Association Between Delayed Discharge from Acute Care and Rehabilitation Outcomes and Length-of-Stay: A Retrospective Cohort Study

Abstract

Objective: To examine the association between discharge delays from acute to rehabilitation care due to capacity strain in the rehabilitation units, and patients' Length-of-Stays (LOS) and functional outcomes in rehabilitation.

Design: Retrospective cohort study using an instrumental variable to remove potential biases due to unobserved patient characteristics.

Setting: Two campuses of a hospital network providing inpatient acute and rehabilitation care.

Participants: Patients admitted to and discharged from acute care categories of Medicine and Neurology/Musculoskeletal (Neuro/MSK) and subsequently admitted to and discharged from inpatient rehabilitation between 2013 and 2019.

Interventions: none.

Main Outcome Measures: Rehabilitation length-of-stay (LOS), Functional Independence Measure (FIM) scores at admission and discharge, and rehabilitation efficiency defined as FIM score improvement per day of rehabilitation.

Results: The final cohort contained 3,690 records for Medicine and 1,733 for Neuro/MSK category. For Medicine, one additional day of delayed discharge was associated with an average 5.1% (95% CI [3%, 7.3%]) increase in rehabilitation LOS, and 0.08 (95% CI [0.03, 0.13]) reduction in rehabilitation efficiency. For Neuro/MSK, one additional day of delayed discharge was associated with an average 11.6% (95% CI [2.8%, 20.4%]) increase in rehabilitation LOS and 0.08 (95% CI, [-0.07, 0.23]) reduction in rehabilitation efficiency.

Conclusions: Delayed discharge from acute care to rehabilitation due to capacity strain in rehabilitation had a strong association with prolonged LOS in rehabilitation. An important policy implication of this "cascading" effect of delays is that reducing capacity strain in rehabilitation could be highly effective in reducing discharge delays from acute care and improving rehabilitation efficiency.

Key Words: Patient admission; rehabilitation; capacity strain.

List of Abbreviations:
Alternative Level of Care (ALC)
Length-of-Stay (LOS)
Functional Independence Measure (FIM)
Instrumental Variable (IV)
National Rehabilitation Reporting System (NRS)
Discharge Abstract Database (DAD)
Canadian Institute for Health Information (CIHI)
Electronic Health Records (EHR)
Resource Intensity Weight (RIW)
Two-stage Least Squares (2SLS)
Ordinary Least Squares (OLS)

Delays in discharge from acute care are prevalent in North American hospitals and those around the world [1-5]. These delays can be particularly long for patients requiring post-acute care such as rehabilitation. Delayed discharges are costly for the health system as the delayed patients keep occupying acute care beds, possibly blocking new admissions and leading to hospital overcrowding [2]. In Canada, once an acute care patient is determined to be clinically stable and no longer in need of the intensity of resources or services provided in acute care, his/her status is changed to Alternative Level of Care (ALC) [6] until he/she is discharged to an appropriate care setting or reverts back to acute status. The age-adjusted average total acute Length-of-Stay (LOS) in Canada (except Quebec) has been relatively stable at around 7 days in recent years [7]. In 2020-21, 5.4% of hospital stays had ALC days and 16.9% of patient days, or more than 2.7 million days, were in ALC [7].

For patients requiring rehabilitation after their acute care, the transition can sometimes be delayed due to capacity-related constraints in the rehabilitation facility (e.g., lack of available beds, care providers, and/or staff to coordinate transitions). We refer to such delays as capacity-driven delays. With a limited number of beds and staff and an increasing demand due to the aging population, rehabilitation facilities often operate at or close to full occupancy.

In addition to interrupting patient flow, delays in admission to rehabilitation care could adversely impact outcomes [8-12]. Although patients may receive lower intensity rehabilitation in acute care, the goal is often to prevent further deterioration of the patients' conditions before they are admitted to rehabilitation care. The association between early initiation of rehabilitation activities in an inpatient rehabilitation facility and shorter LOS has been previously reported in the literature, e.g., for stroke [13, 14], severe trauma [15], and elective hip and knee arthroplasty [9]. In addition, several studies have reported an association between early admission to rehabilitation care and improved functional outcomes [8-12]. In these studies, delay typically

includes the acute LOS, e.g., defined as the time between the event of stroke or trauma and admission to rehabilitation. This does not single out the effect of capacity-driven delays incurred after completion of acute care. The impact of transfer delays – as measured by the number of ALC days – on rehabilitation LOS and functional status at discharge is investigated in [15] but only focusing on patients with severe trauma.

We examined the association between capacity-driven delays, and rehabilitation LOS and functional outcomes for acute care categories of Medicine and Neurology / Musculoskeletal (Neuro/MSK) using data from two sites of a large hospital network. Our goal was to quantify and gain insights on the hospital-wide benefits of reducing capacity strain in rehabilitation.

Methods

Setting

Our study involved two sites of a large hospital network providing both acute and inpatient High Tolerance, Short Duration (HTSD) rehabilitation care. One site provided HTSD rehabilitation in a single facility with 55 beds, whereas the other provided HTSD rehabilitation in 4 facilities with a total capacity of 137 beds.

Defining Delays

Figure 1 illustrates the process of admitting a patient from acute to rehabilitation care at our institution.

The number of days spent with ALC status (ALC LOS) measures the total delay in discharge from acute care and admission to rehabilitation care. We further distinguish between two types

of delays. Capacity-driven delays are those that are impacted by capacity strain in rehabilitation and can be reduced by increasing bed and/or other resource capacity. Examples include delays due to unavailability of rehabilitation beds, or delays in reviewing rehabilitation applications due to unavailability of staff. Non-capacity-driven delays, on the other hand, cannot be eliminated by increasing capacity and arise from necessary operations in the transition. Examples include the time to plan rehabilitation activities or the time spent physically transporting the patient.

Study Design and Data Sources

We conducted a retrospective cohort study using hospitalization records for patients who were admitted to acute care after September 28th, 2013 and subsequently discharged from inpatient HTSD rehabilitation before September 30th, 2019. The data included patient characteristics as well as clinical and operational information. The data was extracted from the National Rehabilitation Reporting System (NRS), the Discharge Abstract Database (DAD) of the Canadian Institute for Health Information (CIHI) [16], and the hospitals' Electronic Health Records (EHR). The details of specific variables used in our study are described in Appendix 1, Table S1. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for cohort studies. Our study was exempted from review for human subjects' research by the Research Ethics Board of our institution.

Patient Cohort

We limited our study to the two largest acute care categories: Medicine and Neuro/MSK. We utilized data for all patient categories to calculate the daily occupancy level of the rehabilitation units for the study period. We then restricted our analysis to January 1st, 2015 to January 1st, 2019 to ensure accurate calculation of occupancy levels (See Appendix 2 for details). In order to reduce the estimation bias due to outliers, we excluded patient records with Acute LOS smaller

than the 1st percentile (3 days) and larger than the 97.5th percentile (56 days) as well as patient records with Acute ALC LOS larger than the 97.5th percentile (16 days). In our models, we controlled for rehabilitation categories and acute sub-categories. We excluded rehabilitation categories and acute sub-categories with less than 50 records.

Outcomes and Covariates

The exposure variable was delay in care transition from acute to rehabilitation, measured by ALC LOS in acute care. In our analysis, we controlled for Age, Sex, Comorbidity Level, Resource Intensity Weight (RIW), Intervention (Therapeutic or Diagnostic), Rehabilitation Category, and Site. Comorbidity levels are mutually exclusive levels (between 0 and 4) assigned based on the cumulative percentage increase in patient cost associated with certain comorbidity codes [16]. RIW measures the total use of hospital resources compared to typical acute patients and depends on factors including Age, Comorbidities, and Interventions [16]. As such, it can be viewed as a proxy for disease severity.

We considered five outcomes: (1) Log Rehabilitation active LOS (LogRehLOS) is the natural logarithm of the number of days a patient received active rehabilitation care, i.e., excluding days spent in rehabilitation due to delay in discharge, (2) Functional Independence Measure (FIM) score at admission to rehabilitation (AdmFIM), (3) FIM score at discharge from rehabilitation (DisFIM), (4) FIM score gain (FimGain), and (5) rehabilitation efficiency (RehEff). FIM is a standard measure between 18 and 126 for evaluating the functional capabilities of rehabilitation patients [17]. We took the logarithm of rehabilitation LOS since it had a long tail, i.e., took very large values for a small portion of patients. FIMGain is defined as (DisFim - AdmFIM) and measures the improvement in functional capability of patients. RehEff is calculated using

(FIMGain / Rehabilitation active LOS), and measures the improvement in functional capability per day of rehabilitation.

Statistical Analysis

To accurately measure the effect of capacity-driven delays on rehabilitation outcomes, one would ideally conduct a randomized experiment where patients are randomly assigned to experience different delays. Since such an experiment was infeasible, we instead conducted an observational study. Observational data can however lead to biased estimates due to unobserved patient characteristics that are correlated with both acute ALC LOS and rehabilitation outcomes. In addition, our single measurement of discharge delay (ALC LOS) may include both capacity-driven and non-capacity driven delays.

To tackle these challenges, we utilized the IV method [18, 19]. A proper instrument is one that appropriately mimics a randomized experiment. It should be correlated with the exposure variable -- capacity-driven delays. Moreover, it should not affect the outcome variables except through its effect on capacity-driven delays, i.e., it should be uncorrelated with unobserved patient characteristics. The IV approach has been used, e.g., to examine the effect of early rehabilitation on in-hospital mortality for patients with aspiration pneumonia [20].

We used rehabilitation occupancy at the time when the patient's status was changed to ALC as the IV. Occupancy is defined as the ratio of the number of patients in rehabilitation or waiting to be admitted, to total rehabilitation bed capacity. Since the rehabilitation LOS was relatively long (on average 21.1 days), rehabilitation occupancy, which varies on a daily basis, at the time of receiving ALC status is unlikely to affect the rehabilitation outcomes other than through its effect on delays. In addition, rehabilitation occupancy only affects the capacity-driven delays, and is

unlikely to have an impact on non-capacity-driven delays. Therefore, it allows us to single out the effect of capacity-driven delays.

We examined the validity of the instrument using the Wald test [18] and by inspecting its correlation with ALC LOS. We used the two-stage least squares method (2SLS) to estimate the models with the IV. We compared the estimates using 2SLS with those obtained using ordinary least squares (OLS), i.e., without the IV.

To examine the robustness of our results, we considered five different model specifications. In Model 1 (base model) we controlled for Age, Sex, Comorbidity Level, Intervention, and Rehabilitation Category. In Model 2, we also controlled for the Site where the patient received care in addition to the controls in the base model. Model 3 was similar to Model 1, except that we controlled for RIW instead of Comorbidity Level. In Model 4, we controlled for Acute Subcategory in addition to the controls in the base model. In Model 5, we controlled for Acute Diagnosis in addition to the controls in the base model. We pooled diagnoses with less than 100 observations into one category. Finally, we conducted stratified analysis of Model 1 for the top diagnosis of each category.

Results

Cohort Characteristics

Figure 2 summarizes our patient cohort selection. The final cohort for estimation contained 5,423 hospitalization records with 3,690 belonging to the Medicine category and 1,733 to Neuro/MSK.

Table 1 provides summary statistics for Medicine and Neuro/MSK categories. The two categories combined comprised 77.3% of the total acute care patients requiring rehabilitation during the study period.

