

BrainXchange
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Cognitive Activity and Brain Health: What the Evidence Shows and Practical Strategies

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DIRECTOR, Quebec Network for Research on Aging (RQRV)

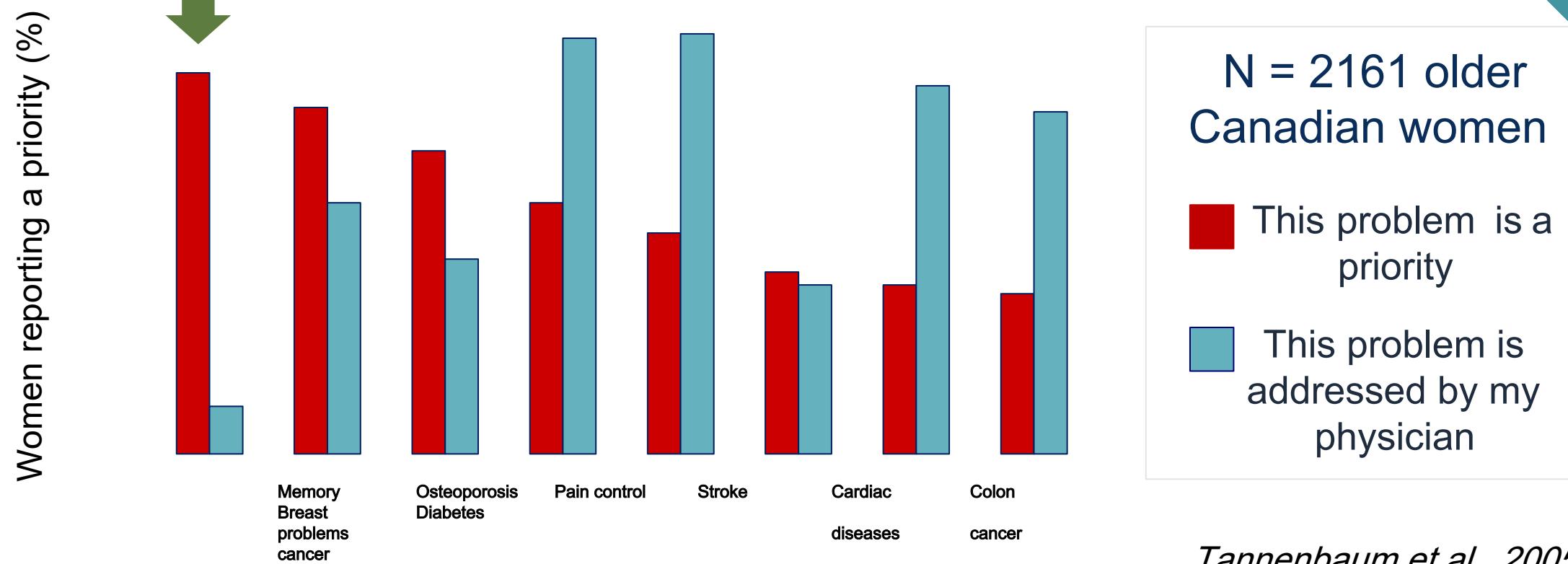


OUTLINE OF THE PRESENTATION



- 1) Modifiable risk factors for cognition: cognitive reserve and brain maintenance.
- 2) The impact of different cognitively stimulating activities: hobbies, volunteering, multilingualism, work and retirement, social and cultural activities.
- 3) Cognitive training programs.
- 4) Combining approaches and practical advices.

COGNITION: A TOP HEALTH PRIORITY THAT IS NOT WELL ADDRESSED BY HEALTH PRACTITIONERS



COGNITIVE ABILITIES DECLINE AGE AND THE RISK FOR ALZHEIMER'S DISEASE INCREASE



Prevalence of Alzheimer's disease

- 5% at 65-74 years of age.
- 13% at 75-84 years of age.
- 35% for those older than 85.

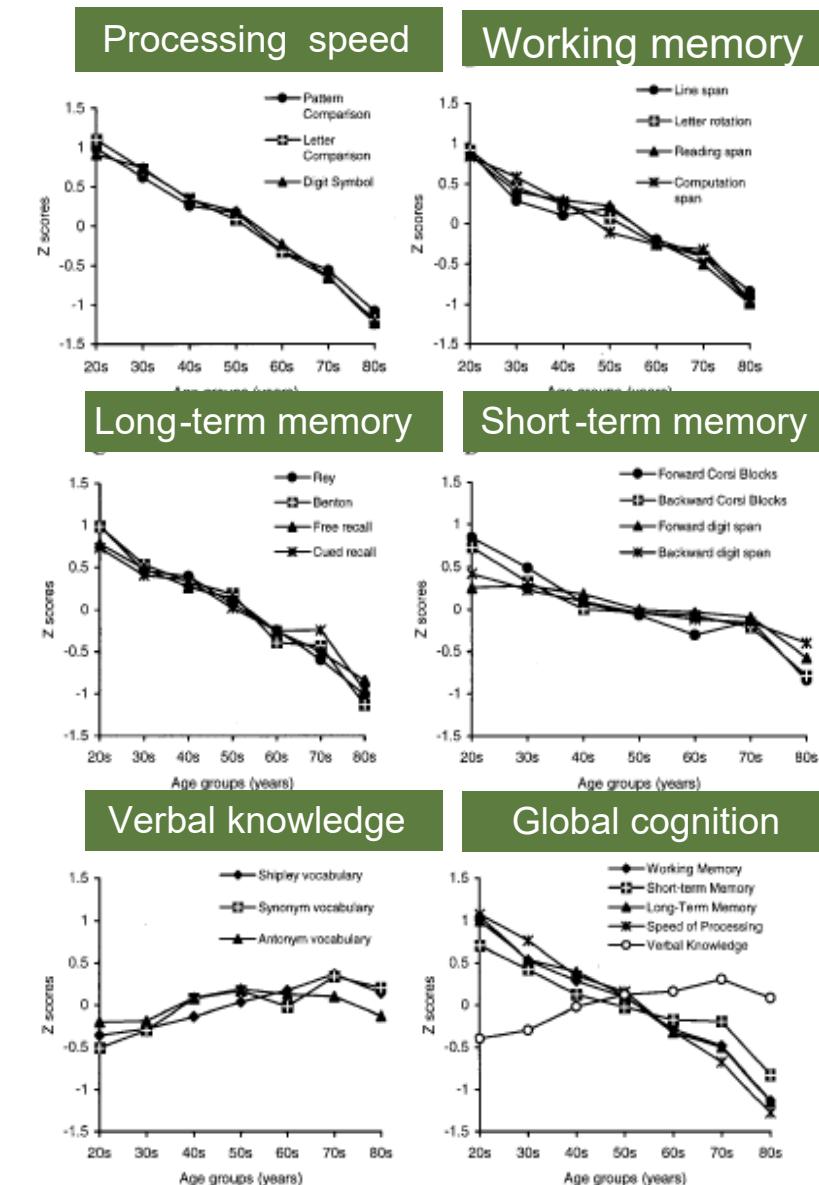
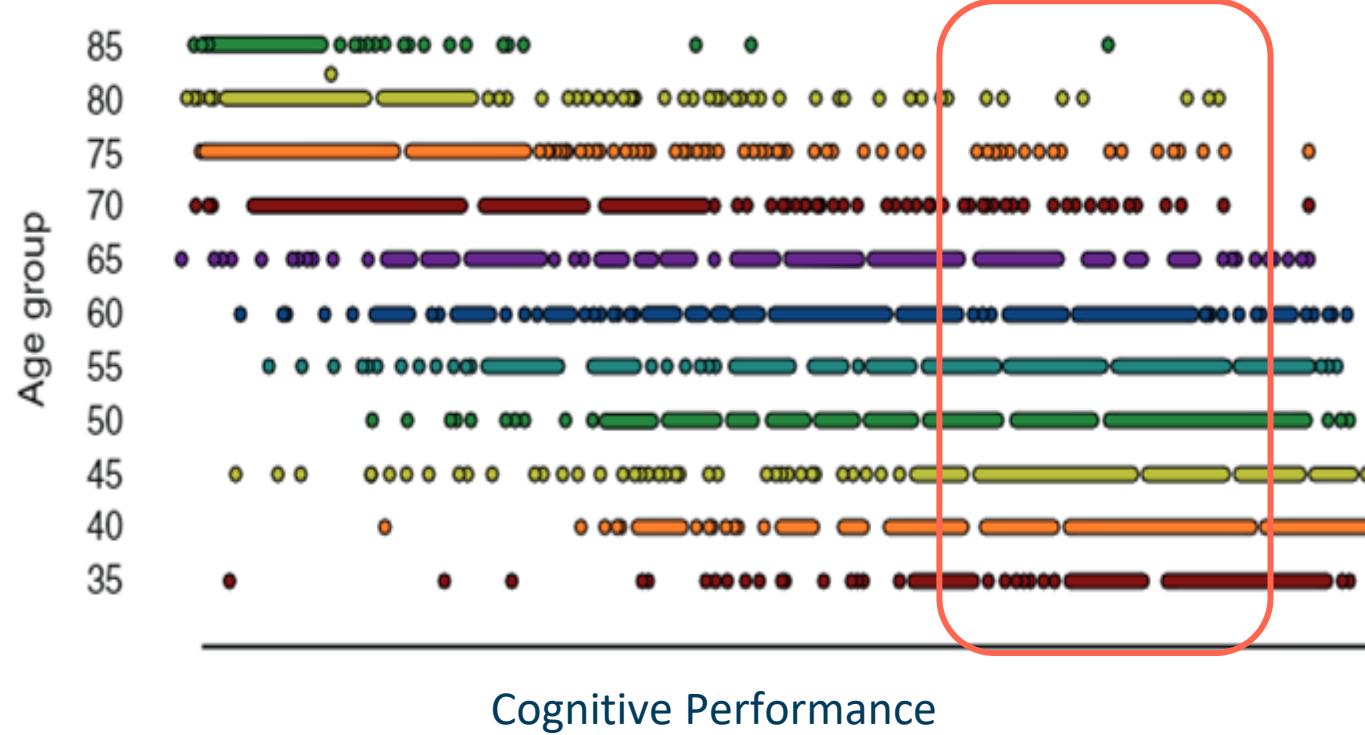


Figure 1. Life span performance measures. A: Speed of processing measures. B: Working memory measures (visuospatial and verbal). C: Long-term memory measures (visuospatial and verbal). D: Short-term memory measures (visuospatial and verbal). E: Knowledge-based verbal ability measures. F: A composite view of the aforementioned measures. Composite scores for each construct represent the z score of the average of all measures for that construct.

