Interactions Between Physical Activity and Mental and Cognitive Health:

What Do We Know and What Next?

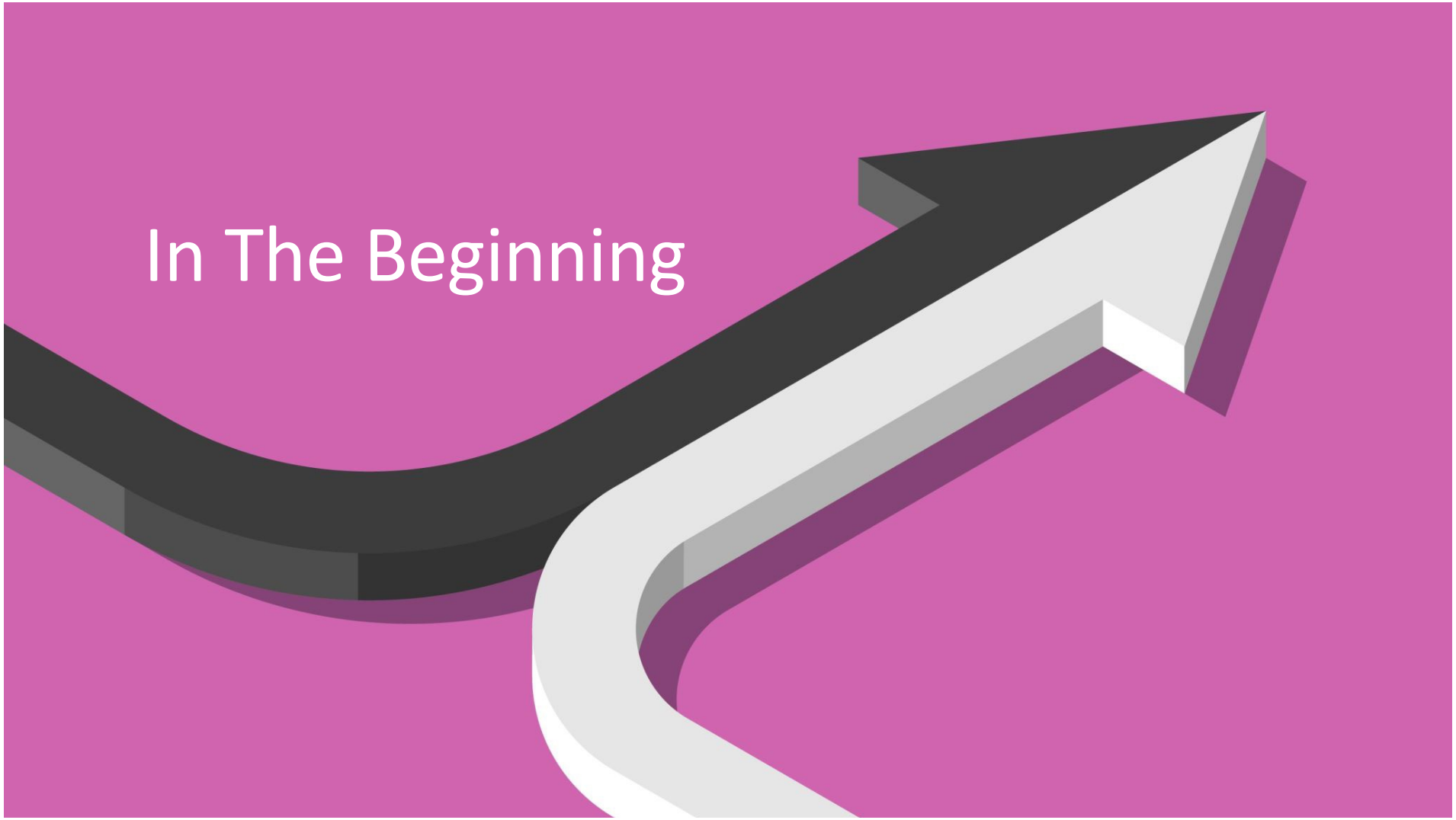
Theone Paterson, Ph.D. R. Psych

Background

- The early years...


Grad School
SFU
SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

In The Beginning



BACKGROUND - MEDICATION ADHERENCE

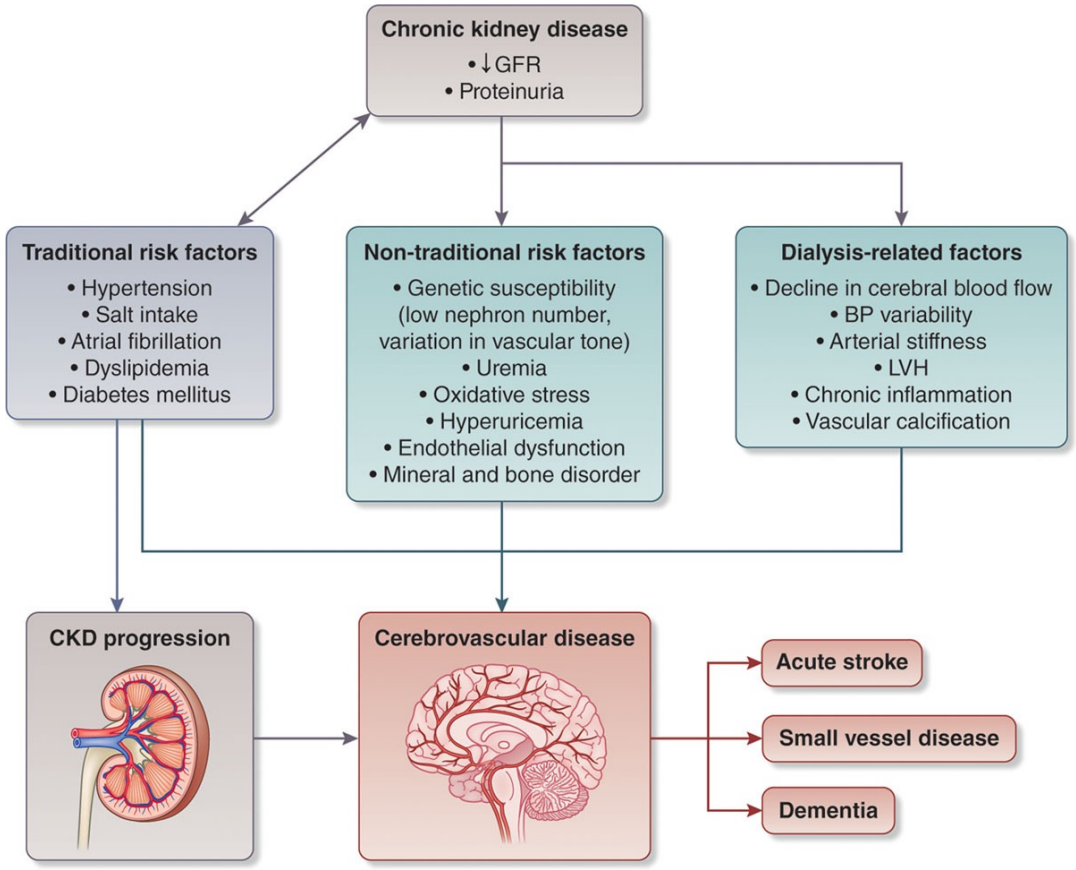
Risk factors

Attitudes & beliefs:

- Lower SE (De Geest et al., 1995)
- Depression (e.g., Gelb et al., 2010)

Treatment related:

- Adjusting doses (Cedillo-Galindo & Gracida, 2011)
- Forgetting medications (Cedillo-Galindo & Gracida, 2011)
- Understanding medications (Vasquez, et al, 2003)
- Number of medications (Vasquez, et al, 2003)



Kelly et al., 2021

RENAL DISEASE & TRANSPLANT

- Important risk factor for cerebrovascular disease
  - shared traditional risk factors
  - Uremia-related risk
  - Dialysis-related risk
- Increased risk
  - Stroke
  - Small vessel disease
  - Dementia

DEPRESSION IN RENAL TRANSPLANT

- Rates nearly 3x the general population

  (NIMH, 2016; Palmer et al., 2013)

- Explains 20-30% of the variance in non-mood-related aspects of HRQOL (Kovaks et al., 2011)
  - Increased mortality (Novak et al., 2010; Zelle et al., 2012)
  - Organ rejection (Tsunoda et al., 2010).
  - Predicts adherence (e.g. Griva et al., 2012)

NEUROCOGNITIVE ABILITIES

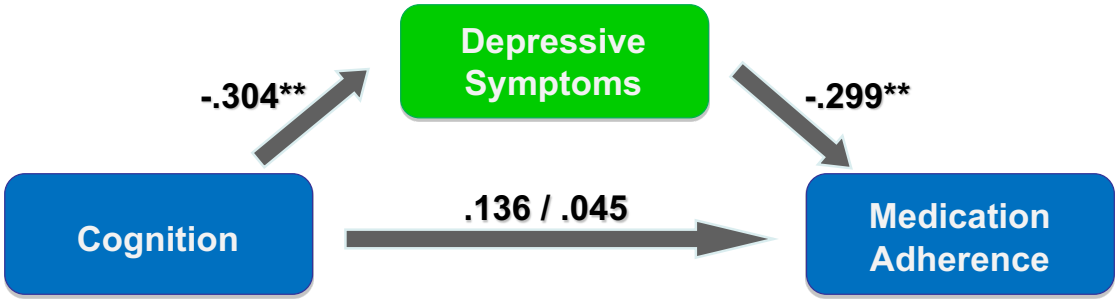
- Memory and executive function deficits in CKD

  (e.g. Fiorina et al., 2012; Thornton, et al, 2007)

