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# Physical Activity and Symptoms of Depression During the Australian COVID-19 Pandemic Response: A Co-Twin Control Study

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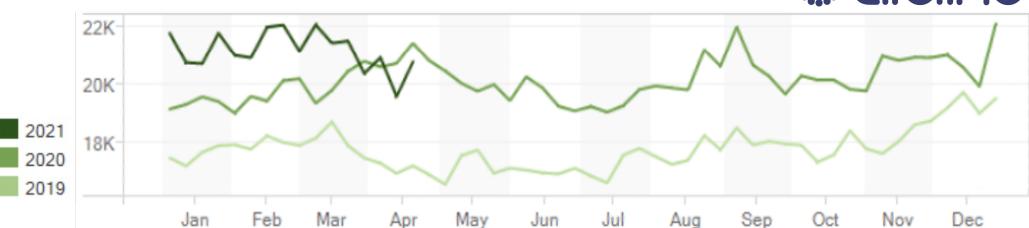


## Physical Activity & Depression Symptoms

- 1 in 7 Australians will experience depression in their lifetime.<sup>1</sup>
- National prevalence of depression symptoms: 10% for 2017-2018.<sup>2</sup>
- Physical activity (PA) protects against symptoms of depression.<sup>3,4</sup>
- Inducing sedentary behaviour in a healthy adult → 84% increase in depressive symptoms in a **single week**.<sup>5</sup>