Among the Medicine patients, 48% were male, the median age was 81, 49% had comorbidity level 2 or above, and 45% experienced discharge delays (non-zero ALC LOS). Patients who had ALC status required more complex care as measured by RIW (1.6 vs. 1.3, *p*-value of two-sided t-test = 0.000) and were more likely to have at least one comorbidity (71% vs. 64%, *p*-value of Chi-squared test = 0.000) compared to patients without ALC status.

Among the Neuro/MSK category, 63% of the patients were male, the median age was 76, 18% of the patients had comorbidity level 2 or more, and 12% experienced delayed discharge. Patients who had ALC status required more complex care as measured by RIW (2.6 vs. 1.9, *p*-value of two-sided t-test = 0.000), but there was no significant difference in the proportion of patients with at least 1 comorbidity (37% vs. 33%, *p*-value of Chi-squared test = 0.1806).

Table 2 provides summary statistics for the acute and rehabilitation LOS stratified by the most responsible diagnosis. The fraction of patients with ALC status varied from 22% to 61% for Medicine and from 4% to 14% for Neuro/MSK among the top five diagnoses. The median ALC LOS (for those with ALC status) varied between 5-6 days among the top five diagnoses for Medicine and between 2-7 days for Neuro/MSK. The median rehabilitation LOS also varied among the top five most responsible diagnoses, from 17 to 22 for Medicine, and from 15 to 22 for Neuro/MSK.

Table 3 presents summary statistics for rehabilitation outcomes stratified by the top five most responsible diagnoses. Outcomes varied across the different diagnoses. In particular, the

median Admission FIM score varied from 48 to 69 for Medicine and from 58 to 65 for Neuro/MSK.

Validity of the Instrument

The instrument was highly correlated with the ALC LOS as illustrated in Figure 3, i.e., patients whose statuses were changed to ALC when the occupancy was higher, experienced higher ALC LOS on average. Wald test showed no evidence (*p*-value = 0.000) that the instrument is weak. First-stage estimation similarly indicates a significant correlation (see, Appendix 3, Table S2).

Estimation Results

Table 4 provides the estimated coefficient of ALC LOS for different outcomes and for Medicine and Neuro/MSK categories, respectively. Detailed estimation results for all 5 models can be found in Appendix 4, Tables S5-S17. Based on the results of Model 1, delayed discharge from acute care had a negative and statistically significant association with LogRehLOS for both categories. One additional day of delayed discharge on average increased the LogRehLOS of Medicine and Neuro/MSK patients by 0.05 and 0.12, respectively. These values translate to 1 and 2.4 day or equivalently 5.1% (95% CI [3%, 7.3%]) and 11.6% (95% CI [2.8%, 20.4%]) increase in the rehabilitation active LOS on average.

The effect of delayed discharge on FIMGain was not statistically significant. All other results were significant (at 0.05 significance level) except the effects on DischFIM and RehEff for Neuro/MSK patients. One additional day of delayed discharge decreased the Admission FIM scores for Medicine and Neuro/MSK patients respectively by 1.43 (95% CI [0.72, 2.13]) and 3.11 (95% CI [0.44, 5.78]); Discharge FIM scores by 1.55 (95% CI [0.66, 2.44]) and 2.29 (95%

CI [-0.85, 5.42]); and Rehabilitation Efficiency by 0.08 (95% CI [0.03, 0.13]) and 0.08 (95% CI, [-0.07, 0.23]) on average. The results were consistent across the other 4 models, although stratified analysis for the top diagnoses suggests that disease-level estimates could vary within each category.

Discussion

Using retrospective data from a large hospital network, we measured the association between delayed discharge from acute care due to capacity strain in rehabilitation, and rehabilitation LOS and functional outcomes for patients of Medicine and Neuro/MSK acute categories. The magnitude of the association with rehabilitation LOS was substantial for both categories but larger for Neuro/MSK. We also found a negative association with FIM scores at admission and discharge, but the magnitude was relatively small. There was no significant association with the absolute improvement in functionality. However, there was significant negative association with rehabilitation efficiency for Medicine patients.

Our results have important implications for reducing discharge delays from acute care and improving rehabilitation efficiency. The observation that delayed transition due to capacity strain increases rehabilitation LOS, points to a “cascading” effect for delays: delayed patients occupy rehabilitation beds longer, hence further contributing to capacity strain and leading to additional delays in transition for future patients. These delays can also be negatively associated with functional scores of patients at both admission and discharge. Combining the two effects, one additional day of delayed discharge is associated with an 0.08 decrease in per day improvement in functional capabilities of patients. Therefore, increasing the bottleneck capacity in rehabilitation (beds or staff) as well as better streamlining the admission process to reduce capacity-driven delays can be highly effective in improving the patient flow and rehabilitation

outcomes. In particular, reducing capacity-driven delays not only reduces patients' acute LOS, allowing more patients to get timely access to acute care, but also reduces patients' rehabilitation LOS, improving the throughput of rehabilitation.

There are two potential sources of bias in standard OLS estimation (without IV). First, even though we controlled for some patient severity information, there are likely unobserved patient severity related characteristics. In general, more severe patients could be more likely to experience a longer delay and are also more likely to require a longer rehabilitation LOS. This unobserved patient severity information is likely to cause an overestimation of the magnitude of the effect of capacity-driven delays. Second, ALC LOS may include both non-capacity-driven and capacity-driven delays. Non-capacity-driven delays could potentially improve patient outcomes by preparing the patient for rehabilitation. Not being able to separate the two types of delays is likely to cause an underestimation of the magnitude of the effect of capacity-driven delay. Compared to the OLS estimates, the magnitudes of the coefficient for acute ALC LOS with IV were larger (See Appendix 4, Tables S3 and S4). This suggests that the effect of the second bias is dominating. These results also highlight the importance of removing biases due to unobserved confounders.

Study Limitations

Our study has several limitations: (1) We measure delays using the amount of time a patient has ALC status. The timing of ALC designation is decided by the acute physician. As such, our measurement of discharge delay is subject to under- or over-reporting. Over-reported delays would imply that the impact of delays is even larger than estimated in our study, while under-reported delays mean that our estimates can be inflated. However, our results from Model 2 suggest that our findings are consistent across sites and hence possibly not sensitive to

variations in assigning ALC status. (2) Our study used data from two sites of a single institution and for its two largest acute care categories. The robustness of our observations to other institutions and for other acute categories should be investigated in future research. (3) We did not control for intensity of the rehabilitation which could impact discharge FIM scores. However, we expect the intensity to be independent of the rehabilitation occupancy, and hence the IV approach should adjust for the potential bias. An examination of this requires granular data on the rehabilitation intensity. (4) Our study population was highly heterogeneous. Although our analysis suggests that estimates of the average effects across acute categories are robust, the estimates may differ at the disease level. Estimating disease-specific effects requires larger samples for different diagnoses and should be investigated in future research.

Conclusion

Our study identified an association between delayed discharge from acute care due to capacity strain in rehabilitation, and prolonged LOS and lower efficiency in rehabilitation. Reducing capacity strain in rehabilitation by expanding capacity to eliminate delays could be highly effective in reducing discharge delays in acute care and increasing the efficiency of rehabilitation. Due to the observed cascading effect of delays, even a small reduction in capacity-driven delays could lead to a substantial improvement in rehabilitation efficiency and availability of bed capacity in acute care.

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Figure Legends

Figure 1: Summary of the steps involved in the rehabilitation admission process starting from the assignment of ALC status to admission. Steps highlighted in red indicate the possibility of incurring delays.

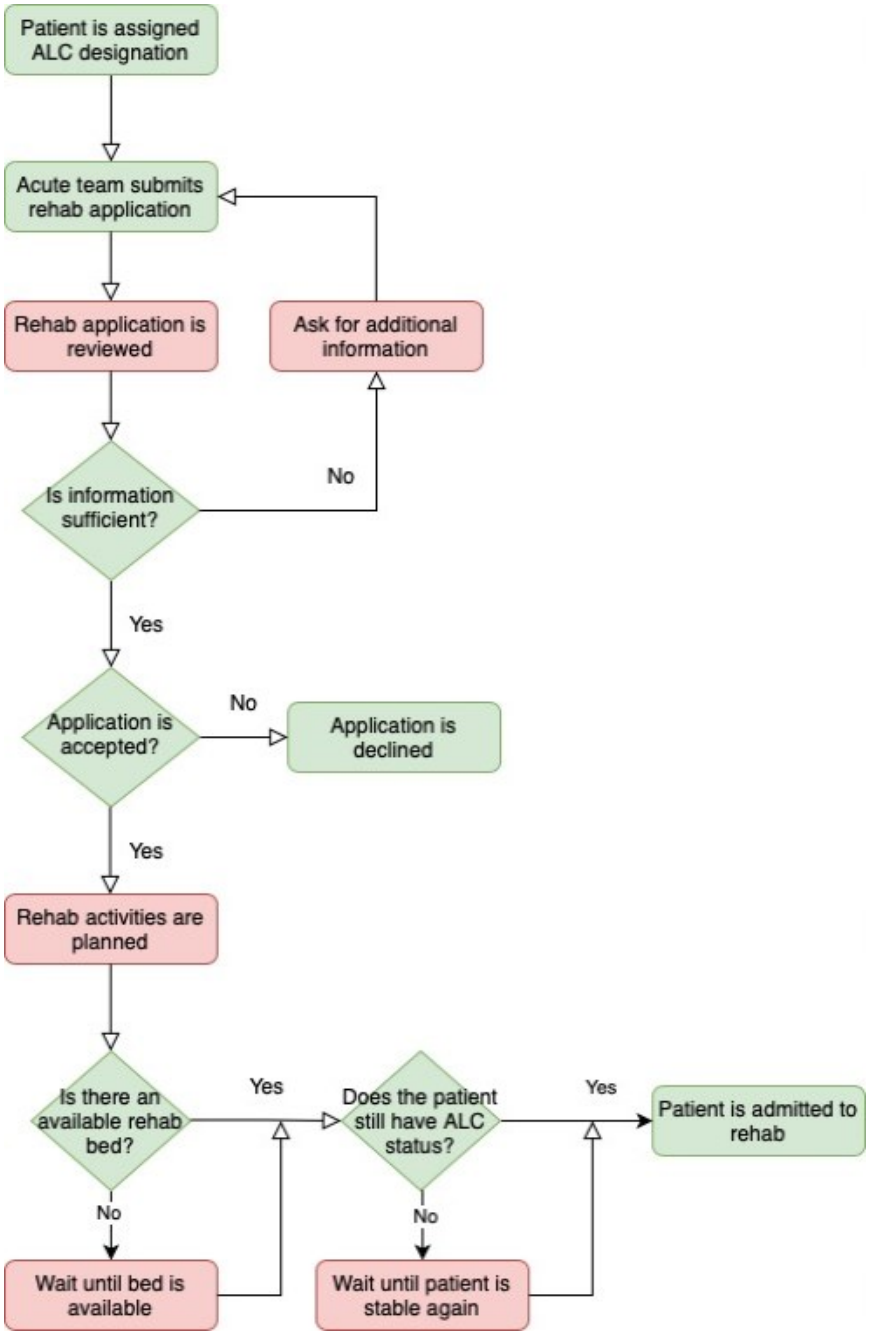


Figure 2: Selection of patient cohort.

