community-living seniors with acute medical illness. We also examine how the effects of physical function at admission on this relationship vary.

Methods

Study design and data collection

The study sites were two USA metropolitan teaching hospitals with 350 (hospital A) and 415 (hospital B) beds. Study site hospitals have neither a geriatric unit nor geriatric consultation service teams. The study period was 2 years (January 2009 to December 2010). Inclusion criteria were: (i) patients were Medicare beneficiaries; (ii) aged 65 years or older; (c) admitted to the general medicine floor; and (d) community-living persons before hospital admission. Exclusion criteria were: (i) enrolment in hospice care or admission to an intensive care unit; (b) "extreme" severity of illness at admission per the All Patient Refined Diagnostic Related Group (APR-DRG), because these participants are not eligible to receive rehabilitation therapy during their hospitalizations; and (c) admission to the stroke service unit where rehabilitation therapy had been provided separately from the general medicine floor.

Administrative claim data were collected from the Department of Medical Operations, which was unaware of the study objectives and was abstracted by the researchers. Clinical data from electronic medical records were matched with administrative data by name and date of birth. For internal consistency and validation of extraction accuracy, a random sample of 10% of matched data was cross-reviewed. We estimated that a sample size of 462 was required for each group (usual and intensified rehabilitation therapy) based on an expected decrease in SNF transition rate from 21% (usual rehabilitation) to 14% (intensified rehabilitation) with an alpha of 5%, power of 80% and a two-sided analysis.[1,5,6,35] We increased the sample size by 20%, to a total of 554 patients per group, to account for possible follow-up loss. Figure 1 shows the flow chart of sample enrolment, allocation, follow up and analysis. The initial participants meeting inclusion criteria were 1108. A total of 101 participants were excluded for the following reasons: hospice or intensive care enrolment ($n = 12$), "extreme" severity of illness ($n = 36$) and admission to the stroke service unit ($n = 53$). Among participants allocated to the intensified rehabilitation group ($n = 501$), 29 participants were withdrawn because of placement at other destinations ($n = 19$) and death ($n = 9$). Among participants allocated to the usual rehabilitation group ($n = 506$), 30 participants were withdrawn because of placement at other destinations ($n = 17$) and deaths ($n = 13$). Other destinations included long-term residential facilities and referrals to other hospitals. Long-term residential facilities included residential care homes, assisted living facilities, group homes and adult foster homes where rehabilitation therapy was not usually provided. Referrals to other hospitals included substance abuse care and psychiatric

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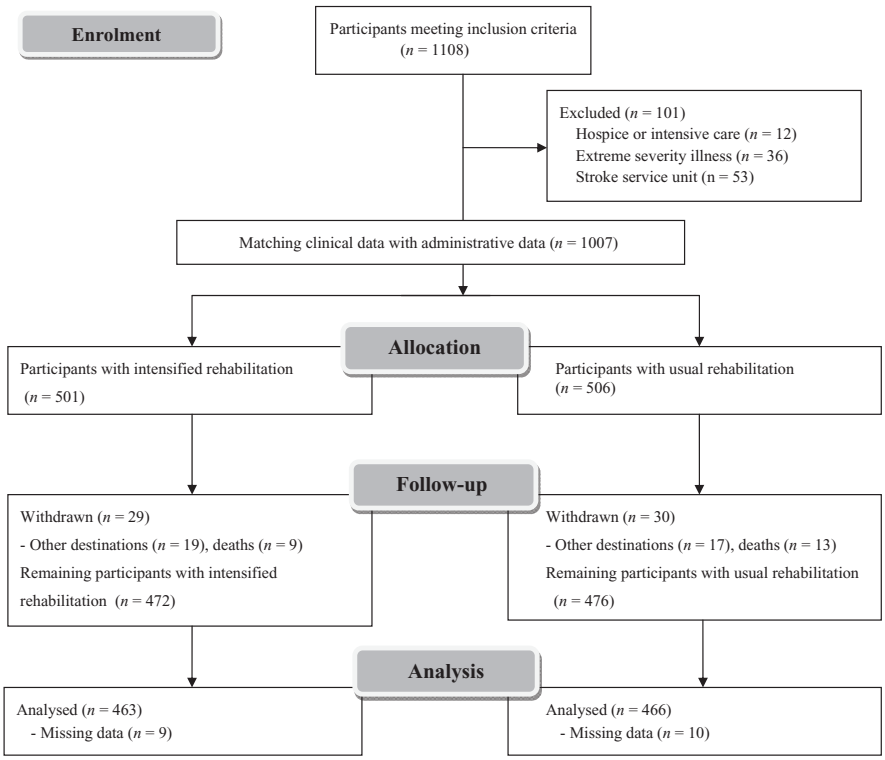

