Beyond the biomechanics: How knee factors, physical activity, depressed mood, and health modulate the relationship between obesity and altered gait

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Background

- Obesity is associated with numerous health risks, but also with altered gait characteristics such reduced gait velocity and step length and increased step width[1,2]
- Obesity is also associated with an array of additional factors including knee osteoarthritis, depression, reduced physical activity, and poorer physical health[3,4,5]
- How secondary factors modulate the relationship between obesity and altered gait remains underexplored.

Objective

To assess how knee buckling, knee pain, depressed mood, physical activity, and physical health mediate or moderate the relationship between obesity at spatiotemporal gait parameters

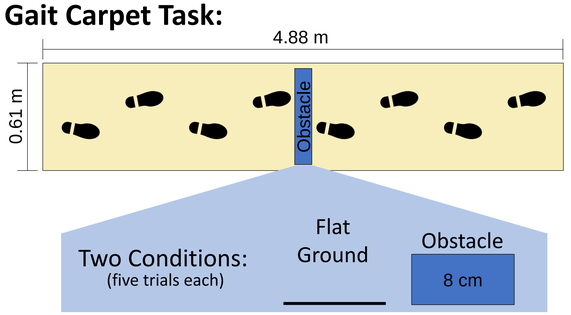
Methods

Participants:

n = 40 (39 women) participants with obesity

	Age (years)	Height (cm)	Weight (kg)	BMI (kg/m²)	Waist Circ (cm)
Mean	45.95	164.79	114.63	42.19	116.14
SD	8.36	7.52	14.71	4.56	12.52

Gait Carpet Task:

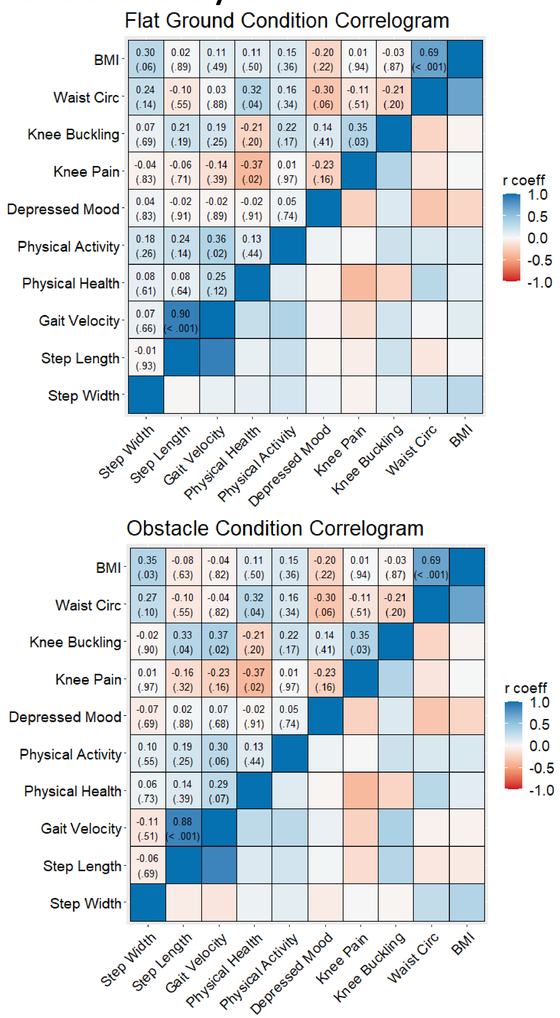


Additional Factors

- **Knee Buckling**: Self report of buckling events within past 3 months (Y/N)
- **Knee Pain**: Visual Analog Scale for pain
- **Depressed mood**: Center for Epidemiological Studies Depression (CES-D) inventory
- **Physical Activity**: Physical Activity Scale for the Elderly (PASE)
- **Physical Health**: SF-12 Health Survey

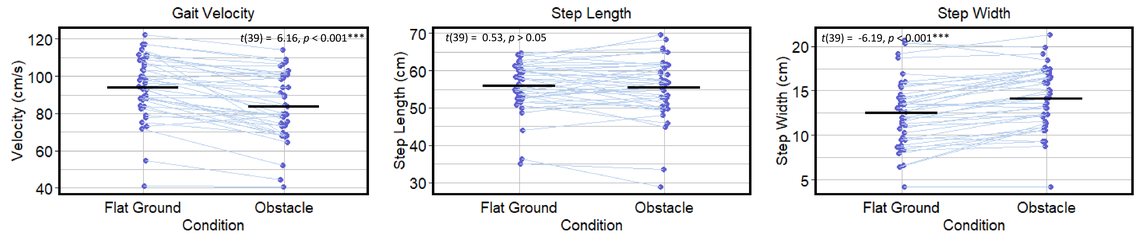
Results

Correlation analysis



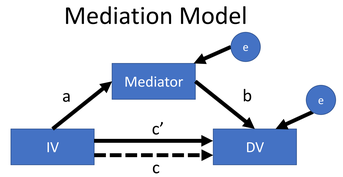
- Strong correlations found for BMI vs. Waist Circumference and Gait Velocity vs. Step Length
- Weak/moderate correlations found between some predictors and DVs (ex. BMI vs. Step Width, Physical Activity vs. Gait Velocity), particularly in obstacle condition