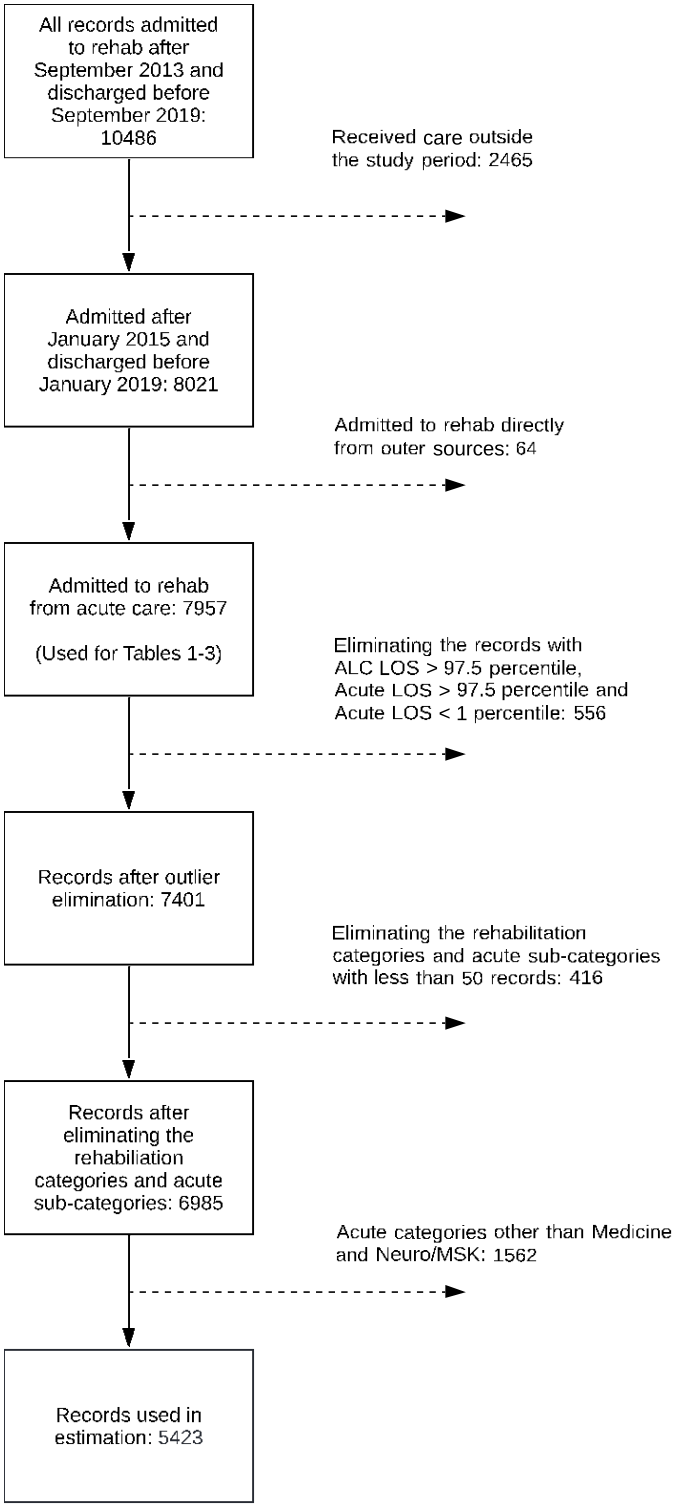


Figure 3: The relation between rehabilitation occupancy and ALC LOS. Each point on the figure presents the average ALC LOS of the patients for the corresponding range of occupancy (including patients on the waiting list) in rehabilitation sites. The bin intervals are selected such that each interval contains the same number of observations.

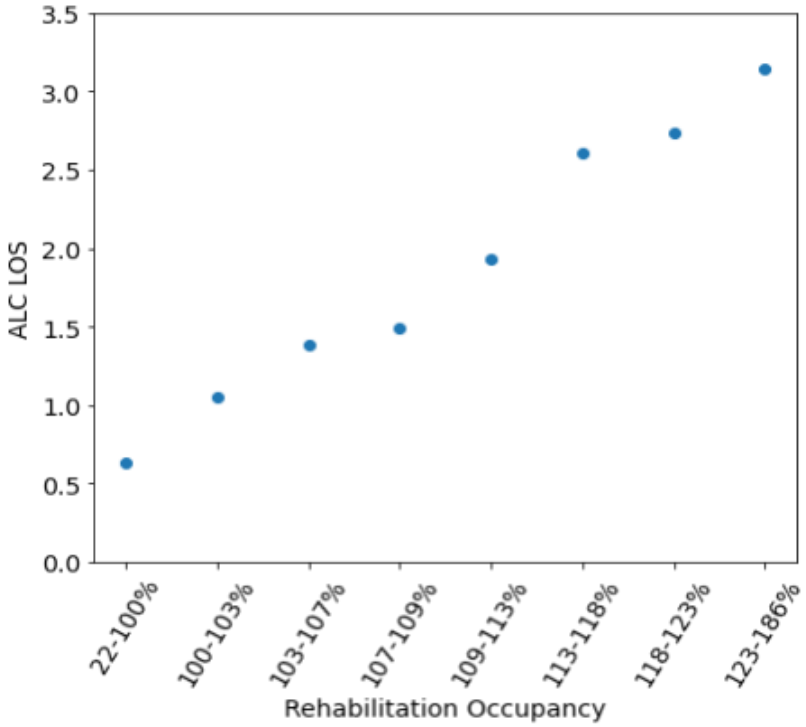


Table 1: Patient characteristics, acute and rehabilitation information for Medicine and Neuro/MSK patients. IQR represents the interquartile range.

		Medicine			Neuro/MSK		
		Non-ALC	**ALC**	**Total**	**Non-ALC**	**ALC**	**Total**
Number of observations		2352	1904	4256	1639	232	1871
Patient characteristics							
Age, d, median (IQR)		81.0 (71.0, 87.0)	81.0 (71.0, 88.0)	81.0 (71.0, 88.0)	76.0 (67.0, 84.0)	73.0 (62.7, 82.0)	76.0 (67.0, 84.0)
Sex: Male		47%	49%	48%	63%	60%	63%
Comorbidity	No Comorbidity	36%	29%	33%	67%	63%	67%
	Level 1	18%	18%	18%	16%	13%	15%
	Level 2	20%	20%	20%	10%	10%	10%
	Level 3	17%	20%	18%	5%	10%	6%
	Level 4	9%	13%	11%	2%	4%	2%
Acute characteristics							
Resource Intensity Weight (RIW), d, median (IQR)		1.3 (0.9, 2.1)	1.6 (1.0, 2.8)	1.4 (0.9, 2.4)	1.9 (1.5, 2.7)	2.6 (1.7, 4.0)	1.9 (1.5, 2.8)
Acute Active LOS, d, median (IQR)		8.0 (5.0, 13.0)	8.0 (5.0, 13.0)	8.0 (5.0, 13.0)	8.0 (6.0, 12.0)	8.0 (5.0, 14.0)	8.0 (6.0, 12.0)
Rehabilitation Characteristics							
Rehabilitation Group	Medically Complex	30%	42%	36%	1%	1%	1%
	Orthopedic Conditions	8%	8%	8%	62%	40%	59%
	Stroke	27%	10%	20%	2%	4%	2%
	Brain Dysfunction	13%	10%	12%	6%	17%	8%
	Debility	11%	15%	13%	0%	0%	0%
	Spinal Cord Dysfunction	2%	2%	2%	27%	34%	28%
	Neurological Conditions	3%	4%	3%	1%	3%	1%
	Cardiac	1%	2%	1%	-	-	-
	Pulmonary	2%	3%	2%	-	-	-
	Others	3%	4%	3%	2%	1%	1%
Rehabilitation Active LOS, d, median (IQR)		19 (13.0, 28.0)	20 (14.0, 28.0)	19 (13.0, 28.0)	19.0 (13.0, 27.0)	21.0 (13.0, 29.0)	19.0 (13.0, 28.0)

Discharge disposition	Home with paid health services	65%	65%	65%	67%	64%	67%
	Assisted living	15%	16%	16%	11%	9%	11%
	Residential care	7%	7%	7%	8%	9%	8%
	Acute care	6%	7%	6%	5%	7%	5%
	Home without health services	5%	4%	5%	8%	9%	8%
	Others	2%	1%	1%	2%	2%	2%

Table 2: Descriptive statistics for active and ALC LOS for Medicine and Neuro/MSK categories. IQR represents the interquartile range. Values are rounded to the closest integer.

Acute Diagnosis	No. of patients	% of patients with ALC	Length of Stay, d, median (IQR)			
			Acute Active LOS	Acute ALC LOS for ALC patients	Acute Total LOS	Rehabilitation Active LOS
Medicine	4256	45%	8 (5, 13)	5 (3, 8)	11 (7, 17)	18 (12, 26)
I60-I69 - Cerebrovascular diseases	807	22%	6 (4, 10)	5 (3, 8)	7 (4, 12)	22 (14, 33)
J09-J18 - Influenza and pneumonia	230	61%	8 (5, 13)	5 (3, 8)	12 (8, 18)	17 (11, 24)
F00-F09 - Organic, including symptomatic, mental disorders	217	46%	8 (5, 14)	6 (3, 10)	11 (7, 18)	18 (14, 27)
A30-A49 - Other bacterial diseases	165	54%	12 (8, 20)	6 (4, 9)	15 (11, 24)	21 (14, 28)
I30-I52 - Other forms of heart disease	162	53%	10 (7, 17)	6 (3, 9)	14 (10, 19)	18 (13, 25)
Others	2675	49%	8 (5, 14)	5 (3, 8)	11 (7, 18)	19 (13, 27)
Neuro/MSK	1871	12%	8 (6, 12)	5 (3, 9)	8 (6, 13)	18 (12, 26)
S70-S79 - Injuries to the hip and thigh	636	7%	8 (6, 12)	7 (4, 12)	8.5 (6, 13)	22 (15, 28)
M40-M54 - Dorsopathies	440	14%	7 (5, 9)	3 (2, 6)	7 (6, 10)	15 (9.75, 23)

M00-M25 - Arthropathies	179	4%	6 (4, 9)	2 (1.5, 6)	6 (4, 9)	15 (11, 22)
S30-S39 -Injuries to the abdomen, lower back, lumbar spine, pelvis and external genitals	99	12%	8 (5, 12)	7 (3.75, 8)	8 (5, 13)	21 (15, 27)
T80-T88 - Complications of surgical and medical care, not elsewhere classified	73	12%	9 (6, 15)	5 (2, 8)	10 (6, 16)	22 (15, 29)
Others	444	21%	10 (6, 16)	6 (4, 10)	12 (7, 19)	21 (13, 30)

Table 3: Descriptive statistics of rehabilitation outcomes for Medicine and Neuro/MSK patients. Values are rounded to the closest integer.