Figure 1 Flowchart of sample enrolment, allocation, follow up and analysis.

hospitals. Missing data occurred in nine instances in the intensified rehabilitation group and 10 instances in the usual rehabilitation group. The final number of analyzed participants was 463 in the intensified rehabilitation group and 466 in the usual rehabilitation group.

Main outcomes: Discharge places

Discharge places were categorized into either "SNF" or "return to their communities". We defined the main outcome as transitions from acute care hospital to SNF. SNF included extended-care facilities, where rehabilitation therapy was provided as a core medical service. "Return to their communities" meant discharge to home, where seniors had lived before hospital admission.

Covariates

Covariates were age, sex, ethnicity, living situation, severity of illness, study site, physical function at admission, rehabilitation therapy, cognitive impairment, delirium and principal diagnoses at admission. Living situation was categorized as either "living at risk" or "secure and stable living". "Living at risk" was defined as either living alone or in need of home care or day care services before hospital admission. Participants in need of social care services (either home care or day care services) without receiving these services were categorized as "living at risk". Participants who received these services were categorized as "secure and stable living". Participants not meeting the criteria for "living at risk" were defined as "secure and stable living".[36]

The APR-DRG severity of illness classification system was used to estimate the severity of illness.[37] The APR-DRG data were gathered based on the 3 M Health Information System (Wallingford, CT, USA). The APR-DRG data were collected from the Department of Medical Operations, which was unaware of this study's objectives and was abstracted by the authors. The validity of APR-DRG severity of illness in acute hospital care has been discussed elsewhere.[35]

Study sites were hospitals A and B. To define rehabilitation therapy, we examined the length of stay (LOS) across all relevant therapies added together. For example, we added the total physical therapy (PT) and occupational therapy (OT) hours and divided the sum by the LOS.[21,22] Patients did not need to receive both therapies to be included in these analyses. We defined 0.5 h or more a day as rehabilitation therapy. Patients did not need to receive all therapies to be included in these analyses. To compare the prior studies, we defined 0.5 h or more a day as rehabilitation therapy.[21,22]

Physical function was also assessed by admission nursing staff. The Katz Index of Independence in Activities in Daily Living (ADL) was the assessment tool of physical function with a range from most dependent (0) to most independent (6).[38] The Katz Index has shown to have an acceptable internal consistency ($\alpha = 0.87$) and validity ($\kappa = 0.74$ to 0.88) when nurses carried out the

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assessment.[39,40] The interobserver agreement ($\kappa = 0.64$) and intraobserver reproducibility ($\kappa = 0.88$) of the Katz Index of the present study were relatively high. The Katz Index was categorized by the severity of physical limitation as follows: no limitation (6), mild limitations (4–5) and moderate to severe limitations (0–3).[6] Validating the categorization of the Katz Index for hospitalized older adults has been addressed elsewhere.[6]

