Impact of physical activity on the relation between frailty and hypertension in males and females in the CLSA

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Overview of Today's Webinar

1) Discuss Frailty and Cardiovascular Health

3) Relation of Frailty with Hypertension & Heart Disease

4) Role of Activity as a Mediator of Frailty-CV Health Among Males & Females

5) Future Directions of Interest

6) Translating Information to Guide Other Studies within my Research Program

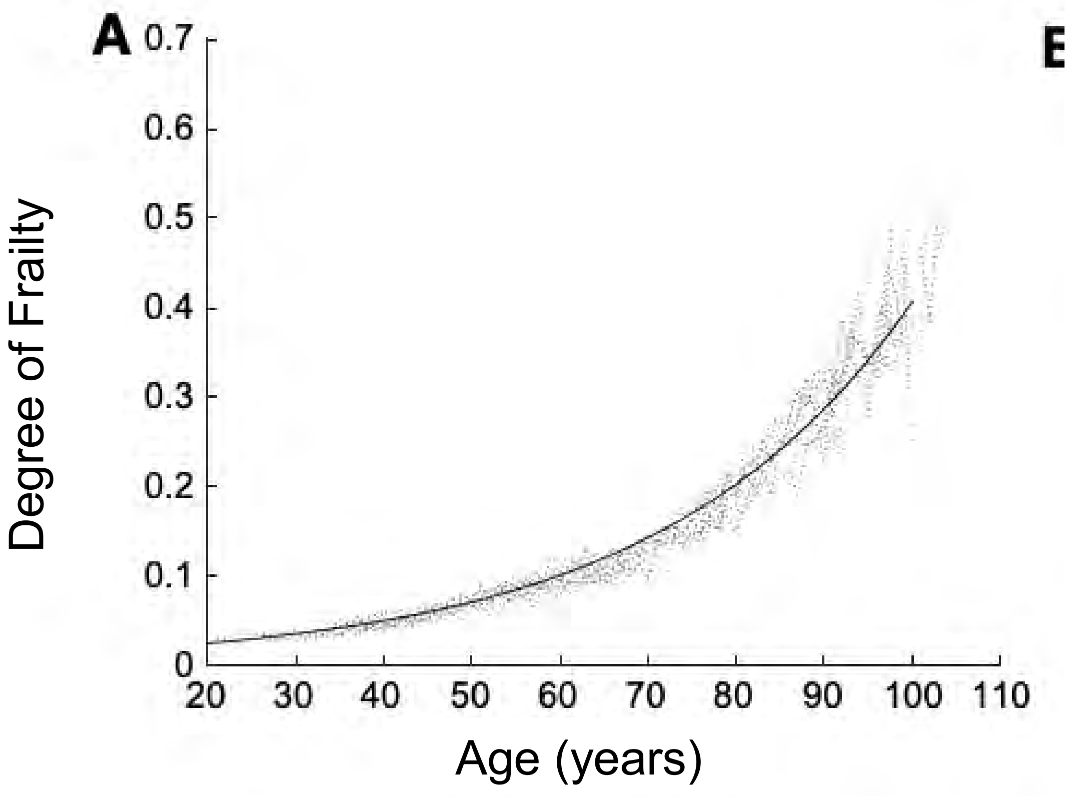
Frailty as a Concept

The concept of vulnerability to adverse outcomes of people of the same chronological age

Describes heterogeneity in aging

Frailer older adults are more vulnerable to physiological and psychological stressors – sick more likely to get sicker

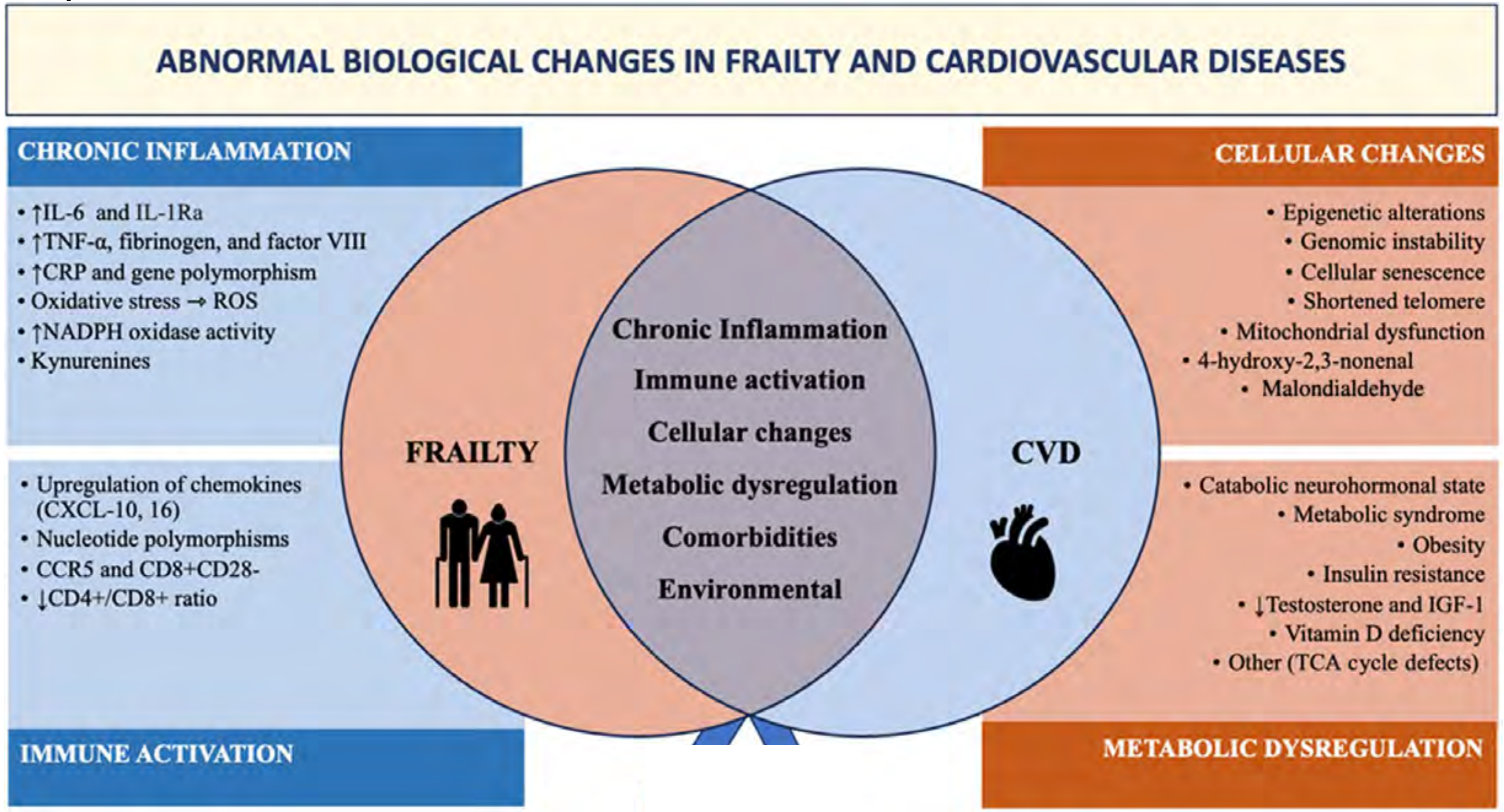
Commonly measured via the phenotype (physical frailty) or index (multidimensional)



Mitnitski & Rockwood, 2017, Biogerontology, 199-204

Link between Frailty & Development of Cardiovascular Conditions

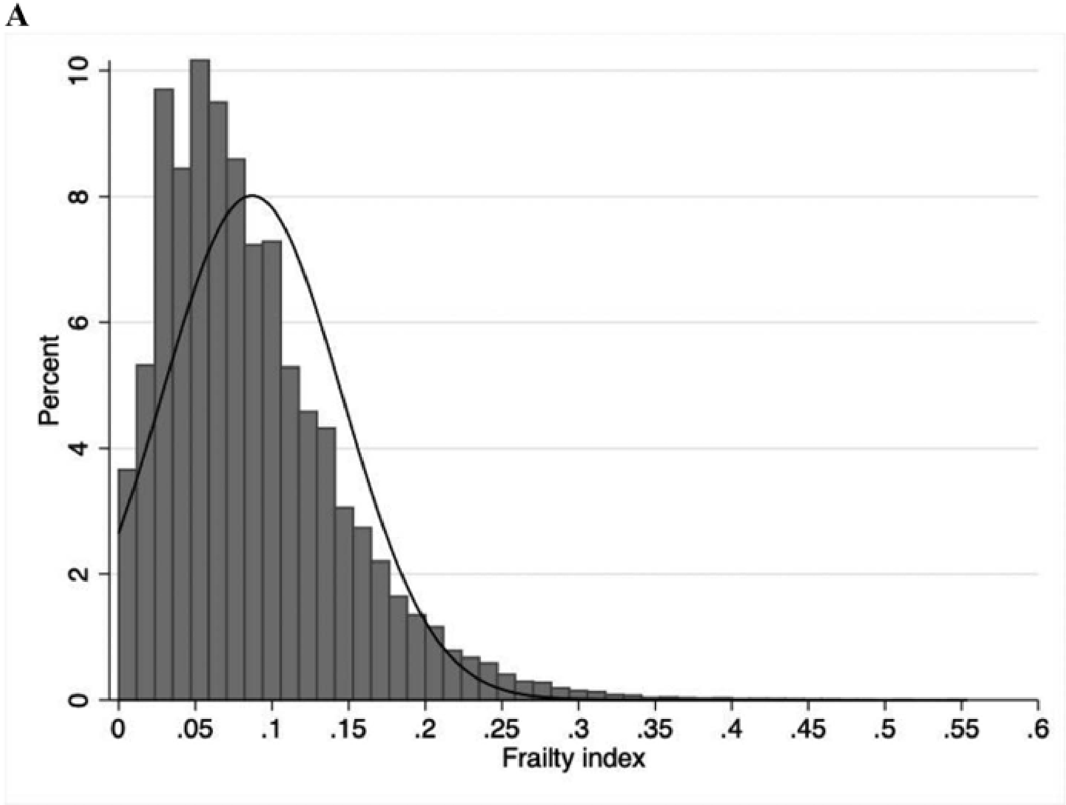
Geroscience hypothesis: posits that since aging physiology plays a major role in many — if not all — chronic diseases, therapeutically addressing aging physiology directly will prevent the onset or mitigate the severity of multiple chronic diseases

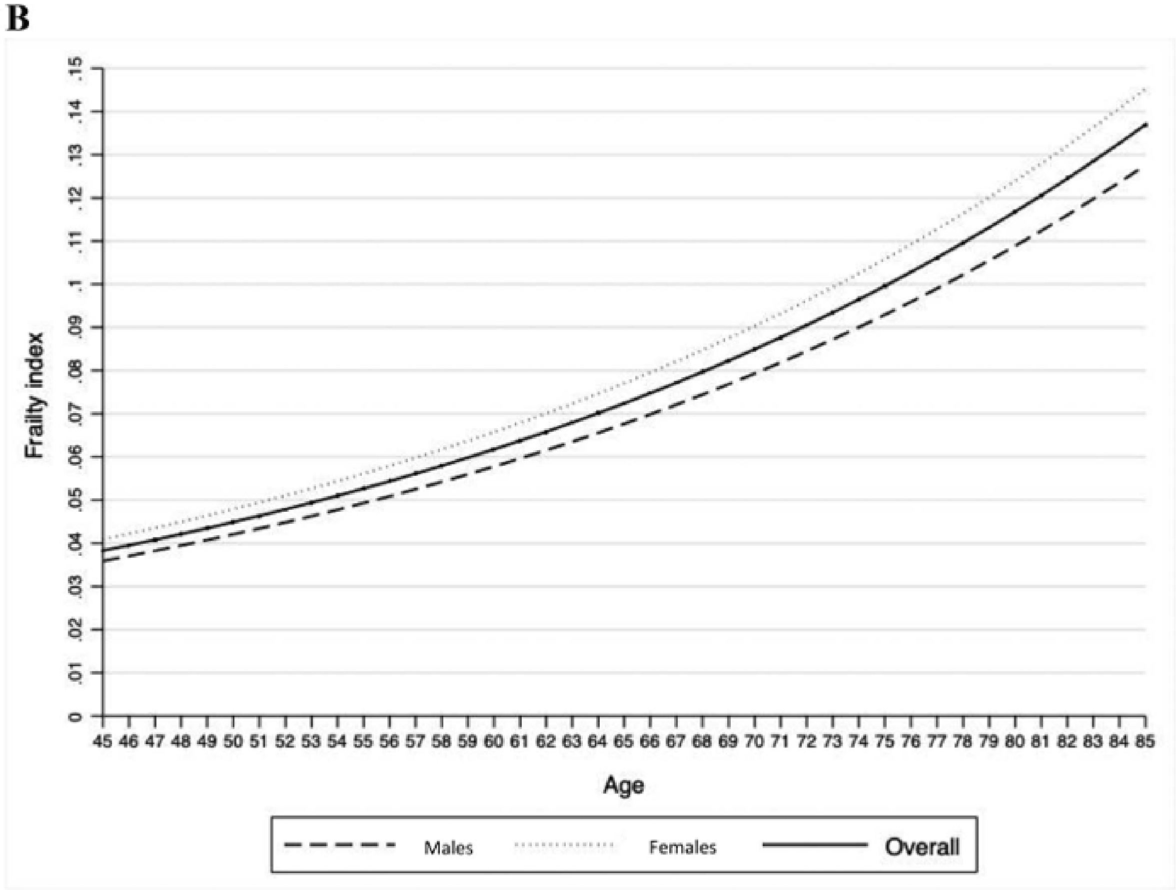


Cardiovascular diseases are among the most common causes of death.