## Mental Health Impacts of COVID-19

- Increase in demand for crisis support services in Australia.<sup>6</sup>

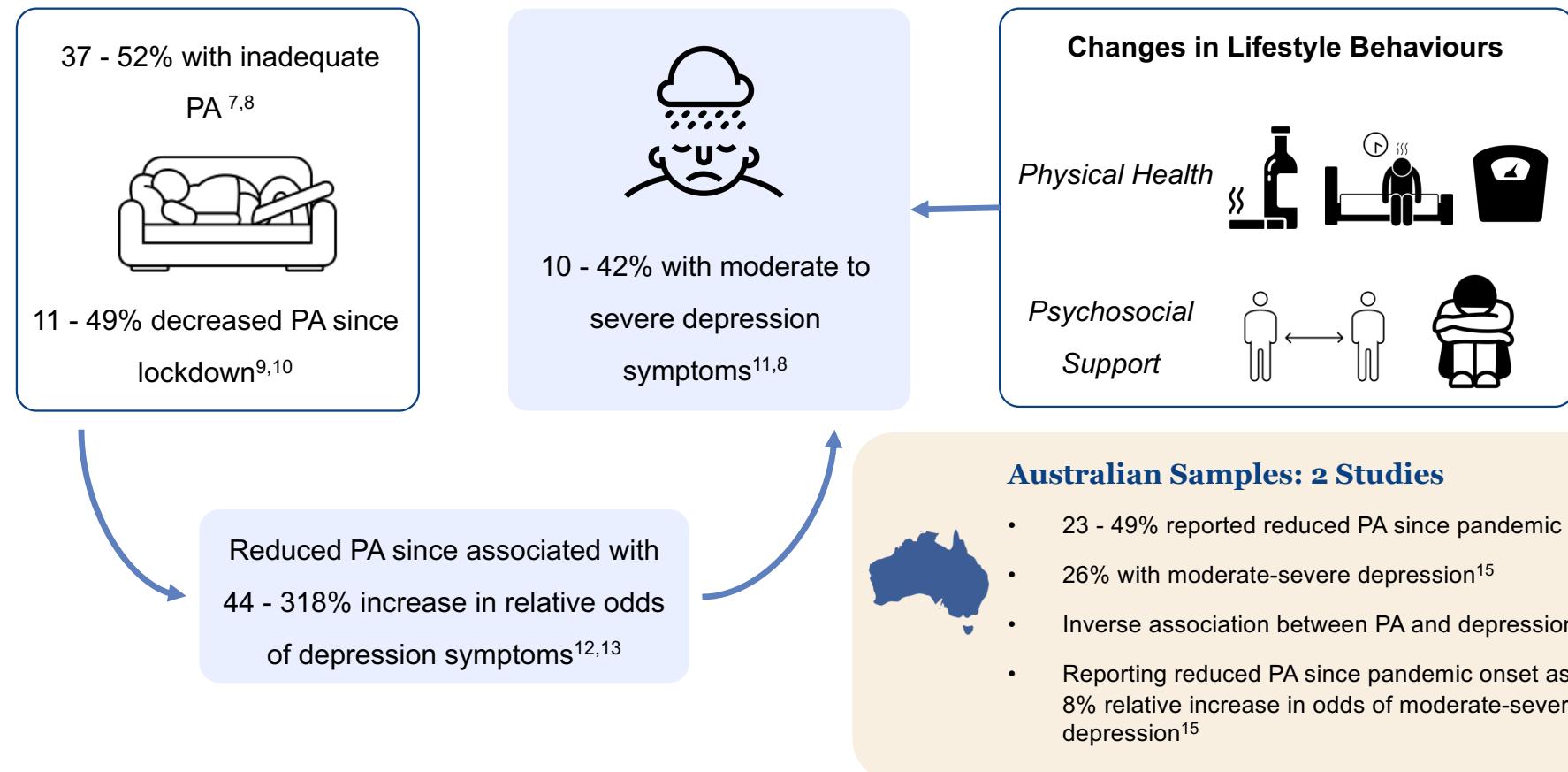


→ Need for **low-cost, evidence-based** strategies to support population mental health.