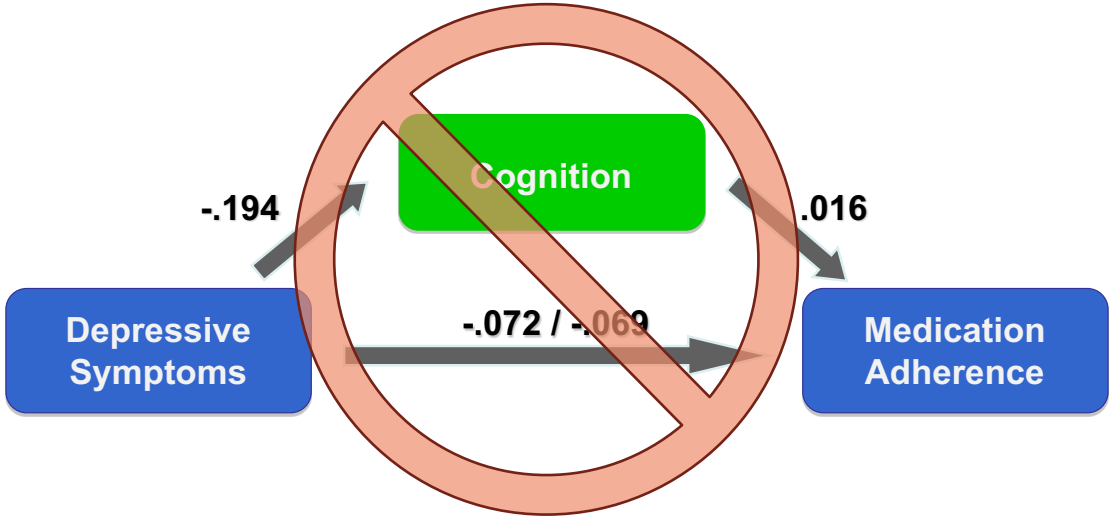
- Difficulties persist post-transplant

  (Gelb et al, 2008; Troen et al., 2012)

- Possible relationship between cognition and adherence? (Cheng, et al, 2012 ; Griva, et al, 2012)



Sobel's Z = 2.18, p <.05



(Paterson,. Shapiro, & Thornton, 2010)

EVERYDAY PROBLEM SOLVING

- EPS better predicts everyday functioning

  (Allaire & Marsiske, 2002; Gelb et al, 2010; Thornton et al, 2010)

- Other neurocognitive tasks may artificially decrease estimates of performance (Thornton et al., 2010)

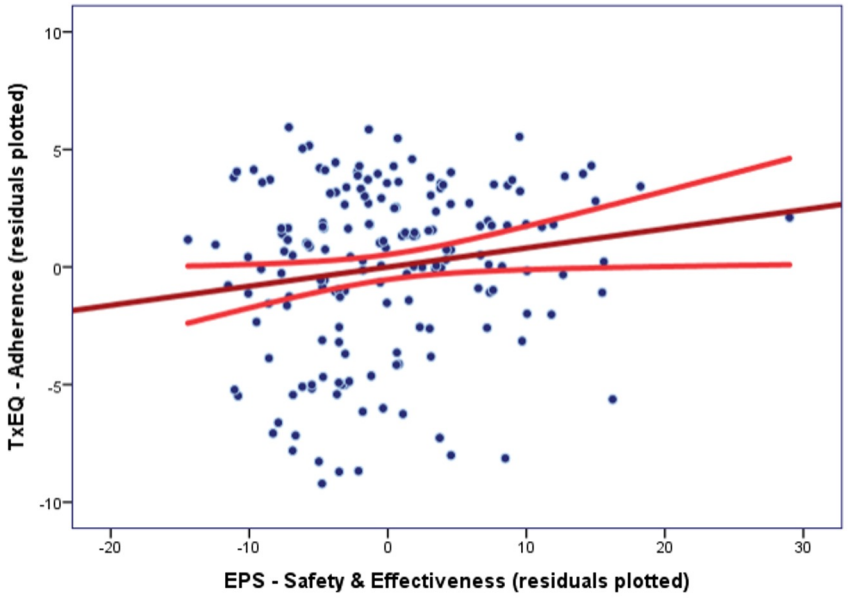
- Predicts independence, functioning, and mortality

  (e.g., Allaire & Marsiske, 2002; Allaire & Willis, 2006; Thornton et al, 2007; Thornton et al., 2010)

EPS IN CHRONIC ILLNESS

- Better EPS predicts better self-reported adherence in RTR, after accounting for neurocognitive abilities (Gelb et al., 2010)

	1	2	3	4	5	6	7	8	9
1. Age	--								
2. Gender	-.00	--							
3. ESL Status	.02	-.19*	--						
4. Education	.11	.05	-.26**	--					
5. Ethnicity	-.19*	.24*	-.67**	.24*	--				
6. EPS	.15	.05	-.05	.31**	.07	--			
7. ECB-KQ	.08	.01	.06	.03	-.13	.18	--		
8. KBIT-II Verbal	-.02	-.17	.35**	.20*	-.30**	.19	.19	--	
9. KBIT-II Nonverbal	.01	-.02	.05	.29**	-.11	.26**	.22*	.39**	--



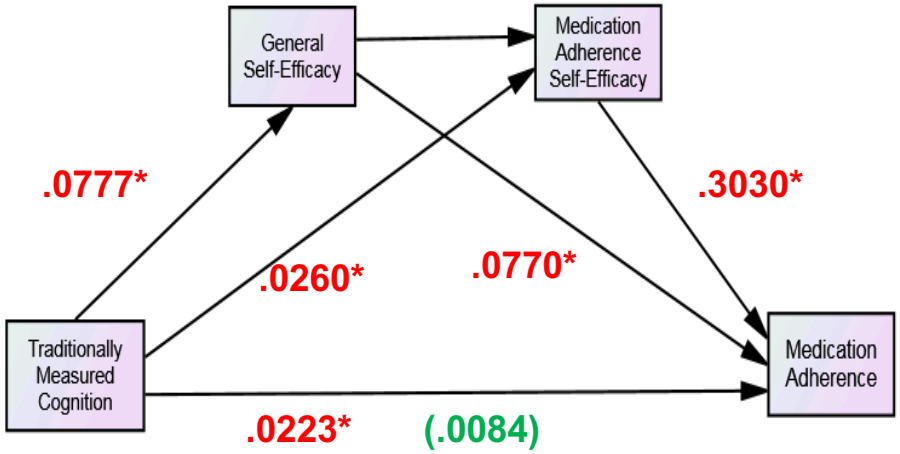
(Paterson, Shapiro, & Thornton, 2013 & 2015)

SELF-EFFICACY & ADHERENCE

- Willingness, effort and/or persistence in relation to aspects of daily life.
  - Measured for specific behaviours including adherence (Fernandez et al., 2008)

- ↑ SE relates to better self-management and QOL in RTR (Weng et al., 2010)

- ↑ Adherence SE relates to better adherence in RTR (Massey et al., 2013;Tucker et al., 2001)