James et al. 2024. JAHA. e031736

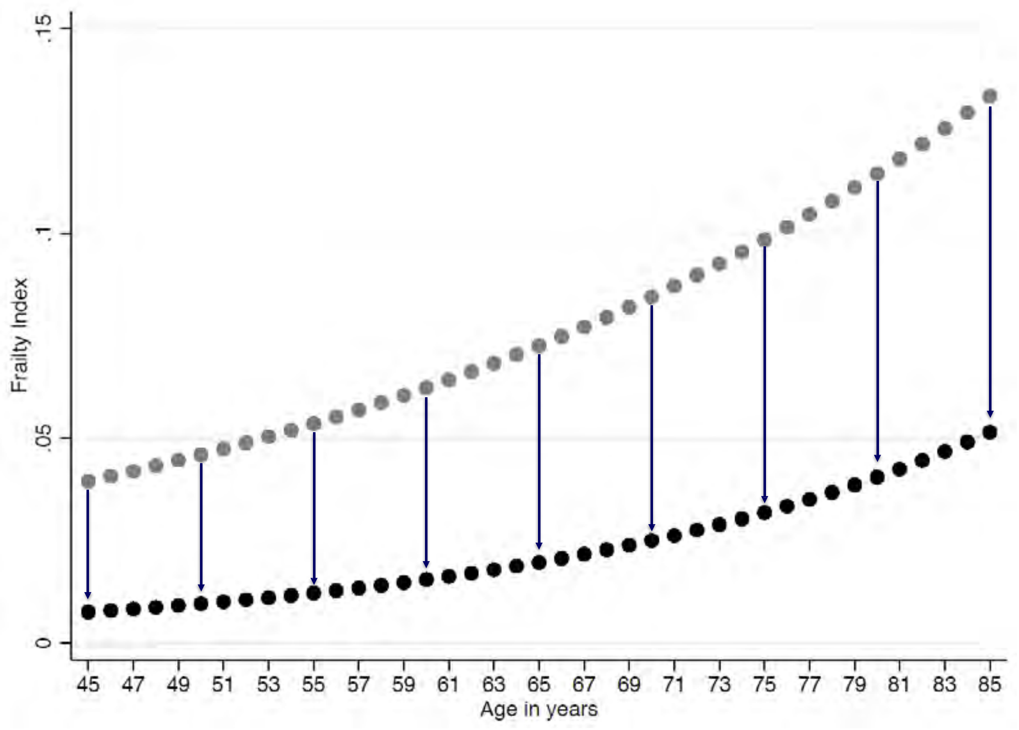
Frailty in the CLSA: Consistently Higher among Females

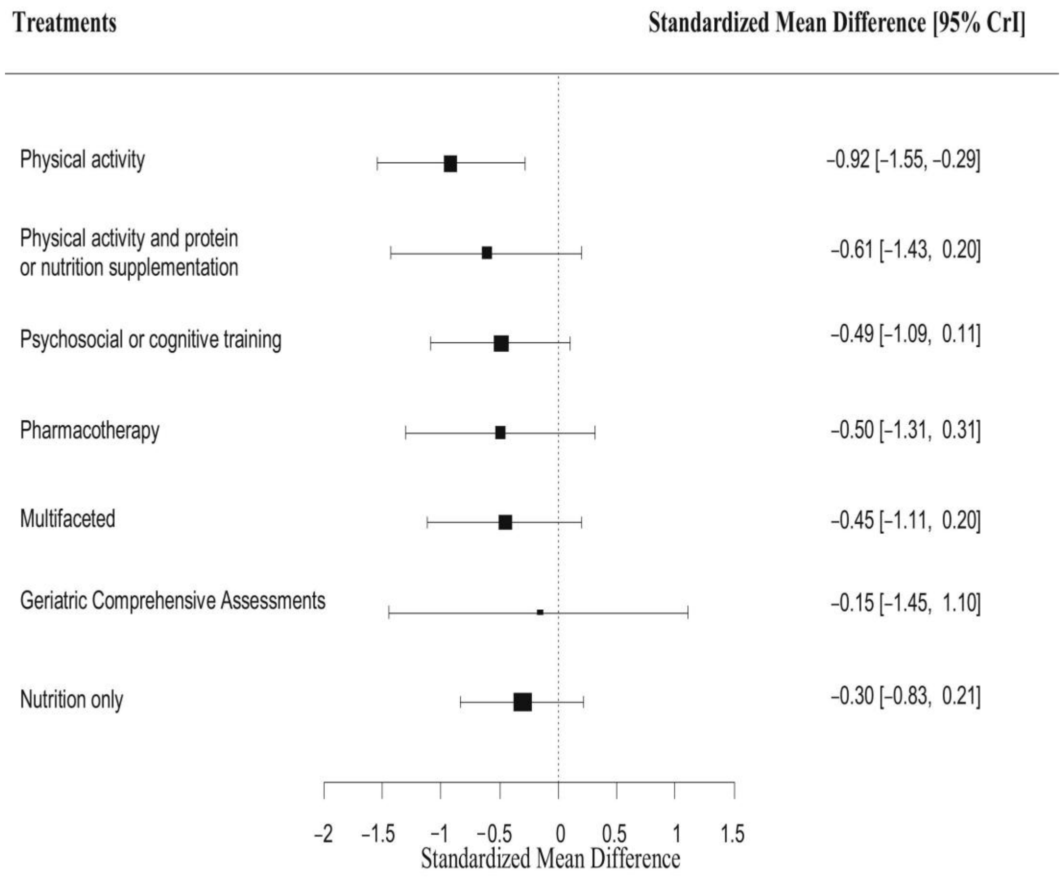




Perez-Zepeda et al. 2021. Age & Ageing. 447-456

Frailty as a Target for Healthy Aging via Lifestyle





Negm et al. J Am Med Dir Assoc. 2019 Oct;20:1190-98

Hypotheses Tested in Our Study

https://doi.org/10.1152/ajpheart.00179.2024

Hypotheses:

1) frailty will be longitudinally, positively associated with the presence of hypertension and heart disease

2) Habitual movement mediates the relationship between frailty and the presence of hypertension and heart disease in males and females.

Exploratory: The specific habitual movements (e.g., sitting vs. strengthening activity) were explored as mediators within sexes

Am J Physiol Heart Circ Physiol 327: H108–H117, 2024.
First published May 17, 2024; doi:10.1152/ajpheart.00179.2024

american physiological society

AMERICAN JOURNAL OF PHYSIOLOGY
HEART AND CIRCULATORY PHYSIOLOGY

RESEARCH ARTICLE

Sex as a Biological Variable

Relation between frailty and hypertension is partially mediated by physical activity among males and females in the Canadian Longitudinal Study on Aging

Myles W. O'Brien[1,2,3,4,5,6] **and Olga Theou**[1,2,3,4]

[1]Faculty of Health, School of Physiotherapy, Dalhousie University, Halifax, Nova Scotia, Canada; [2]Faculty of Medicine, Department of Medicine, Dalhousie University, Halifax, Nova Scotia, Canada; [3]Geriatric Medicine Research, Dalhousie University, Halifax, Nova Scotia, Canada; [4]Nova Scotia Health, Halifax, Nova Scotia, Canada; [5]Department of Medicine, Université de Sherbrooke, Sherbrooke, Quebec, Canada; and [6]Centre de Formation Médicale Du Nouveau-Brunswick, Université de Sherbrooke, Moncton, New Brunswick, Canada

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Frailty Index (FI) in the CLSA: Deficit Accumulation Approach

Measured by the quantity rather than by the nature of health problems

Originally: 118 items, but any measure directly related to our outcome measure was removed.

Our FI: 73 items encompassing chronic conditions, cognition, activities of daily living, anthropometrics, mental health, hearing & vision, etc.

$$\text{Frailty Index} = \frac{\text{Number of deficits in an individual}}{\text{Total number of deficits measured}}$$

Blodgett et al. 2022. Age Ageing. afac075

Frailty Index (FI) in the CLSA: Deficit Accumulation Approach

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Our FI: 73 items encompassing chronic conditions, cognition, activities of daily living, anthropometrics, mental health, hearing & vision, etc.

$$\text{Frailty Index} = \frac{\text{Number of deficits in an individual}}{\text{Total number of deficits measured}}$$

Males:	Frailty Index: 0.186±0.055	Age: 63.1 ± 10.2
Females:	Frailty Index: 0.192±0.061*	Age: 62.7 ± 10.2*

Blodgett et al. 2022. Age Ageing. afac075

Physical Activity Scale for the Elderly (PASE)

Frequency: “Over the past 7 days, how often did you participate in sitting activities such as reading, watching TV, computer activities, or doing handicrafts?”
Responded: never, seldom (1–2 days), sometimes (3–4 days), or often (5–7days)

Duration: “On average, how many hours per days did you engage in these sitting activities?”.
Responded: <30 min, 30–60 min, 1–2 h, 2–4 h, or >4 h for duration.

Data Analysis: Midpoints taken and multiplied to get hours/week

Similar for:
Muscle Strengthening,
Strenuous activity (*proxy of Vigorous*),
Light-Moderate Activity (combination of light, moderate, and walking)

Hypertension & Heart Disease Outcomes

Determined via self-report: “Has a doctor ever told you that you have heart disease including congestive heart failure”

Other measures not considered due to low incidence at FUP1 (range: 2-8% in males & females)

Peripheral vascular disease:	↑Females
Angina:	↑Males
Myocardial Infarction	↑Males
Stroke	↑Males
Transient Ischemic Attack	XSex

