



Effect of Body Mass Index on Inpatient Rehabilitation Outcomes After Stroke

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Introduction

Recent studies examining the relationship between body mass index (BMI) and rehabilitative outcomes have yielded mixed results. Some studies have reported that lower FIM® function scores,^{1,2} longer lengths of stay (LOS) and greater hospital costs³ are associated with higher BMIs, while others have reported lower mortality rates, less stroke recurrence and greater improvements in functional outcomes for patients with higher BMIs.⁴⁻⁷ Given the variation in findings, the present study sought to examine the relationship between BMI and inpatient rehabilitation LOS, functional outcomes⁸ and discharge destination following stroke using a large pan-Canadian data set.

Methods

Using data from the National Rehabilitation Reporting System (NRS), stroke patients discharged from inpatient rehabilitation between April 1, 2010, and March 31, 2013, (n = 14,197) were divided into five BMI groups: **underweight** (<18.5 kg/m²), **normal** (18.5 to 24.9 kg/m²), **overweight** (25.0 to 29.9 kg/m²), **moderately obese** (30 to 39.9 kg/m²) and **severely obese** (≥40 kg/m²). The relationship between BMI group and

- Discharge FIM® scores and LOS was investigated with a Poisson regression; and
- Being discharged back home was investigated with a logistic regression, while adjusting for the following risk factors:
 - Age
 - Sex
 - Stroke type
 - Admission function scores
 - Discharge destination
 - Province of residence
 - Socio-economic status
 - Number of pre-admission comorbidities
 - Comorbidity of depression, diabetes, hypothyroidism, congestive heart failure or hypertension

1. Measures of patient function used in this analysis are based on data collected using the FIM® instrument, property of Uniform Data System for Medical Rehabilitation, a division of UB Foundation Activities, Inc.

Table 1: Characteristics of Patients Admitted to Inpatient Rehabilitation for Stroke Care

Admission Characteristic	BMI Category				
	Underweight (n = 601)	Normal (n = 5,385)	Overweight (n = 5,007)	Moderately Obese (n = 2,839)	Severely Obese (n = 365)
Male/Female (%)	35/65	52/48	60/40	52/48	37/63
Age (Years)*	72.0 ± 16.3	71.4 ± 14.7	70.3 ± 13.2	67.1 ± 13.0	61.9 ± 13.6
Lives Alone (%)	36.8	30.0	27.3	27.1	26.6
Total FIM® Score at Admission*	72.0 ± 22.3	75.1 ± 22.9	77.4 ± 23.5	77.6 ± 23.1	75.3 ± 23.9
Onset Days*	29.6 ± 59.0	25.7 ± 70.3	23.3 ± 70.4	24.2 ± 59.5	22.0 ± 33.4

Note

* Values are means ± standard deviation.

Source

National Rehabilitation Reporting System, 2010–2011 to 2012–2013, Canadian Institute for Health Information.

Table 2: Results of Regression Analyses Examining LOS and Being Discharged Back Home

Dependent Variable	Potential Predictor	LOS			Discharged Back Home		
		Risk Ratio	Lower CL	Upper CL	Odds Ratio	Lower CL	Upper CL
BMI	Underweight	1.02	1.01	1.03*	0.79	0.64	0.98*
	Overweight	1.00	0.99	1.00	1.12	1.01	1.24
	Moderately Obese	1.00	0.99	1.01	1.21	1.06	1.37*
	Severely Obese	1.01	0.99	1.02	1.19	0.88	1.61
	Normal	1.00			1.00		
Age		0.99	0.99	0.99	0.98	0.97	0.98*
Total FIM® Function Score at Admission		0.99	0.99	0.99	1.05	1.04	1.05*
Number of Pre-Admission Comorbidities		0.99	0.99	0.99	1.02	1.00	1.04*
Sex	Male	1.00	0.99	1.00	1.17	1.07	1.28*
	Female	1.00			1.00		
Type of Stroke	Infarction	0.99	0.98	0.99	0.90	0.78	1.03
	Other Stroke Types	0.96	0.95	0.96	0.83	0.71	0.97*
	Hemorrhage	1.00			1.00		
	Discharge Destination	Home	0.95	0.94	0.96	—	—
	Not Home	1.00					
Comorbidity of Depression	Yes	1.01	1.00	1.02	0.78	0.66	0.92*
	No	1.00			1.00		
Comorbidity of Hypothyroidism	Yes	0.99	0.98	1.00	0.89	0.75	1.05
	No	1.00			1.00		
Comorbidity of Congestive Heart Failure	Yes	0.96	0.95	0.97	0.98	0.79	1.22
	No	1.00			1.00		
Comorbidity of Hypertension	Yes	1.05	1.04	1.05	1.12	1.01	1.24*
	No	1.00			1.00		
Comorbidity of Diabetes	Yes	0.99	0.98	1.00	0.99	0.89	1.10
	No	1.00			1.00		

Notes

* p<0.05.