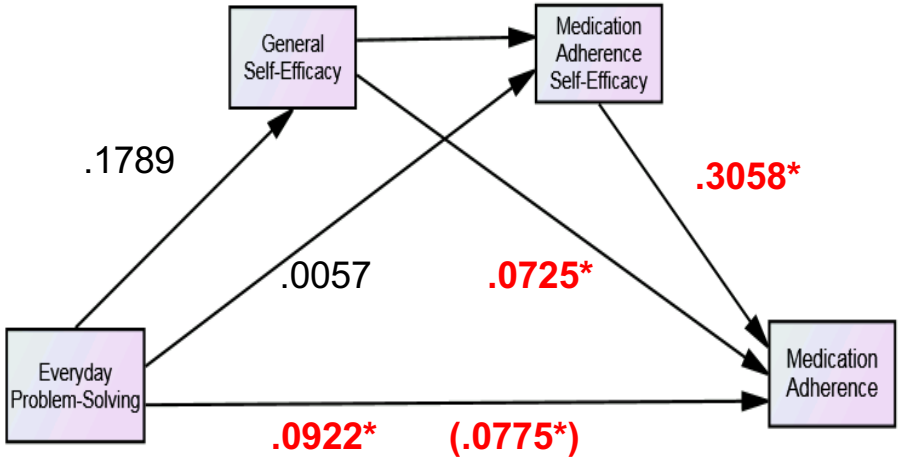


← **Model 1**

R^2 =0.324

Model 2 →

R^2=0.347



PUTTING IT ALL TOGETHER

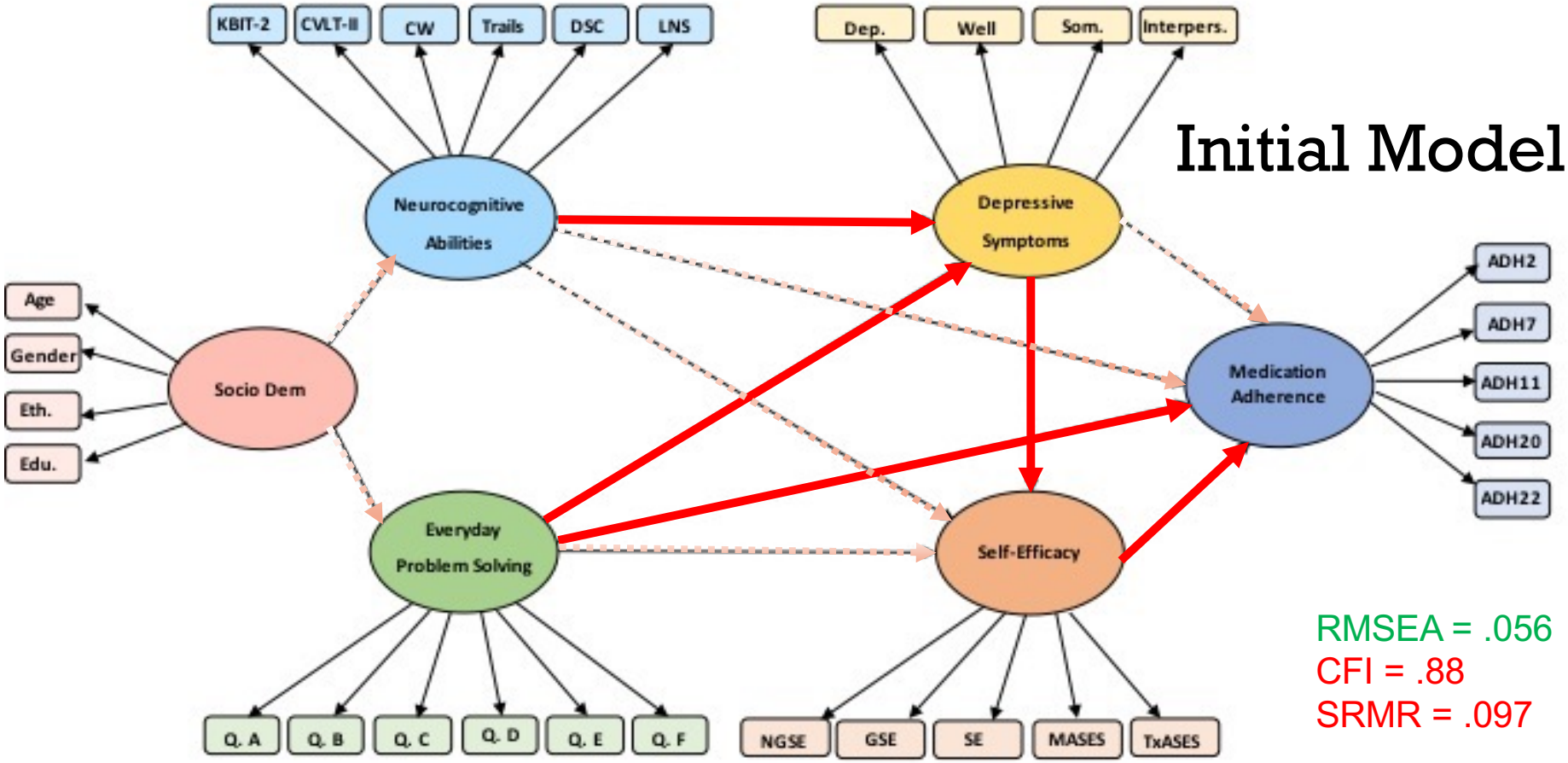
- Multivariate relationships between neurocognitive and psychosocial factors and Medication Adherence

- Structural equation model (Ullman, 2006)
  - Four latent variables predicting adherence
    - Neurocognitive abilities
    - EPS
    - Depressive symptoms
    - SE

PARTICIPANTS & PROTOCOL

Neurocognitive functions	WAIS-III DSC & LNS, DKEFS CW & Trails; CVLT-II; KBIT-2
Everyday Problem Solving	EPS Test, ECB-KQ
Depressive Symptoms	CES-D Factors
Self-Efficacy	SE; GSE; NGSE; Tx-ASES; MASES-R
Medication Adherence	TxEQ; MPR; Serum Target level

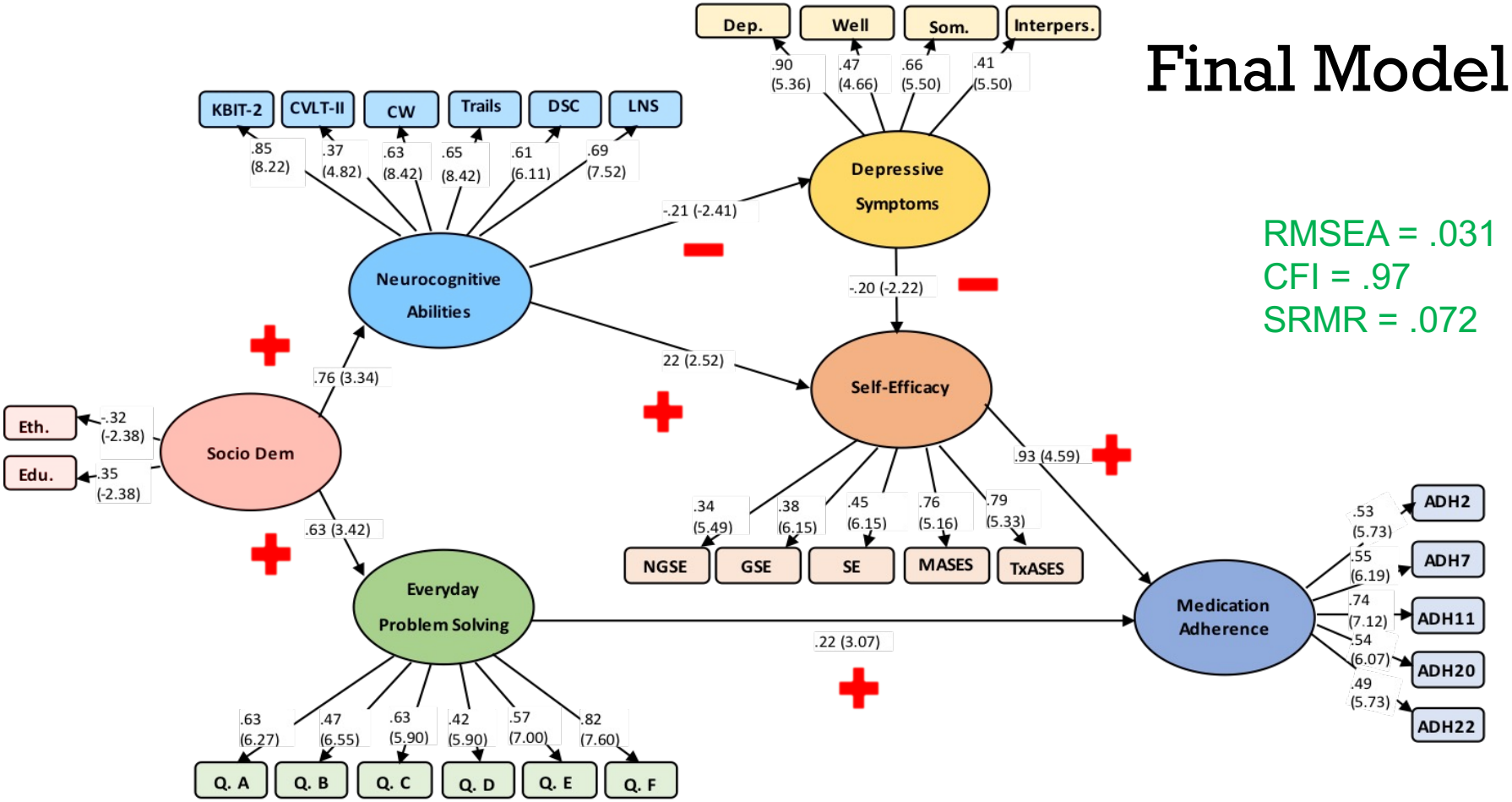
Initial Model



RMSEA = .056
CFI = .88
SRMR = .097

(Paterson, O'Rourke, Shapiro, & Thornton, 2018)

Final Model



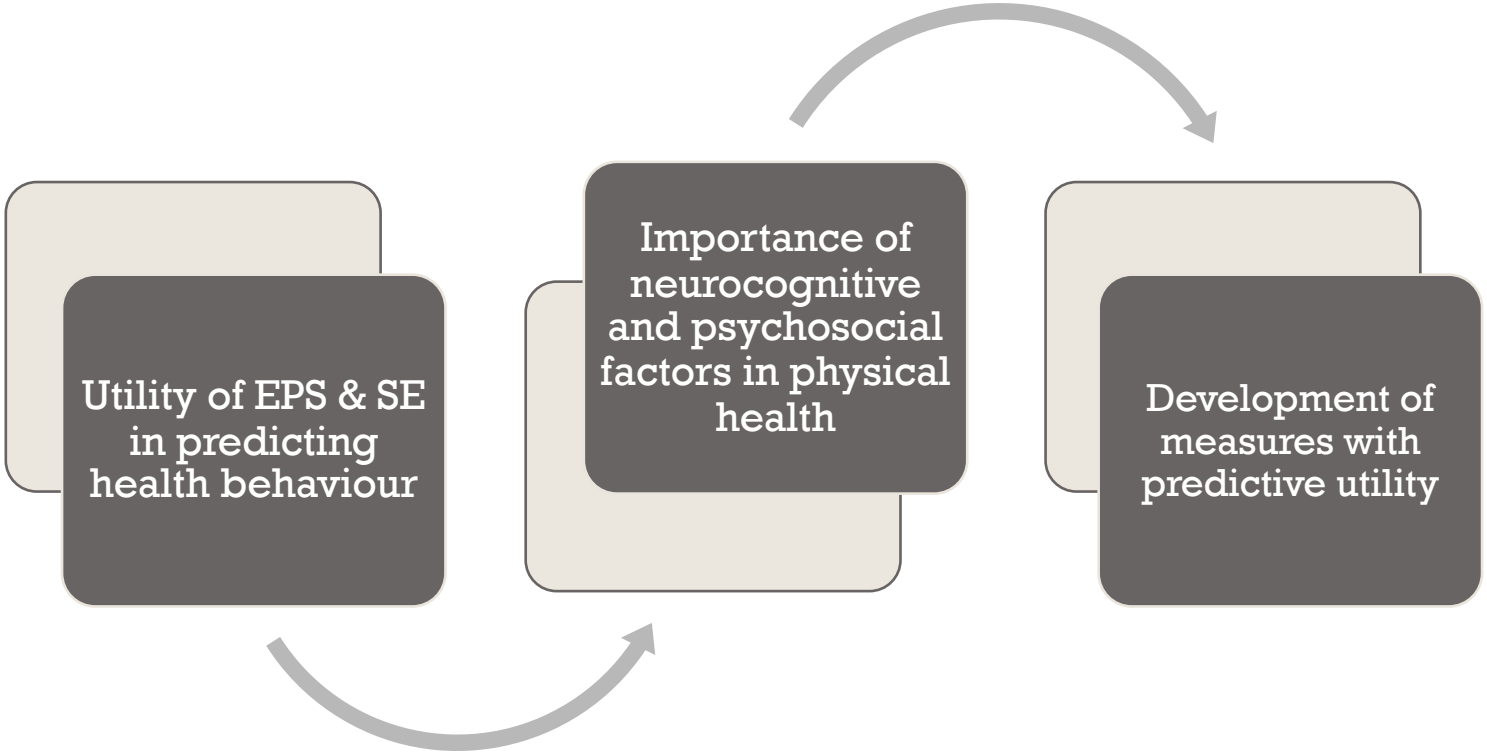
RMSEA = .031
CFI = .97
SRMR = .072

(Paterson, O'Rourke, Shapiro, & Thornton, 2018)