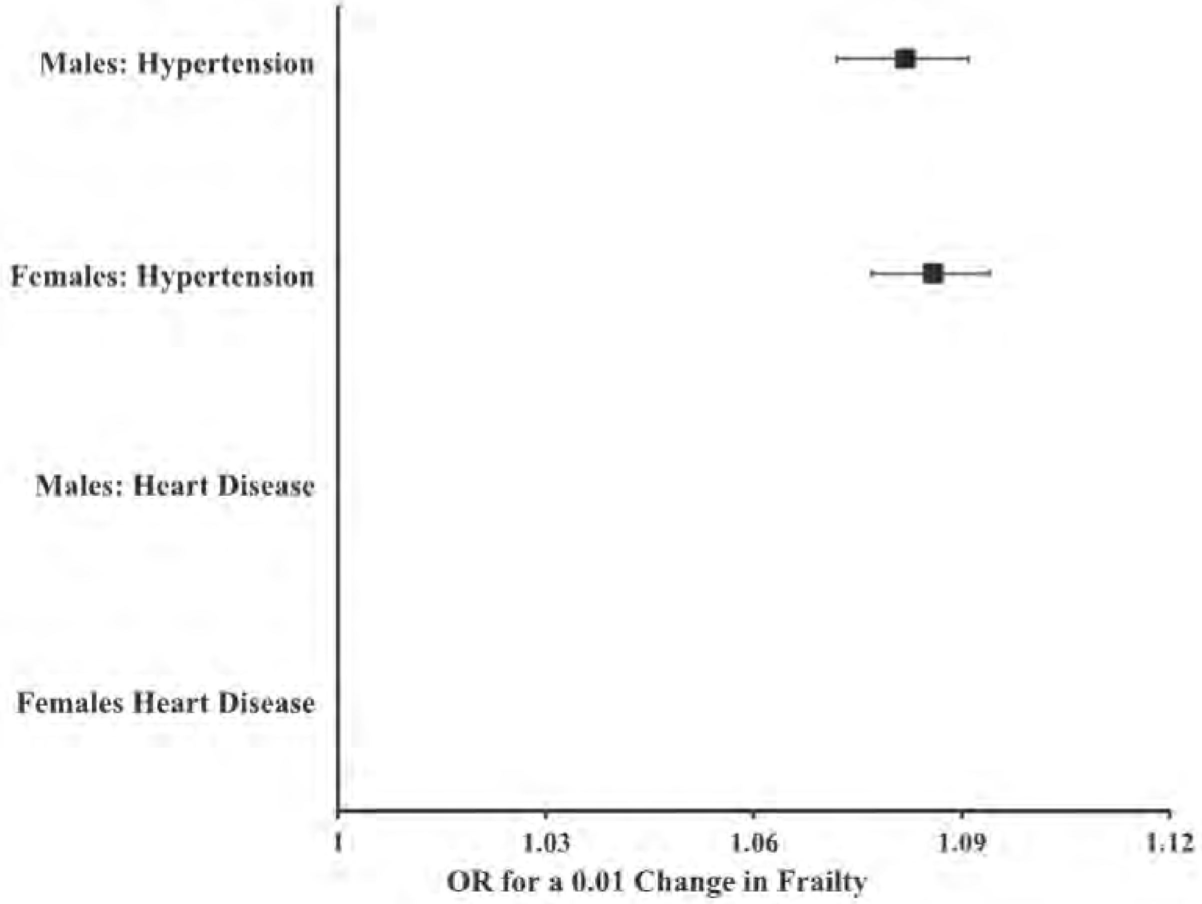
Association of Frailty with HTN

Frailty: Baseline

Hypertension / Heart Disease: FUP1

The logistic regressions were adjusted for marital status, dwelling type, and chronological age.

Hypertension: Males 39%, Females: 35%*
Years HTN: 12.5±10.9 vs 13.7±11.8*



Association of Frailty with HTN / Heart Disease

Frailty: Baseline

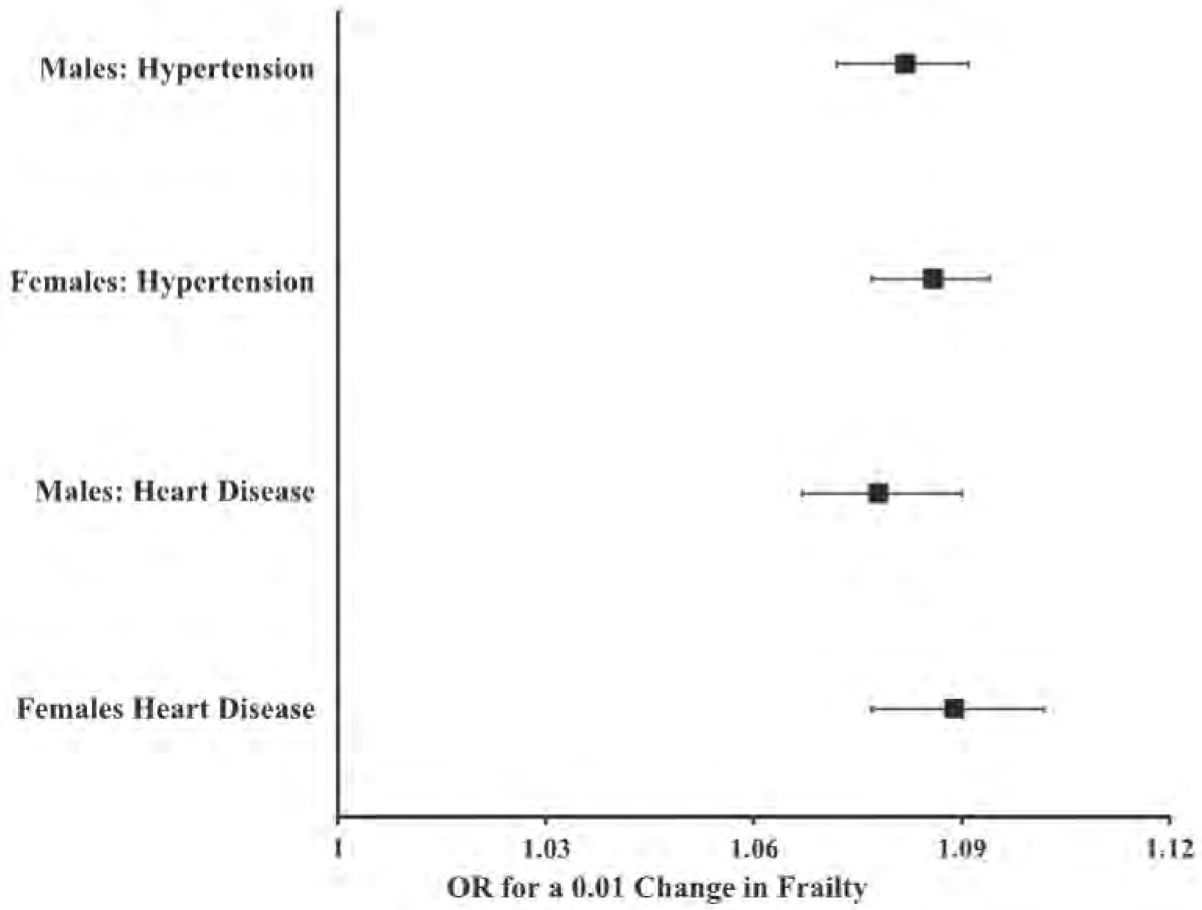
Hypertension / Heart Disease: FUP1

The logistic regressions were adjusted for marital status, dwelling type, and chronological age.

Hypertension: Males 39%, Females: 35%*
Years HTN: 12.5±10.9 vs 13.7±11.8*

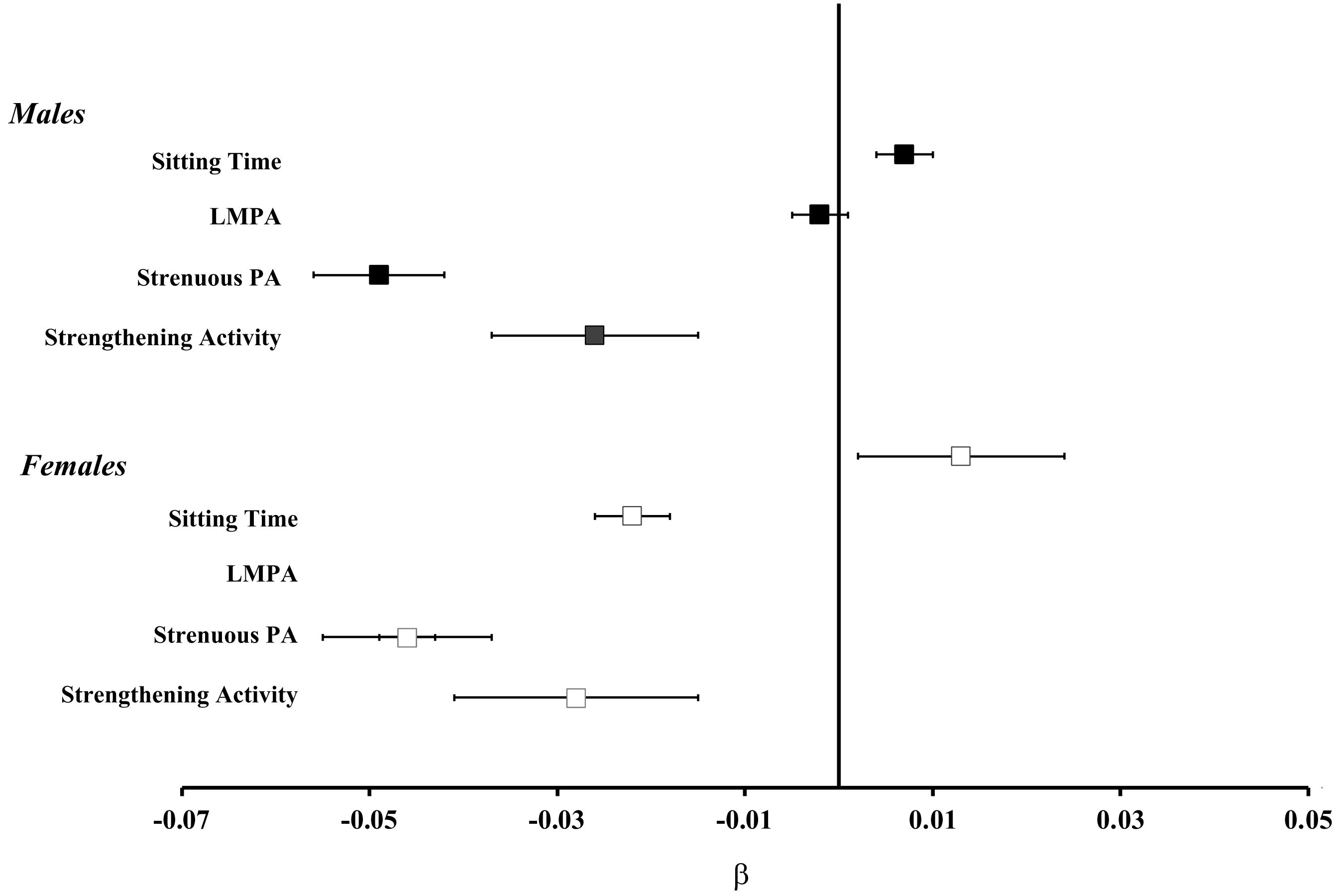
Heart Disease: Males 15%, Females: 8%*

A 0.01 unit change in Frailty associated with ORs of 1.08-1.09 regardless of specific CV measure and sex



Association of Activity with Hypertension by Sex

Activity in hr/week



All activity measures were associated with Frailty

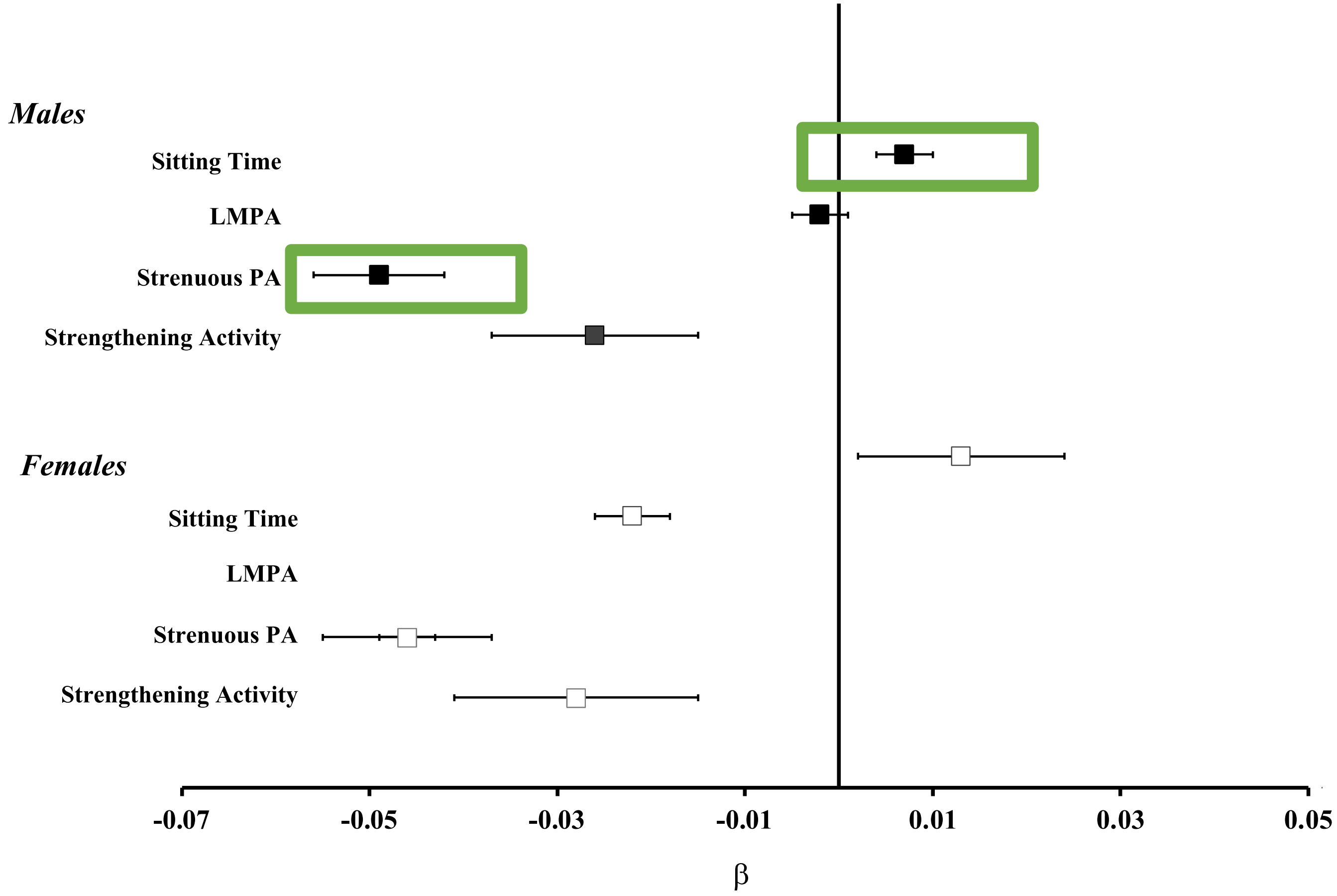
Heart Disease: associations were: Strenuous (both sexes), sitting time (females only) and LMPA (females only)