Park & al., 2002

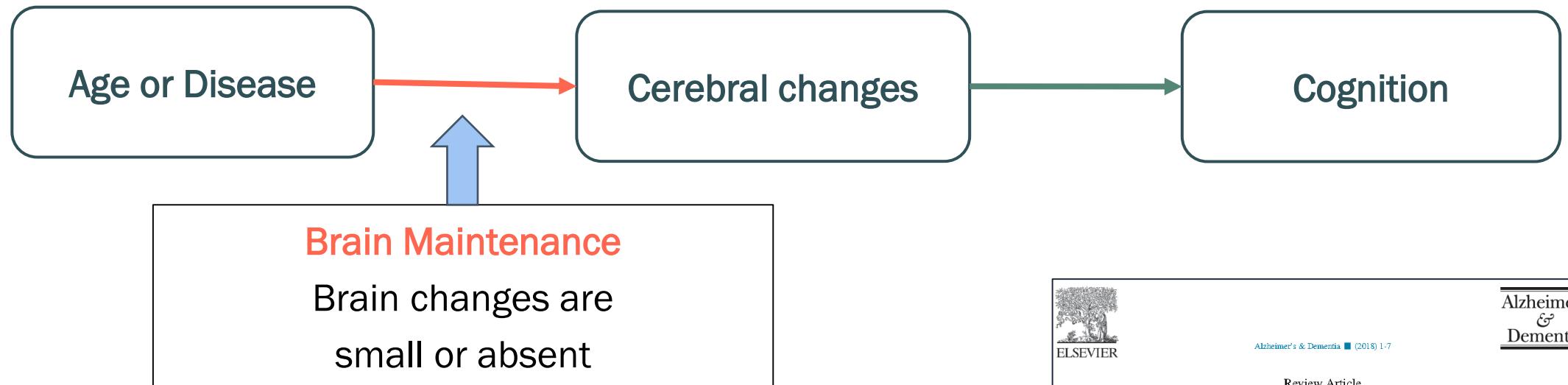
SOME PEOPLE EXPERIENCE LITTLE COGNITIVE DECLINE WITH AGE



Why and what can we do to help more people achieve those outcomes!

Habib et al., 2007; Betula longitudinal study

BRAIN MAINTENANCE AND COGNITIVE RESERVE



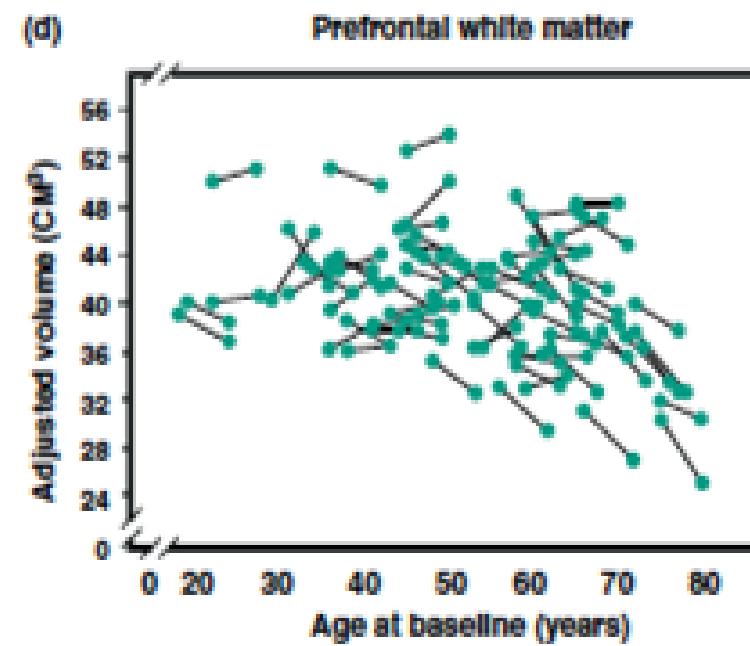
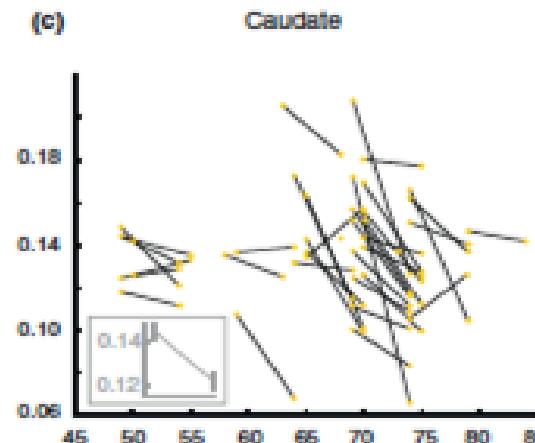
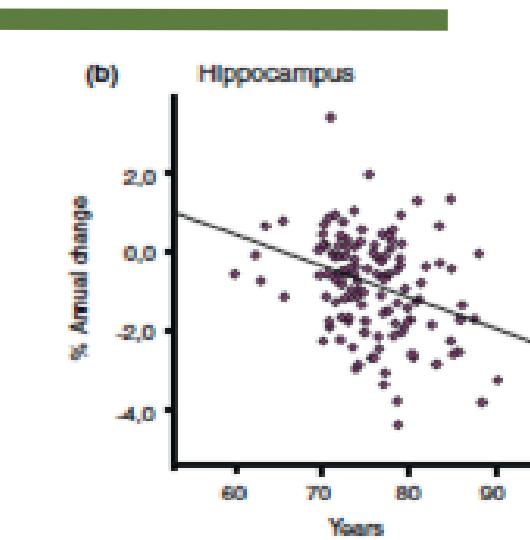
Alzheimer's & Dementia ■ (2018) 1-7

Review Article

Whitepaper: Defining and investigating cognitive reserve,
brain reserve, and brain maintenance

Yaakov Stern^{a,*}, Eider M. Arenaza-Urquijo^b, David Bartrés-Faz^{c,d,e}, Sylvie Belleville^f,
Marc Cantillon^g, Gael Chetelat^h, Michael Ewersⁱ, Nicolai Franzmeier^j, Gerd Kempermann^j,
William S. Kremen^k, Ozioma Okonkwo^l, Nikolaos Scarmeas^{m,n}, Anja Soldan^o,
Chinedu Udeh-Momoh^p, Michael Valenzuela^q, Prashanthi Vemuri^r, Eero Vioksimaa^s, and the
Reserve, Resilience and Protective Factors PIA Empirical Definitions and Conceptual
Frameworks Workgroup

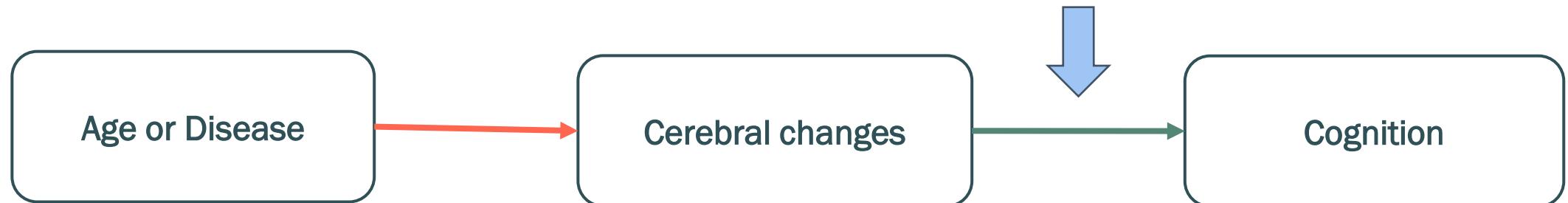
BRAIN MAINTENANCE



Lupien et al., 2007; Fjell et al., 2009; Nyberg et al., 2010; Raz et al., 2005

BRAIN MAINTENANCE AND COGNITIVE RESERVE

Cognitive Reserve
Preserving your cognition even if you have
changes in your brain



Alzheimer's & Dementia ■ (2018) 1-7

Alzheimer's
&
Dementia

Review Article

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Reserve, Resilience and Protective Factors PIA Empirical Definitions and Conceptual
Frameworks Workgroup

→ The effect of social networks on the relation between Alzheimer's disease pathology and level of cognitive function in old people: a longitudinal cohort study