FINDINGS

EPS	Directly predicts adherence	
Neurocognition	Indirect association with adherence	
Depressive symptoms	No direct effect	↑ loadings for depressed affect and somatic symptoms
Self-Efficacy	Directly predicts adherence	↑ Adherence SE loadings loadings on construct

PUTTING IT ALL TOGETHER



Physical Health Impacts on Mental & Cognitive Health

Physical Activity and Cardiovascular Health

Physical Activity has been associated with improved physical health outcomes, and has been linked to a lower risk of:

- Coronary Heart Disease
- Heart Attack
- Stroke
- High Blood Pressure
- High low-density lipoprotein [LDL] level cholesterol

(Myers, 2003)

Physical Activity and Cognitive Health

Physical activity is associated with:

- Increased brain volume
- Improved mood and sleep
- Lowered risk of cognitive decline
- Fighting against reduction of brain connections

Goal: 150 minutes per week of exercise

(Harvard Health, 2021; Mayo Clinic, 2021)

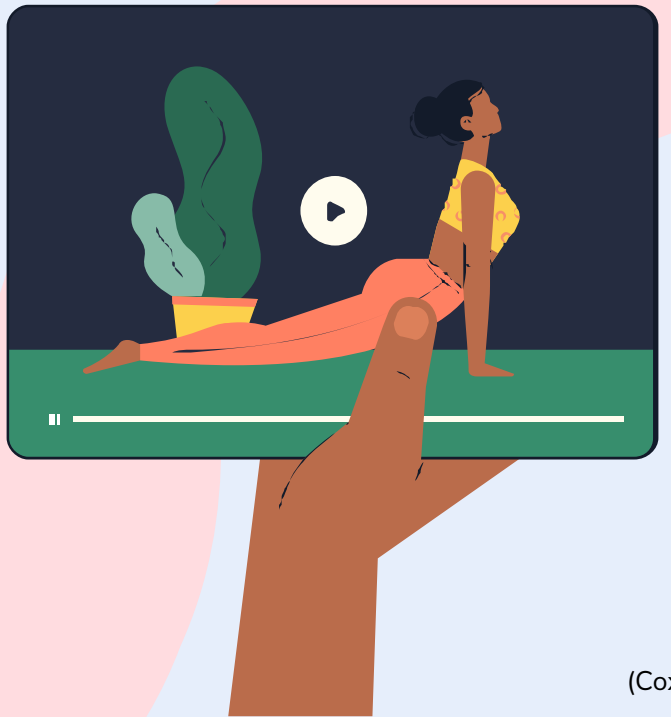
Physical Activity and Cognition

Review of literature

18-50 year olds consistently exercised for 12+ months

Results:

- Improved executive function
- Improved memory
- Improved processing speed

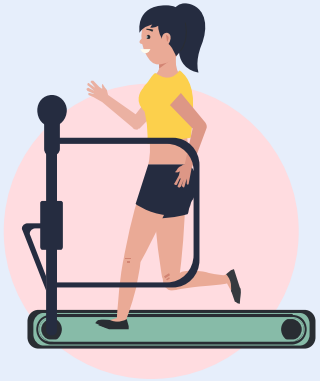


(Cox et al., 2016)

Physical Activity and Cognitive Function in Older Adults

Physical activity is associated with:

Higher scores on tests of attention, executive function, processing speed, memory



Improved overall cognitive functioning

Lower risk of Alzheimer's Disease and Cognitive Impairment

(Busse et al., 2009)

Aerobic or Anaerobic Exercise?

Aerobic Exercise

Correlated with:

- Improved reaction time
- Improved reaction accuracy

Anaerobic Exercise

Correlated with:

- Improved cognitive function
- Improved short-term memory (in cognitively healthy adults)

(Ishihara et al., 2021; Coelho-Junior et al., 2020)

Physical activity promotes cognitive function beyond preventing brain pathology

Improved memory

Better visuospatial abilities

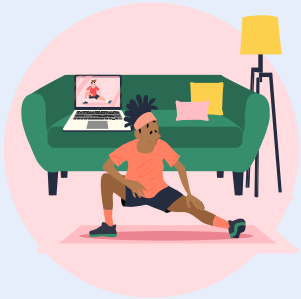
Faster processing speed

(Buchman et al 2019)

Physical Activity and Mental Health

Decreases Symptoms of Depression

Decreases Symptoms of Anxiety



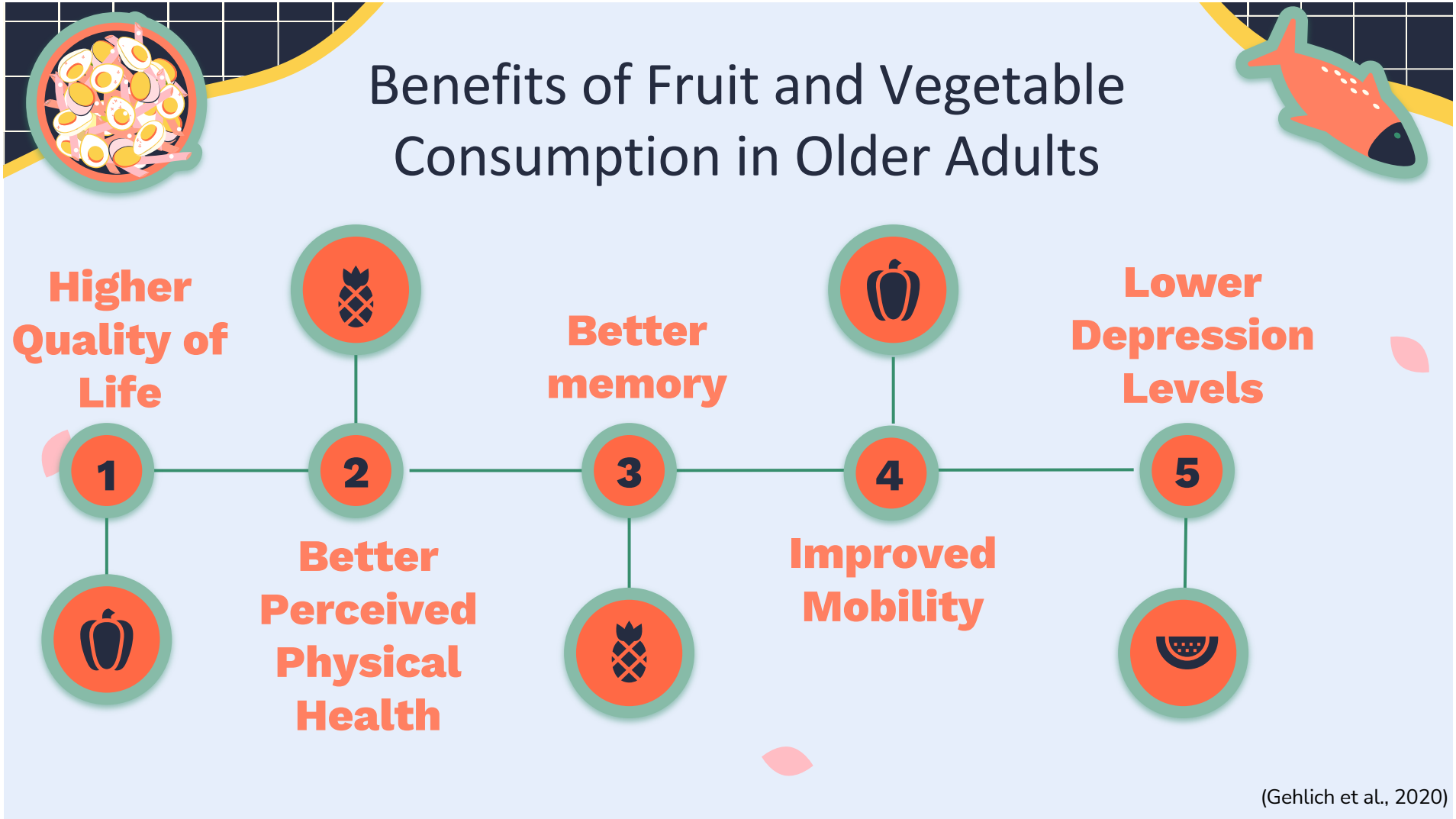
Can have Adverse Effects on those with Panic Disorder

(Paluska & Schwenk, 2000)

Physical Activity and Mental Health in Older Adults

(Yao et al., 2021)