Association of Activity with Hypertension by Sex

Activity in hr/week

Comparing Beta-coefficients

Males: 7*Sit vs Strenuous
Females 3.5*Sit vs Strenuous



All activity measures were associated with Frailty
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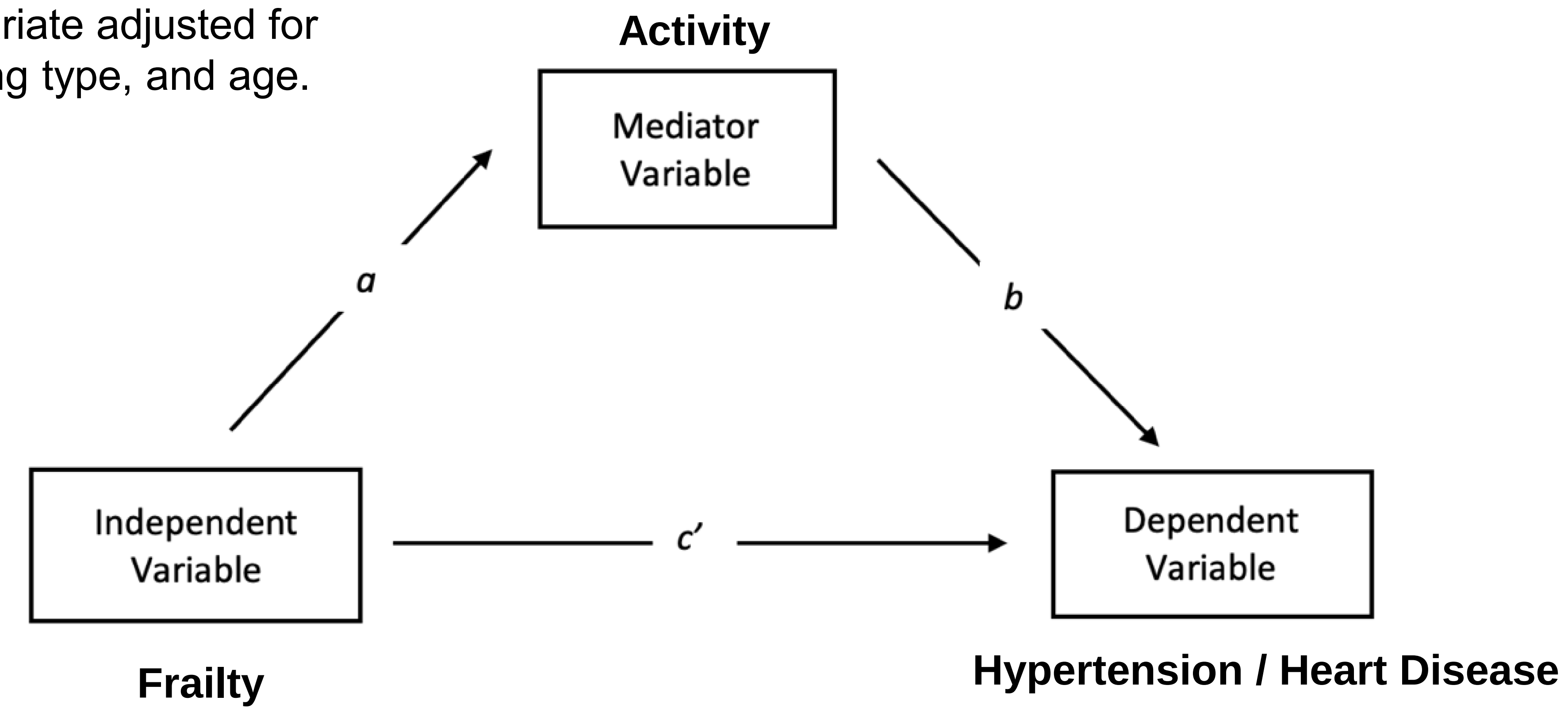
Brief Introduction to Mediation Models

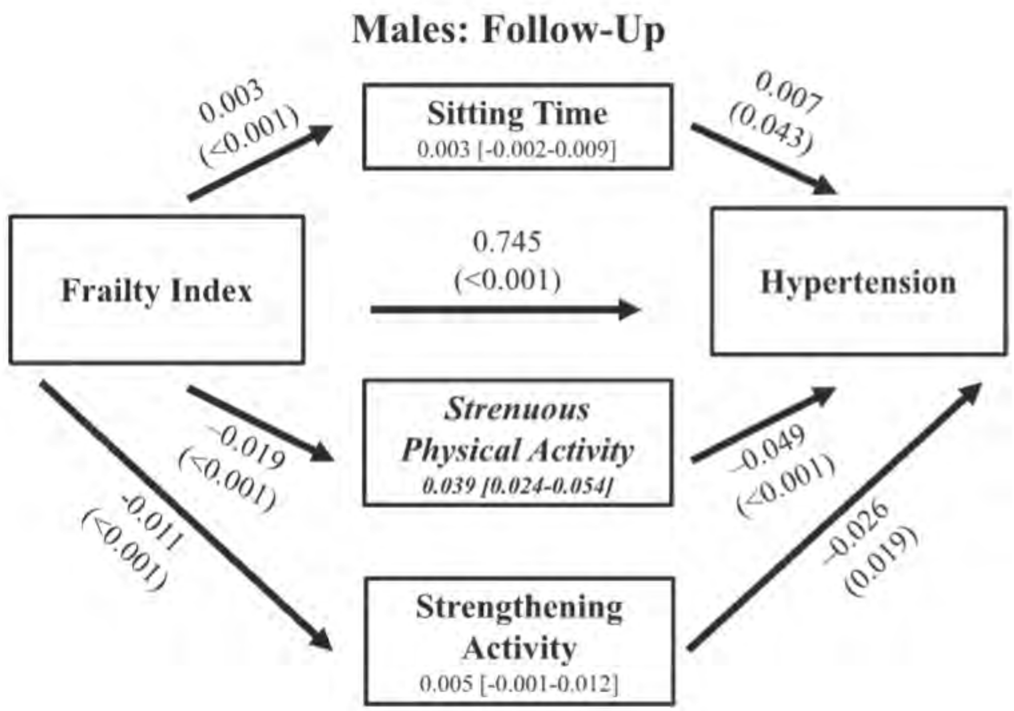
For mediation: a, b ,c’ are significant.

We conducted parallel mediation for all activity measures that were eligible.

All models were covariate adjusted for marital status, dwelling type, and age.

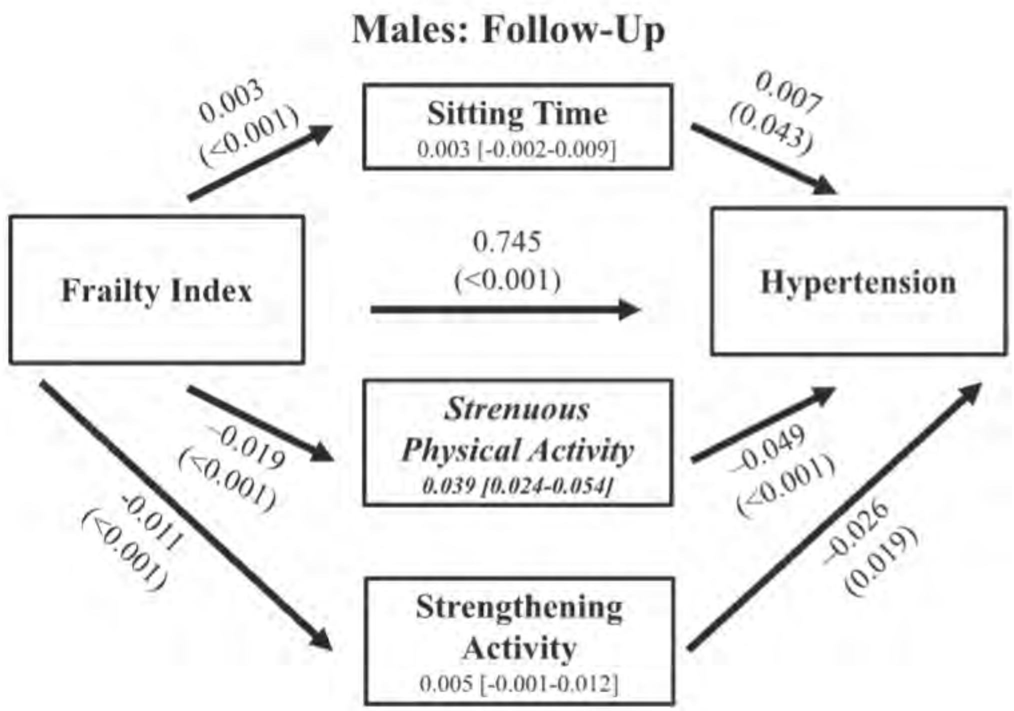


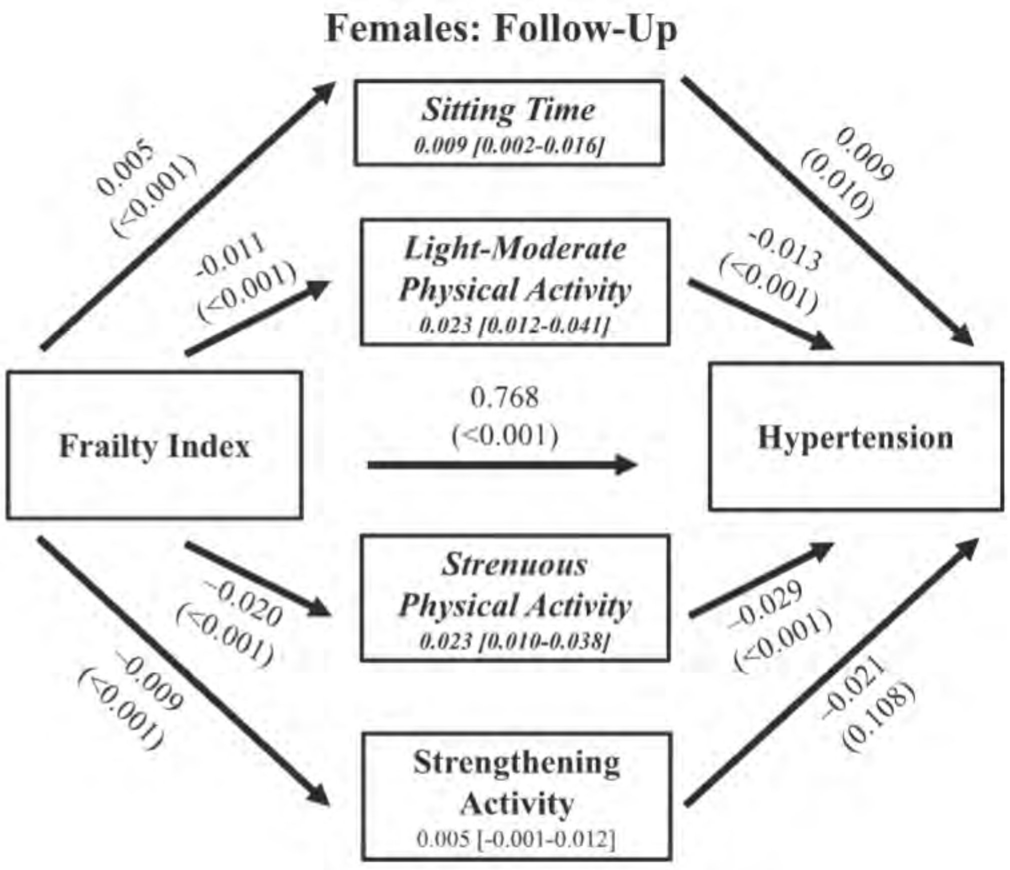
Activity Mediating Frailty-Hypertension



Italics indicate a statistically significant mediator.