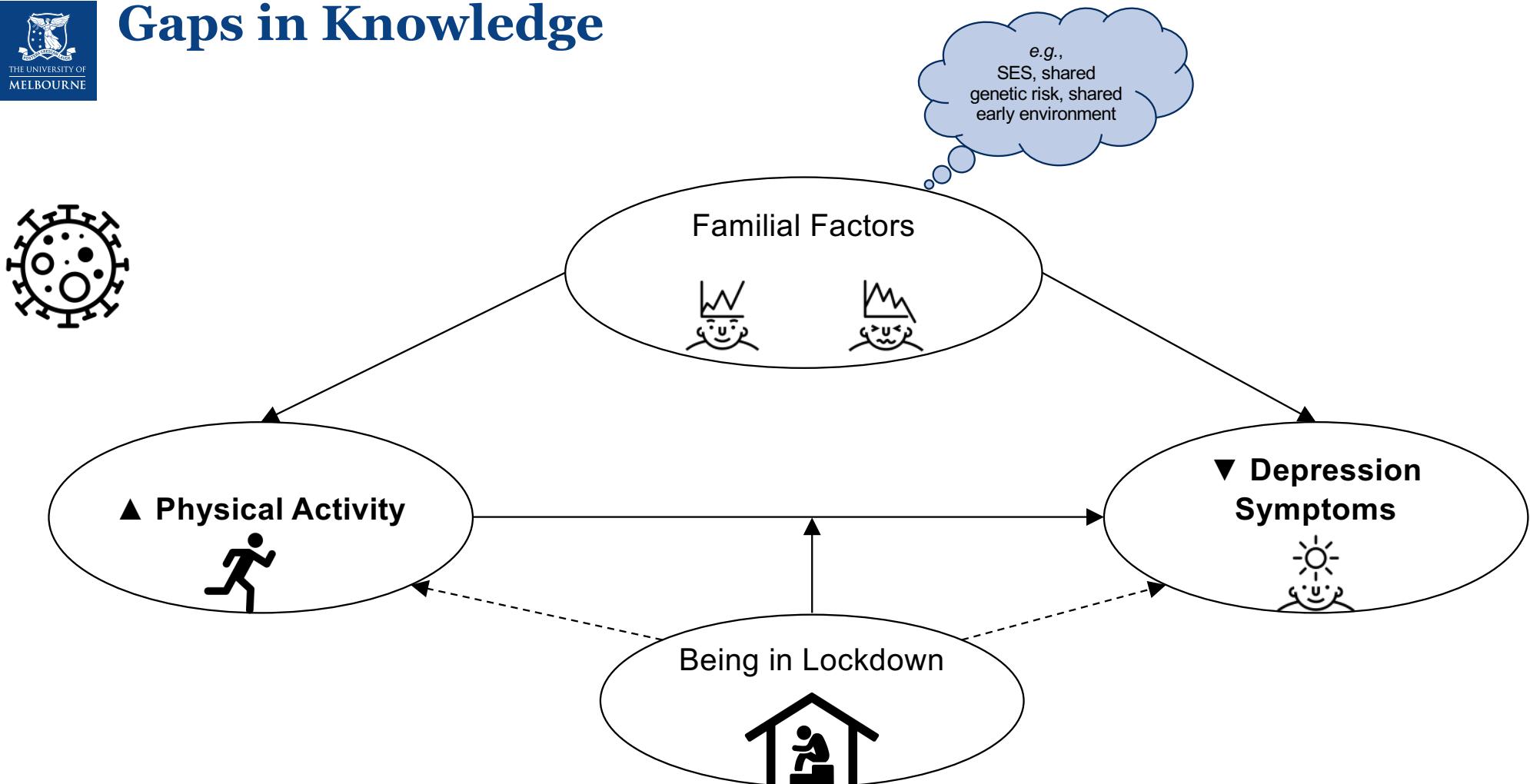
# Literature Review

48 studies of association between PA and depression symptoms since pandemic onset, globally.





# Gaps in Knowledge





# Research Questions



For a sample of Australian adult twins:

1. Are self-reported PA levels associated with depression symptoms after adjusting for potential physical health and psychosocial confounders?
2. Is the potential association between self-reported PA levels and depression symptoms **modified by being in lockdown** after adjusting for potential physical health and psychosocial confounders?
3. Are self-reported PA levels associated with symptoms of depression after adjusting for potential physical health and psychosocial confounders and controlling for **familial confounding**?

## Importance of this Research

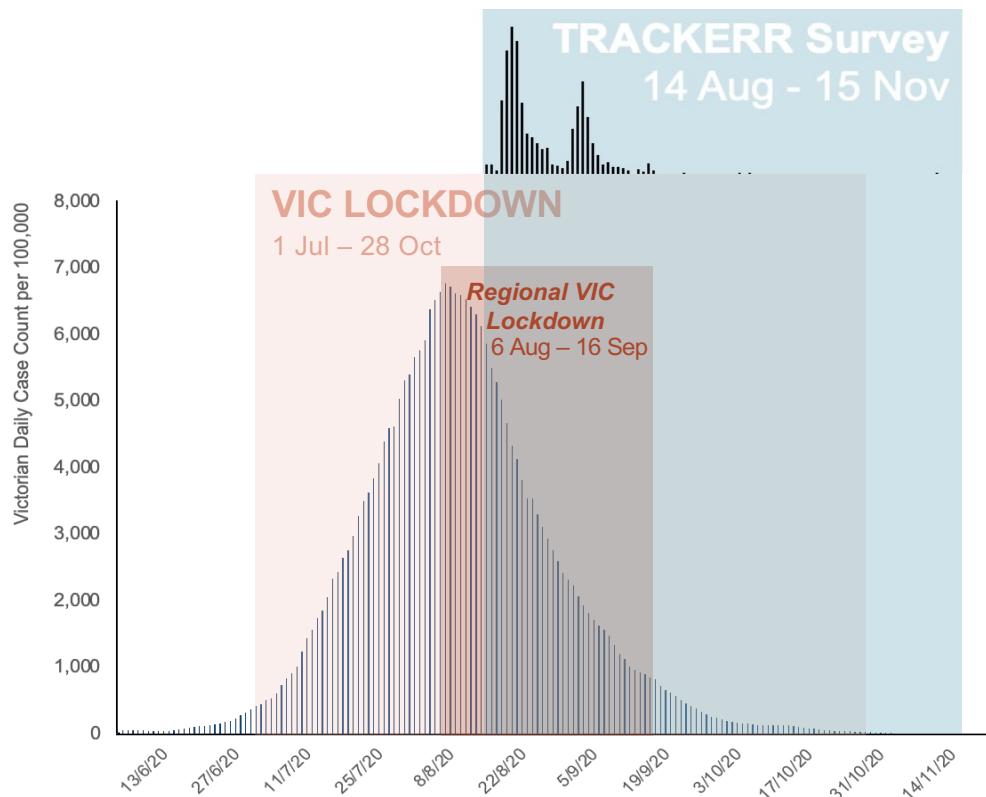
Explores PA as a **low-cost, evidence-based** public health intervention to support population mental health.  
Controls for familial factors that would otherwise be costly to measure in epidemiological research.