Benefits of Fruit and Vegetable Consumption in Older Adults



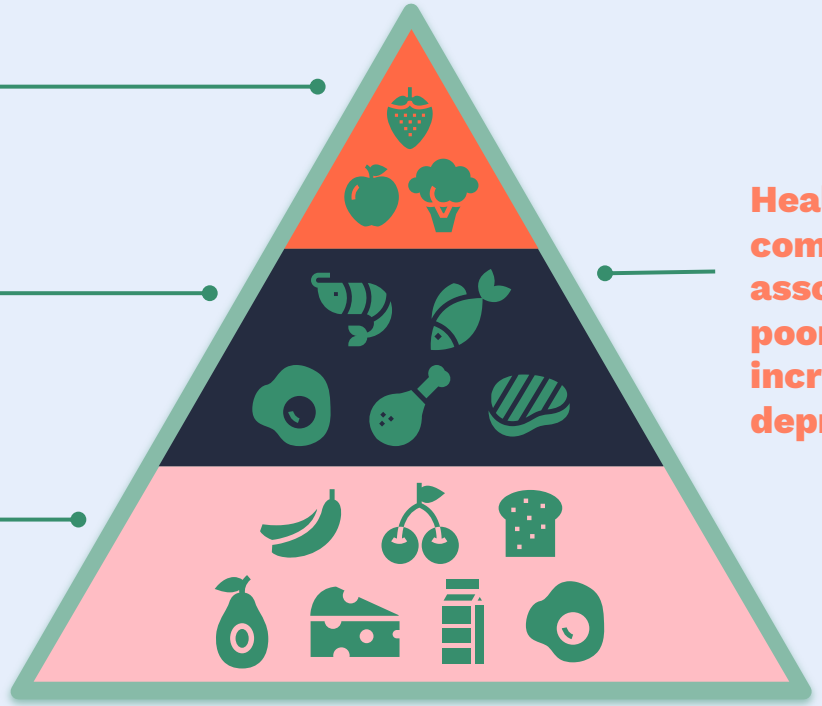
(Gehlich et al., 2020)

Diet and Mental Health in Older Adults

Poor diet can interfere with normal brain function, impacting mood

Nutritional deficiencies can increase risk of depression

High caffeine consumption linked to depression and anxiety



Health complications associated with poor diet can increase risk of depression

(Harbottle, 2019)

Mediterranean Diet

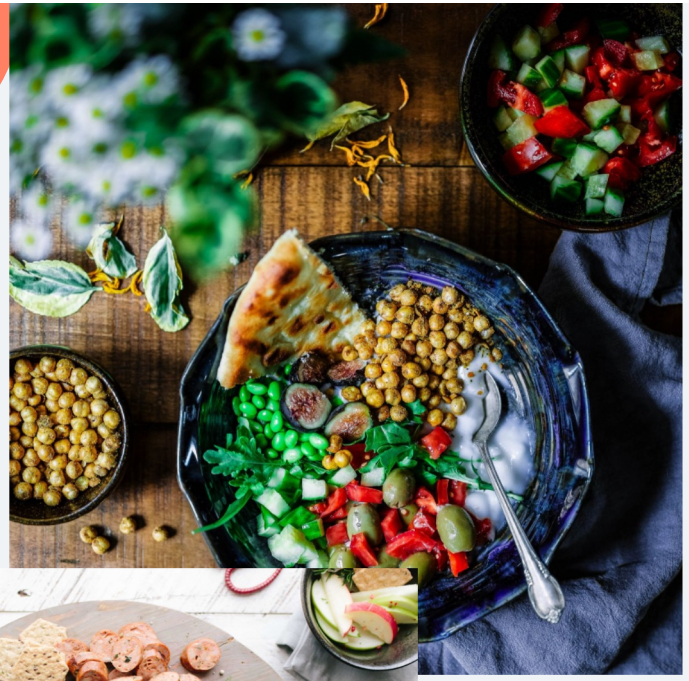
From countries surrounding the Mediterranean Sea (Greece, Italy, etc.)

Main components:

- Mostly plant-based but includes fish and poultry
- Vegetables, fruit, nuts, seeds, whole grains
- Olive oil
- Red wine (in moderation)

Prevents heart disease and stroke

(Mayo Clinic, 2021)



Mediterranean Diet Research

Fish Oil

Component of the Mediterranean diet found in Sea Fish

Fatty Acid

Correlated with:

- Higher brain volume
- Improved executive function + abstract thinking

Plants

Focus of the Mediterranean diet is basing meals around vegetables, legumes, and fruit

Polyphenols (Flavonols)

Correlated with:

- Higher scores on cognitive abilities tests
- Better associated learning and memory

(Huhn et al., 2015)

DASH Diet

Dietary Approaches to Stop Hypertension

Prevents and treats hypertension

Main components:

- Little sodium (up to 1 tsp) and saturated fats
- Low-fat and fat-free dairy products
- Fruit and vegetables, whole grains, beans, nuts
- Fish and poultry, limited fatty meat

(Mayo Clinic, 2021)

MIND Diet

Mediterranean-DASH Intervention for Neurodegenerative Delay

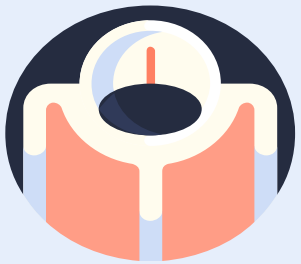
Designed for brain health and dementia prevention

Main components:

- Leafy greens
- Berries
- Nuts
- Olive oil
- Mostly plant-based but includes fish
- Red wine (in moderation)

(Mayo Clinic, 2019)

MIND Diet Research



Correlated with:

- Better cognition
- Improved long-term cognitive function
- Improved subjective memory

Found to be more effective than the Mediterranean diet and the DASH diet

- MIND incorporates the best components of both diets

(Kheirouri & Alizadeh, 2021)

Canadian Data?

Canadian Longitudinal Study on Aging (CLSA)

Journal of Aging and Physical Activity, 2022, 30, 136-147
https://doi.org/10.1123/japa.2020-0393

clsa élcv
Canadian Longitudinal Study on Aging
Étude longitudinale canadienne sur le vieillissement

Human Kinetics
ORIGINAL RESEARCH

Social Support and Physical Activity in Older Adults: Identifying Predictors Using Data From the Canadian Longitudinal Study on Aging

Chantelle Zimmer and Meghan H. McDonough

This study examined which of nine forms of social support were the strongest predictors of physical activity in older adults, and to what degree these associations were moderated by eight demographic indicators of groups at increased risk of social isolation. Baseline data from 21,491 adults aged 65 and older who were participants of the Canadian Longitudinal Study on Aging were analyzed using multiple regression. Greater social network size, social contact with network members, and participation in community-related activities predicted greater physical activity, whereas being in a domestic partnership and perceiving more tangible support to be available were negatively associated. The strength and direction of these associations varied by sex, living arrangement, and income. Given the findings, various forms of social support should be incorporated in physical activity interventions but tailored to meet the needs of different segments of the aging population.

Keywords: CLSA, social isolation, social relationships, vulnerable populations, exercise

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journal homepage: www.elsevier.com/locate/ypmed

The combined effect of behavioural risk factors on disability in aging adults from the Canadian Longitudinal Study on Aging (CLSA)

Parminder Raina [a,b,c,*], Muhammad Usman Ali [a,b,c,d], Divya Joshi [a,b,c], Anne Gilsing [a,b,c], Alexandra Mayhew [a,b,c], Jinhui Ma [a,c], Diana Sherifali [c,d,e], Mary Thompson [f], Lauren E. Griffith [a,b,c]

[a] Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, Ontario, Canada
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[d] School of Nursing, McMaster University, Hamilton, Ontario, Canada
[e] Population Health Research Institute, McMaster University and Hamilton Health Sciences, Hamilton, Ontario, Canada
[f] Department of Statistics & Actuarial Science, University of Waterloo, Waterloo, Ontario, Canada

Hamond & Stinchcombe, 2022

- Many types of physical activity may be protective of memory performance

Empirical Article

Research on Aging
2022, Vol. 0(0) 1–15

DOI: 10.1177/01640275211070001
journals.sagepub.com/home/roa

Prospective Associations between Physical Activity and Memory in the Canadian Longitudinal Study on Aging: Examining Social Determinants

Nicole G. Hammond[1] **and Arne Stinchcombe**[2]

Abstract

Objectives: To examine associations between physical activity (PA) and prospectively assessed memory in a cohort of cognitively healthy adults, after accounting for understudied social determinants.

Methods: We used data from the Canadian Longitudinal Study on Aging (CLSA). PA (exposure) and memory (outcome) were assessed using validated measures in 2013–2015 and 2015–2018, respectively. Respondents reported their daily number of hours spent engaging in five different PAs. We conducted multiple imputation and used linear regression (n = 41,394), adjusting for five categories of covariates: demographics, sensory health characteristics, health behaviors, health status, and social determinants (sex/gender, education, income, social support, perceived social standing, race, and sexual orientation).

Results: In crude models, nearly every intensity and duration of PA was associated with better memory. In fully adjusted models, protective associations were attenuated; however, some associations held: all durations of walking, most durations of light activities, moderate activities for ≥1 hour, and strenuous activities for 1 to <2 hours.

Discussion: Some forms of PA may be associated with better memory. The benefits of higher intensity PA may only be realized after social determinants are addressed.