Activity Mediating Frailty-Hypertension





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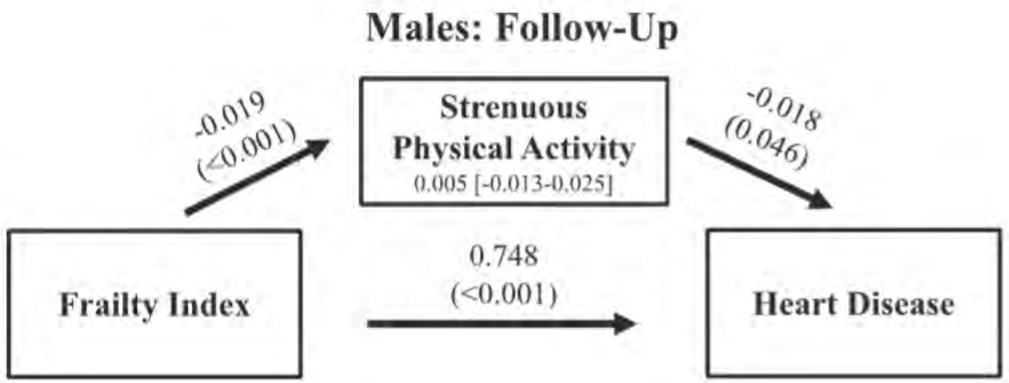
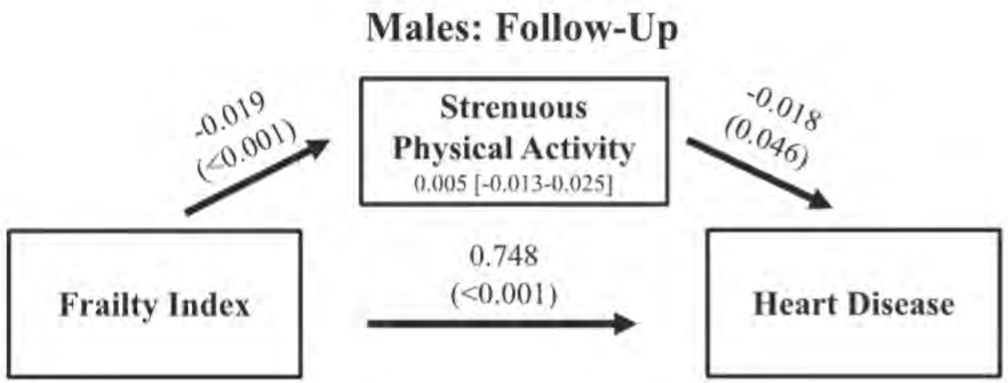
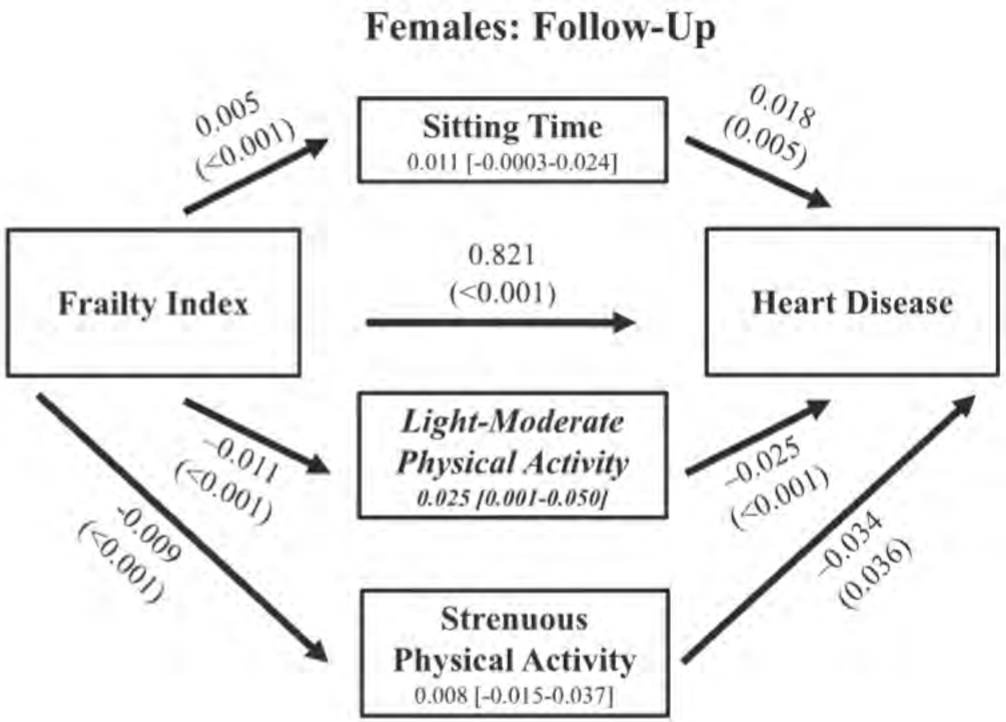
Activity Mediating Frailty-Heart Disease



Activity Mediating Frailty-Heart Disease





Summary of Our Main Findings

1) Frailty is associated with Hypertension and Heart Disease regardless of sex

2) For Frailty-Hypertension: strenuous activity partially mediated this relation for males

3) For Frailty-Hypertension: strenuous activity, sitting time, and LMPA partially mediated this relation for females

4) For Frailty-Heart Disease: no mediator for males, but LMPA was partially for females (small effect)

Exercise more, sit less to manage frailty and hypertension risk in aging, says study

by American Physiological Society

Modifiable movement factors such as <u>sitting less</u> and engaging in <u>more physical activity</u> may be feasible interventions for reducing the prevalence of frailty & high blood pressure and uncoupling the link between susceptibility to disease and adverse cardiovascular health

Considerations for Future Lines of Inquiry

Leveraging the CLSA to further probe the links between Frailty, Activity, and Cardiovascular Function.

Considerations for Frailty-Cardiovascular Health

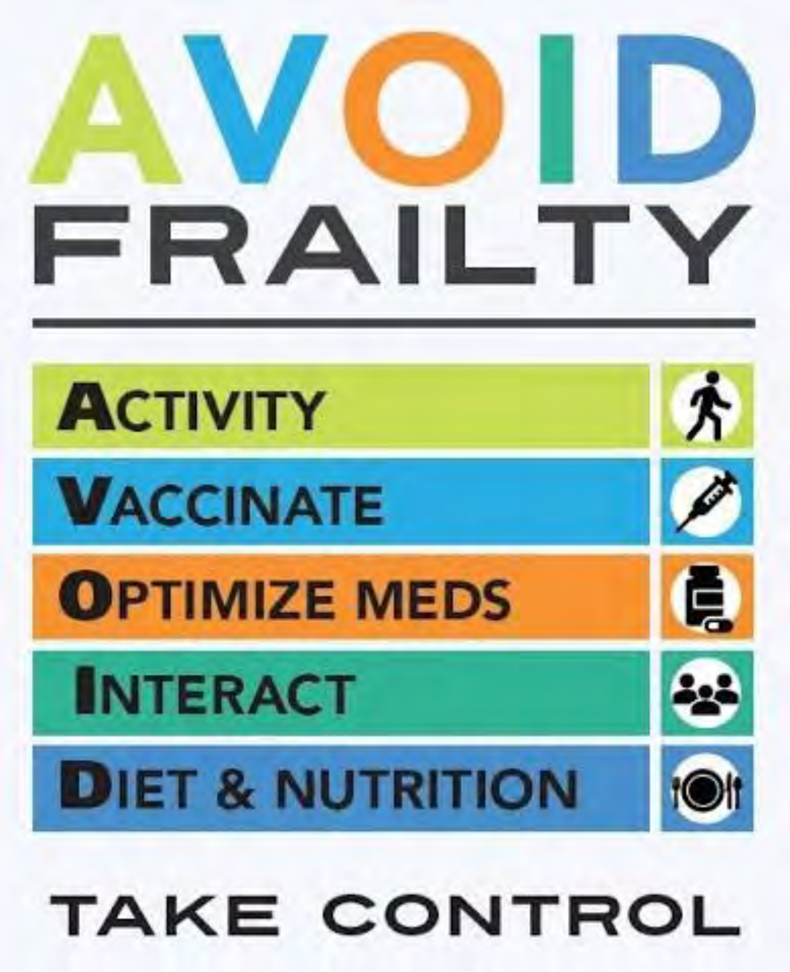
A partial (5-10%) mediation was observed.

What are the impact of other lifestyle behaviours?

RESEARCH ARTICLE

A standard procedure for constructing a multi-level social vulnerability index using CLSA and SOS data as working examples

Jasmine C. Mah[1,2]*, Olga Theou[3,4], Mario Ulises Perez-Zepeda[5], Jodie L. Penwarden[3], Judith Godin[3], Kenneth Rockwood[2], Melissa K. Andrew[2]



Canadian Frailty Network

Considerations for Frailty-Cardiovascular Health

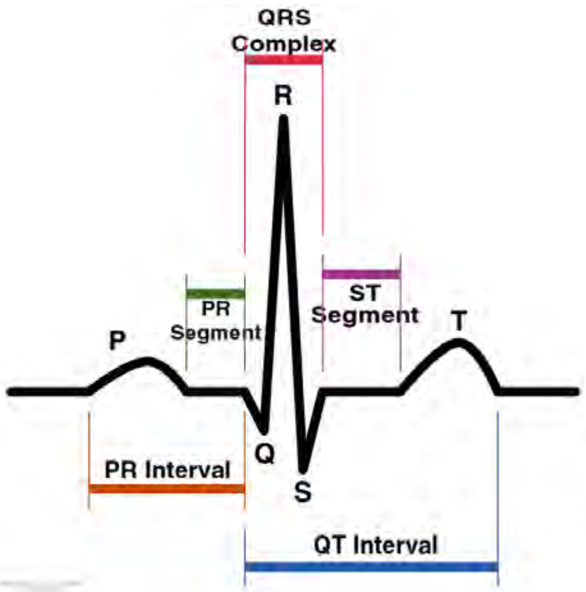
Measures to provide additional insight:

Original Article

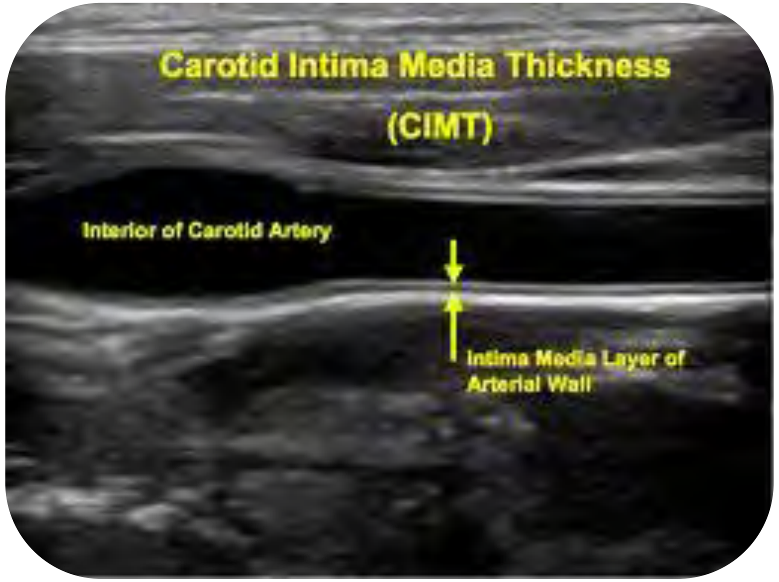
Impact of age and sex on the relationship between carotid intima-media thickness and frailty level in the Canadian Longitudinal Study of Aging