David A Bennett, Julie A Schneider, Yuxiao Tang, Steven E Arnold, Robert SWilson



D. A. Bennett et al. Neurology 2003; 60:1909-1915

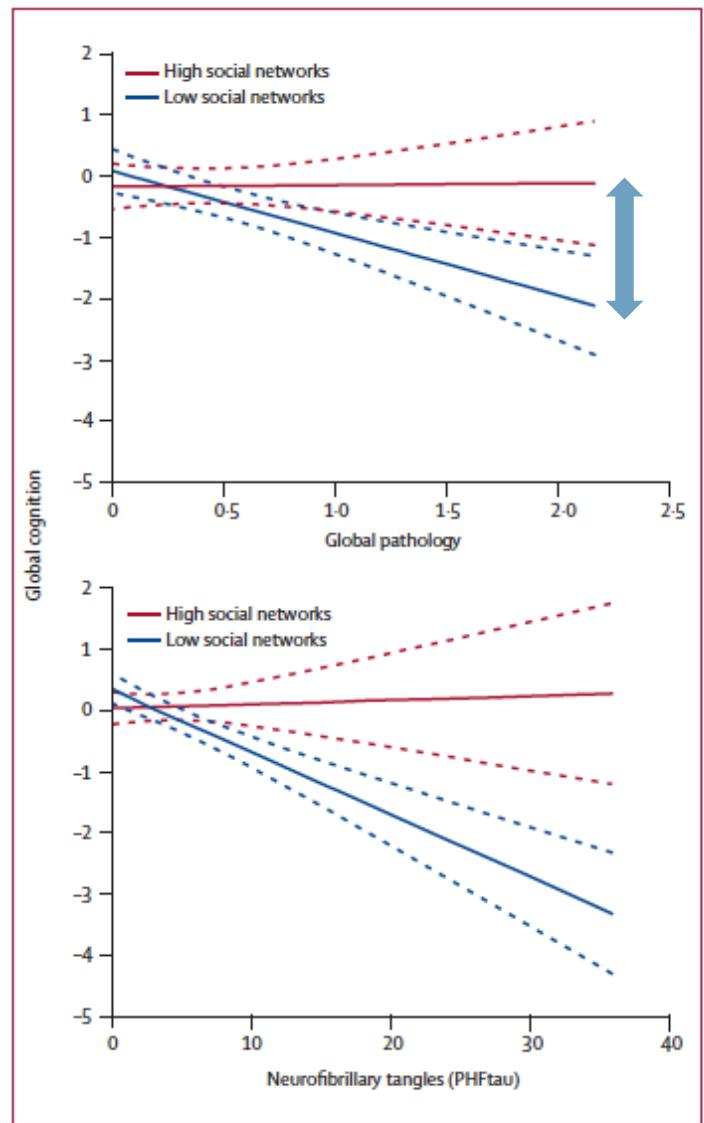
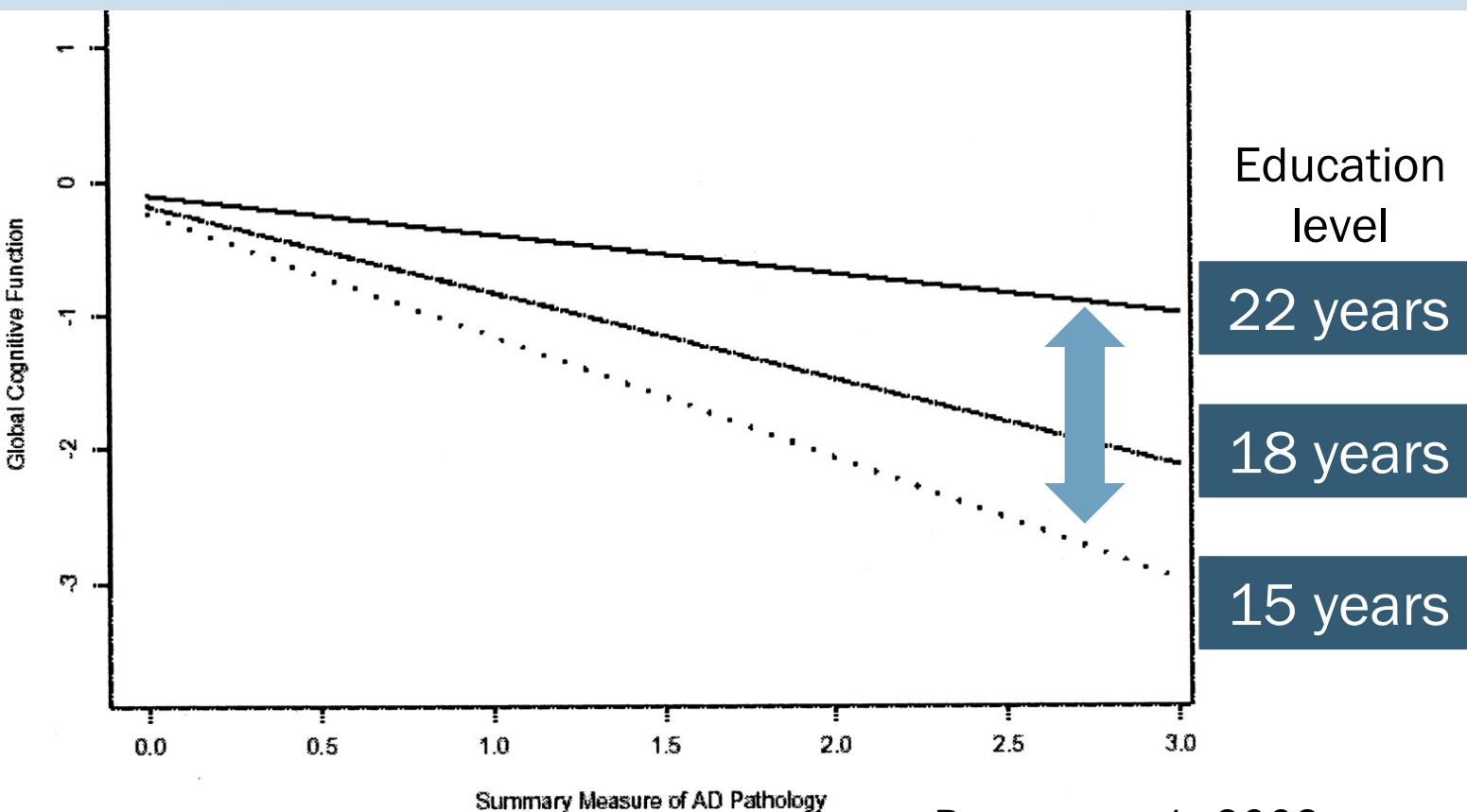


Figure 1: Predicted association between pathology and global cognitive function score proximate to death

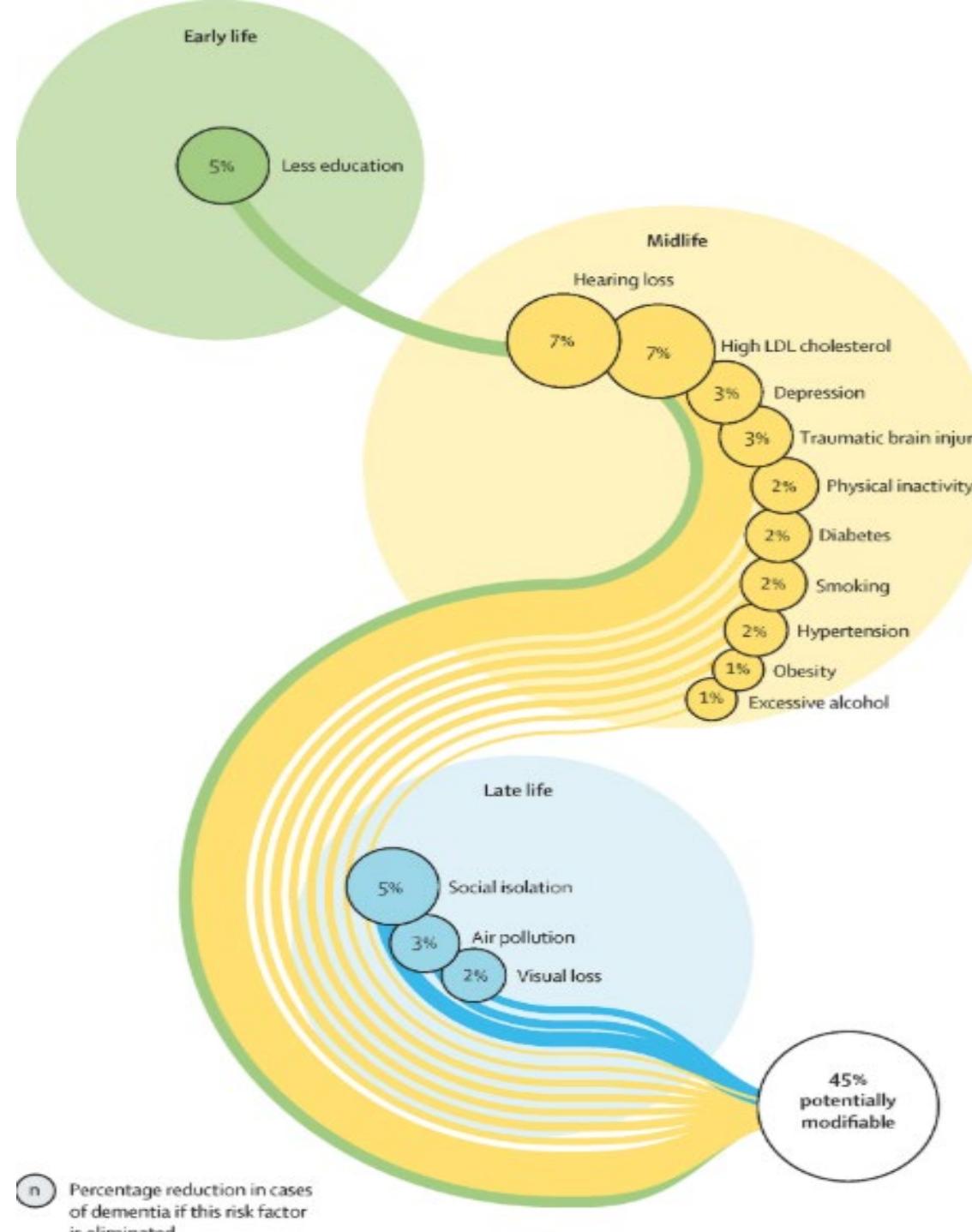
People with similar levels of AD pathology show different levels of symptoms depending on education or social network



Bennett et al., 2003

WHAT CAN BE DONE TO MAINTAIN A HEALTHY BRAIN AND INCREASE COGNITIVE RESERVE?