Keywords
exercise, social determinants, memory, Canadian Longitudinal Study on Aging, epidemiology

clsa élcv
Canadian Longitudinal Study on Aging
Étude longitudinale canadienne sur le vieillissement

THE GERONTOLOGICAL SOCIETY OF AMERICA®

Journals of Gerontology: Medical Sciences
cite as: *J Gerontol A Biol Sci Med Sci*, 2021, Vol. 76, No. 12, 2223–2231
doi:10.1093/gerona/glab165
Advance Access publication June 11, 2021

OXFORD

Research Article

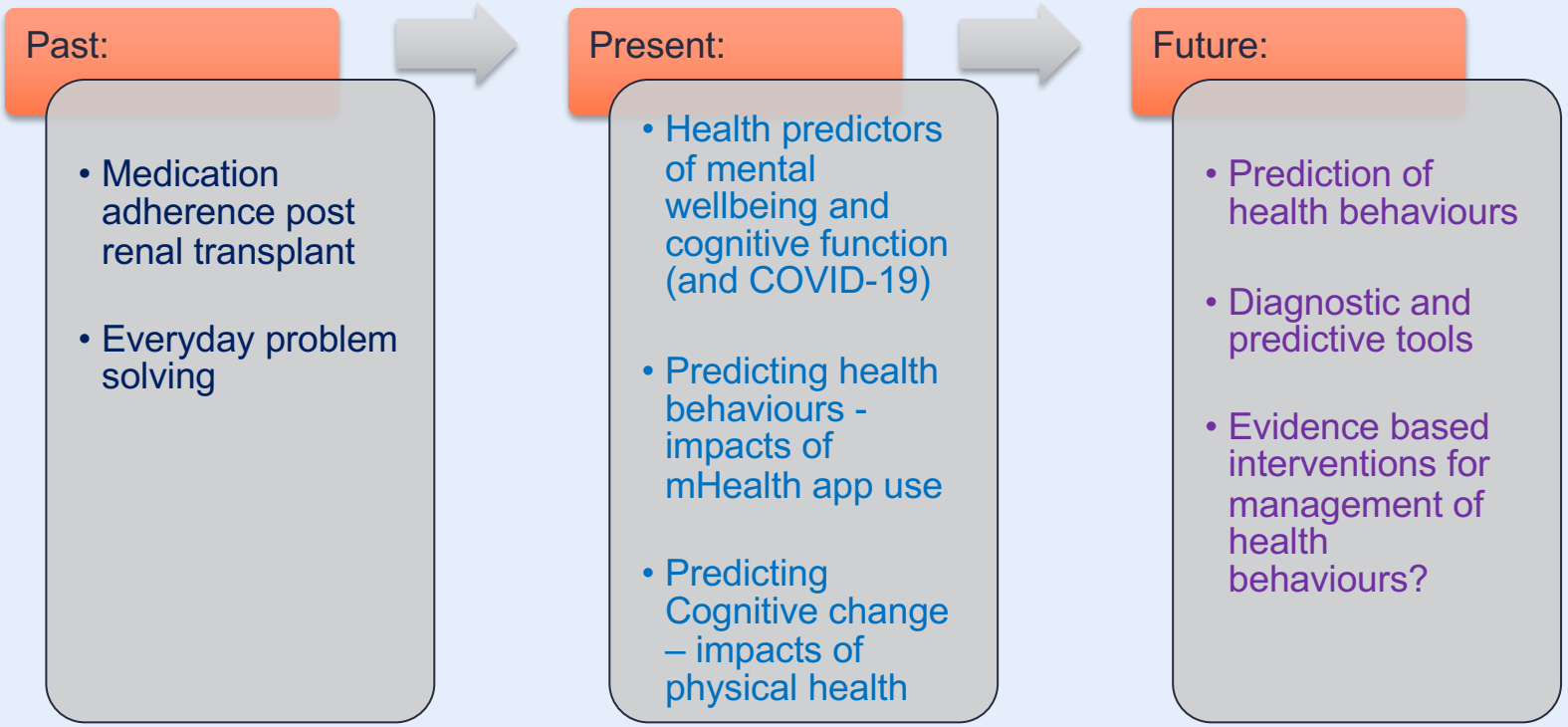
clsa élcv
Canadian Longitudinal Study on Aging
Étude longitudinale canadienne sur le vieillissement

Milk, Yogurt, and Cheese Intake Is Positively Associated With Cognitive Executive Functions in Older Adults of the Canadian Longitudinal Study on Aging

Anne-Julie Tessier, RD,[1,2] Nancy Presse, RD, PhD,[3,4,5,] Elham Rahme, PhD,[6,7] Guylaine Ferland, PhD,[8,9] Louis Bherer, PhD,[5,9,10] and Stéphanie Chevalier, RD, PhD[1,2,7,*,]

In The Now

Past, Present, & Future



Current Projects

Variable	B	R^2	ΔR^2	ΔF	t
Step 1		0.005		5.705**	
Gender	4.390				2.389*
Step 2		0.008	0.003	3.798*	
Gender	4.330				2.358*
Exercise	-0.035				-1.949*
Step 3		0.052	0.044	54.619***	
Gender	4.429				2.466*
Exercise	-0.015				-0.829
SS	-8.032				-7.390***
Step 4		0.501	0.449	1067.374***	
Gender	2.392				1.833
Exercise	0.002				0.181
SS	-3.941				-4.933***
ERS	1.267				32.671***
Step 5		0.505	0.004	10.112**	
Gender	1.996				1.528
Exercise	0.002				0.178
SS	-3.910				-4.913***
ERS	1.244				31.625***
Sleep	-2.220				-3.180**
Step 6		0.521	0.017	41.140***	
Gender	2.487				1.932*
Exercise	0.007				0.550
SS	-2.954				-3.707***
ERS	1.057				21.853***
Sleep	-1.958				-2.848**
Mind.	-0.792				-6.414***

Modeling mental health in undergraduate students

- Impacts of self-care behaviours
  - sleep,
  - exercise
  - mindfulness
- emotion regulation
- social support
- academic recreation orientations