Myles W. O'Brien (PhD) [a,b,c], Derek S. Kimmerly (PhD) [a], Olga Theou (PhD) [b,c,*]

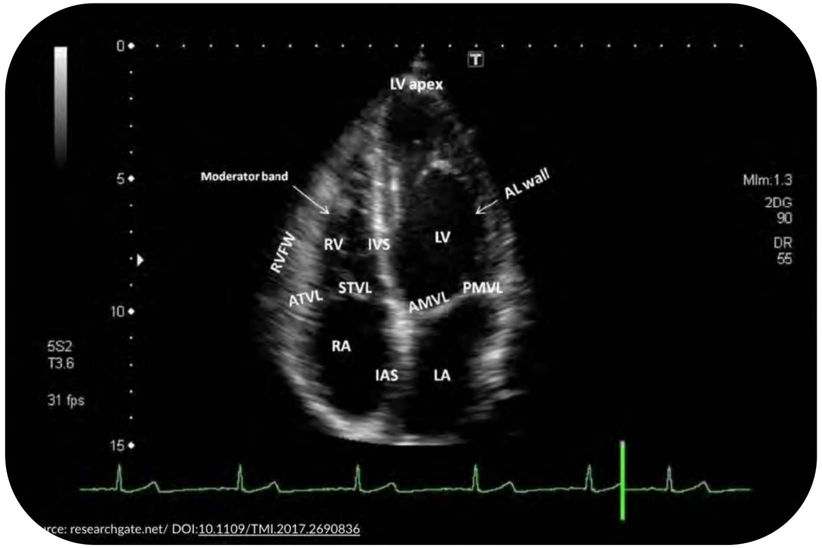
Electrocardiogram



Carotid Intima-Media Thickness



Echocardiography (Future FUP)



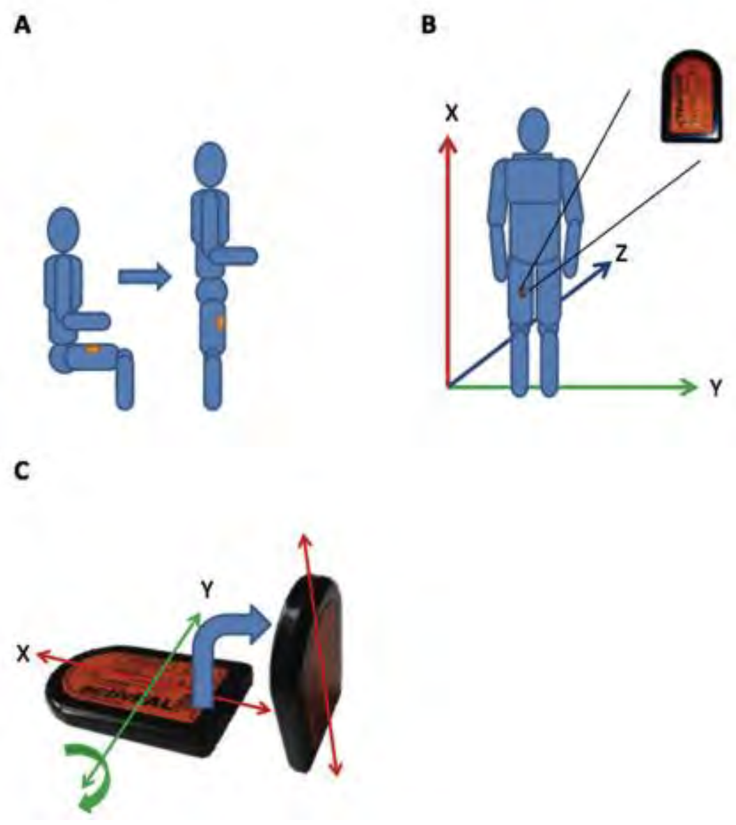
Considerations for Frailty-Cardiovascular Health

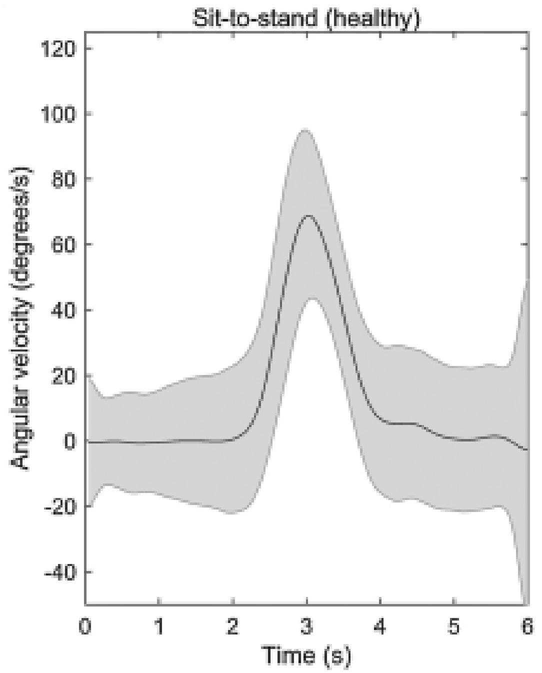
Translating PASE determined activity to recommendations is challenging.

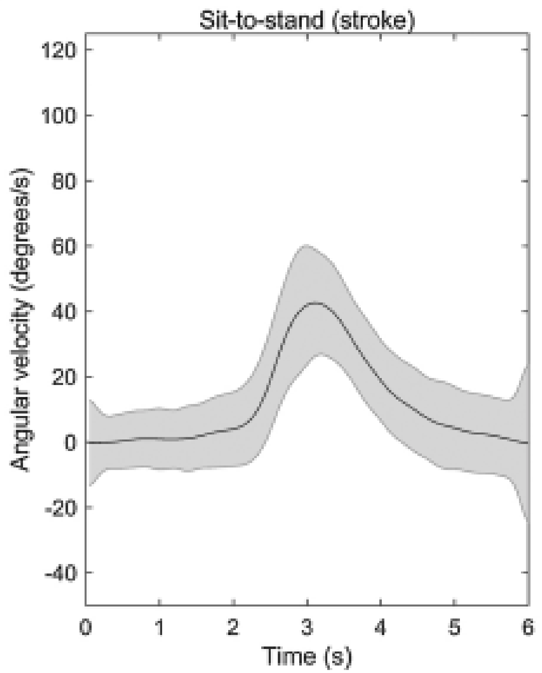
CLSA is integrating mobility trackers, including an accelerometer on participants' thigh for 7 days

Understanding the Link between Specific Postures & Frailty / Cardiovascular Health

Sit-to-stand Speed in free-living conditions





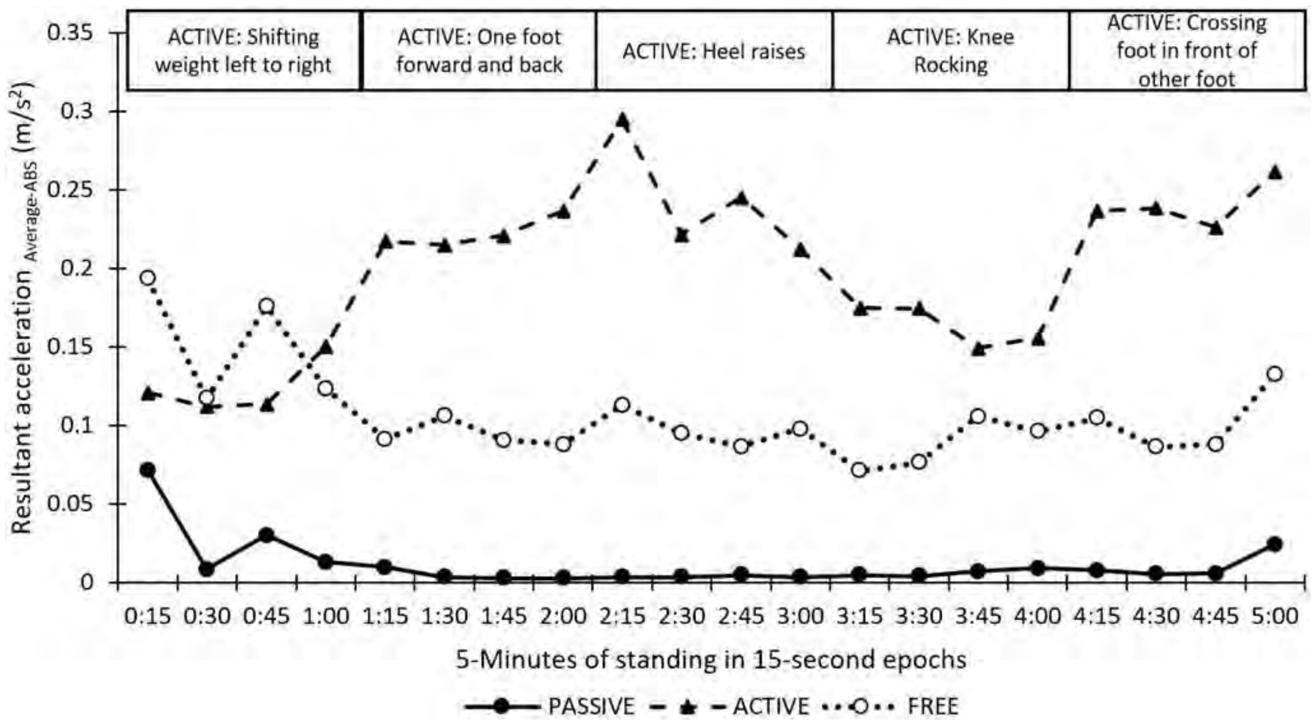


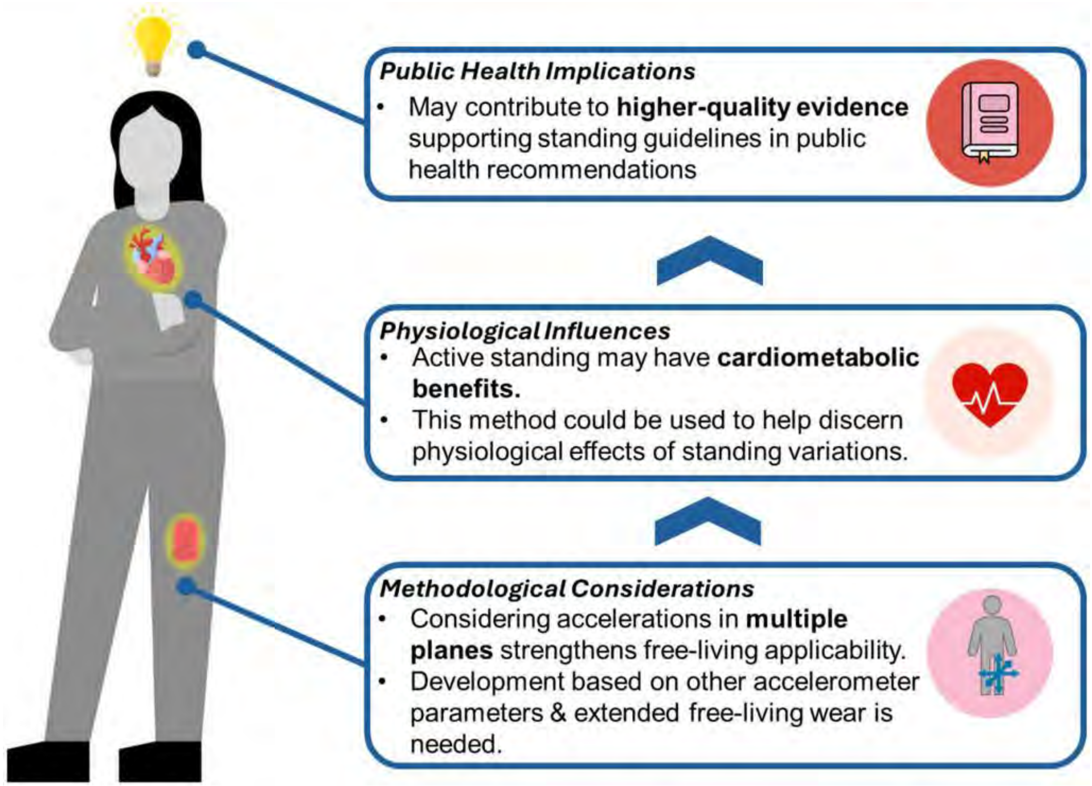


Pickford et al. 2019. Gait Posture. 140-146

Understanding the Link between Specific Postures & Frailty / Cardiovascular Health