# Methods

**Study Design** Cross-sectional study in twin pairs.

**Survey** Administered online by TRA.



## Measures



Depression symptoms over week



Change in PA since lockdown:  
*(improved, stayed the same, worsened)*

PA levels over week:



Days of  $\geq$  30 minutes moderate PA



Days of  $\geq$  20 minutes vigorous PA

Physical Health & Lifestyle Behaviours:

*BMI, sleep, alcohol, smoking*



Psychosocial Support: *Loneliness scores*



Lockdown status for week





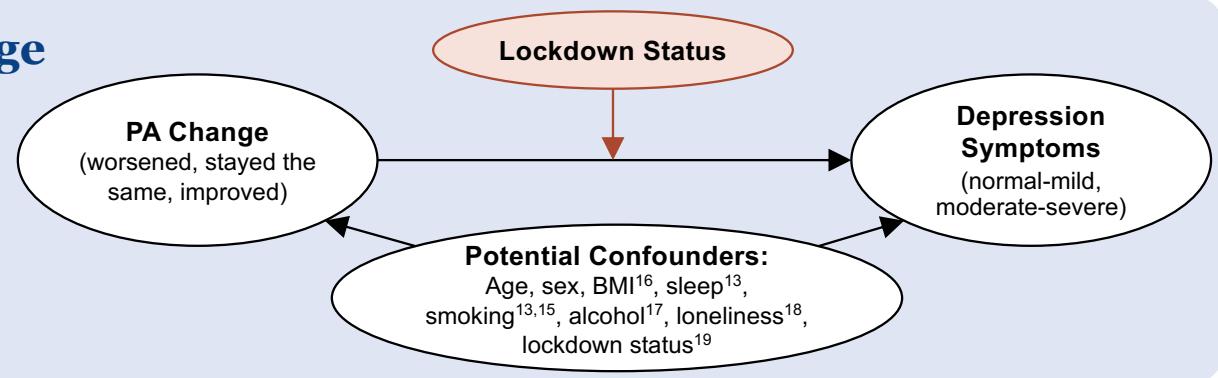
# Statistical Methods

## Model 1. Multivariable Logistic Regression

Treating twins as individuals.

PA change since pandemic onset
Worsened (reference)
Stayed the same
Improved

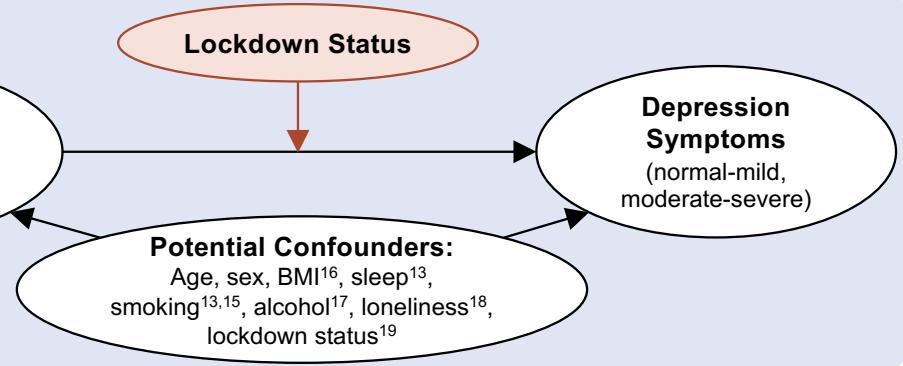
### PA Change



### PA Level

PA Status	Moderate PA (Mins)	Vigorous PA (Mins)
Poor (reference)	< 60	&
Intermediate	60-149	or
Optimal	≥150	or
		≥75