Psychological Impacts of COVID-19 On Canadians Study

Wave 1

August 18th to October 1st, 2020

Wave 2

December 21, 2020 to March 30, 2021

Wave 3

September 7, 2021- December 7, 2021

Wave 1: 6,629

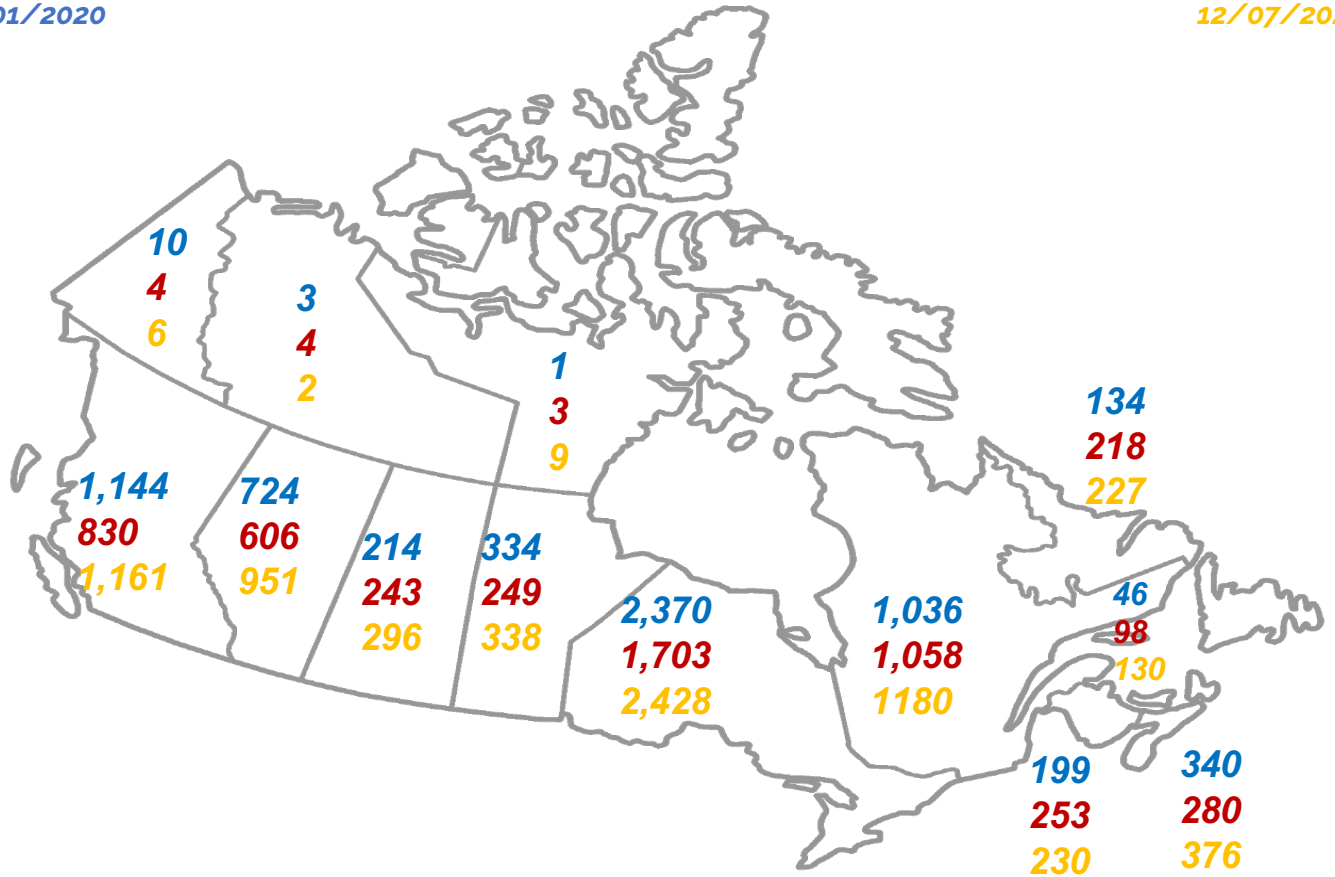
08/18/2020 to
10/01/2020

Wave 2: 5,675

12/21/2020 to 02/26/2021

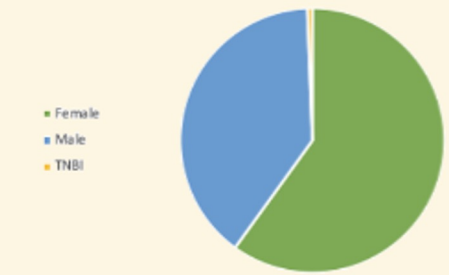
Wave 3: 7,354

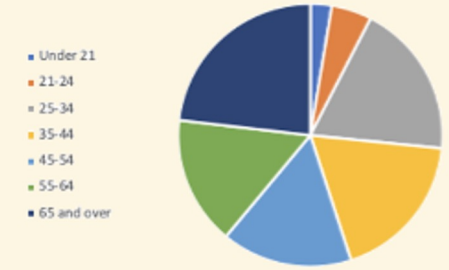
09/07/2021 to
12/07/2020

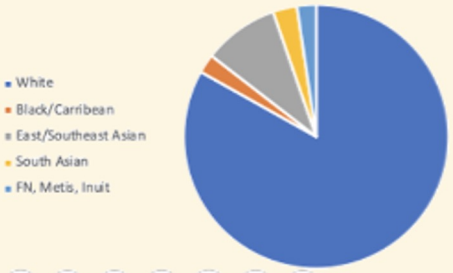


Wave 1: 6,629

08/18/2020 to 10/01/2020

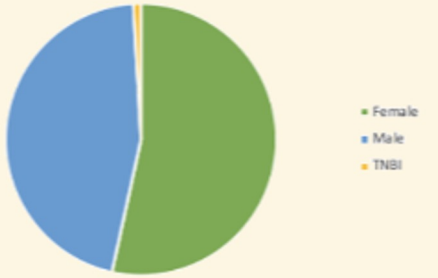


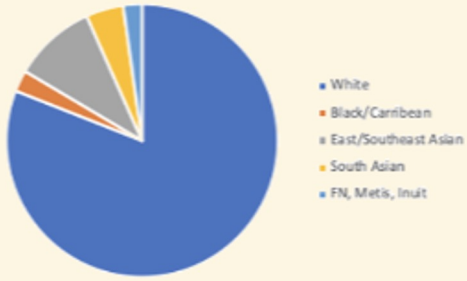




Wave 2: 5,675

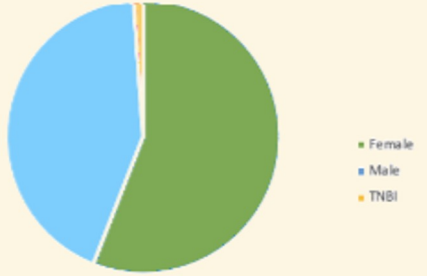
12/21/2020 to 02/26/2021

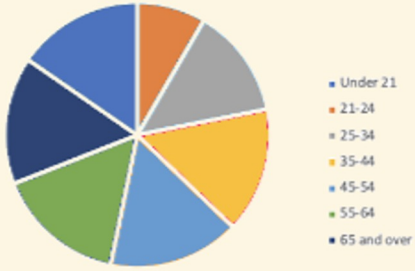


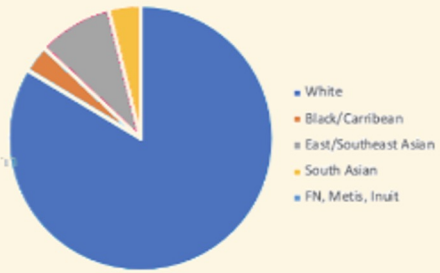


Wave 3: 7,354

09/07/2021 to 12/07/2020

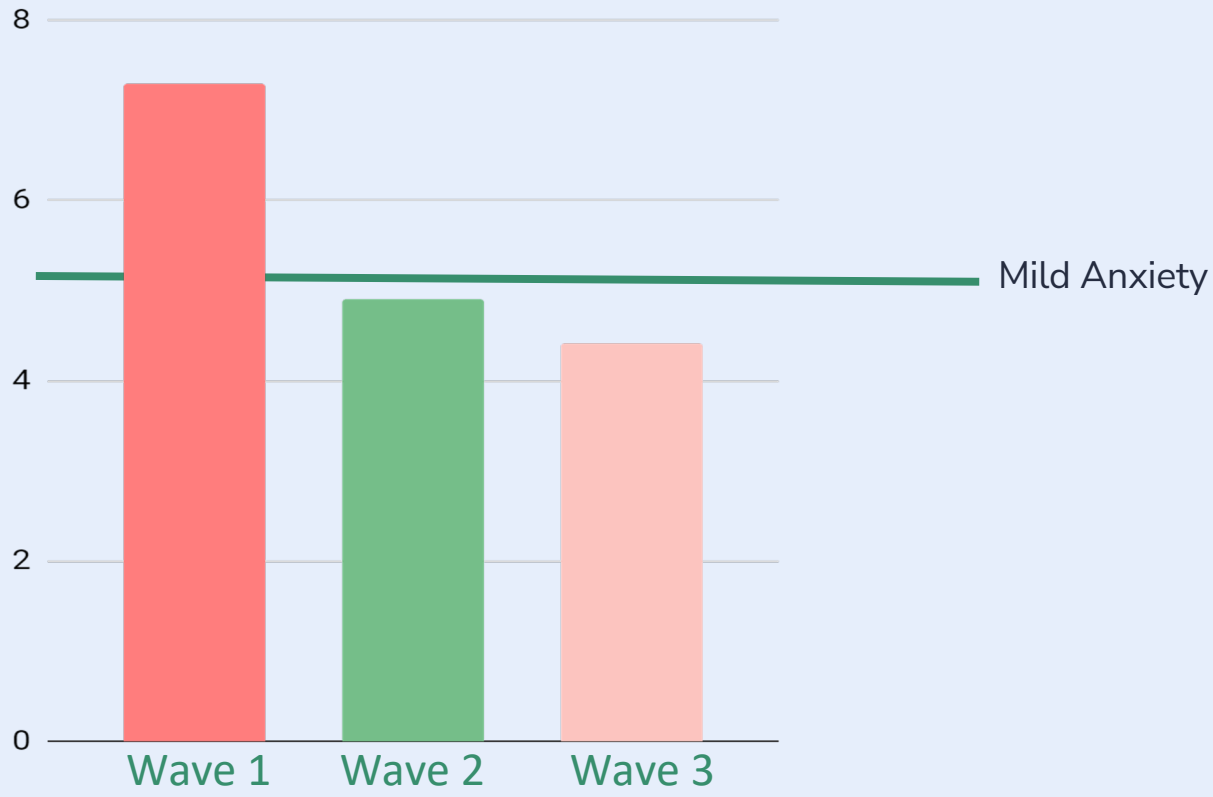




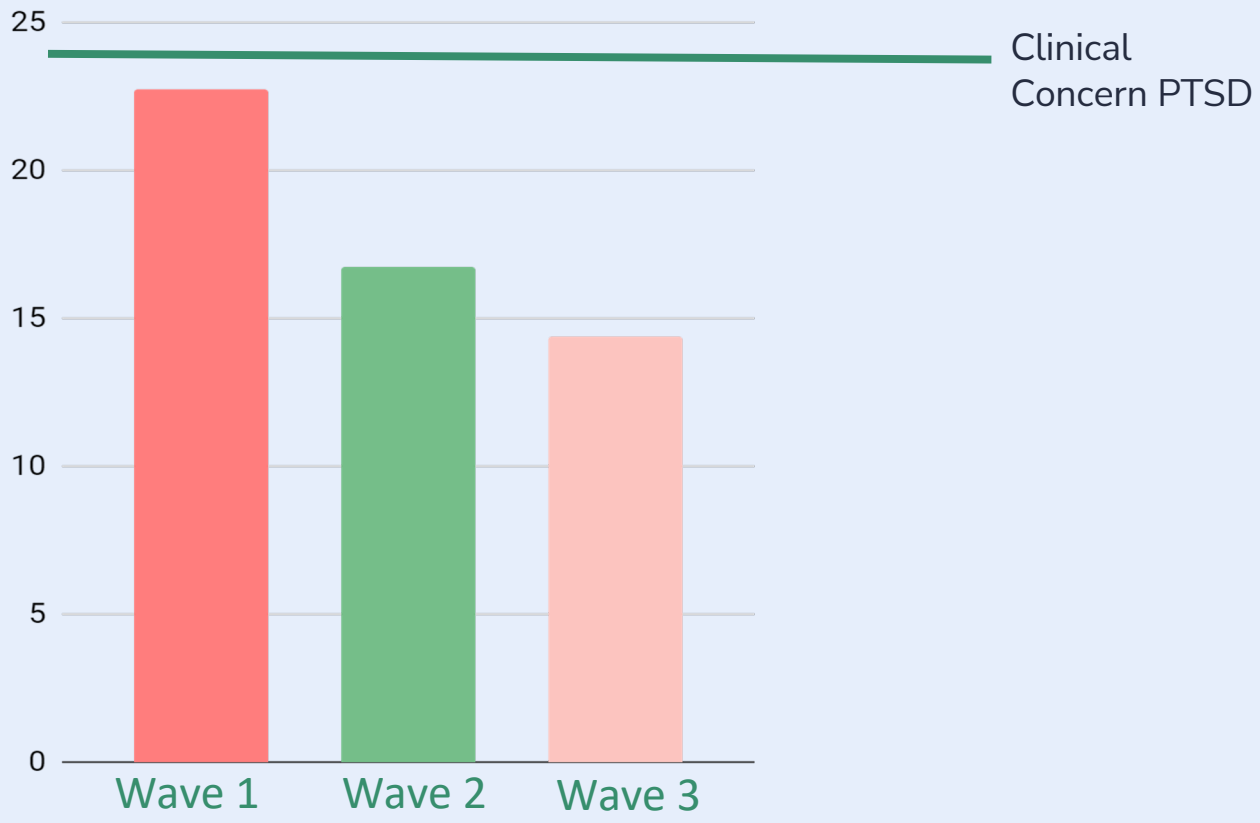


Depressive Symptoms

Anxiety Symptoms

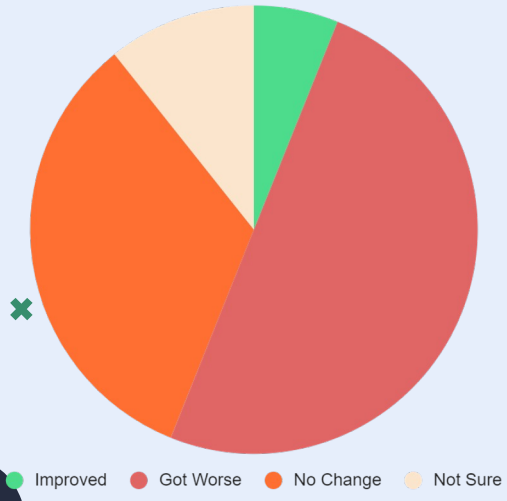


Posttraumatic Distress Symptoms

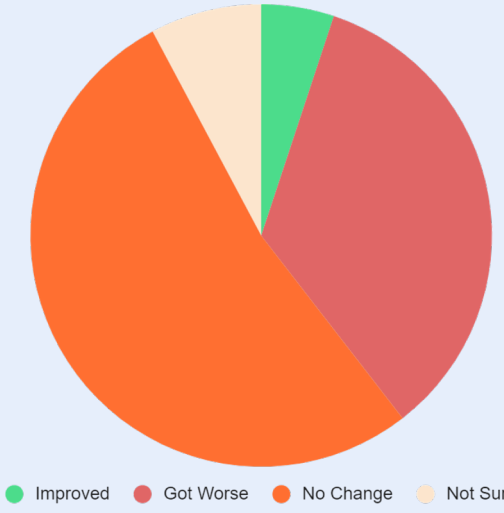


Changes in Self-Reported Mental Health During COVID-19 Pandemic

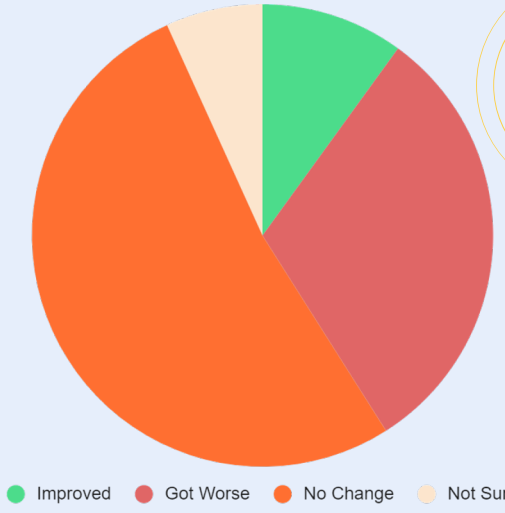
Wave 1



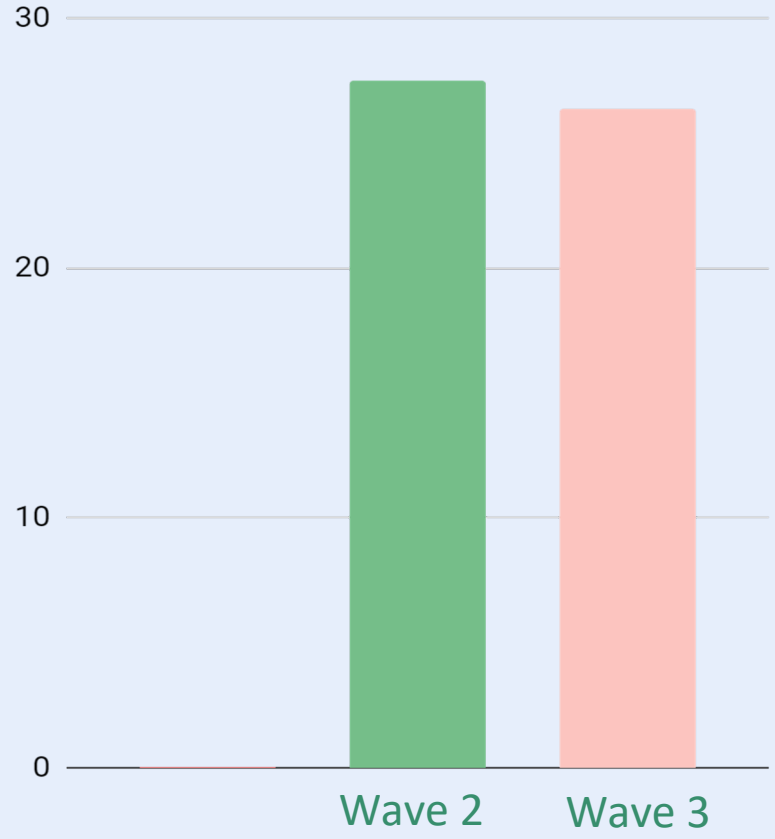
Wave 2



Wave 3



Perceived Cognitive Functioning



Women were at an increased risk for:

- Anxiety
- Depression
- Perceived Cognitive Impairment
- Posttraumatic Distress

Older age group was associated with..

Decreased depressive symptoms