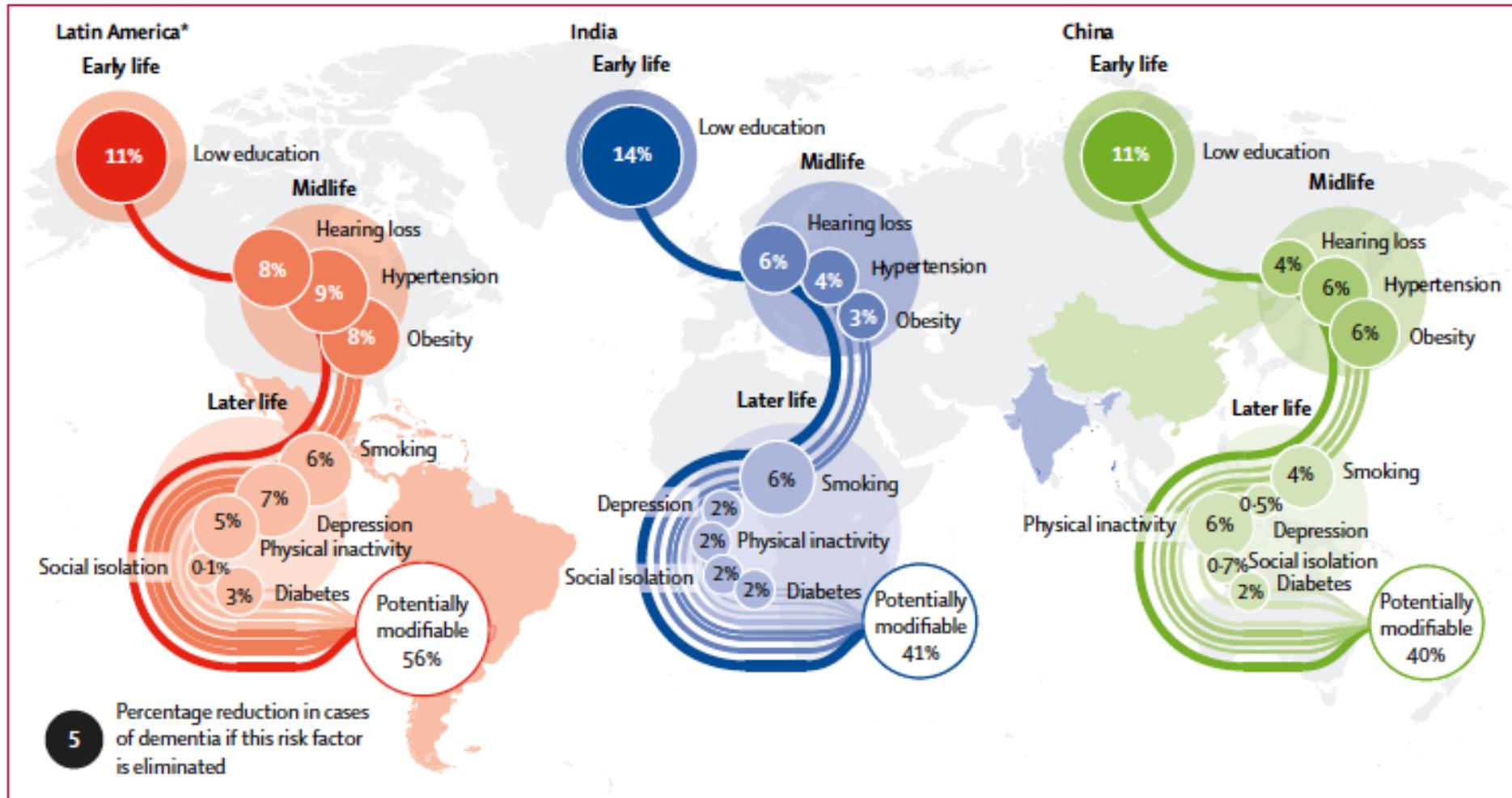
Dementia prevention, intervention, and care: 2024 report of the *Lancet* standing Commission

Gill Livingston, Jonathan Huntley, Kathy Y Liu, Sergi G Costafreda, Geir Selbæk, Suvarna Alladi, David Ames, Sube Banerjee, Alistair Burns, Carol Brayne, Nick C Fox, Cleusa P Ferri, Laura N Gitlin, Robert Howard, Helen C Kales, Mika Kivimäki, Eric B Larson, Noeline Nakasujja, Kenneth Rockwood, Quincy Samus, Kokoro Shirai, Archana Singh-Manoux, Lon S Schneider, Sebastian Walsh, Yao Yao, Andrew Sommerlad*, Naheed Mukadam*

14 MODIFIABLE RISK FACTORS ACCOUNT FOR ABOUT 45% OF DEMENTIA CASES WORLDWIDE

Population Attributable Fraction: based on the **strength of the association**, relative risk (risk in exposed/risk in unexposed)
AND the prevalence of the risk in the population
AND Communality.

BECAUSE OF DIFFERENCES IN PREVALENCE, THE IMPACT VARIES ACCORDING TO THE POPULATION



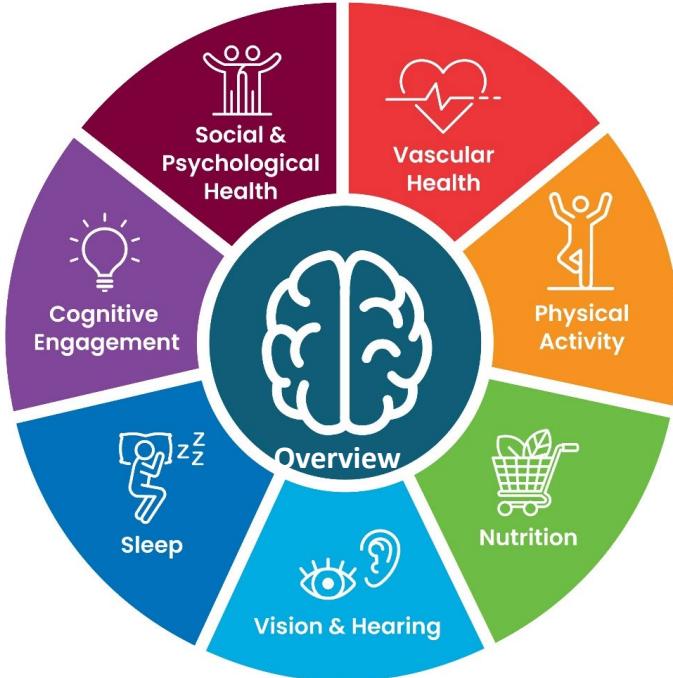


Potentially Modifiable Dementia Risk Factors in Canada: An Analysis of Canadian Longitudinal Study on Aging with a Multi-Country Comparison

S. Son^{1,2}, M. Speechley¹, G.Y. Zou^{1,3}, M. Kivipelto^{4,5,6,7}, F. Mangialasche^{4,6}, H.H. Feldman^{8,9}, H. Chertkow^{10,11}, S. Belleville^{1,2,12}, H. Nygaard¹⁴, V. Hachinski^{1,2,15}, F. Pieruccini-Faria^{2,16}, M. Montero-Odasso^{1,2,16}

THE IMPACT IN CANADA

BRAIN HEALTH PRO TO REDUCE THE RISK OF COGNITIVE DECLINE



Speedometers to show risk on each factor



Contents lists available at ScienceDirect
The Journal of Prevention of Alzheimer's Disease
journal homepage: www.elsevier.com/locate/jpad

Original Article
Brain health PRO/Santé cerveau PRO: The development of a web-based program for dementia literacy and risk factor reduction

Sylvie Belleville ^{a,b,*}, Nicole D. Anderson ^{c,d}, Louis Bherer ^{a,e,f}, Richard Camicioli ^{g,h}, Julie Carrier ^{b,i}, Senny Chan ^d, Marc Cuesta ^a, Thien Thanh Dang-Vu ^{a,j}, Emily Dwosh ^{k,l}, Alexandra J. Fiocco ^m, Guylaine Ferland ^{f,n}, Brigitte Gilbert ^o, Elaine Harris ^p, Inbal Itzhak ^q, Pamela Jarrett ^{k,s}, Mohamed Abdelfadif Kadri ^a, Danielle Laurin ^t, Teresa Liu-Ambrose ^{u,v,w}, Chris A. McGibbon ^x, Laura Middleton ^y, Lesley Miller ^p, Haakon B. Nygaard ^{k,l}, Manuel Montero-Odasso ^{z,aa,bb}, Kelly Murphy ^d, Natalie Phillips ^{cc}, M. Kathleen Pichora-Fuller ^d, Julie M. Robillard ^s, Eric E. Smith ^{dd,ee}, Mark Speechley ^{kk}, Amal Trigui ^{u,n}, Walter Wittich ^f, Howard Chertkow ^{q,g,s,h,i}, Howard H. Feldman ^{jj}, the CTU expert group for the Canadian Consortium on Neurodegeneration in Aging (CCNA), CAN-THUMBS UP Study Group

Personalization

- Risk level is assessed every 3 months for each factor with online questionnaires.
- Speedometers show risk on the 7 modifiable factors.
- Select priorities and personal goals and provide more content.

