Obesity Prevalence Before and After Spinal Cord Injury

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ABSTRACT

BACKGROUND

Obesity prevalence is high in persons with spinal cord injury (SCI). SCI-related changes in body composition (i.e., muscle atrophy, increase in fat mass, decrease in bone density, etc.) provide evidence to reduce body mass index (BMI) values that classify obesity for those at risk of obesity-related secondary health conditions. Clinicians may find it advantageous to examine BMI trajectories to better understand patient's obesity risk.

OBJECTIVE

Using the traditional and SCI-adjusted BMI classification systems, we determined obesity prevalence each year, and obesity trajectories two years pre-SCI through two years post-SCI.

DESIGN

Retrospective clinical record review using "Advanced Text Explorer"

METHODS

Electronic medical records identified traumatic SCI participants that sought care at Mayo Clinic. Participants with a BMI measurement each year from two years pre-SCI through two years post-SCI were included.

RESULTS

The traditional BMI classification system shows one third of participants were obese pre-SCI. The shift from traditional to SCI-adjusted BMI classification system shows obesity prevalence post-SCI increasing two-fold for motor complete injuries, and three-fold for motor incomplete injuries, and increasing two-fold for tetraplegic injuries, and three-fold for paraplegic injuries. Overall, BMI values decreased slightly over the span of one year pre-SCI through two years post-SCI for all groups.

CONCLUSIONS

Following SCI, obesity prevalence increased to encompass nearly all participants two years after injury. The SCI-adjusted BMI classification system may better identify obese individuals, but the numerical shift by the SCI-adjusted BMI classification system dictated the high obesity prevalence in our participants. Importantly, the increase in obesity prevalence was not driven by an increase in BMI values.

BMI CLASSIFICATION SYSTEMS

	Traditional (kg/m^2)	SCI-Adjusted (kg/m^2)
Underweight	<18.5	<18.5
Normal	18.5 - 24.9	18.5 - 22.0
Overweight	25.0 - 29.9	>22.0
Obese	>30.0	>22.0

METHODS

PROCEDURAL FACTORS

Patients were identified on 4/27/2020

→ Search syntax: "Spinal cord injury" or "SCI" and "traumatic" not "non- traumatic" or " non traumatic"

→ All records from 1996 - 2020

Injury Severity	n	Level of injury	n
AIS A	18	Tetraplegia	40
AIS B	6	Paraplegia	22
AIS C	12		
AIS D	26		
Total	**62**		**62**

RESULTS: OBESITY PREVALENCE

	Motor Complete				Motor Incomplete				
	n =	BMI >30	n =	BMI > 22		n =	BMI >30	n =	BMI > 22
Timeline: Year -2	8	33%	20	83%	Year -2	13	34%	36	95%
Year -1	8	33%	20	83%	Year -1	14	37%	35	92%
SCI					SCI				
Year +1	6	25%	18	75%	Year +1	13	34%	35	92%
Year +2	9	38%	20	83%	Year +2	11	29%	36	95%

	Tetraplegia				Paraplegia				
	n =	BMI >30	n =	BMI > 22		n =	BMI >30	n =	BMI > 22
Timeline: Year -2	14	35%	36	93%	Year -2	7	23%	20	91%
Year -1	15	38%	35	88%	Year -1	7	23%	20	91%
SCI					SCI				
Year +1	11	28%	35	88%	Year +1	7	23%	18	82%
Year +2	13	33%	35	88%	Year +2	7	23%	21	95%

RESULTS: CHANGES IN BMI

	Motor Complete				Motor Incomplete			
	Mean	Median	SD	CI (95%)	Mean	Median	SD	CI (95%)
Timeline: Year -2	28.4	27.6	6.2	[25.70, 31.05]	28.5	28.3	4.6	[26.93, 29.98]
Year -1	28.6	27.5	6.2	[25.91, 31.27]	28.4	28.5	4.6	[26.85, 29.91]
SCI								
Year +1	27.1	25.6	6.2	[24.40, 29.77]	28.2	27.6	4.5	[26.75, 29.73]
Year +2	27.4	27.3	5.5	[25.01, 29.78]	28.2	28.4	4.4	[26.68, 29.63]
Change: -1 to +1	-1.5*	-1.4	1.9	[-2.31, -0.69]	-0.1*	0.0	1.6	[-0.69, 0.41]
-1 to +2	-1.2	-1.4	2.9	[-2.46, 0.07]	-0.2	0.1	2.1	[-0.91, 0.46]