Information on cognitive impairment before hospital admission was collected from medical records by researchers, and included Alzheimer's disease, vascular dementia, dementia with Lewy bodies, dementia with Parkinsonism, Pick's disease, senile degeneration of the brain, cerebral degeneration, uncomplicated senile dementia, dementia not otherwise specified and cognitive disorder not otherwise specified. The Confusion Assessment Method (CAM) was used to detect the development of delirium. It has a sensitivity between 94% and 100%, and a specificity of 90–95%, with high interobserver reliability.[41] Delirium was assessed daily from hospital admission by physicians. Principal diagnoses at admission were classified into the following eight groups: (i) cardiovascular diseases; (ii) respiratory diseases; (iii) cancer and blood organ diseases; (iv) infectious diseases; (v) endocrine and metabolic diseases; (vi) digestive and urogenital tract diseases; (vii) neurological diseases except for acute stroke; and (viii) others. Classification of diseases and procedures was based on the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM).

For ease of interpretation, participant characteristics were categorized as follows: ethnicity (white people *vs* non-white people), living situation (living at risk *vs* secure and stable living), severity of illness (mild *vs* moderate *vs* major), study site (hospital A *vs* B), rehabilitation therapy (intensified *vs* usual), physical limitations at admission (none *vs* mild *vs* moderate-severe limitations), cognitive impairment (yes *vs* no), delirium (yes *vs* no) and principal diagnoses at admission (8 groups).[35] The study was approved by the institutional review board at Cleveland Clinic Health System. Because data were not directly gathered from patients, the requirement to obtain informed consents from patients was waived.

Statistical analysis

Bivariate comparisons of characteristics of participants between the intensified and usual rehabilitation groups were examined using χ^2-tests to compare categorical data and *t*-test to compare continuous data.[35] All reported *P*-values were two-tailed, and $P < 0.05$ was considered statistically significant.

We carried out multivariate logistic regressions of transitions to SNF including data from all study participants, and then carried out separate regressions using data from participants' scores on the Katz Index categories. The mean multivariate-adjusted probabilities of transitions to SNF with corresponding 95% confidence intervals (CI) were computed by adjusting for covariates.[42] Adjusted odds ratios (OR) of transitions to SNF along with 95% CI were derived after adjusting for covariates. An $OR > 1$ indicated that the probability of a transition to SNF for the intensified rehabilitation group was higher than that for the usual rehabilitation group.

Sensitivity and multicollinearity

Sensitivity analyses were used to explore alternative categories of ethnicity, (white people *vs* black people *vs* others), rehabilitation therapy type (threshold, 1.0 h per day) and Katz Index (0–2 *vs* 3–4 *vs* 5–6). Results for these alternative categories were similar to those of the original categories of ethnicity (white people *vs* non-white people), rehabilitation therapy type, (threshold, 0.5 h per day) and Katz Index scores (0–3 *vs* 4–5 *vs* 6), so the results for alternative categories are not included here.[42,43]

We also examined multicollinearity.[41] A significant correlation between age and physical function at admission was found (coefficient = 0.75; $P < 0.001$, variance inflation factor = 4.61.) For this reason, physical function at admission was retained and age was excluded from regressions. A significant correlation between delirium and severity of illness was found (coefficient = 0.79; $P < 0.001$, variance inflation factor = 4.14); severity of illness was retained and delirium was excluded from regressions. All models, both of overall participants and stratified participants by physical function at admission, fit well as determined by Hosmer–Lemeshow test results ($P = 0.72$, overall participants; $P = 0.85$, participants with no physical limitation; $P = 0.63$, participants with mild physical limitations; $P = 0.69$, participants with moderate to severe physical limitations.) All regressions had good discrimination as determined by *c*-statistics: $c = 0.80$, overall participants; $c = 0.83$, participants with no physical limitation; $c = 0.68$, participants with mild physical limitations; $c = 0.72$, participants with moderate to severe physical limitations.[42,43] All statistics were carried out using SAS statistical software version 9.2 (SAS Institute, Cary, NC, USA).

Results

Participant characteristics

Of the total participants ($n = 929$), the numbers of participants of the intensified and usual rehabilitation therapy were 463 and 466, respectively. Table 1 presents participant characteristics by rehabilitation therapy type. Participant characteristics did not differ statistically between the intensified and usual rehabilitation therapy groups.