Brain Health PRO in a Nutshell



Knowledge

It is possible to **lower your risk of developing dementia**. Factors such as physical health, diet, sleep, sensory and social health can reduce your risk of developing dementia.



Action

To lower your risk of dementia, implement positive **lifestyle changes**, such as exercising, sleeping well, solving sensory problems, or by having an active cognitive and social life.

Social & Psychological Health

Knowledge: Having a large and diverse social network with regular interactions supports your brain health.

Action: Reconnect with older friends, pursue your hobbies, exercise with your friends and family, and take on volunteer or mentorship roles.

Cognitive Engagement

Knowledge: Engaging in new cognitively stimulating activities increases your cognitive capacities.

Action: It is never too late to improve your cognition and your memory, so start now! Begin by learning new skills and by learning and applying memory strategies.

Sleep

Knowledge: Sleeping well strengthens your immune system, helps maintain your overall health, and improves your memory and cognition.

Action: If you are having trouble sleeping, do not resort to medications right away. Begin by practising relaxation techniques before bed, and adopt a good sleep hygiene.



Vascular Health

Knowledge: High blood pressure is the most important risk factor for heart disease and stroke. A healthy blood pressure can prevent a stroke, heart attack, and dementia.

Action: Increase your physical activity, improve your diet, and talk to your doctor about blood pressure.

Physical Activity

Knowledge: Physical activity like jogging, swimming, cycling, or walking can improve brain function.

Action: Incorporate physical activity into your day and your week.

Nutrition

Knowledge: Good nutrition includes eating vegetables every day which is known to lower your risk of Alzheimer's disease, heart disease, diabetes, and cancer.

Action: Explore new healthy foods and try them with your friends and family! Think about the types of foods recommended in Canada's Food Guide and the Brain Health Food Guide.



Feedback



CCNA

CCNV

Consult with a health professional before making any significant change in your lifestyle.

Cognitive Engagement



Knowledge

Cognition changes with age. There are many cognitive processes. Some may remain stable and not change, while others may even improve with age.

- **Learning new skills** and learning and applying memory strategies help improve cognition.
- **Don't be afraid of external aids.** Use a calendar or an organizer to prevent schedule overload or conflicts. They are known to be great memory aids.

People who engage in many stimulating cognitive activities are known to live longer and suffer less cognitive decline over time.

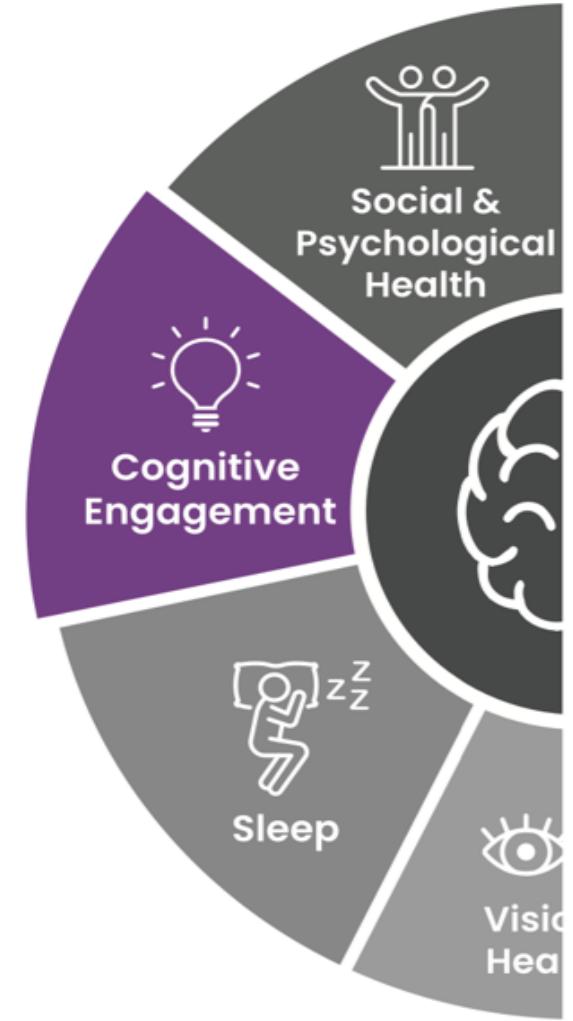


Action

It is **never too late** to improve your memory and cognition. Start now!

- There are many **memory strategies** that can be used in daily life.
- The activities can be of many types. What is important is that they are **varied and enjoyable**.
- Try to move out of your comfort zone by learning and practising **new cognitive activities** or by gradually increasing their difficulty level.

What is important is to use memory strategies often so that they can be a **part of your daily life**. **Practise and repeat** them with your friends and family!



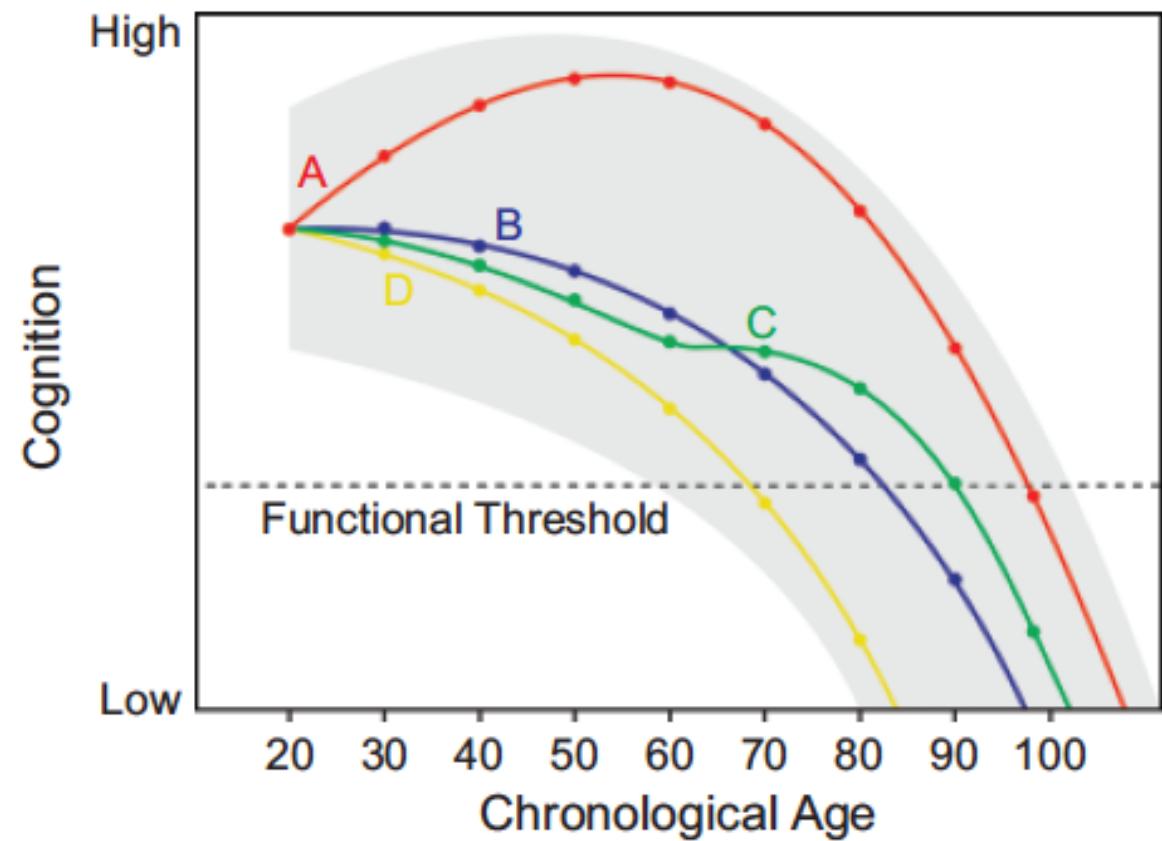
Sylvie Belleville, Nicole Anderson, Louis Bherer, Brigitte Gilbert and Aline Moussard

ENRICHMENT HYPOTHESIS (USE IT OR LOSE IT)

Cognition is enhanced by participation in various intellectual, physical, and social activities.

Hertzog et al., 2008,
Psychological Science in the Public Interest

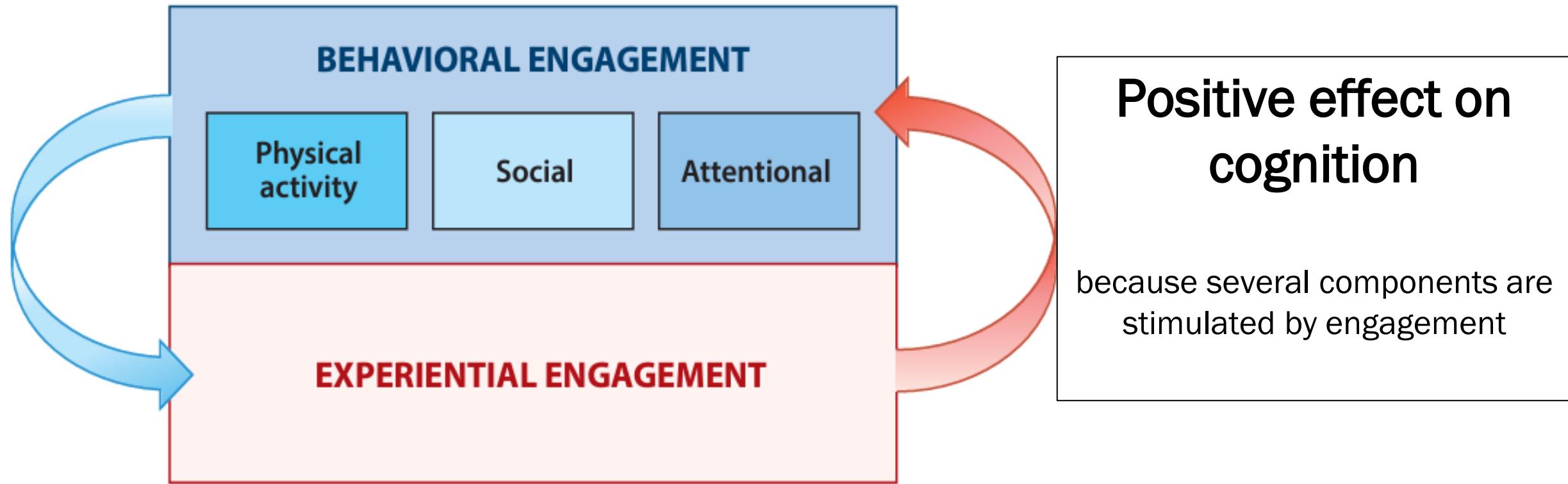
Different trajectories can depend on personal and environmental factors



A and C = Upper movements at different times in life

ENGAGEMENT

Stine-Morrow & Manavbasi 2022, *Ann Rev Dev Psych.*



Ecological approach

Bronfenbrenner & ceci, 1994; Moreau & Conway, 2014; Moreau, 2022

COGNITIVELY STIMULATING HOBBIES

What is a cognitively stimulating hobby?