Active (micromovement) vs Passive (minimal move) Standing





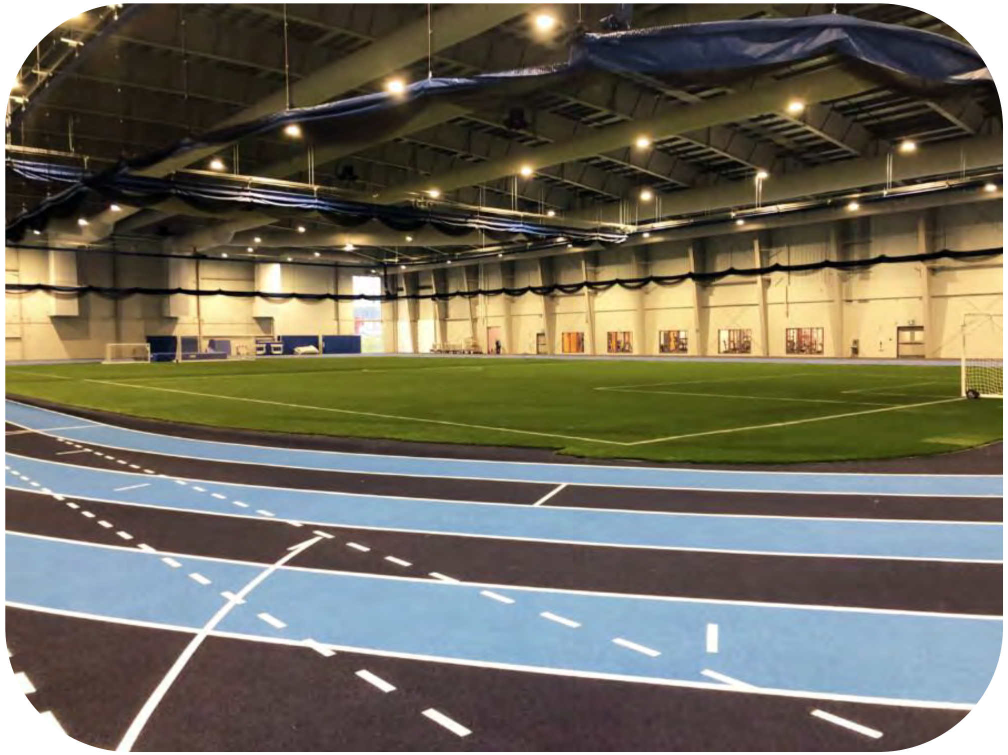
Kowalsky et al. 2024. JMPB. 1-8

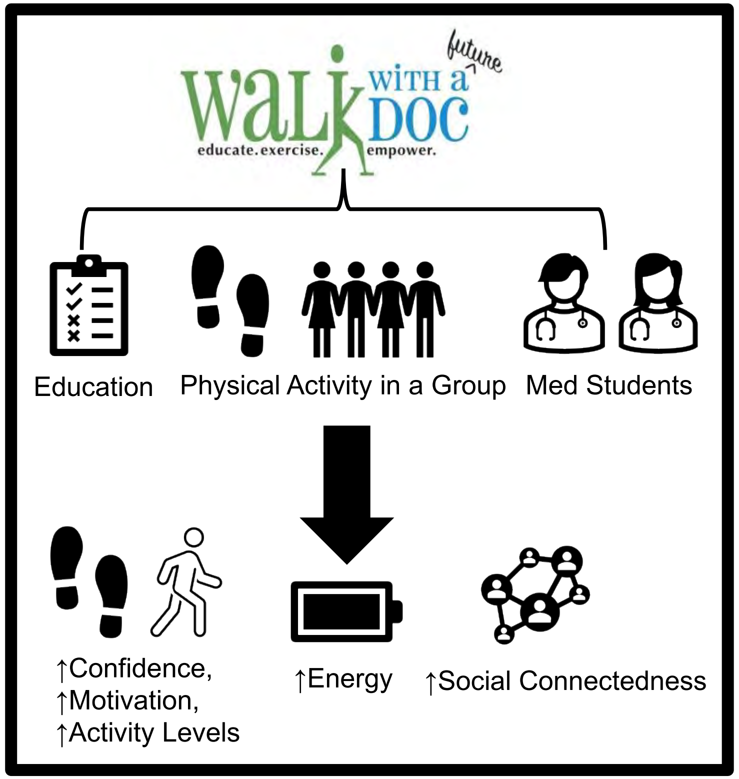
Translating Knowledge

Using CLSA Findings to Guide our Local Studies.

Impact of Movement Programs on Posture Local Study: Walk with a Future Doc

Medical student led 12-week education & walking program at Saint John, NB





6th group finish mid-April

30-50 people per cohort (70% female)

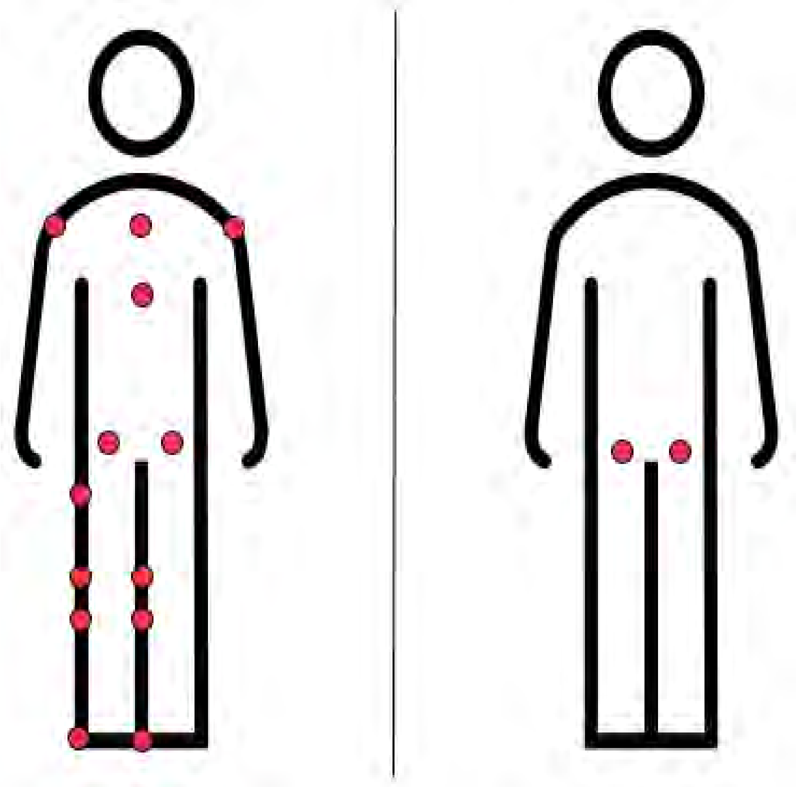
Avg # of health conditions: 2.9±2.6

Mostly hypertension and osteoarthritis

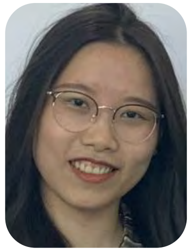
Decreases Frailty: ✅

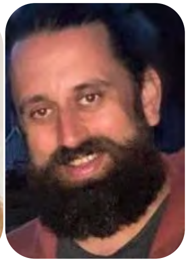
Wilson, Theou, O'Brien, Can Med Ed J. 2024.

Free-Living Posture Surveillance System in Humans



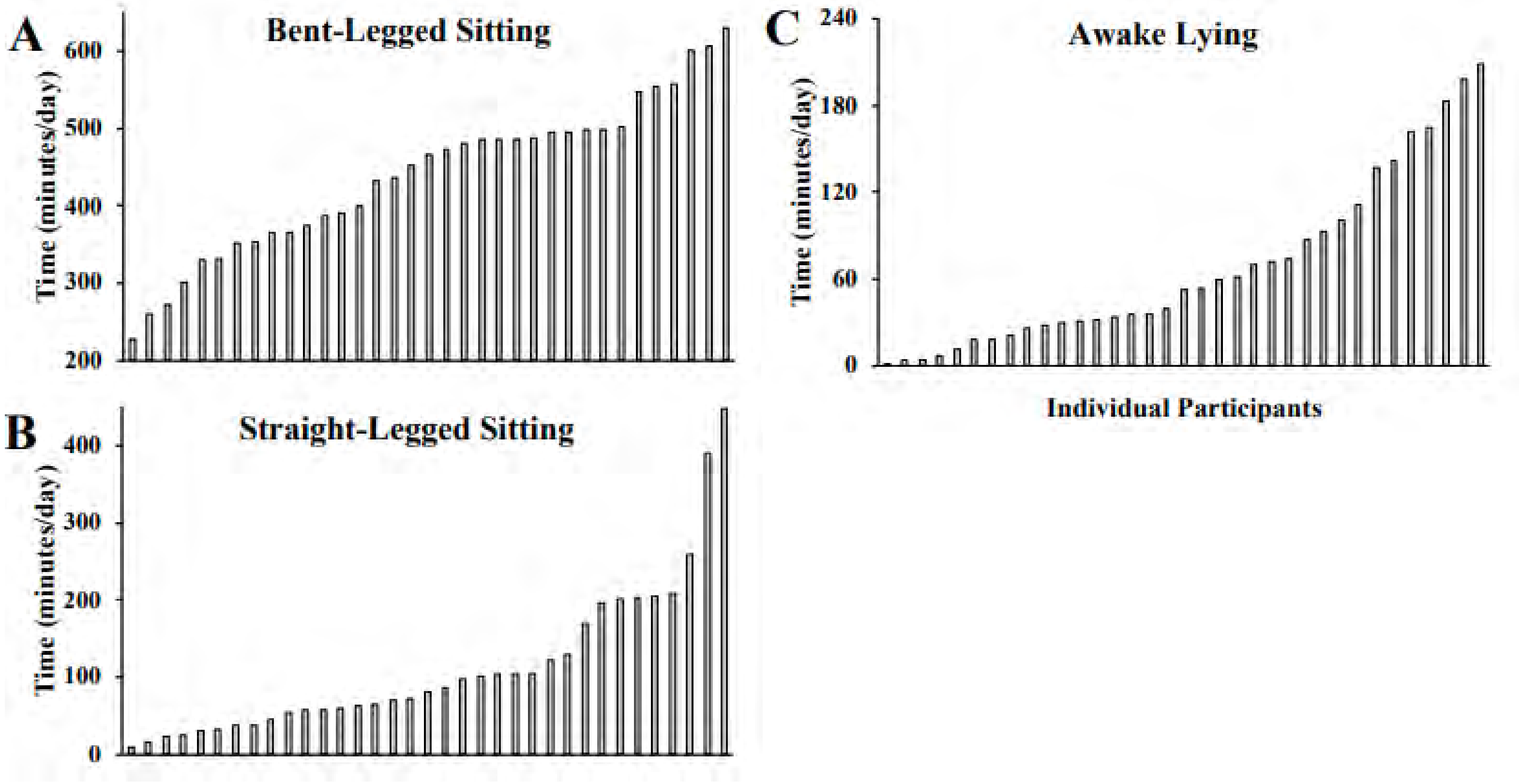
~5° error compared to motion capture





Wu et al. J Meas Phys Behav 2024: jmpb.2023-0027

Heterogeneity in Specific Postures & Link with CV In Young Adults



O'Brien et al. 2023. Sensors. 587

O'Brien et al. Appl Physiol Nutr Metab. 2023, 876-881

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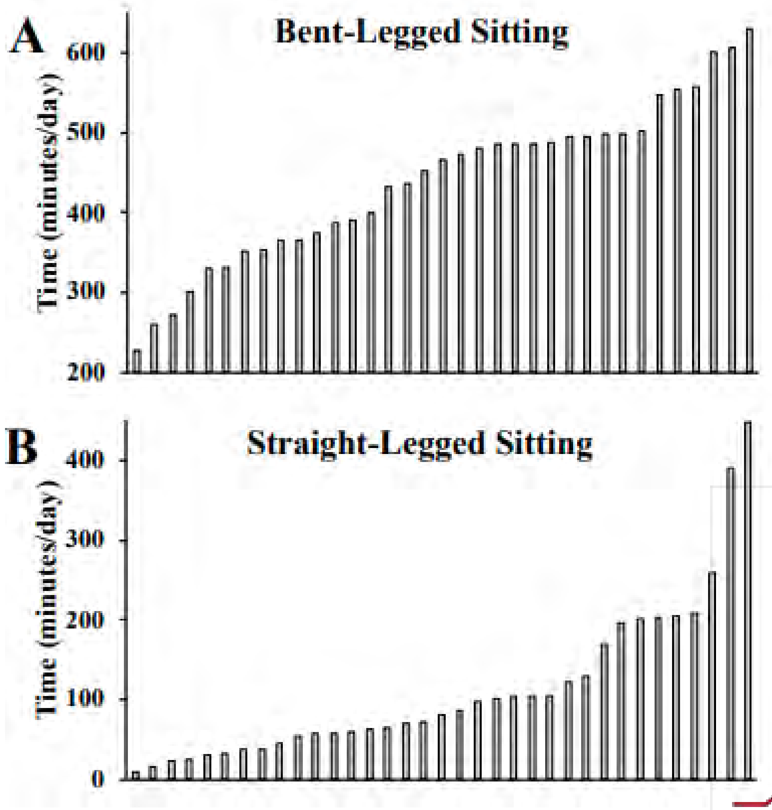