## Model 2. Effect Modification by Lockdown Status?





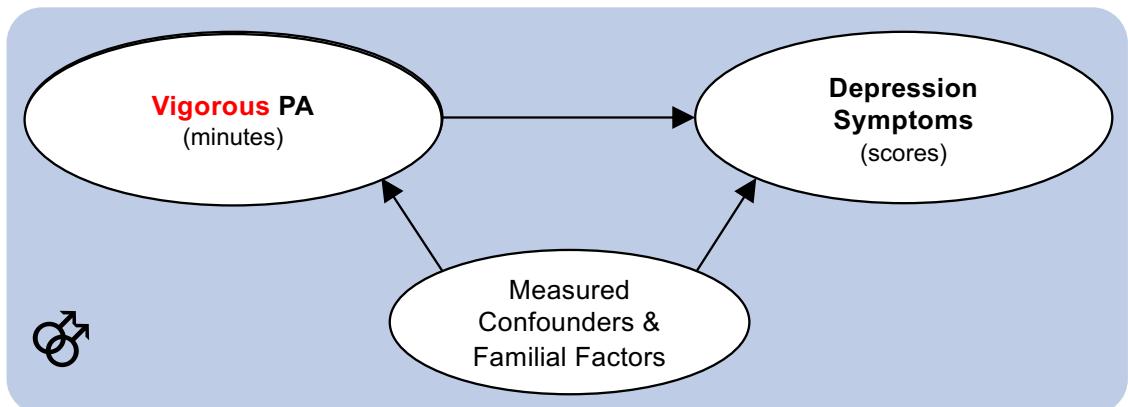
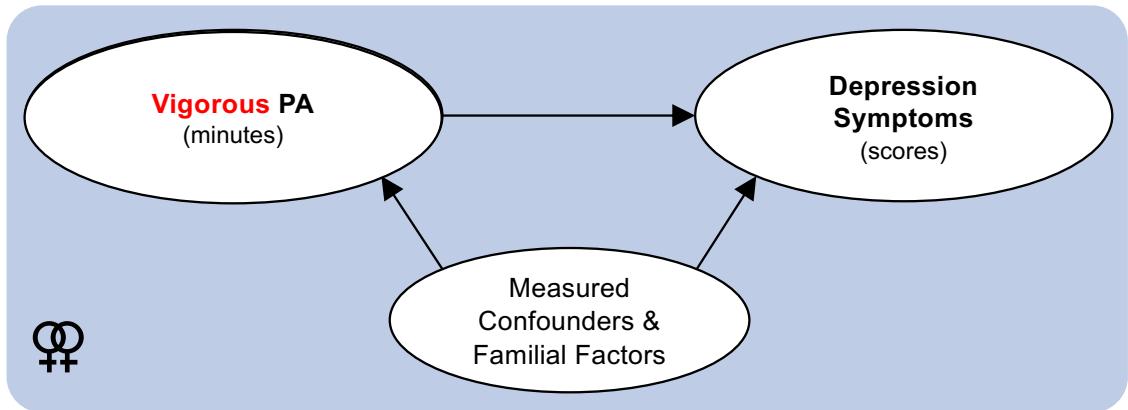
# Statistical Methods

Studying associations **within** twin pairs controls for:

- Age
- Sex (if we consider same-sex pairs only)
- Familial factors (e.g., shared early environment, genetic risk markers)