- One that involves a range of **complex mental processes**, for instance, memory, attention or reasoning,
- Implicates **learning new skills**.
- Involves **some diversity** in hobbies.
- **Appropriate level of difficulty** = not too easy; not too difficult.
- **Individualized** = the same hobby can be stimulating for one person but not for another one.

...reading, crossword puzzles, woodworking, learning photography, sudoku/chess, strategy games, museums, debates, learning a new language, learning computers, book clubs...



COGNITIVELY STIMULATING HOBBIES

HOBBIES BRING PLEASURE = positive effects on mood, stress and self-esteem. Also allows social engagement, make new friends and acquaintances, and discover new interests.

A high level of cognitively stimulating hobbies during life reduces the risk of cognitive decline by 47% compared to a low level (Wilson et al., 2002).

Cognitively stimulating hobbies is associated with better cognition at an older age:

- independent of your level of education or type of jobs.

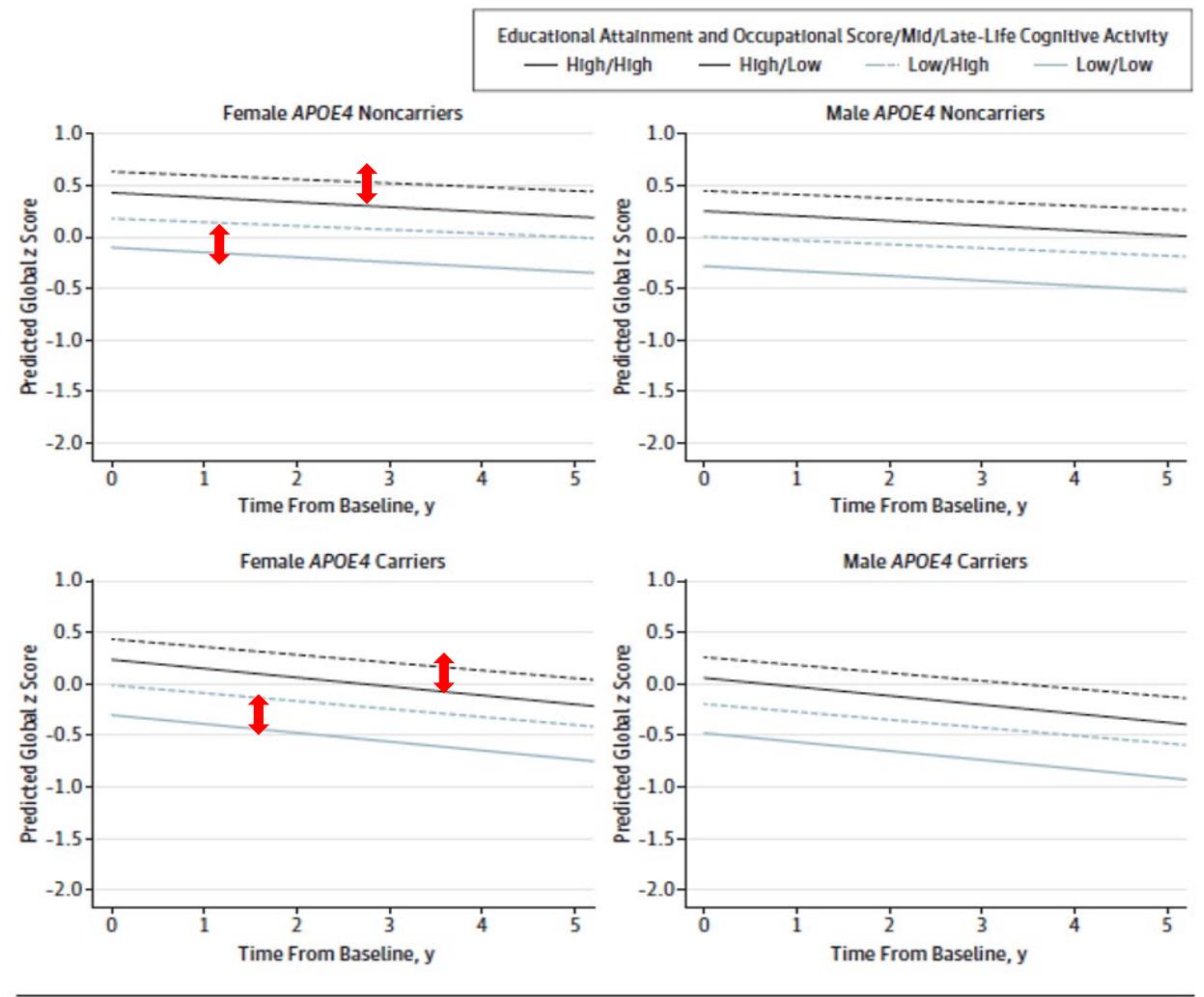


COGNITIVELY STIMULATING HOBBIES

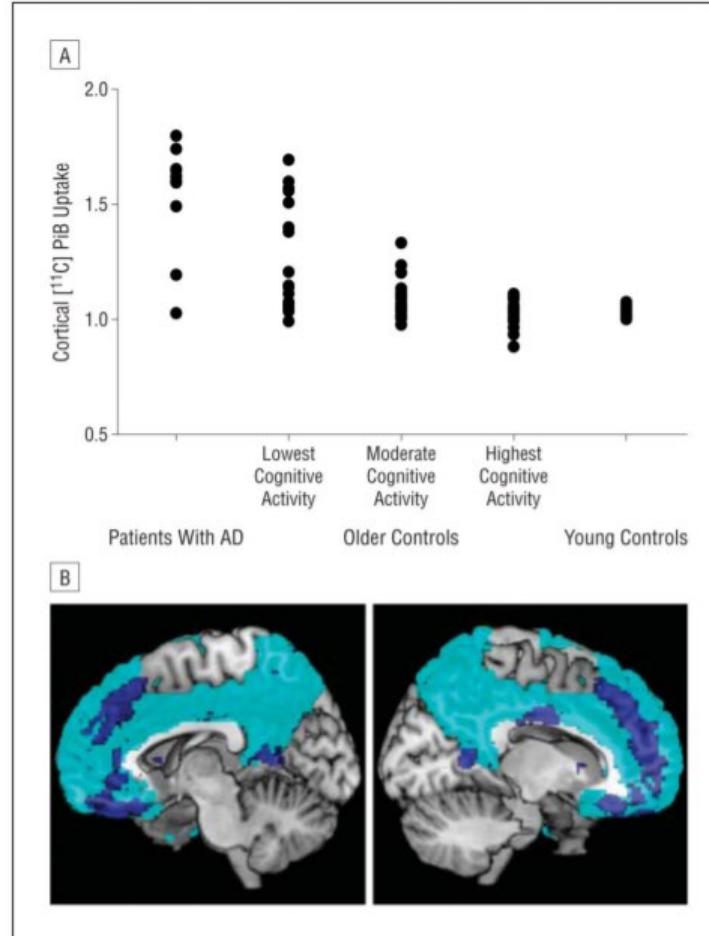
Cognitive activity during mid-late life reduces the level of cognitive deficits:

- In males and females;
- In people with or without a genetic risk;
- larger protection in those with low education/occupation.