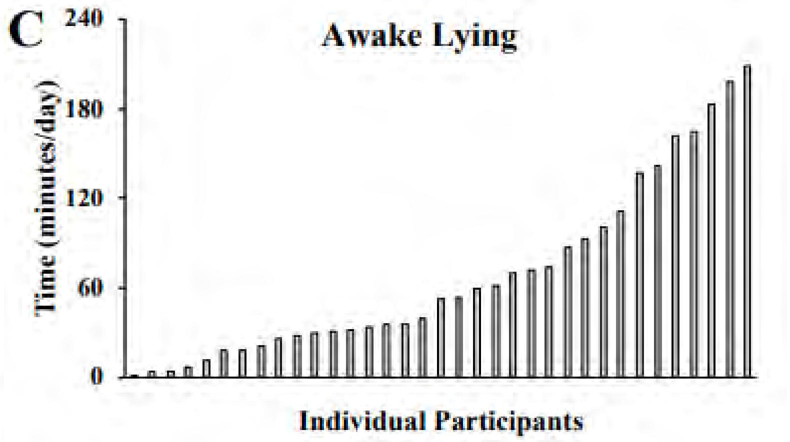

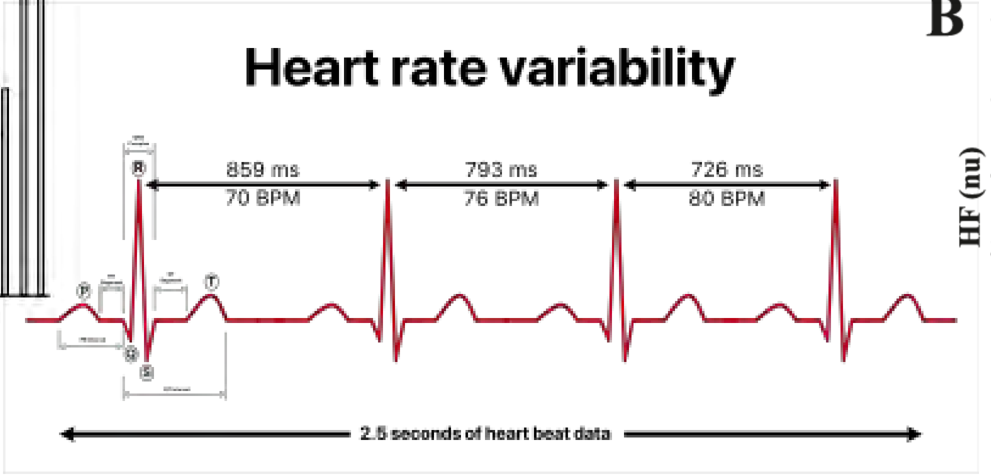

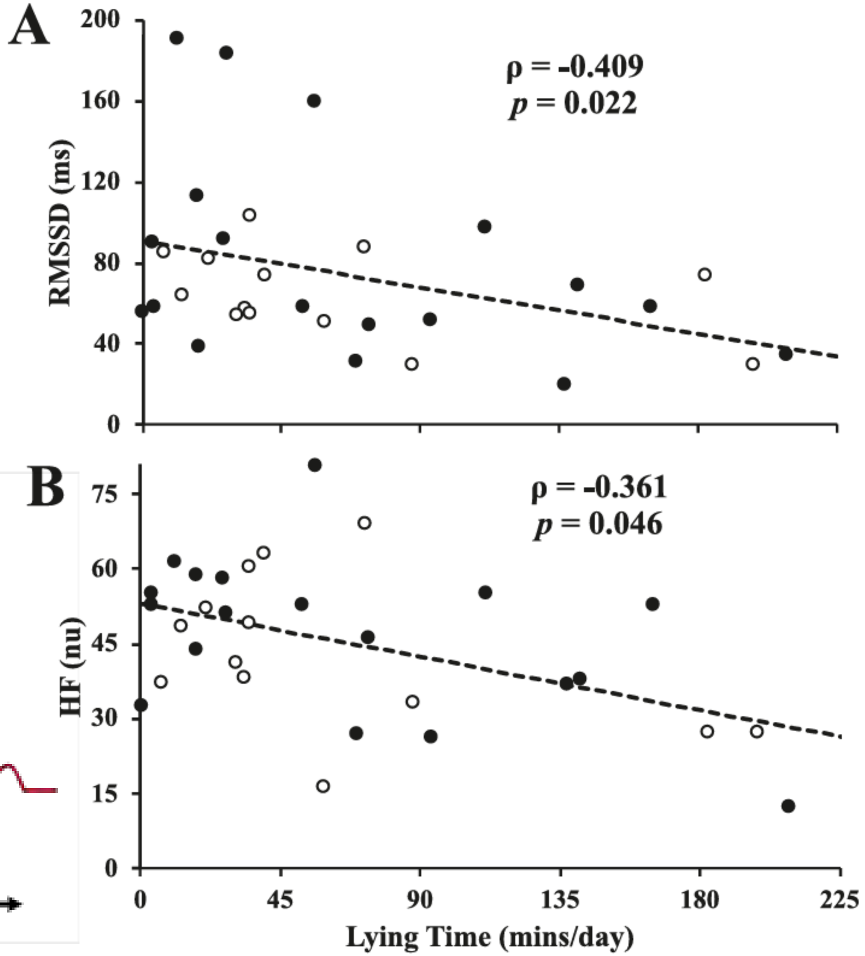

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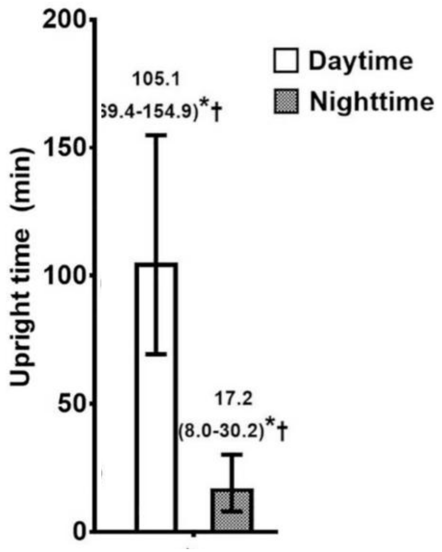
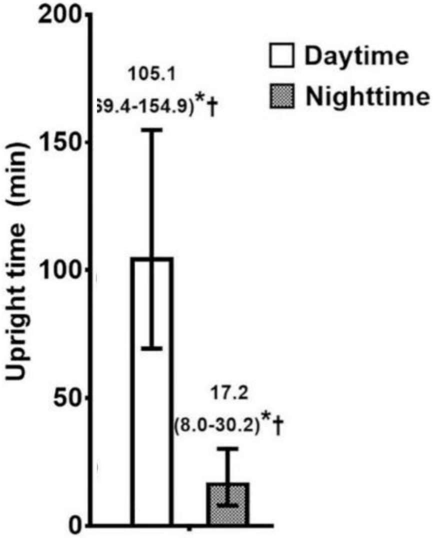
Impact of Movement Programs on Posture
Local Study: Making Hospitals Sites of Activity



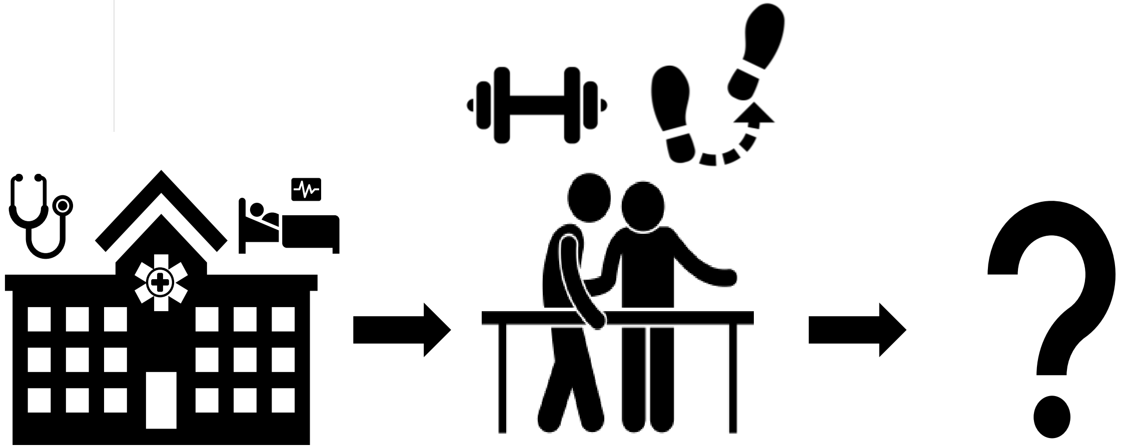
Ambulate Independently

Impact of Movement Programs on Posture
Local Study: Making Hospitals Sites of Activity

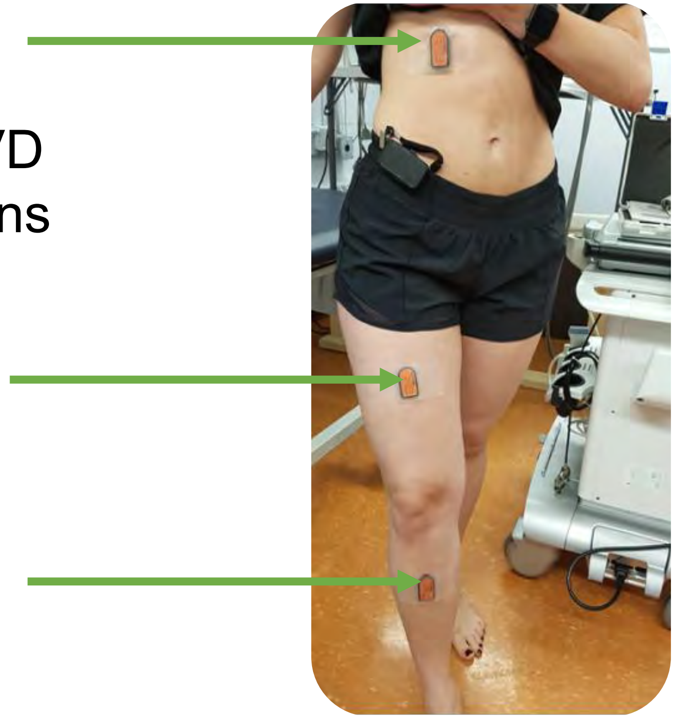


Ambulate Independently

Clinical Trial: Patients with and without CVD receive Kinesiologist delivered mobilizations to combat frailty levels



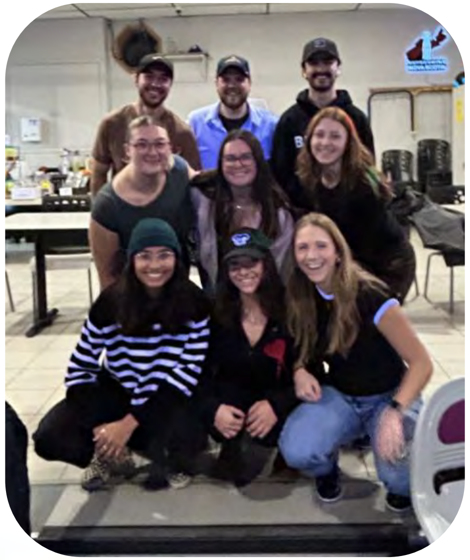
Accelerometers to Derived Detailed Postures



Questions, Collaborations, or Further Interest in Our Work?

Email: Myles.OBrien@USherbrooke.ca

IMPACTS



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