Acute Diagnosis	No. of patients	% of patients with ALC	Rehabilitation Outcomes		
			Admission FIM Scores	Discharge FIM Scores	Rehabilitation Efficiency
Medicine	4256	45%	58 (46, 75)	90 (67, 104)	1 (1, 2)
I60-I69 - Cerebrovascular diseases	807	22%	69 (49, 85)	102 (83, 110)	1 (1, 2)
J09-J18 - Influenza and pneumonia	230	61%	56 (43, 71)	87 (63, 99)	1 (1, 2)
F00-F09 - Organic, including symptomatic, mental disorders	217	46%	48 (37, 61)	76 (57, 92)	1 (1, 2)
A30-A49 - Other bacterial diseases	165	54%	56 (47, 70)	89 (63, 100)	1 (1, 2)
I30-I52 - Other forms of heart disease	162	53%	57 (45, 73)	88 (63, 101)	1 (1, 2)

Others	2675	49%	57 (46, 73)	88 (66, 103)	1 (1, 2)
Neuro/MSK	1871	12%	65 (50, 80)	101 (84, 110)	2 (1, 2)
S70-S79 -Injuries to the hip and thigh	636	7%	59 (46, 75)	98 (76, 108)	2 (1, 2)
M40-M54 - Dorsopathies	440	14%	74 (58, 85)	106 (94, 112)	2 (1, 3)
M00-M25 - Arthropathies	179	4%	64 (50, 77)	101 (85, 108)	2 (1, 3)
S30-S39 -Injuries to the abdomen, lower back, lumbar spine, pelvis and external genitals	99	12%	58 (43, 79)	95 (77, 105)	1.4 (1, 2)
T80-T88 - Complications of surgical and medical care, not elsewhere classified	73	12%	65 (52, 83)	99 (80, 106)	1.1 (1, 2)
Others	444	21%	66 (50, 80)	100 (85, 110)	1.4 (1, 2)

Table 4: The estimated coefficient of ALC LOS for different outcomes and the Medicine and Neuro/MSK categories. Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01). Standard errors are provided in parentheses.

	Medicine					**Neuro/MSK**				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
AdmFIM	-1.43*** (0.36)	-2.06*** (0.41)	-1.42*** (0.36)	-1.48*** (0.36)	-1.43*** (0.36)	-3.11*** (1.34)	-5.14*** (1.68)	-2.79*** (1.38)	-3.42*** (1.35)	-3.36** (1.41)
DischFIM	-1.55*** (0.46)	-1.74*** (0.49)	-1.55*** (0.45)	-1.62*** (0.46)	-1.61*** (0.46)	-2.29 (1.58)	-3.44* (1.84)	-1.91 (1.63)	-2.20 (1.58)	-2.68* (1.64)
FIM Gain	-0.09 (0.30)	0.38 (0.33)	-0.09 (0.30)	-0.12 (0.30)	-0.15 (0.3)	0.65 (1.12)	1.50 (1.27)	0.70 (1.15)	1.04 (1.11)	0.50 (1.16)
RehEff	-0.08*** (0.02)	-0.06*** (0.02)	-0.08*** (0.02)	-0.08*** (0.02)	-0.08*** (0.02)	-0.08 (0.08)	-0.11 (0.09)	-0.07 (0.08)	-0.08 (0.08)	-0.10 (0.08)
log(RehLOS)	0.05*** (0.01)	0.06*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.11*** (0.04)	0.18*** (0.05)	0.10*** (0.04)	0.12*** (0.04)	0.11*** (0.04)

Model 1: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + ALC LOS
Model 2: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Rehabilitation Site + ALC LOS
Model 3: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + RIW + ALC LOS
Model 4: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Acute Subcategory + ALC LOS
Model 5: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Acute Diagnosis + ALC LOS

Supplementary Material

Appendix 1: Description of Variables

Table S1: Description of variables used in the study

Covariate	Description	Type	Data Source
Acute Admit Date	Timestamp of patient's admission to acute care	Datetime	EHR
Acute Discharge Date	Timestamp of patient's discharge from acute care	Datetime	EHR
Acute Total LOS	Patient's length of stay in acute care (Acute Discharge Date - Acute Admit Date) (days)	Integer	EHR
Rehabilitation Location	Rehabilitation ward	Categorical	EHR
Rehabilitation Site	The site where the patient received rehabilitation care.	Categorical	EHR
Rehabilitation Admit Date	Timestamp of patient's admission to rehabilitation	Datetime	EHR
Rehabilitation Discharge Date	Timestamp of patient's discharge from rehabilitation	Datetime	EHR
Acute MRDiagnosis Category	Most Responsible Diagnosis Grouping of the patients	Categorical	DAD
Resource Intensity Weight (RIW)	Score that measures how resource intensive the patient's care is based on CMG+ methodology	Float	DAD
Sex		Categorical	DAD
Acute Comorbidity Level	Number of comorbidities a patient has	Categorical	DAD
Acute Category	Acute Provider Program of the patients	Categorical	DAD
Acute Subcategory	Acute Provider Subprogram of the patients	Categorical	DAD
Intervention Partition	Type of intervention (Therapeutic or Diagnostic)	Categorical	DAD
Discharge Living Setting Description	Discharge location of the patient	Categorical	NRS
Rehabilitation Client Group	Rehabilitation group of the patient	Categorical	NRS

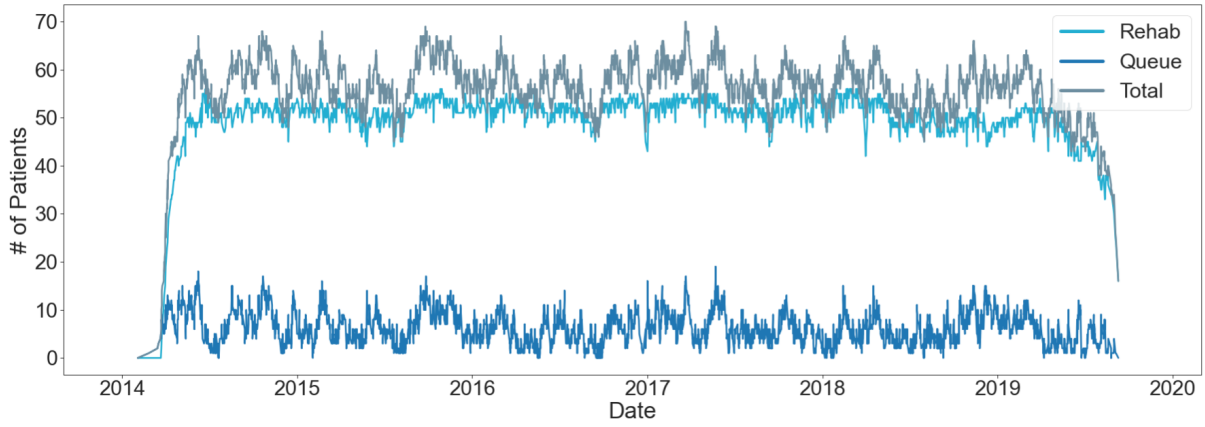
Category Description			
Rehabilitation Client Group Subcategory Description	Rehabilitation subgroup of the patient	Categorical	NRS
Admission FIM Total Score	Patient’s Functional Score at Admission (measures patients’ cognitive and motor skills at point of entry, higher number would indicate patient is in better health)	Integer	NRS
Discharge FIM Total Score	Patient’s Functional Score at Discharge	Integer	NRS
FIM Score Difference	Discharge FIM - Admission FIM	Integer	NRS
LOS Efficiency	Average change in Total Functional Score per day a client is participating in the rehabilitation program. A higher value indicates client experienced greater improvements in Total Function Score per Day	Float	NRS
Length of Stay (Days)	Patient's length of stay in rehabilitation (days)	Integer	NRS
Waiting For Discharge (Days)	Number of days patient spends in rehabilitation after their rehabilitation care is completed (days)	Integer	NRS
Active Rehabilitation Length of Stay (Days)	Patient's length of stay in rehabilitation excluding the waiting for discharge delays	Integer	NRS

Appendix 2: Calculating Occupancy

The rehabilitation occupancy is calculated separately for each location by dividing the number of patients already in rehabilitation or waiting to be admitted, by the bed capacity of the location. In principle, we can calculate the number of patients in rehabilitation or waiting given the timestamps of the admission and discharge, and the number of days spent with ALC status for each patient. However, in our data we see a record for each patient who was admitted to acute care after September 28th, 2013 and discharged from rehab before September 30th, 2019. Therefore, patients who were admitted to acute care before September 28th, 2013, although were discharged from rehabilitation before September 30th, 2019, do not appear in our dataset. Similarly, we do not observe any records for patients who were admitted to acute care after September 28th, 2013 and discharged from rehabilitation after September 30th, 2019. Therefore, we cannot accurately calculate the occupancy at the beginning and end of the study periods. As an example, Figure S1 illustrates the number of patients in rehabilitation (Rehab) and waiting to be admitted (Queue) as well as the sum of these values (Total) in time for one of the rehab locations calculated using our data.

In order to ensure accurate calculation of occupancy levels, we removed the last 9 months and first 15 months of the data and restricted our study to January 1st, 2015 to January 1st, 2019. The restricted time window was chosen given the observed LOS in acute (99% quantile: 80 days) and rehabilitation (99% quantile: 102 days). We removed more observations from the beginning period to also account for LOS of patients in acute care.

Figure S1: Rehabilitation occupancy calculated using data for one of the rehab locations.



Appendix 3: First-stage Results

Table S2: First-stage estimation results for Medicine and Neuro/MSK patients: estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

First Stage		
Covariate	**Medicine**	**Neuro/MSK**
Intercept	-4.3446*** (0.613)	-0.913 (0.567)
Acute Comorbidity: Level 2	0.0136 (0.177)	0.024 (0.206)
Acute Comorbidity: Level 3	0.3686** (0.182)	0.313 (0.260)
Acute Comorbidity: Level 4	0.0780 (0.219)	0.750* (0.458)
Acute Comorbidity: No Significant	-0.2015 (0.162)	-0.004 (0.144)
Sex: Male	0.1288 (0.112)	-0.142 (0.108)
Reh. Category: Cardiac	0.3598 (0.537)	-
Reh. Category: Debility	0.6983*** (0.219)	-2.272 (2.134)
Reh. Category: Medically Complex	0.5856*** (0.186)	-0.680 (0.465)
Reh. Category: Neurological Conditions	0.7438** (0.342)	1.107* (0.575)
Reh. Category: Orthopedic Conditions	0.3438 (0.246)	-1.409*** (0.205)
Reh. Category: Pulmonary	0.0775 (0.402)	-
Reh. Category: Spinal Cord Dysfunction	0.0212 (0.406)	-1.198*** (0.213)
Reh. Category: Stroke	-0.3182 (0.212)	-0.864** (0.390)
Intervention Partition: Therapeutic	-0.0015 (0.205)	-0.297* (0.159)
Age	-0.0086* (0.005)	0.002 (0.004)
Rehabilitation Occupancy	6.3870*** (0.396)	2.536*** (0.377)

Appendix 4: Detailed Estimation Results

Table S3: Effect of capacity-driven delays on the Rehabilitation LOS and Outcomes for Medicine patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Medicine									
	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	IV	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**	**OLS**
AdmFIM	-1.43*** (0.36)	-0.2** (0.09)	-2.06*** (0.41)	-0.24*** (0.09)	-1.42*** (0.36)	-0.18** (0.09)	-1.48*** (0.36)	-0.2** (0.09)	-1.43*** (0.36)	-0.19** (0.09)
DischFIM	-1.55*** (0.46)	-0.25** (0.11)	-1.74*** (0.49)	-0.26** (0.11)	-1.55*** (0.45)	-0.25** (0.11)	-1.62*** (0.46)	-0.26** (0.11)	-1.61*** (0.46)	-0.26** (0.11)
FIM Gain	-0.09 (0.30)	-0.05 (0.08)	0.38 (0.33)	-0.01 (0.08)	-0.09 (0.30)	-0.07 (0.08)	-0.12 (0.30)	-0.06 (0.08)	-0.15 (0.3)	-0.06 (0.08)
RehEff	-0.08*** (0.02)	-0.02*** (0.01)	-0.06*** (0.02)	-0.02 *** (0.01)	-0.08*** (0.02)	-0.02*** (0.01)	-0.08*** (0.02)	-0.02*** (0.01)	-0.08*** (0.02)	-0.02*** (0.01)
log(RehLOS)	0.05*** (0.01)	0.01*** (0.0)	0.06*** (0.01)	0.01*** (0.01)	0.05*** (0.01)	0.01*** (0.00)	0.05*** (0.01)	0.01*** (0.0)	0.05*** (0.01)	0.01*** (0.0)