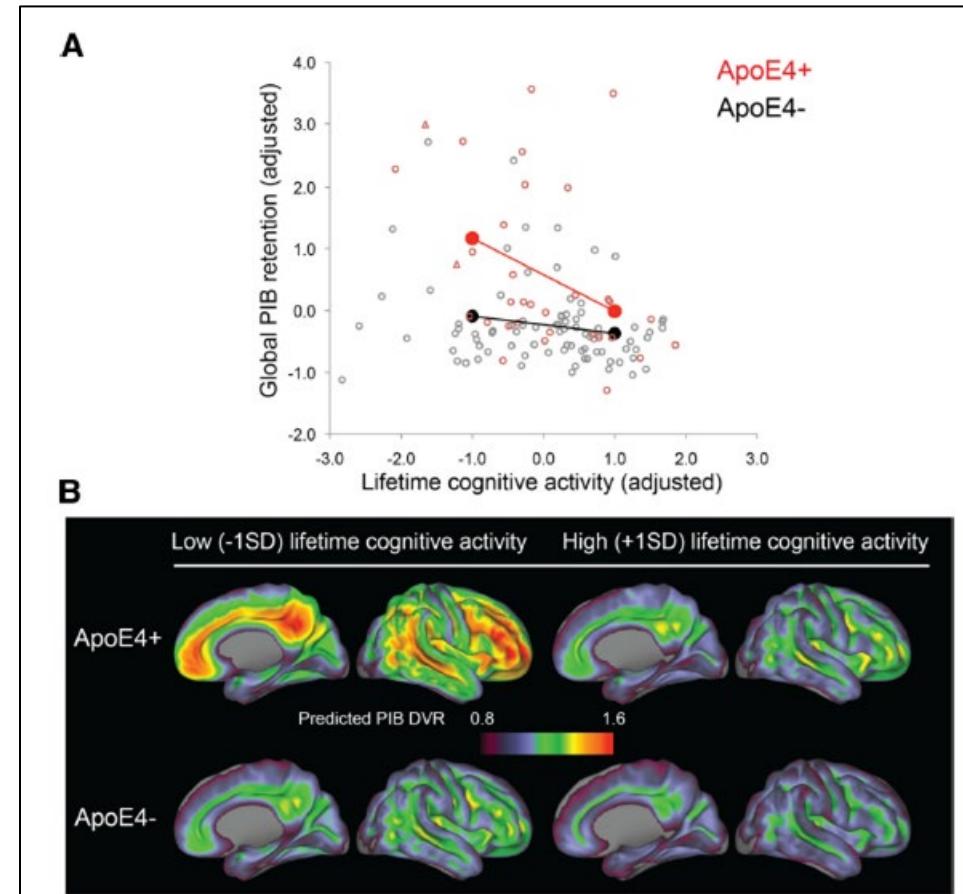
Most favorable: different activities at least 3 times per week.



COGNITIVELY STIMULATED = LOWER AMYLOID DEPOSITION EVEN IF GENETIC RISK (MAINTENANCE)

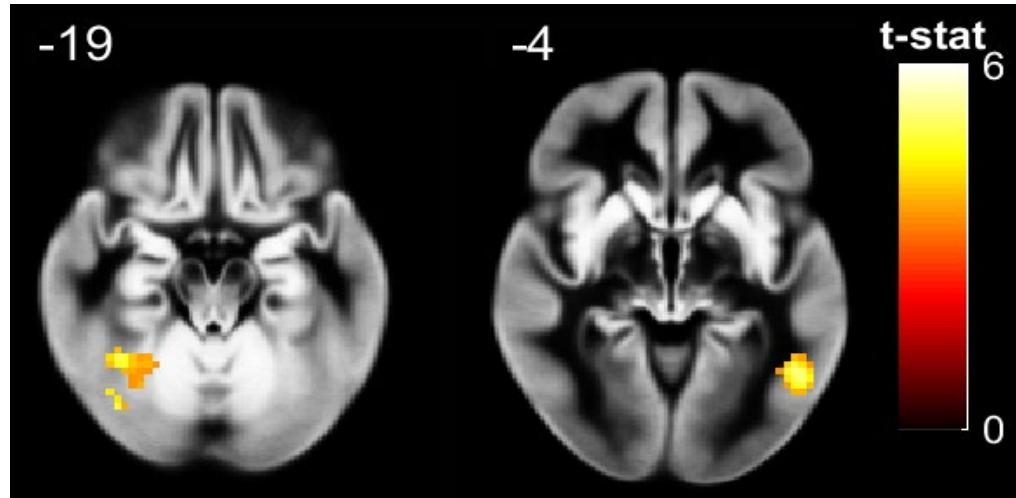


Landau *et al.*, 2012



Wirth *et al.*, 2012

COGNITIVE ACTIVITY= A MORE ACTIVE BRAIN THAT PROTECTS AGAINST HIPPOCAMPAL ATROPHY (COGNITIVE RESERVE)



350 older adults from the CIMAQ Cohort

More cognitive activity during life is associated with **more activation** in the temporal and parietal regions.

The temporal activation **protects against the detrimental effect of hippocampal atrophy on memory**:

- The more this region is active the less, the atrophy impacts your memory.

Belleville et al., 2021

AN INTERVENTION WITH COGNITIVE ACTIVITY: THE SYNAPSE STUDY



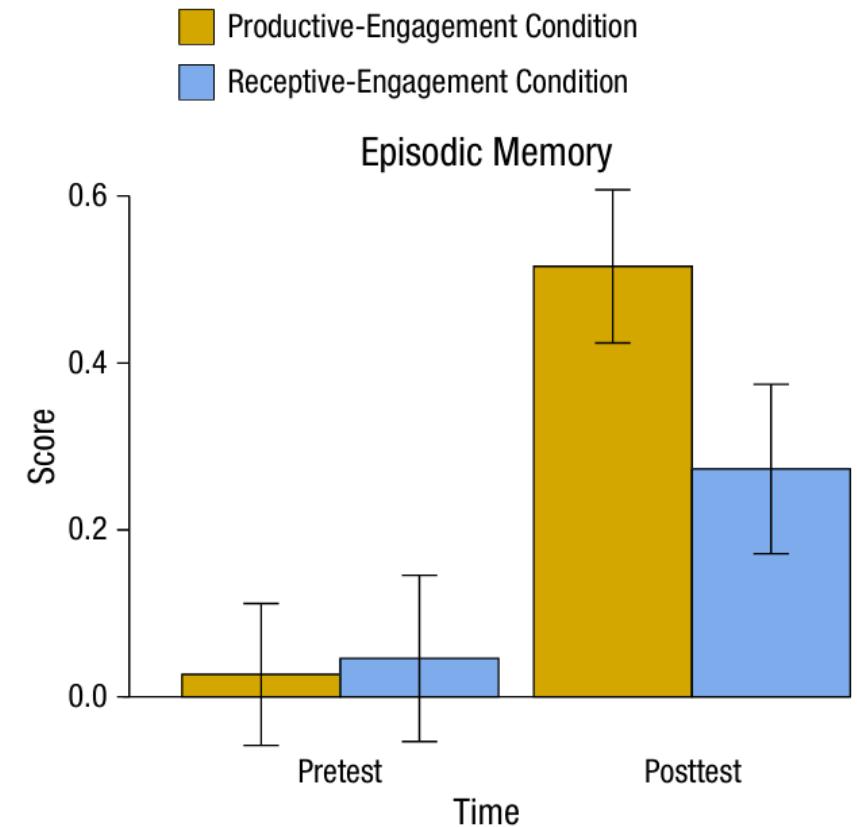
259 older adults 60 to 90 years of age.

Productive-engagement (digital photography or quilting).

Receptive-engagement (socialization : playing cards, cooking, having a discussion or watching movies).

A **control condition** (read magazines, watch documentaries) (15hrs per week, for 14 weeks).

Productive-engagement and **Receptive-engagement** improved cognition relative to controls, and the effect was much larger following **Productive-engagement**.



Park et al., 2014

SOCIAL ENGAGEMENT: VOLUNTEERING, POLITICAL AND CIVIC ENGAGEMENT, ADVOCACY



Positive effects:

- Physical health:
 - physical health over time AND functional independence (e.g., household maintenance).
- Mental health:
 - Reduces depression, increases self-esteem and life satisfaction associated with a lower risk of developing dementia.
- Longer lifespan:
 - A study, combining results from 14 studies, showed volunteers were 24% less likely to die.
- Cognitive health:
 - Better memory and less cognitive decline.

EXPERIENCE CORPS STUDY: They learned how to manage conflicts between students, guide them with their homework, and manage the school library.

LEARNING A NEW LANGUAGE



- **Multilingualism:**

"... people who have been able to speak, understand, and read in two or more languages the majority of their lives"

Associated with:

- Better executive functions (attention, inhibition, multitasking).
- Delays diagnosis of MCI and dementia.
- Stronger brain connectivity and cortical thickness.

WORK AND COGNITION



- People with more cognitively stimulating jobs show less cognitive deterioration.
- An older retirement age is associated with a reduced risk of dementia (especially in those who had a stimulating work).
- Loss of stimulation after retirement can affect cognition. **BUT** Engaging in cognitively stimulating leisure or part-time work has positive effect.

*Mental stimulation is key and not employment itself.

MUSIC AND ARTS

Practicing music (professional or amateur) was associated with better :

- mood and well-being (stress reduction);
- physical health;
- maintenance of cognitive skills with age;
- brain structure and neural efficiency;

Just listening to music can have positive effects on mood but not as long-lasting for cognition.

Cultural activities (e.g., art, theater, writing, etc.) also support mood and in some cases, cognition.



Cuddy et al., 2020 ; Muinos & Ballesteros, 2021, Predovan et al., 2019, for review), theatre: Cohen & Ergis, 2014.

A Living Lab in an Urban Area: Innovative Neighborhood Côte-des-Neiges

Bier et al., 2025



Living lab: Collaborative, real-world environment where researchers and users co-create and test innovations.

Côte-des-Neiges neighborhood: Important communities of immigrants and people with low-socio-economic status.

Co-develop a
cognitively stimulating
program
with staff from the
local library and
cultural centre

**ENRICH CURRENT
ACTIVITIES**
(music, creative writing, visual art)

PROPOSE NEW ONES
(Brain Health PRO; ENGAGE)

COLLABORATIVE DEVELOPMENT OF COGNITIVELY STIMULATING ACTIVITIES

- Practical guide/reference sheet: "Cognitively stimulating activities".
- Workshop: "Musical lunchtimes".
- Writing workshops: "Resilience".



COGNITIVE TRAINING PROGRAMS

- Non-pharmacological programs designed to improve cognitive function using learning and training techniques.
 - Commercial computer programs:
e.g.: Neuroactive, Happy Neuron, Lumosity, etc.
 - Small groups to learn strategies, i.e., new ways of performing cognitive tasks, most often for memory:
e.g.: Memory and Aging Program; MEMO; Atelier de stimulation cognitive.