## Model 3. Within-Pair Differences Regression

- Co-twin control design<sup>20,21</sup>





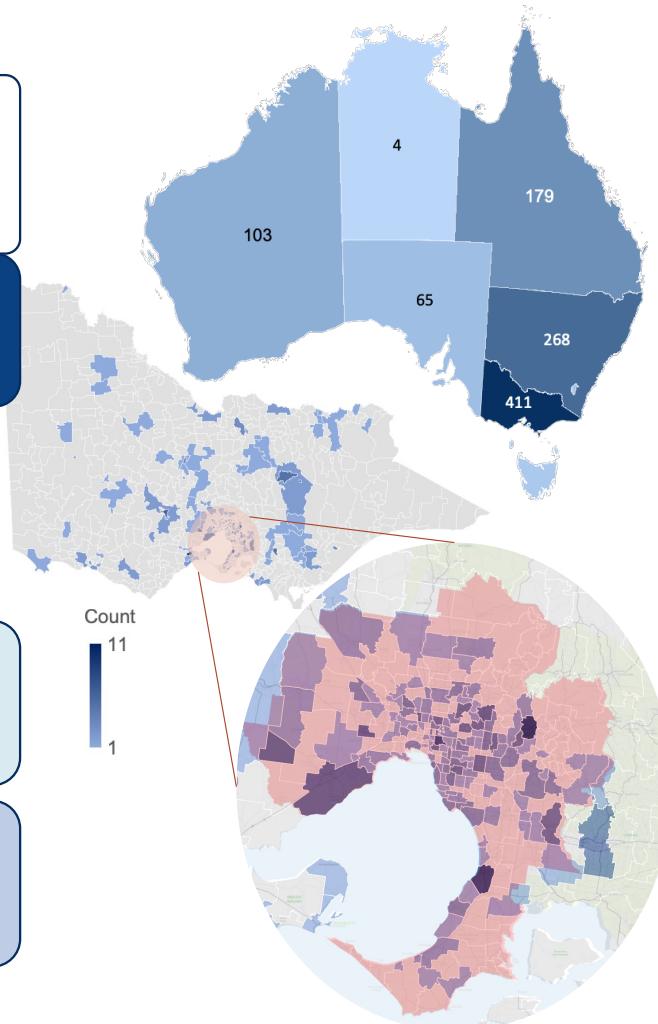
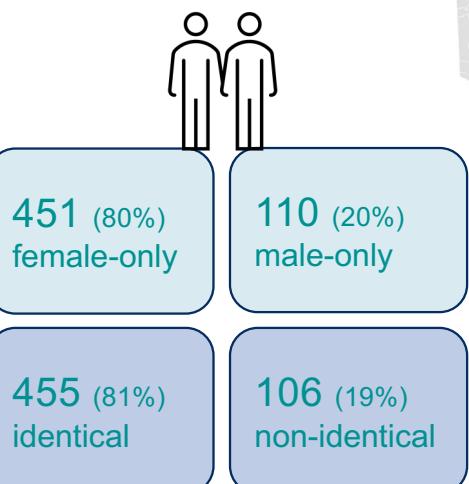
# Results: Sample Descriptives