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Table 1 Participant characteristics by rehabilitation therapy type

% (*n*) or median (interquartile range)		Intensified rehabilitation, *n* = 463	Usual rehabilitation, *n* = 466	†*P*
Age		80.4 (73.8–89.8)	81.3 (74.5–91.6)	0.08
Female		58 (269)	62 (289)	0.27
Non-white people		52 (239)	55 (256)	0.36
Living at risk		34 (157)	31 (144)	0.22
Severity of illness (APR-DRG)	Mild	20 (90)	17 (80)	0.14
	Moderate	41 (189)	40 (187)	
	Major	39 (184)	43 (199)	
Study site	Hospital B	45 (209)	43 (201)	0.66
Physical function at admission	No limitation, Katz Index 6	44 (203)	41 (191)	0.25
	Mild limitations, Katz Index 4–5	30 (139)	28 (131)	
	Moderate-severe limitations, Katz Index 0–3	26 (121)	31 (144)	
Cognitive impairment before hospital admission		24 (113)	27 (126)	0.23
Delirium during hospitalization		21 (97)	24 (112)	0.18
Principal diagnoses at admission	Cardiovascular diseases	17 (79)	16 (74)	0.44
	Respiratory diseases	14 (64)	14 (66)	
	Cancer and blood organ diseases	9 (42)	8 (37)	
	Infectious diseases	16 (74)	15 (70)	
	Endocrine/metabolic diseases	13 (59)	12 (56)	
	Digestive/urogenital tract diseases	15 (69)	16 (74)	
	Neurological diseases	9 (42)	10 (47)	
	Others	7 (34)	9 (42)	

†*P*-values were derived from bivariate comparisons of participant characteristics by rehabilitation type. APR-DRG, all patient refined-diagnosis related group.

Table 2 Multivariate-adjusted probability of "transitions to skilled nursing facility" in overall participants and subsets by physical function at admission

Mean (95% CI range)	Intensified rehabilitation *n* = 463	Usual rehabilitation *n* = 466	†Odds ratio (95% CI)	*P*
Overall participants, *n* = 929	14% (8–22%)	21% (15–29%)	.59 (.22–.96)	.02
Subsets by physical function at admission				
No physical limitation (Katz Index 6), *n* = 394	9% (5–15%) *n* = 203	11% (7–17%) *n* = 191	.91 (0.63–1.20)	.53
Mild physical limitations (Katz Index 4–5), *n* = 270	16% (12–21%) *n* = 139	23% (19–28%) *n* = 131	.46 (.17–.94)	.01
Moderate to severe physical limitations (Katz Index 0–3), *n* = 265	18% (14–22%) *n* = 121	28% (24–32%) *n* = 144	.34 (.07–.89)	.004

†Odds ratios were computed by adjusting for covariates. Odds ratio > 1 indicated that the probability of intensified rehabilitation was higher than that of usual rehabilitation. CI, confidence intervals; SNF, skilled nursing facility.

Multivariate-adjusted probability of "transitions to SNF" in overall participants and subsets by physical function at admission

Table 2 presents multivariate logistic regressions to determine the probability of transitions to SNF in the overall participants and subsets by physical function at admission. In the model of the overall participants (*n* = 929), the adjusted probability of transitions to SNF for participants in the intensified rehabilitation group (14%; 95% CI 8–22%) was significantly lower than that for the usual rehabilitation group (21%; 95% CI

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15–29%; OR 0.59; 95% CI 0.22–0.96; $P = 0.02$). In the model of participants with mild physical limitations (Katz Index 4–5, $n = 270$), the adjusted probability of transitions to SNF for the intensified rehabilitation group (16%; 95% CI 12–21%) was significantly lower than that for the usual rehabilitation group (23%; 95% CI 19–28%; OR 0.46; 95% CI 0.17–0.94; $P = 0.01$). In the model of participants with moderate to severe physical limitations (Katz Index 0–3, $n = 265$), the adjusted probability of transitions to SNF for the intensified rehabilitation group (18%; 95% CI 14–22%) was significantly lower than that for the usual rehabilitation group (28%; 95% CI 24–32%; OR 0.34; 95% CI 0.07–0.89; $P = 0.004$). However, in the model of participants without physical limitation ($n = 394$), there was no significant difference in the adjusted probability of transitions to SNF between the intensified and usual rehabilitation groups ($P = 0.53$).