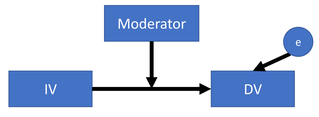
Spatiotemporal Gait Parameters



- Gait became less efficient (slower, wider steps) when encountering obstacle

Mediation and Moderation





Variables included in final models

IV	Mediator/ Moderator	DV
BMI	Knee Buckling (mediator) Knee Pain (mediator) Depressed Mood (moderator) Physical Activity (moderator) Physical Health (moderator)	Gait Velocity Step Width
At both flat ground and obstacle conditions		

Key mediation/moderation findings

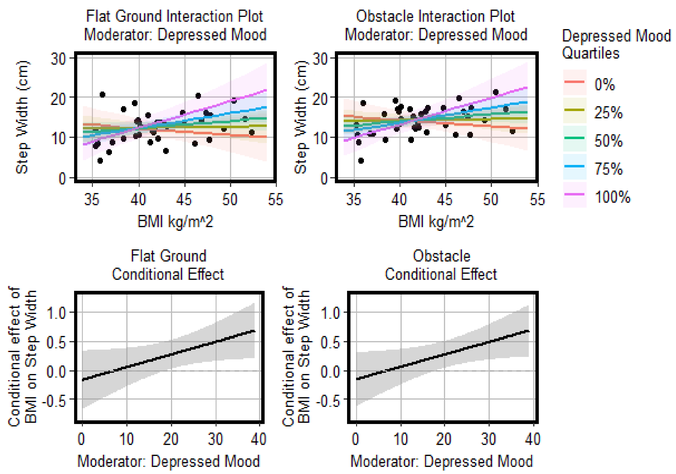
BMI did not predict changes in Gait Velocity, but positively predicted changes in Step Width over flat ground ($p = 0.06^{+}$) and during obstacle crossing ($p < 0.05^{*}$)

Knee Buckling and Knee Pain did not mediate the relationship between BMI and gait parameters in either condition (all $p > 0.05$)

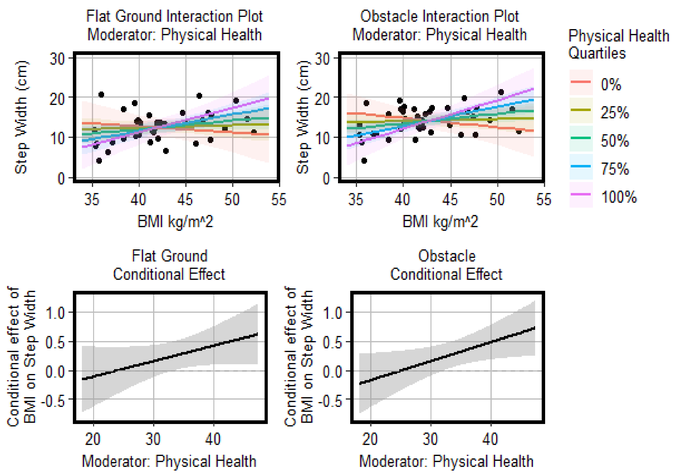
Depressed mood positively moderated the relationship between BMI and Step Width in the flat ground ($p = 0.06^{+}$) and obstacle conditions ($p < 0.05^{*}$)

Physical Health positively moderated the relationship between BMI and Step Width only in the obstacle condition ($p < 0.05^{*}$).

Moderating effects of Depressed Mood



Moderating effects of Physical Health



Summary

- In a sample of participants with obesity, BMI predicted altered step width. Greater depressed mood and better physical health positively moderated the relationship between BMI and step width.
- Depressed mood has been shown to be related to changes in gait[6], and thus may moderate spatiotemporal gait parameters for people with obesity.
- Better physical health may allow for better adaptive gait characteristics (i.e., increased step width) to accommodate for instability.
- Presence of external constraints (i.e., obstacle) may help to reveal altered gait characteristics and other meaningful relationships in people with obesity.

References:
1) Desrochers et al., (2021) *J Musculoskelet Neuronal Interact.*
2) Gill et al., (2016) *Surg Obes Relat Dis*
3) Raud et al., (2020) *Scientific Reports*
4) Pereira-Miranda et al., (2017) *J Am Coll Nutr*
5) Wee et al., (2008) *Health Qual Life Outcomes*
6) Lemke, et al., (2000) *J. Psychiatr. Res.*