N = 1,122

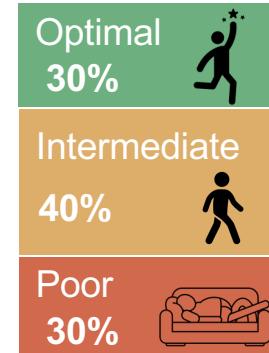
561 twin pairs

Aged 18 – 89 years

Mean (SD) = 52 (16) years



## Physical Activity Levels



34% reported worse PA levels since pandemic onset

## Physical Health

52% overweight or obese

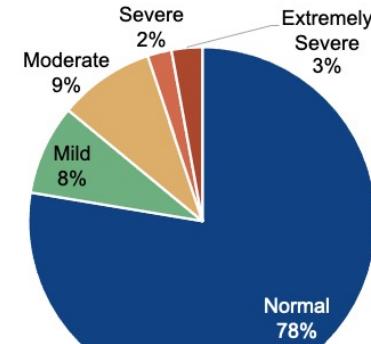
9% inadequate sleep

5% current smokers

19% heavy drinkers



## Depression



14% with moderate-severe depression symptoms

## Psychosocial Support



9% severely lonely

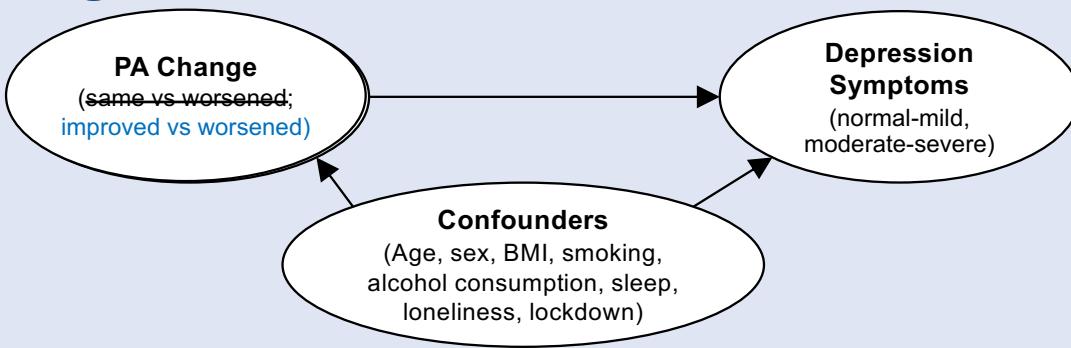
## Lockdown Status



36% in lockdown

# Results: MLR & Effect Modification

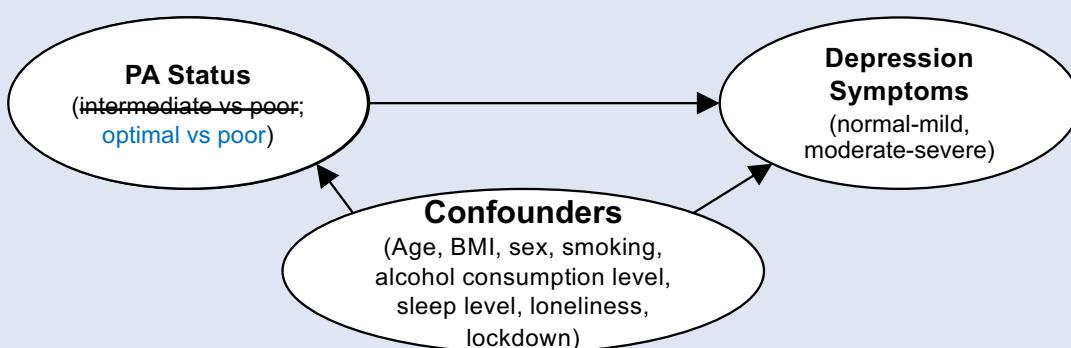
## PA Change



Compared to worse PA, **improved** PA associated with 0.57-fold (43%) decrease in relative odds of moderate-severe depression ( $OR = 0.57$ ; 95% CI: 0.329, 0.997;  $P = 0.049$ ).

No evidence of effect modification by lockdown status.