Model 1: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + ALC LOS
Model 2: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Rehabilitation Site + ALC LOS
Model 3: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + RIW + ALC LOS
Model 4: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Acute Subcategory + ALC LOS
Model 5: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Acute Diagnosis + ALC LOS

Table S4: Effect of Capacity-driven delays on the Rehabilitation LOS and Outcomes for Neuro/MSK patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Neuro/MSK									
	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	IV	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**	**OLS**
AdmFIM	-3.11*** (1.34)	-0.34* (0.19)	-5.14*** (1.68)	-0.4** (0.19)	-2.79*** (1.38)	-0.27 (0.10)	-3.42*** (1.35)	-0.37* (0.19)	-3.36** (1.41)	-0.31* (0.19)
DischFIM	-2.29 (1.58)	-0.79*** (0.23)	-3.44* (1.84)	-0.82*** (0.23)	-1.91 (1.63)	-0.07*** (0.23)	-2.2 (1.58)	-0.79*** (0.24)	-2.68* (1.64)	-0.82*** (0.23)
FIM Gain	0.65 (1.12)	-0.45*** (0.18)	1.5 (1.27)	-0.42*** (0.18)	0.7 (1.15)	-0.43*** (0.18)	1.04 (1.11)	-0.42** (0.18)	0.5 (1.16)	-0.5*** (0.18)
RehEff	-0.08 (0.08)	-0.05*** (0.01)	-0.11 (0.09)	-0.05*** (0.01)	-0.07 (0.08)	-0.05*** (0.01)	-0.08 (0.08)	-0.05*** (0.02)	-0.1 (0.08)	-0.05*** (0.01)
log(RehLOS)	0.11*** (0.04)	0.01** (0.01)	0.18*** (0.05)	0.01*** (0.01)	0.1*** (0.04)	0.01 (0.01)	0.12*** (0.04)	0.01** (0.01)	0.11*** (0.04)	0.01 (0.01)

Model 1: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + ALC LOS
Model 2: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Rehabilitation Site + ALC LOS
Model 3: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + RIW + ALC LOS
Model 4: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Acute Subcategory + ALC LOS
Model 5: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Acute Diagnosis + ALC LOS

Table S5: Model 1 estimation results for Medicine patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Model 1				
	Medicine				
Covariate	**log Rehabilitation Active LOS**	**Admission FIM**	**Discharge FIM**	**FIM Gain**	**Rehabilitation Efficiency**
Intercept	2.747*** (0.084)	90.858*** (2.759)	126.38*** (3.38)	35.818*** (2.492)	2.348*** (0.183)
Acute Comorbidity: Level 2	0.026 (0.028)	-3.061*** (0.994)	-4.337*** (1.277)	-1.386 (0.878)	-0.127* (0.068)
Acute Comorbidity: Level 3	0.057* (0.029)	-2.573** (1.045)	-3.768*** (1.331)	-1.1 (0.904)	-0.136* (0.073)
Acute Comorbidity: Level 4	0.073** (0.036)	-5.377*** (1.207)	-3.454** (1.517)	1.858 (1.135)	-0.073 (0.084)
Acute Comorbidity: No Significant	0.044* (0.026)	-0.012 (0.918)	-0.109 (1.108)	-0.102 (0.759)	-0.055 (0.058)
Sex: Male	0.023 (0.018)	-0.472 (0.635)	-0.412 (0.805)	0.009 (0.567)	-0.026 (0.044)
Reh. Category: Cardiac	-0.134 (0.086)	12.054*** (2.786)	6.904 (4.231)	-4.687* (2.848)	-0.089 (0.224)
Reh. Category: Debility	-0.197*** (0.034)	12.025*** (1.269)	10.223*** (1.624)	-2.05* (1.083)	0.093 (0.084)
Reh. Category: Medically Complex	-0.047* (0.029)	8.921*** (1.031)	8.753*** (1.426)	-0.169 (0.983)	0.020 (0.080)
Reh. Category: Neurological Conditions	0.057 (0.056)	5.944*** (2.046)	4.493* (2.641)	-1.506 (1.689)	-0.162 (0.121)
Reh. Category: Orthopedic Conditions	0.065 (0.039)	6.909*** (1.357)	10.378*** (1.753)	3.43*** (1.191)	0.063 (0.098)
Reh. Category: Pulmonary	-0.306*** (0.058)	20.331*** (2.095)	15.551*** (2.611)	-4.585** (1.879)	0.084 (0.175)
Reh. Category: Spinal Cord Dysfunction	0.044* (0.067)	7.834*** (2.189)	6.159** (2.781)	-1.671 (1.919)	-0.226* (0.128)
Reh. Category: Stroke	0.179*** (0.035)	10.956*** (1.225)	11.371*** (1.642)	0.393 (1.177)	-0.303*** (0.083)
Intervention Partition: Therapeutic	0.003 (0.034)	0.495 (1.263)	-0.545 (1.549)	-1.31 (1.026)	-0.049 (0.070)
Age	0.000 (0.001)	-0.427*** (0.028)	-0.56*** (0.033)	-0.136*** (0.024)	-0.008*** (0.002)
Acute ALC LOS	0.050*** (0.010)	-1.429*** (0.359)	-1.548*** (0.455)	-0.094 (0.3)	-0.076*** (0.023)

Model 1: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + ALC LOS

Table S6: Model 1 estimation results for Neuro/MSK patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Model 1				
	Neuro/MSK				
Covariate	**log Rehabilitation Active LOS**	**Admission FIM**	**Discharge FIM**	**FIM Gain**	**Rehabilitation Efficiency**
Intercept	2.426*** (0.135)	102.63*** (4.446)	134.25*** (4.869)	31.931*** (3.559)	2.272*** (0.284)
Acute Comorbidity: Level 2	0.04 (0.056)	-0.888 (1.765)	-1.569 (2.057)	-0.939 (1.633)	-0.15 (0.118)
Acute Comorbidity: Level 3	-0.003 (0.077)	0.59 (2.393)	-1.236 (3.145)	-1.748 (2.211)	-0.153 (0.16)
Acute Comorbidity: Level 4	-0.13 (0.173)	0.735 (5.186)	-2.992 (6.382)	-3.561 (4.651)	0.147 (0.361)
Acute Comorbidity: No Significant	-0.073* (0.041)	3.829*** (1.21)	3.773*** (1.426)	-0.045 (1.15)	0.058 (0.092)
Sex: Male	-0.015 (0.029)	-0.793 (0.915)	-0.928 (1.06)	-0.278 (0.823)	0.087 (0.07)
Reh. Category: Debility	0.858*** (0.116)	-8.388** (3.913)	-8.964** (4.32)	-0.966 (3.075)	-0.978*** (0.229)
Reh. Category: Medically Complex	-0.066 (0.139)	-3.31 (4.892)	-8.588* (4.805)	-5.454 (3.732)	-0.166 (0.234)
Reh. Category: Neurological Conditions	0.052 (0.225)	3.935 (7.289)	-1.453 (5.926)	-5.228 (4.653)	-0.33 (0.264)
Reh. Category: Orthopedic Conditions	0.084 (0.085)	-1.722 (2.905)	0.524 (3.161)	1.931 (2.244)	0.178 (0.164)
Reh. Category: Spinal Cord Dysfunction	-0.032 (0.08)	3.004 (2.676)	2.954 (2.855)	-0.389 (2.1)	0.336** (0.156)
Reh. Category: Stroke	0.388*** (0.123)	-8.134* (4.309)	-9.283* (5.399)	-1.349 (3.829)	-0.469** (0.223)
Intervention Partition: Therapeutic	0.052 (0.043)	-2.096 (1.51)	-1.051 (1.596)	0.985 (1.171)	0.042 (0.086)
Age	0.005*** (0.001)	-0.486*** (0.037)	-0.55*** (0.041)	-0.062* (0.032)	-0.01*** (0.003)
Acute ALC LOS	0.109*** (0.041)	-3.11** (1.362)	-2.288 (1.601)	0.65 (1.119)	-0.085 (0.077)

Model 1: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + ALC LOS

Table S7: Model 2 estimation results for Medicine patients. Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Model 2				
	Medicine				
Covariate	**log Rehabilitation Active LOS**	**Admission FIM**	**Discharge FIM**	**FIM Gain**	**Rehabilitation Efficiency**
Intercept	2.712*** (0.080)	92.201*** (2.810)	126.940*** (3.374)	35.010*** (2.458)	2.339*** (0.180)
Acute Comorbidity: Level 2	0.013 (0.028)	-2.636*** (1.001)	-4.082*** (1.261)	-1.554* (0.870)	-0.122* (0.067)
Acute Comorbidity: Level 3	0.041 (0.030)	-2.097** (1.068)	-3.615*** (1.326)	-1.417 (0.902)	-0.136* (0.072)
Acute Comorbidity: Level 4	0.051 (0.036)	-4.647*** (1.230)	-3.241** (1.504)	1.336 (1.137)	-0.075 (0.082)
Acute Comorbidity: No Significant	0.044* (0.026)	-0.140 (0.923)	-0.204 (1.099)	-0.056 (0.754)	-0.046 (0.057)
Sex: Male	0.022 (0.018)	-0.425 (0.642)	-0.557 (0.798)	-0.188 (0.558)	-0.037 (0.043)
Reh. Category: Cardiac	-0.095 (0.086)	10.718*** (2.762)	6.757 (4.175)	-3.517 (2.729)	-0.060 (0.217)
Reh. Category: Debility	-0.146*** (0.035)	10.117*** (1.290)	9.339*** (1.630)	-0.993 (1.109)	0.106 (0.083)
Reh. Category: Medically Complex	-0.032 (0.030)	8.353*** (1.049)	8.448*** (1.412)	0.092 (0.978)	0.013 (0.078)
Reh. Category: Neurological Conditions	0.044 (0.057)	5.717*** (2.020)	4.299* (2.562)	-1.467 (1.666)	-0.144 (0.118)
Reh. Category: Orthopedic Conditions	0.085** (0.040)	6.174*** (1.365)	9.949*** (1.722)	3.732*** (1.169)	0.056 (0.095)
Reh. Category: Pulmonary	-0.242*** (0.060)	17.704*** (2.127)	14.638*** (2.643)	-2.880 (1.915)	0.121 (0.175)
Reh. Category: Spinal Cord Dysfunction	0.079 (0.069)	6.522*** (2.260)	5.871** (2.787)	-0.626 (1.893)	-0.201 (0.125)
Reh. Category: Stroke	0.243*** (0.038)	8.253*** (1.364)	10.557*** (1.738)	2.309* (1.237)	-0.257*** (0.085)
Intervention Partition: Therapeutic	0.014 (0.033)	0.092 (1.272)	-0.398 (1.530)	-0.765 (1.004)	-0.027 (0.068)
Age	0.001 (0.001)	-0.451*** (0.028)	-0.567*** (0.033)	-0.120*** (0.024)	-0.007*** (0.002)
Acute ALCLOS	0.065*** (0.011)	-2.055*** (0.405)	-1.740*** (0.494)	0.376 (0.326)	-0.063** (0.024)
Rehabilitation Site: M	-0.113*** (0.022)	4.799*** (0.769)	1.472 (0.938)	-3.385*** (0.678)	-0.095* (0.050)