Discussion

The present findings provide new information about the effects of intensified rehabilitation on transition to SNF in community-living seniors with acute medical illness. There are notable reductions in the number of transitions to SNF by the intensified rehabilitation therapy group, and the magnitude of their effects becomes pronounced when their physical function at admission is more impaired. However, reductions in transitions to SNF by the intensified rehabilitation therapy group do not occur when their physical function is not impaired.

Hospital-associated frailty or disability occurs in more than one-third of hospitalized seniors, even when their medical conditions are successfully managed.[2,3,7,8] Processes of hospital care – including numerous procedures, immobility and lack of adaptive accommodations – can lead to additional functional decline during hospitalization.[7,8] Given the central role of hospitalizations in the disabling process, rehabilitation therapy has been studied as an effective method to manage hospital-associated frailty or disability more effectively to promote restoration of function in interventions in the post-acute or intermediate care settings across diverse health systems.[14–18] The present findings show that the reduction in transitions to SNF might stem from preventing or reducing hospital-associated frailty or disability by intensified rehabilitation, even at an acute care hospital setting.

According to a report from the Center for Medicare and Medicaid Services, Medicare charges for each transition from hospital to SNF were $15 141 (daily rate $559) in 2010.[31,32,44–46] Medicare charges for home healthcare per user were $5318 (rate per visit $145) in 2010.[37,44–46] Although no prior cost analysis study has evaluated a direct cost comparison between home health and SNF services as post-acute care, several lines of evidence lead to the expectation of cost-saving effects when hospitalized Medicare beneficiaries are transitioned to less expensive home health services instead of SNF services.[44–46]

Several implications for practice, policy and research can be derived from our findings. Although causality cannot be established by the present study, our findings have strong inferences that intensified rehabilitation therapy seemingly plays a "buffering" role in emancipating community-living seniors from transitions to SNF.[11,17,47] This "buffering" role might make it more feasible for healthcare professionals to reprioritize rehabilitation therapy among the health issues of seniors with acute medical illness. Applying our findings to the agenda of public financial burdens, the positive relationship between the intensified rehabilitation at an acute care setting and reduction in transitions to SNF can have implications of saving public costs by reducing healthcare utilizations at a post-acute care setting.[32,34,44–46] Given the magnified effects of rehabilitation therapy in subsets of more physically impaired seniors, further research of examining dose-dependent effects of rehabilitation therapy on transitions to SNF in this group could be an important next step.

We acknowledge several limitations in data collection and study design. Because data collection was limited to two USA metropolitan hospitals, the findings of the present study cannot be generalized to other hospitals and health systems. The present study was a secondary analysis, and this limited the choice of covariates. Although physical function assessment at hospital admission relied on the same nursing staff, our analyses might have observer variation between hospital A and B. In addition, physical function was assessed once at hospital admission. This might not reflect the pre-admission physical function accurately. Determining the intensity of rehabilitation in the present study is based on hospital LOS. This method might not entirely reflect the actual rehabilitation program and dosage across all disease entities. However, this method has been used by previous studies on rehabilitation outcomes.[21,48] Because rehabilitation data are collected from administrative data, more specific rehabilitation program information (i.e. therapy modality, strength or frequency) is not included. Therefore, the present findings should be interpreted with caution and considered preliminary until they are confirmed in future studies with more representative data.

Disclosure statement

All authors declare no financial support or relationship that may pose conflicts of interest.

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