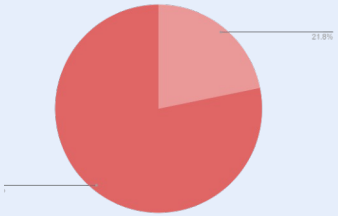
Decreased anxiety symptoms

Decreased posttraumatic distress symptoms

Increased perceived cognitive functioning

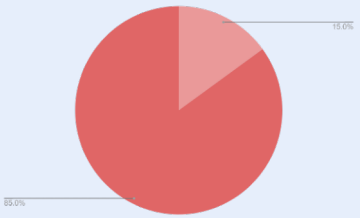
Changes in Physical Exercise During COVID-19 Pandemic

Wave 1



22%

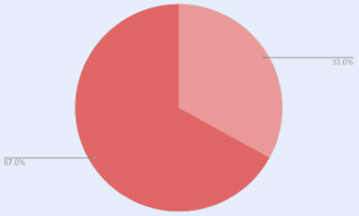
Reduced indoor exercise



15%

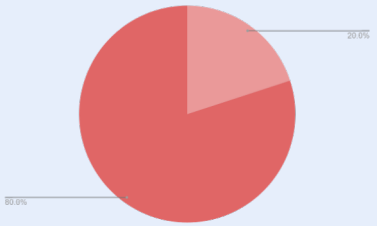
Reduced outdoor exercise

Wave 2



33%

Reduced indoor exercise



20%

Reduced outdoor exercise

Individuals who reported reduced indoor physical exercise during the COVID-19 pandemic experienced:

Increased depressive symptoms

Increased symptoms of posttraumatic distress

Increased anxiety symptoms

Decreased perceived cognitive functioning

Individuals who reported reduced outdoor physical exercise during the COVID-19 pandemic experienced:

Increased depressive symptoms

Increased symptoms of posttraumatic distress

Increased anxiety symptoms

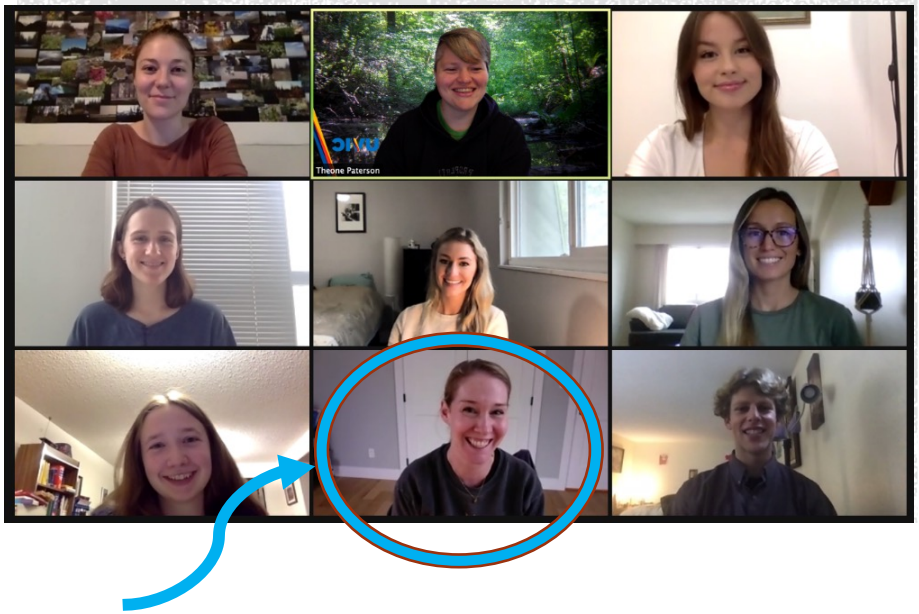
Decreased perceived cognitive functioning

The Effect of Decreased Physical Activity on Perceived Changes in Mental Health

Decreased physical activity was linked to reports of declining mental health during the pandemic in both Wave 1 and Wave 2.

CURRENT TEAM(S)

- Behavioural Research on Aging and Illness in Neuropsychology (BRAIN) Lab
- COVID-19 Mental Health Study Team



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Thanks

Any questions?

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