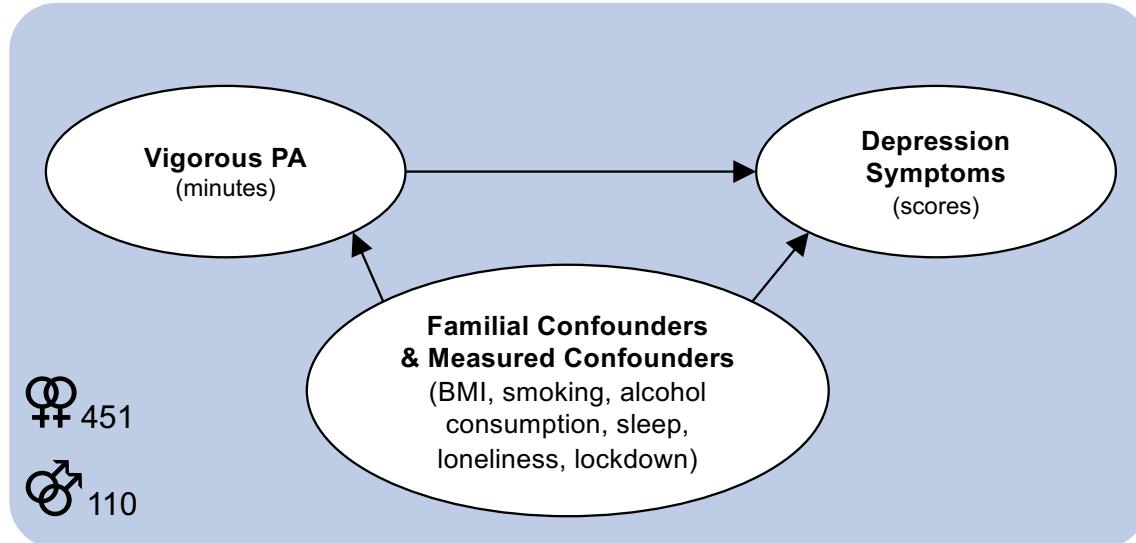
## PA Level



Compared to poor PA, **optimal** PA associated with 0.54-fold (46%) decrease in relative odds of moderate-severe depression ( $OR = 0.54$ ; 95% CI: 0.32, 0.94;  $P = 0.028$ ).

No evidence of effect modification by lockdown status.

# Results: Within-Pair Differences Regression



After controlling for familial confounders, no evidence of association between depression symptom scores and either moderate or vigorous PA.

Moderate PA Interaction Terms:

- Females-only pairs: -0.002 (95%CI: -0.012, 0.009), P = 0.740
- Male-only pairs: -0.012, (95%CI: -0.027, 0.004), P = 0.135

Vigorous PA Interaction Terms:

- Female-only pairs: -0.018, (95%CI: -0.037, 0.001), P = 0.070
- Male-only pairs: -0.010, (95%CI: -0.041, 0.021), P = 0.518



## Discussion: Summary of Findings

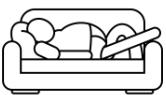


**Depression Prevalence.** 14% with moderate-severe depression symptoms.



**PA Levels.** One third of sample not meeting recommended PA guidelines.

Over one third reported worse PA since pandemic onset.



**Association between PA and Depression.** After controlling for physical health and psychosocial confounders, lower relative odds of moderate to severe depression were associated with:

- Reporting increased PA since the pandemic onset, *and*
- Reporting optimal PA levels for the week prior.



**Familial Confounding.** Association between PA and depression attenuated to the null after controlling for familial factors.



# Comparison to Previous Research

## Prevalence Rates

- 14% with moderate-severe depression symptoms: higher than national prevalence rate (10%)<sup>2</sup> but lower than comparable study of Australian sample (26%).<sup>15</sup>
- 34% reporting reduced PA since pandemic comparable to rates identified in other Australian samples (23-49%).<sup>14,15</sup>

## Association between PA & Depression

- Inverse association between PA and depression consistent with all other studies, globally.
- Larger magnitude of effect size for increased odds of moderate-severe depression for reduced vs. improved PA since pandemic in Australia (this study OR = 1.75 vs. OR = 1.08<sup>15</sup>).

## Controlling for Familial Confounding

Consistent with US twin study finding attenuation to null of inverse association between change in self-reported PA since pandemic onset and anxiety symptoms.<sup>22</sup>

## Critical Appraisal of this Study

### Strengths:

Design matched for familial confounders.<sup>19,20</sup>

### Limitations:

Low statistical power.

Measurement error: self-reported PA susceptible to recall bias.<sup>23</sup>

External validity: are twins representative of general population?<sup>24,25</sup>

Observational design does not support causal inference.



## Discussion: Public Health Implications

1. Obtaining at least 150 minutes of moderate PA or at least 75 minutes of vigorous PA per week is associated with reduced odds of moderate to severe depression.
2. Improving PA levels since pandemic onset associated with reduced odds of moderate to severe depression.
3. Both PA behaviours and depressive symptoms are potentially clustered *within* families, suggesting a role for future intervention research delivered at the family level.
4. PA is not a replacement for evidence-based treatments for depression, especially not for complex, severe or co-occurring mental health conditions.

## Future Research

- RCTs evaluating PA interventions delivered at the family, rather than individual level.
- Consider PA type, frequency, social aspects.
- Objective PA measurement with actigraphy.



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# Questions



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