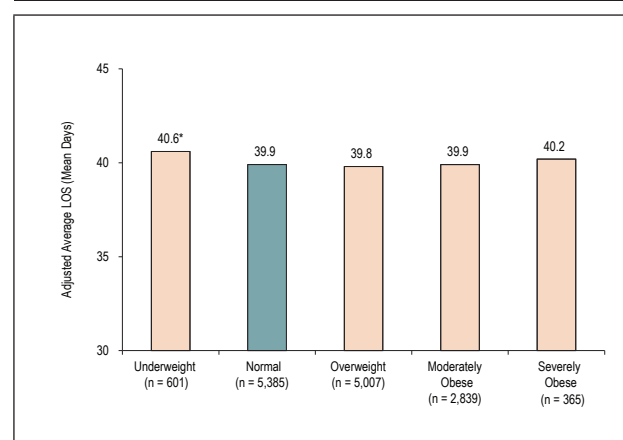
CL: Confidence limit.

Province of residence, statistical area classification of residence (level of urban/rural) and socio-economic status (both Social Deprivation and Material Deprivation scales) were also statistically significant predictors of LOS and being discharge back home that may warrant further investigation.

Source

National Rehabilitation Reporting System, 2010–2011 to 2012–2013, Canadian Institute for Health Information.

Figure 1: Adjusted LOS by Admission BMI Group



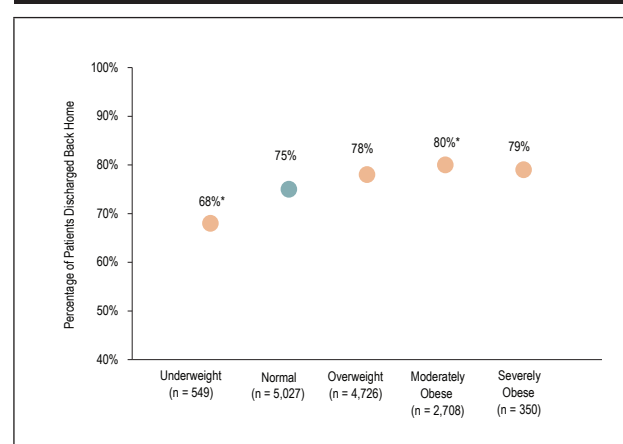
Note

* p<0.05.

Source

National Rehabilitation Reporting System, 2010–2011 to 2012–2013, Canadian Institute for Health Information.

Figure 2: Percentage of Patients Discharged Home Who Were Home Prior to Admission



Note

* p<0.05.

Source

National Rehabilitation Reporting System, 2010–2011 to 2012–2013, Canadian Institute for Health Information.

Results

- Average age and proportion of patients living alone prior to admission decreased as BMI increased. Admission function scores tended to be lowest for **underweight** patients (Table 1).
- After controlling for the above-mentioned patient characteristics (Table 2), **underweight** patients stayed longer (Figure 1) to achieve the same functional gains and were 21% less likely to be discharged back home (Figure 2) compared with patients in the **normal** BMI group.
- **Moderately obese** patients had the same LOS (Figure 1) as those in the **normal** BMI group but had slightly higher average discharge function scores (98.6 versus 97.6; p<0.05) and demonstrated the greatest odds of returning home (Figure 2).
- The **overweight** and **severely obese** BMI groups did not differ significantly from the **normal** BMI group in terms of discharge function score, LOS or likelihood of returning home.

Limitations

- Measures of acute stroke severity were not available for these analyses; however, total function score at admission was included in the risk-adjusted models.

Conclusions

Inpatient rehabilitation following stroke provided comparable increases in function regardless of admission BMI. However, **underweight** patients demonstrated the poorest outcomes overall, since patients in this group stayed longer to achieve comparable increases in function and were less likely to be discharged back home. Our findings suggest that targeted interventions in underweight individuals are needed to optimize inpatient rehabilitation care delivery.

References

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About the NRS

The NRS contains client data related to adult inpatient rehabilitation in Canada. As of 2012–2013, the NRS contained 13 years of data from more than 100 facilities in 9 provinces.

Facilities collect data on admission and discharge from the inpatient rehabilitation program and send it to CIHI. Flexible comparative reporting is available for all participating facilities, and data is also made available to the public through Quick Stats and focused analytical publications.