Model 2: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Rehabilitation Site + ALC LOS

Table S8: Model 2 estimation results for Neuro/MSK patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Model 2				
	Neuro/MSK				
Covariate	**log Rehabilitation Active LOS**	**Admission FIM**	**Discharge FIM**	**FIM Gain**	**Rehabilitation Efficiency**
Intercept	2.527*** (0.152)	99.537*** (4.915)	132.490*** (5.032)	33.242*** (3.629)	2.240*** (0.290)
Acute Comorbidity: Level 2	0.032 (0.063)	-0.662 (1.996)	-1.443 (2.113)	-1.032 (1.690)	-0.148 (0.118)
Acute Comorbidity: Level 3	-0.027 (0.087)	1.325 (2.706)	-0.823 (3.238)	-2.055 (2.254)	-0.145 (0.161)
Acute Comorbidity: Level 4	-0.188 (0.212)	2.485 (6.229)	-2.004 (6.538)	-4.295 (5.035)	0.164 (0.363)
Acute Comorbidity: No Significant	-0.062 (0.045)	3.517*** (1.337)	3.594** (1.450)	0.088 (1.186)	0.054 (0.091)
Sex: Male	-0.004 (0.032)	-1.103 (0.991)	-1.102 (1.083)	-0.150 (0.843)	0.083 (0.070)
Reh. Category: Debility	0.977*** (0.139)	6.242*** (1.333)	3.551** (1.561)	0.546 (3.319)	0.062 (0.090)
Reh. Category: Medically Complex	-0.055 (0.169)	-11.983*** (4.557)	-10.999** (4.686)	-5.322 (4.129)	-1.013*** (0.239)
Reh. Category: Neurological Conditions	-0.016 (0.296)	-3.623 (5.680)	-8.766* (4.849)	-6.100 (5.139)	-0.169 (0.229)
Reh. Category: Orthopedic Conditions	0.130 (0.103)	5.993 (9.208)	-0.281 (6.844)	2.509 (2.362)	-0.308 (0.285)
Reh. Category: Spinal Cord Dysfunction	0.061 (0.099)	-3.108 (3.378)	-0.253 (3.386)	0.805 (2.298)	0.164 (0.169)
Reh. Category: Stroke	0.458*** (0.149)	0.168 (3.203)	1.346 (3.162)	-0.459 (4.012)	0.307* (0.166)
Intervention Partition: Therapeutic	0.066 (0.049)	-10.246** (4.862)	-10.481* (5.594)	1.163 (1.214)	-0.490** (0.228)
Age	0.004*** (0.001)	-2.530 (1.693)	-1.290 (1.663)	-0.072** (0.034)	0.037 (0.086)
Acute ALCLOS	0.176*** (0.051)	-5.1364*** (1.683)	-3.437* (1.838)	1.504 (1.275)	-0.105 (0.087)
Rehabilitation Site: M	-0.207*** (0.041)	-0.461*** (0.042)	-0.536*** (0.043)	-2.640** (1.206)	-0.009*** (0.002)

Model 2: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Rehabilitation Site + ALC LOS

Table S9: Model 3 estimation results for Medicine patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Model 3				
	Medicine				
Covariate	**log Rehabilitation Active LOS**	**Admission FIM**	**Discharge FIM**	**FIM Gain**	**Rehabilitation Efficiency**
Intercept	2.736*** (0.075)	91.628*** (2.674)	126.110*** (3.225)	34.760*** (2.379)	2.345*** (0.172)
Resource Intensity Weight (RIW)	0.009*** (0.004)	-0.473*** (0.156)	-0.254 (0.199)	0.213 (0.158)	-0.012 (0.012)
Sex: Male	0.026 (0.017)	-0.654 (0.629)	-0.725 (0.796)	-0.110 (0.558)	-0.038 (0.043)
Reh. Category: Cardiac	-0.149* (0.084)	12.579*** (2.802)	7.180* (4.225)	-4.944* (2.790)	-0.088 (0.219)
Reh. Category: Debility	-0.190*** (0.033)	12.112*** (1.239)	10.102*** (1.589)	-2.248** (1.068)	0.072 (0.083)
Reh. Category: Medically Complex	-0.052* (0.029)	9.082*** (1.015)	8.748*** (1.399)	-0.334 (0.967)	0.010 (0.078)
Reh. Category: Neurological Conditions	0.038 (0.055)	6.175*** (1.990)	4.635* (2.568)	-1.598 (1.655)	-0.146 (0.118)
Reh. Category: Orthopedic Conditions	0.069* (0.038)	7.414*** (1.311)	10.836*** (1.699)	3.385*** (1.161)	0.055 (0.095)
Reh. Category: Pulmonary	-0.309*** (0.057)	20.237*** (2.075)	15.528*** (2.602)	-4.633** (1.871)	0.077 (0.174)
Reh. Category: Spinal Cord Dysfunction	0.045 (0.065)	8.727*** (2.157)	7.232*** (2.772)	-1.486 (1.893)	-0.218* (0.127)
Reh. Category: Stroke	0.178*** (0.034)	11.367*** (1.225)	11.883*** (1.600)	0.491 (1.148)	-0.303*** (0.081)
Intervention Partition: Therapeutic	-0.0112 (0.0341)	1.023 (1.258)	0.028 (1.562)	-1.256 (1.094)	-0.012 (0.073)
Age	0.0007 (0.0008)	-0.449*** (0.027)	-0.575*** (0.032)	-0.130*** (0.024)	-0.008*** (0.002)
Acute ALCLOS	0.0502*** (0.0103)	-1.425*** (0.3550)	-1.547*** (0.450)	-0.094 (0.297)	-0.077*** (0.022)

Model 3: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + RIW + ALC LOS

Table S10: Model 3 estimation results for Neuro/MSK patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Model 3				
	Neuro/MSK				
Covariate	**log Rehabilitation Active LOS**	**Admission FIM**	**Discharge FIM**	**FIM Gain**	**Rehabilitation Efficiency**
Intercept	2.342*** (0.124)	105.950*** (4.191)	138.090*** (4.642)	32.408*** (3.415)	2.407*** (0.259)
Resource Intensity Weight (RIW)	0.019* (0.010)	-0.588* (0.312)	-1.009** (0.395)	-0.386 (0.338)	-0.057** (0.022)
Sex: Male	-0.014 (0.029)	-0.891 (0.910)	-1.026 (1.060)	-0.294 (0.821)	0.088 (0.070)
Reh. Category: Debility	0.841*** (0.110)	-7.050* (3.775)	-7.766* (4.176)	-1.073 (2.985)	-0.985*** (0.222)
Reh. Category: Medically Complex	-0.078 (0.137)	-2.666 (4.834)	-7.648 (4.805)	-5.140 (3.745)	-0.134 (0.231)
Reh. Category: Neurological Conditions	0.071 (0.210)	3.075 (6.971)	-2.587 (5.804)	-5.510 (4.804)	-0.369 (0.252)
Reh. Category: Orthopedic Conditions	0.081 (0.081)	-1.229 (2.800)	0.914 (3.058)	1.865 (2.194)	0.166 (0.159)
Reh. Category: Spinal Cord Dysfunction	-0.046 (0.078)	3.816 (2.637)	3.937 (2.825)	-0.208 (2.093)	0.359** (0.156)
Reh. Category: Stroke	0.336*** (0.125)	-7.119 (4.428)	-7.762 (5.424)	-0.914 (3.847)	-0.336 (0.223)
Intervention Partition: Therapeutic	0.021 (0.046)	-1.134 (1.609)	0.445 (1.710)	1.470 (1.276)	0.121 (0.092)
Age	0.005*** (0.001)	-0.498*** (0.036)	-0.565*** (0.041)	-0.066** (0.032)	-0.010*** (0.002)
Acute ALCLOS	0.100** (0.041)	-2.791** (1.379)	-1.907 (1.630)	0.703 (1.148)	-0.068 (0.078)

Model 3: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + RIW + ALC LOS

Table S11: Model 4 estimation results for Medicine patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Model 4				
	Medicine				
Covariate	**log Rehabilitation Active LOS**	**Admission FIM**	**Discharge FIM**	**FIM Gain**	**Rehabilitation Efficiency**
Intercept	2.68*** (0.086)	91.381*** (3.015)	125.53*** (3.886)	34.303*** (2.756)	2.311*** (0.227)
Acute Comorbidity: Level 2	0.026 (0.028)	-3.068*** (0.994)	-4.348*** (1.279)	-1.391 (0.878)	-0.127* (0.069)
Acute Comorbidity: Level 3	0.056* (0.029)	-2.594** (1.044)	-3.844*** (1.334)	-1.148 (0.906)	-0.139* (0.074)
Acute Comorbidity: Level 4	0.073** (0.036)	-5.471*** (1.208)	-3.585** (1.515)	1.821 (1.136)	-0.076 (0.084)
Acute Comorbidity: No Significant	0.049* (0.026)	0.008 (0.921)	-0.148 (1.114)	-0.152 (0.764)	-0.065 (0.058)
Acute Subcategory: Internal Medicine	0.045 (0.043)	-0.509 (1.509)	1.412 (2.138)	2.072 (1.436)	0.107 (0.126)
Acute Subcategory: Nephrology	0.228*** (0.061)	-0.977 (2.109)	-2.332 (3.114)	-1.194 (2.366)	-0.371** (0.184)
Acute Subcategory: Respirology	-0.094 (0.058)	5.74*** (2.076)	6.913** (2.723)	1.054 (1.858)	0.192 (0.161)
Sex: Male	0.02 (0.018)	-0.496 (0.636)	-0.372 (0.806)	0.07 (0.567)	-0.017 (0.044)
Reh. Category: Cardiac	-0.14* (0.085)	12.085*** (2.751)	7.018* (4.223)	-4.593 (2.861)	-0.076 (0.225)
Reh. Category: Debility	-0.192*** (0.035)	11.83*** (1.276)	10.205*** (1.633)	-1.863* (1.09)	0.102 (0.085)
Reh. Category: Medically Complex	-0.051* (0.03)	8.639*** (1.047)	8.729*** (1.435)	0.108 (0.977)	0.044 (0.08)
Reh. Category: Neurological Conditions	0.057 (0.057)	6.012*** (2.054)	4.456* (2.652)	-1.619 (1.695)	-0.17 (0.122)
Reh. Category: Orthopedic Conditions	0.061 (0.04)	6.998*** (1.36)	10.423*** (1.758)	3.377*** (1.191)	0.063 (0.098)
Reh. Category: Pulmonary	-0.208*** (0.064)	16.094*** (2.304)	11.861*** (2.884)	-3.976* (2.04)	0.018 (0.185)
Reh. Category: Spinal Cord Dysfunction	0.043 (0.067)	7.955*** (2.195)	6.109** (2.796)	-1.855 (1.925)	-0.24* (0.13)
Reh. Category: Stroke	0.182*** (0.036)	11.025*** (1.267)	11.243*** (1.66)	0.187 (1.189)	-0.323*** (0.084)
Intervention Partition: Therapeutic	0.004 (0.035)	0.521 (1.299)	-0.09 (1.585)	-0.857 (1.074)	-0.015 (0.075)
Age	0.0 (0.001)	-0.428*** (0.028)	-0.564*** (0.033)	-0.141*** (0.025)	-0.009*** (0.002)
Acute ALC LOS	0.053*** (0.01)	-1.476*** (0.361)	-1.624*** (0.458)	-0.12 (0.3)	-0.082*** (0.023)

Model 4: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Acute Subcategory + ALC LOS