	Tetraplegia				Paraplegia			
	Mean	Median	SD	CI (95%)	Mean	Median	SD	CI (95%)
Timeline: Year -2	28.1	27.9	5.0	[26.52, 29.77]	28.8	27.9	5.7	[26.36, 31.51]
Year -1	28.3	28.1	5.2	[26.60, 29.95]	28.9	28.0	5.4	[26.31, 31.27]
SCI								
Year +1	27.8	27.1	5.1	[26.16, 29.50]	27.7	26.6	5.4	[25.26, 30.20]
Year +2	27.8	28.4	5.1	[26.13, 29.44]	28.0	27.3	4.5	[25.95, 30.05]
Change: -1 to +1	-0.5	-0.3	1.6	[-0.98, 0.08]	-1.1	-1.2	2.2	[-2.05, -0.08]
-1 to +2	-0.5	-0.2	2.4	[-1.28, 0.29]	-0.8	-1.2	2.6	[-1.97, 0.38]

*p < .01; SD = standard deviation; CI = confidence intervals

RESULTS: OBESITY PREVALENCE

Figure: Heat map comparison of obesity prevalence in motor complete injuries using two classification systems

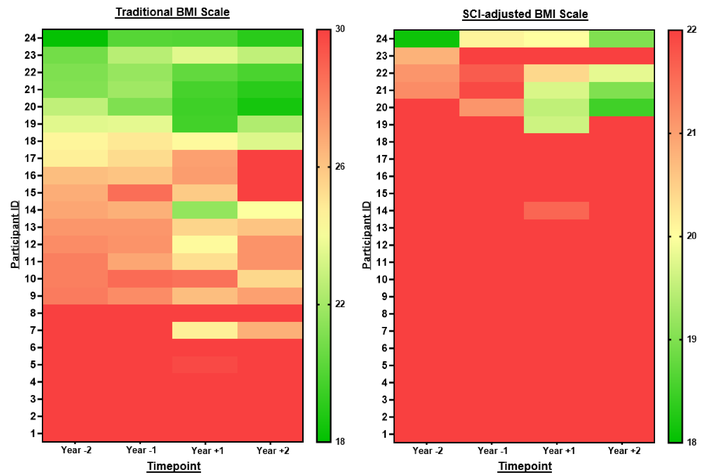
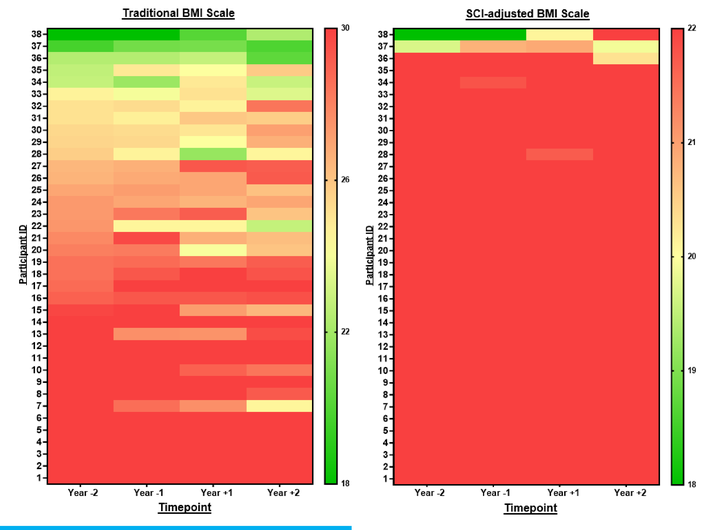


Figure: Heat map comparison of obesity prevalence in motor incomplete injuries using two classification systems



*All data presented is currently under review in the *Journal of Spinal Cord Medicine*

DISCUSSION

OBESITY PREVALENCE

Results show high prevalence of obesity after injury, regardless of injury severity or level of injury

- Increase in obesity prevalence was not driven by an increase in BMI
  - →Tissue composition data not available
  - →Increased prevalence partially due to change in BMI classification system
- BMI best used as a screening tool, and tissue analysis should be performed when possible

BMI TRAJECTORY

Mean BMI for all groups decreased slightly from before injury to after injury

- The BMI decrease from one year before to one year after injury was significantly different for motor complete injuries compared to motor incomplete injuries but not for one year before to two years after
- When stratified by level of injury, no significant differences in BMI were found from one year before injury to one and two years after injury.
- We report no significant differences in BMI between motor complete and incomplete injuries, or between tetraplegia and paraplegia at one year and two years after injury
- BMI trajectory appears stable for all groups from two years before injury to two years after injury

LIMITATIONS

- Our sample size was small for the analyses.
- Our sample distribution favored tetraplegic, motor complete injuries
- Our analysis did not account for age or sex, which could be factors in sustained obesity after SCI

FINAL THOUGHTS

Trajectory analysis could be applied throughout the first year following SCI onset to predict patients who are at higher risk of developing obesity or determine worsening BMI for those already classified as obese

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