Table S12: Model 4 estimation results for Neuro/MSK patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Model 4				
	Neuro/MSK				
Covariate	**log Rehabilitation Active LOS**	**Admission FIM**	**Discharge FIM**	**FIM Gain**	**Rehabilitation Efficiency**
Intercept	2.389*** (0.139)	105.12*** (4.465)	134.6*** (4.987)	29.799*** (3.684)	2.197*** (0.288)
Acute Comorbidity: Level 2	0.066 (0.056)	-1.488 (1.779)	-1.811 (2.084)	-0.624 (1.676)	-0.185 (0.116)
Acute Comorbidity: Level 3	0.006 (0.079)	0.174 (2.431)	-1.5 (3.24)	-1.614 (2.289)	-0.161 (0.164)
Acute Comorbidity: Level 4	-0.205 (0.177)	4.146 (5.08)	-1.687 (6.583)	-5.654 (4.439)	0.188 (0.373)
Acute Comorbidity: No Significant	-0.07* (0.042)	3.533*** (1.218)	3.763*** (1.441)	0.234 (1.171)	0.072 (0.093)
Acute Subcategory: Orthopaedic Surgery	0.023 (0.051)	-4.107*** (1.53)	-2.634 (1.836)	1.424 (1.304)	0.121 (0.109)
Sex: Male	-0.018 (0.03)	-0.806 (0.918)	-1.122 (1.063)	-0.466 (0.835)	0.086 (0.071)
Reh. Category: Medically Complex	-0.076 (0.142)	-1.231 (4.926)	-7.136 (4.871)	-6.061 (3.9)	-0.216 (0.246)
Reh. Category: Neurological Conditions	0.528*** (0.164)	-12.412 (8.466)	-23.976*** (6.055)	-11.811*** (3.984)	-0.977*** (0.194)
Reh. Category: Orthopedic Conditions	0.075 (0.09)	0.86 (3.0)	2.554 (3.325)	1.406 (2.397)	0.112 (0.174)
Reh. Category: Spinal Cord Dysfunction	-0.033 (0.082)	3.175 (2.704)	3.27 (2.866)	-0.249 (2.156)	0.345** (0.154)
Reh. Category: Stroke	0.51*** (0.133)	-12.94*** (4.662)	-15.161** (6.2)	-2.378 (4.509)	-0.72*** (0.223)
Intervention Partition: Therapeutic	0.069 (0.044)	-2.896* (1.521)	-0.754 (1.628)	2.079* (1.198)	0.078 (0.086)
Age	0.005*** (0.001)	-0.485*** (0.038)	-0.55*** (0.042)	-0.062* (0.033)	-0.01*** (0.003)
Acute ALC LOS	0.116*** (0.04)	-3.415** (1.346)	-2.198 (1.585)	1.043 (1.113)	-0.082 (0.077)

Model 4: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Acute Subcategory + ALC LOS

Table S13: Model 5 estimation results for Medicine patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Model 5				
	Medicine				
Covariate	**log Rehabilitation Active LOS**	**Admission FIM**	**Discharge FIM**	**FIM Gain**	**Rehabilitation Efficiency**
Intercept	2.691*** (0.091)	89.747*** (3.316)	125.17*** (4.18)	35.836*** (2.948)	2.391*** (0.211)
Acute Comorbidity: Level 2	0.024 (0.028)	-2.583*** (1.002)	-3.823*** (1.29)	-1.336 (0.882)	-0.118* (0.069)
Acute Comorbidity: Level 3	0.056* (0.029)	-2.441** (1.048)	-3.61*** (1.34)	-1.069 (0.902)	-0.131* (0.073)
Acute Comorbidity: Level 4	0.074** (0.036)	-4.896*** (1.213)	-3.064** (1.524)	1.806 (1.136)	-0.078 (0.085)
Acute Comorbidity: No Significant	0.038 (0.026)	0.315 (0.922)	0.141 (1.106)	-0.15 (0.758)	-0.053 (0.058)
Acute Diagnosis: C00-C97 - Malignant neoplasms	-0.079 (0.102)	-0.79 (3.461)	-2.928 (4.698)	-2.959 (3.312)	-0.23 (0.203)
Acute Diagnosis: E10-E14 - Diabetes mellitus	0.16* (0.086)	0.429 (2.763)	2.35 (3.9)	1.757 (2.873)	-0.21 (0.226)
Acute Diagnosis: F00-F09 - Organic, including symptomatic, mental disorders	0.01 (0.061)	-3.479 (2.228)	-2.071 (3.002)	1.074 (2.024)	0.106 (0.147)
Acute Diagnosis: I20-I25 - Ischaemic heart diseases	0.018 (0.213)	-10.786*** (4.129)	-4.858 (6.277)	5.942 (5.58)	0.349 (0.463)
Acute Diagnosis: I30-I52 - Other forms of heart disease	-0.055 (0.062)	0.689 (2.168)	0.692 (3.02)	0.392 (1.99)	0.041 (0.164)
Acute Diagnosis: I60-I69 - Cerebrovascular diseases	0.044 (0.084)	5.418* (3.162)	4.2 (4.109)	-1.378 (2.836)	-0.167 (0.189)
Acute Diagnosis: I70-I79 - Diseases of arteries, arterioles, and capillaries	0.343* (0.185)	8.606* (4.94)	-2.703 (5.355)	-11.339** (5.136)	-1.219*** (0.218)
Acute Diagnosis: J09-J18 - Influenza and pneumonia	-0.137** (0.057)	2.775 (2.159)	3.081 (2.82)	-0.054 (1.83)	0.263* (0.143)
Acute Diagnosis: J40-J47 - Chronic lower respiratory diseases	-0.02 (0.067)	4.992** (2.454)	7.111** (3.305)	1.638 (2.31)	0.181 (0.172)
Acute Diagnosis: K55-K64 - Other diseases of intestines	-0.1 (0.099)	2.747 (3.269)	2.303 (4.518)	-0.627 (3.076)	0.004 (0.222)
Acute Diagnosis: M00-M25 - Arthropathies	-0.042 (0.088)	0.006 (3.262)	3.545 (4.115)	3.404 (2.948)	0.412* (0.239)
Acute Diagnosis: M40-M54 - Dorsopathies	0.099 (0.074)	3.113 (2.949)	5.54 (3.464)	2.3 (2.362)	-0.0 (0.165)
Acute Diagnosis: N17-N19 - Renal failure	0.001 (0.066)	-0.334 (2.396)	-0.623 (3.547)	-0.435 (2.638)	-0.141 (0.188)
Acute Diagnosis: N30-N39 - Other diseases of urinary system	-0.006 (0.059)	-2.872 (2.26)	-4.078 (3.057)	-1.413 (1.985)	-0.024 (0.136)
Acute Diagnosis: Other	0.025 (0.047)	0.967 (1.783)	1.544 (2.392)	0.416 (1.606)	0.058 (0.112)
Acute Diagnosis: R25-R29 - Symptoms and signs involving the nervous and musculoskeletal systems	0.066 (0.065)	-2.516 (2.377)	-0.614 (3.062)	1.822 (2.068)	0.133 (0.157)

Acute Diagnosis: R50-R69 - General symptoms and signs	0.038 (0.065)	-2.309 (2.397)	-1.568 (3.297)	0.813 (2.284)	0.097 (0.17)
Acute Diagnosis: S00-S09 - Injuries to the head	-0.02 (0.09)	6.467** (3.166)	7.1* (3.962)	0.417 (2.693)	0.099 (0.189)
Acute Diagnosis: S20-S29 - Injuries to the thorax	-0.088 (0.086)	5.529* (2.948)	7.351** (3.658)	1.713 (2.36)	0.344 (0.213)
Acute Diagnosis: S30-S39 - Injuries to the abdomen, lower back, lumbar spine and pelvis	0.073 (0.072)	-1.969 (2.46)	2.345 (3.105)	4.21** (2.136)	0.089 (0.149)
Acute Diagnosis: S70-S79 - Injuries to the hip and thigh	0.06 (0.137)	-9.293** (4.364)	-19.448*** (6.714)	-10.667*** (3.901)	-0.902*** (0.299)
Acute Diagnosis: T80-T88 - Complications of surgical and medical care, not elsewhere classified	0.321*** (0.118)	-0.937 (4.306)	1.601 (5.591)	2.388 (4.646)	-0.236 (0.298)
Sex: Male	0.025 (0.018)	-0.458 (0.632)	-0.417 (0.805)	-0.0 (0.571)	-0.027 (0.044)
Reh. Category: Cardiac	-0.108 (0.091)	12.744*** (2.867)	7.556* (4.544)	-5.118* (2.996)	-0.1 (0.232)
Reh. Category: Debility	-0.198*** (0.036)	12.481*** (1.302)	10.658*** (1.705)	-2.087* (1.138)	0.088 (0.091)
Reh. Category: Medically Complex	-0.04 (0.033)	8.448*** (1.13)	8.488*** (1.572)	-0.008 (1.078)	0.036 (0.088)
Reh. Category: Neurological Conditions	0.045 (0.058)	5.78*** (2.076)	4.286 (2.698)	-1.601 (1.741)	-0.162 (0.127)
Reh. Category: Orthopedic Conditions	0.045 (0.048)	7.11*** (1.615)	9.757*** (2.041)	2.564* (1.418)	0.074 (0.117)
Reh. Category: Pulmonary	-0.282*** (0.069)	17.017*** (2.352)	11.317*** (3.103)	-5.293** (2.174)	0.001 (0.2)
Reh. Category: Spinal Cord Dysfunction	-0.001 (0.074)	7.172*** (2.451)	4.081 (3.102)	-3.155 (2.112)	-0.231* (0.14)
Reh. Category: Stroke	0.149** (0.069)	6.05** (2.641)	8.177** (3.456)	2.081 (2.482)	-0.095 (0.156)
Intervention Partition: Therapeutic	-0.002 (0.034)	0.59 (1.29)	-0.169 (1.572)	-1.031 (1.055)	-0.007 (0.072)
Age	0.001 (0.001)	-0.42*** (0.028)	-0.558*** (0.034)	-0.141*** (0.025)	-0.009*** (0.002)
Acute ALC LOS	0.05*** (0.01)	-1.433*** (0.361)	-1.614*** (0.459)	-0.146 (0.3)	-0.083*** (0.023)

Model 5: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Acute Diagnosis + ALC LOS

Table S14: Model 5 estimation results for Neuro/MSK patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Model 5				
	Neuro/MSK				
Covariate	**log Rehabilitation Active LOS**	**Admission FIM**	**Discharge FIM**	**FIM Gain**	**Rehabilitation Efficiency**
Intercept	2.748*** (0.256)	75.021*** (8.973)	122.95*** (9.561)	48.353*** (11.149)	2.206*** (0.421)
Acute Comorbidity: Level 2	0.017 (0.056)	-1.027 (1.812)	-1.676 (2.085)	-0.968 (1.644)	-0.06 (0.114)
Acute Comorbidity: Level 3	-0.029 (0.076)	0.75 (2.334)	-1.051 (3.042)	-1.765 (2.197)	-0.063 (0.153)
Acute Comorbidity: Level 4	-0.1 (0.16)	-1.134 (4.454)	-4.264 (5.93)	-3.056 (4.62)	0.172 (0.339)
Acute Comorbidity: No Significant	-0.076* (0.04)	3.941*** (1.209)	3.953*** (1.419)	0.01 (1.144)	0.079 (0.088)
Acute Diagnosis: C00-C97 - Malignant neoplasms	-0.326 (0.238)	24.011*** (8.23)	0.248 (8.724)	-23.708** (11.039)	-0.287 (0.395)
Acute Diagnosis: F00-F09 - Organic, including symptomatic, mental disorders	-0.427* (0.25)	4.333 (8.894)	-28.767*** (9.252)	-33.798*** (11.034)	-0.667* (0.391)
Acute Diagnosis: I20-I25 - Ischaemic heart diseases	-1.364*** (0.235)	29.442*** (8.403)	28.725*** (8.356)	-1.028 (10.814)	6.978*** (0.337)
Acute Diagnosis: I60-I69 - Cerebrovascular diseases	-0.608** (0.257)	33.185*** (9.107)	16.933* (9.814)	-16.594 (11.532)	0.359 (0.455)
Acute Diagnosis: I70-I79 - Diseases of arteries, arterioles, and capillaries	-0.969*** (0.282)	41.144*** (8.854)	30.691** (12.563)	-10.319 (17.421)	1.224*** (0.332)
Acute Diagnosis: M00-M25 - Arthropathies	-0.502** (0.228)	22.213*** (8.119)	6.188 (8.164)	-16.482 (10.728)	0.829** (0.349)
Acute Diagnosis: M40-M54 - Dorsopathies	-0.601*** (0.224)	30.596*** (8.03)	14.974* (7.836)	-16.053 (10.646)	0.892*** (0.316)
Acute Diagnosis: N17-N19 - Renal failure	0.976*** (0.253)	-1.811 (8.997)	1.513 (9.334)	2.606 (11.093)	-0.009 (0.4)
Acute Diagnosis: Other	-0.299 (0.219)	25.129*** (7.864)	8.354 (7.724)	-16.932 (10.57)	0.072 (0.3)
Acute Diagnosis: R25-R29 - Symptoms and signs involving the nervous and musculoskeletal systems	-2.218*** (0.457)	92.265*** (15.257)	66.15*** (17.845)	-24.503 (15.563)	2.226*** (0.814)
Acute Diagnosis: R50-R69 - General symptoms and signs	-0.544* (0.29)	29.834** (12.834)	23.667** (12.091)	-5.925 (11.227)	1.38* (0.8)
Acute Diagnosis: S00-S09 - Injuries to the head	-0.458* (0.236)	33.841*** (8.581)	18.619** (8.494)	-15.405 (10.704)	0.379 (0.34)
Acute Diagnosis: S20-S29 - Injuries to the thorax	-0.318 (0.374)	29.836*** (11.252)	12.913 (10.847)	-16.457 (11.757)	0.111 (0.442)
Acute Diagnosis: S30-S39 - Injuries to the abdomen, lower back, lumbar spine and pelvis	-0.294 (0.232)	22.473*** (8.322)	6.119 (8.153)	-16.554 (10.767)	0.075 (0.322)
Acute Diagnosis: S70-S79 - Injuries to the hip and thigh	-0.285 (0.224)	21.733*** (8.002)	4.444 (7.97)	-17.465 (10.654)	0.06 (0.319)

Acute Diagnosis: T80-T88 - Complications of surgical and medical care, not elsewhere classified	-0.26 (0.233)	26.75*** (8.338)	5.047 (8.338)	-21.99** (10.769)	-0.126 (0.335)
Sex: Male	0.0 (0.029)	-1.003 (0.917)	-1.206 (1.059)	-0.347 (0.819)	0.048 (0.067)
Reh. Category: Debility	0.826*** (0.128)	-6.03 (4.216)	-6.068 (4.709)	-0.402 (3.36)	-0.96*** (0.237)
Reh. Category: Medically Complex	-0.073 (0.15)	-1.438 (5.057)	-4.734 (4.868)	-3.39 (3.845)	-0.178 (0.23)
Reh. Category: Neurological Conditions	-0.001 (0.233)	7.478 (7.562)	3.156 (6.482)	-4.101 (4.854)	-0.255 (0.279)
Reh. Category: Orthopedic Conditions	0.027 (0.097)	2.726 (3.219)	5.673 (3.601)	2.643 (2.499)	0.229 (0.176)
Reh. Category: Spinal Cord Dysfunction	0.124 (0.096)	0.663 (3.15)	0.177 (3.397)	-0.666 (2.534)	-0.152 (0.18)
Reh. Category: Stroke	0.575*** (0.14)	-12.156*** (4.678)	-13.52** (6.436)	-1.434 (4.666)	-0.643** (0.302)
Intervention Partition: Therapeutic	0.086 (0.057)	-1.414 (1.901)	0.291 (1.996)	1.7 (1.577)	-0.034 (0.1)
Age	0.005*** (0.001)	-0.486*** (0.038)	-0.555*** (0.042)	-0.066** (0.033)	-0.012*** (0.003)
Acute ALC LOS	0.113*** (0.042)	-3.363** (1.407)	-2.676* (1.645)	0.502 (1.156)	-0.096 (0.078)

Model 5: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + Acute Diagnosis + ALC LOS

Table S15: The estimated coefficient of ALC LOS for different outcomes and two largest diagnosis categories based on Model 1.

	Model 1	
	I60-I69 - Cerebrovascular diseases	**S70-S79 - Injuries to the hip and thigh**
AdmFIM	-2.06** (1.01)	-8.78** (3.53)
DischFIM	-1.90* (1.10)	-5.63 (3.79)
FIM Gain	0.24 (0.79)	3.12 (2.55)
RehEff	-0.04 (0.06)	-0.22 (0.15)
log(RehLOS)	0.05* (0.03)	0.24** (0.10)

Model 1: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + ALC LOS

Table S16: Model 1 estimation results for I60-I69 - Cerebrovascular diseases patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Model 1				
	I60-I69 - Cerebrovascular diseases				
Covariate	**log Rehabilitation Active LOS**	**Admission FIM**	**Rehabilitation Efficiency**	**Discharge FIM**	**FIM Gain**
Intercept	2.595*** (0.179)	89.486*** (5.873)	35.272*** (6.583)	1.963*** (0.348)	124.36*** (8.024)
Acute Comorbidity: Level 2	0.084 (0.066)	-8.372*** (2.264)	0.103 (1.869)	-0.157 (0.106)	-8.015*** (2.617)
Acute Comorbidity: Level 3	0.043 (0.08)	-6.084** (2.962)	1.184 (2.206)	0.084 (0.141)	-4.723 (3.369)
Acute Comorbidity: Level 4	0.147 (0.105)	-15.609*** (3.667)	-2.945 (3.827)	-0.573** (0.247)	-17.908*** (4.656)
Acute Comorbidity: No Significant	0.02 (0.055)	0.512 (1.859)	0.319 (1.458)	0.026 (0.086)	0.988 (1.962)
Sex: Male	0.028 (0.043)	1.002 (1.455)	0.895 (1.293)	0.039 (0.077)	1.837 (1.664)
Reh. Category: Debility	-0.356* (0.216)	15.818*** (4.469)	3.249 (5.614)	0.69 (0.502)	19.361*** (6.767)
Reh. Category: Medically Complex	-0.344 (0.233)	8.292 (9.394)	6.493 (5.648)	1.759** (0.793)	14.823 (11.175)
Reh. Category: Neurological Conditions	0.643 (0.524)	-4.262 (12.773)	11.833** (4.896)	-0.017 (0.806)	7.71 (15.2)
Reh. Category: Orthopedic Conditions	0.149 (0.21)	8.984** (4.061)	-9.245** (4.325)	-0.539* (0.291)	-0.034 (5.509)
Reh. Category: Other Disabling Impairments	0.184 (0.146)	-14.253*** (5.149)	45.157*** (5.663)	2.009*** (0.35)	30.423*** (7.02)
Reh. Category: Spinal Cord Dysfunction	0.808*** (0.199)	-23.721*** (4.349)	29.293*** (5.689)	0.166 (0.305)	5.652 (6.394)
Reh. Category: Stroke	0.233** (0.106)	5.287 (3.629)	4.099 (4.242)	0.077 (0.26)	9.49* (5.406)
Intervention Partition: Therapeutic	0.006 (0.069)	-1.919 (2.448)	1.613 (2.049)	0.054 (0.13)	0.012 (2.725)
Age	0.001 (0.002)	-0.306*** (0.055)	-0.197*** (0.051)	-0.009*** (0.003)	-0.5*** (0.06)
Acute ALC LOS	0.056* (0.032)	-2.056** (1.005)	0.235 (0.795)	-0.041 (0.058)	-1.901* (1.097)

Model 1: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + ALC LOS

Table S17: Model 1 estimation results for S70-S79 - Injuries to the hip and thigh patients. Estimated coefficient and standard error (in parentheses). Stars indicate the statistical significance of the effects (* 0.1, ** 0.05, ***0.01).

	Model 1				
	S70-S79 - Injuries to the hip and thigh				
Covariate	**log Rehabilitation Active LOS**	**Admission FIM**	**Rehabilitation Efficiency**	**Discharge FIM**	**FIM Gain**
Intercept	0.92* (0.504)	120.46*** (19.824)	19.184 (14.614)	3.672*** (1.11)	140.32*** (21.961)
Acute Comorbidity: Level 2	0.166 (0.11)	-3.598 (4.062)	2.616 (3.034)	0.008 (0.206)	-0.95 (4.426)
Acute Comorbidity: Level 3	0.214* (0.125)	-9.262** (4.473)	-3.723 (4.352)	-0.429* (0.236)	-12.998** (5.377)
Acute Comorbidity: Level 4	-0.078 (0.332)	7.615 (7.308)	11.962*** (4.168)	0.88 (0.811)	18.485*** (7.022)
Acute Comorbidity: No Significant	0.044 (0.094)	1.651 (3.214)	4.82* (2.508)	0.204 (0.192)	6.443* (3.428)
Sex: Male	0.036 (0.056)	-2.58 (1.892)	-2.445 (1.586)	-0.122 (0.113)	-5.05** (2.156)
Reh. Category: Debility	-0.352 (0.43)	5.983 (16.804)	5.204 (10.882)	-0.324 (1.069)	9.254 (24.309)
Reh. Category: Medically Complex	-0.477 (0.772)	18.191 (35.573)	-21.791 (18.689)	-0.664 (0.833)	-3.807 (23.727)
Reh. Category: Neurological Conditions	1.738*** (0.407)	-33.842** (16.077)	11.565 (12.317)	-1.562* (0.833)	-22.367 (17.263)
Reh. Category: Orthopedic Conditions	0.944** (0.388)	-4.419 (15.554)	16.446 (11.703)	-0.581 (0.794)	11.953 (16.602)
Reh. Category: Pain Syndromes	-2.043*** (0.76)	83.909*** (28.778)	-1.109 (20.796)	4.341*** (1.33)	82.445*** (31.613)
Reh. Category: Stroke	-0.624 (0.665)	25.307 (44.421)	-1.427 (13.546)	0.285 (1.486)	23.632 (45.972)
Intervention Partition: Therapeutic	0.217* (0.113)	-3.009 (4.236)	5.024 (3.178)	0.022 (0.243)	2.015 (5.267)
Age	0.009*** (0.002)	-0.61*** (0.09)	-0.188*** (0.07)	-0.02*** (0.006)	-0.805*** (0.093)
Acute ALC LOS	0.243** (0.097)	-8.784** (3.535)	3.119 (2.549)	-0.22 (0.15)	-5.636 (3.794)

Model 1: log(RehLOS) = Age + Sex + Intervention + Rehabilitation Category + Comorbidity + ALC LOS