Offered in community organizations, clinical practice, memory clinics, or Alzheimer's Societies.



THE MEMO PROGRAM (for MCI and older adults)



Programme d'intervention
cognitive pour les aînés
MEMO

 Focus on memory: main complaint.

 Provides a **tool-box of memory strategies**.

 Includes **attention training** to help focus on memory.

 Therapist-based small group (4-5 persons).

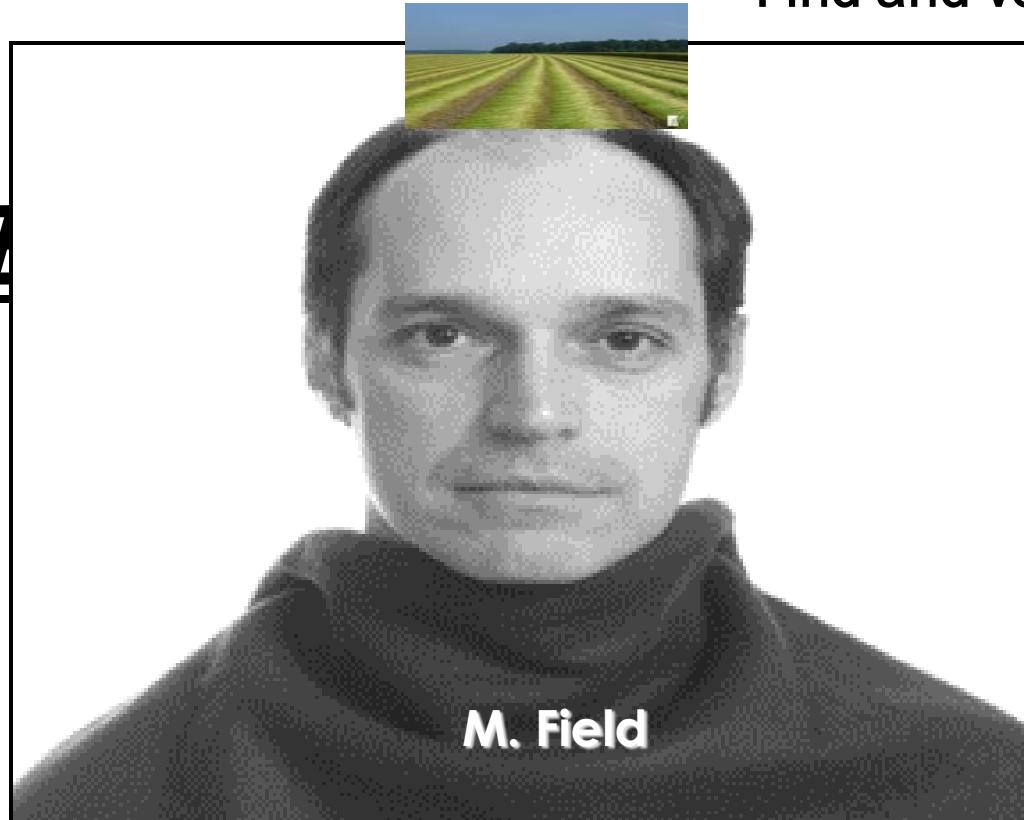
 Designed to promote **self-efficacy**.

 Exercises to practice **use of strategy in everyday life**.

PAY ATTENTION

- **Focus your attention:**
 - slow down, stop, be aware of the present (*stop and find a cue to where I parked the car*).
- **Reduce "irrelevant noise" or visual distractors**
 - (*television, radio*).
- **Try to reduce multitasking and if you have to, focus on the most important task.**
- **Take pauses when doing demanding tasks.**

ENCODE



M. Field

- Relate to things you already know
 - The McConnel building at McGill.

- Find and verbalize meaning

I'd my ring near the sink to my hands.

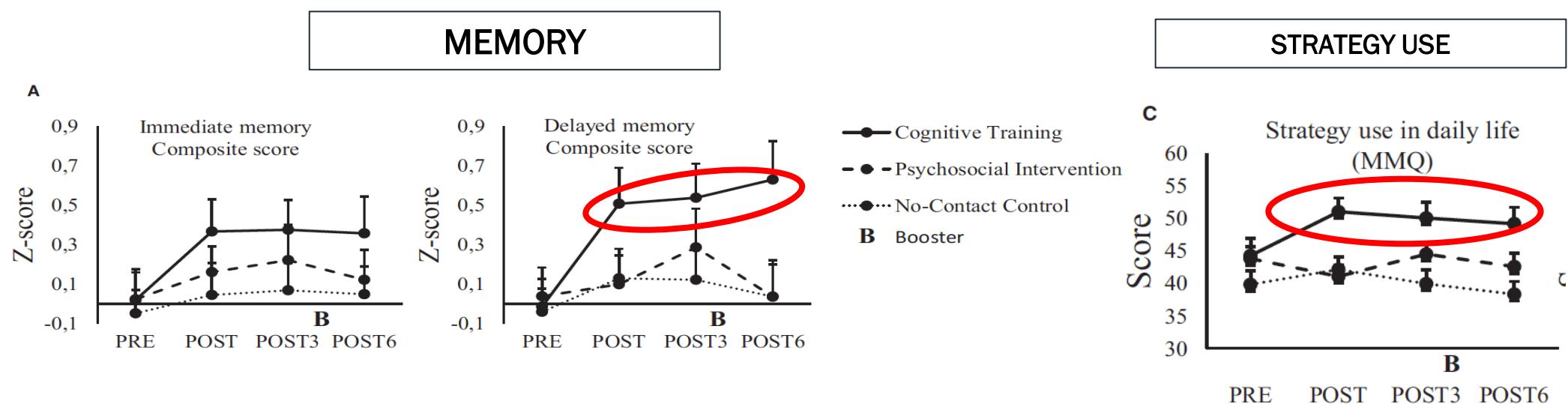
Items in meaningful units
vegetables, all the cleaning
ts on my grocery list.

Using and mental imagery
e, make funny visual
tions.

LEARN PRACTICE AND USE EXTERNAL AIDS

- Well organized planner.
 - Visible and well organized.
- A notepad near the phone.
- An alarm.
- Posting to do lists in plain sight.

POSITIVE EFFECT AT POST, 3 AND 6 MONTHS ON DELAYED MEMORY AND STRATEGY USE COMPARED TO PSYCHOSOCIAL AND NO-CONTACT



145 older adults with MCI

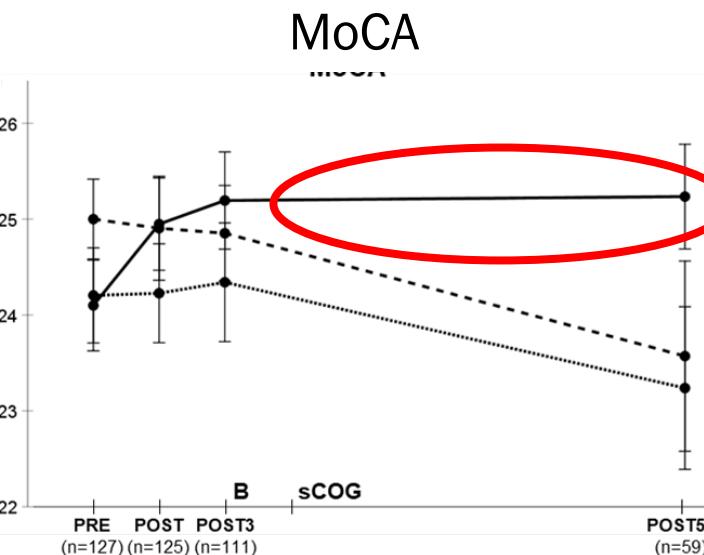
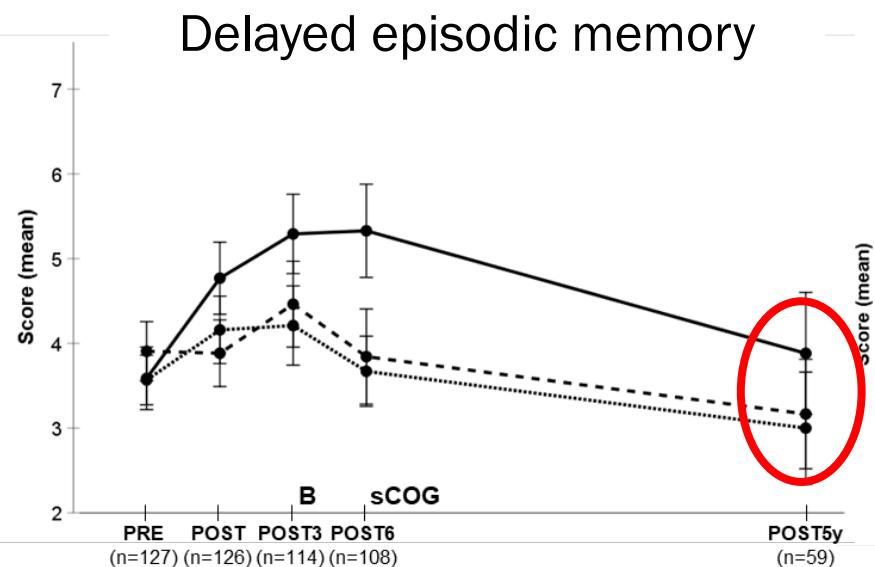
Randomized to MEMO, psychosocial intervention; no contact

MEMO+: Efficacy, Durability and Effect of Cognitive Training and Psychosocial Intervention in Individuals with Mild Cognitive Impairment

JAGS 66:655–663, 2018

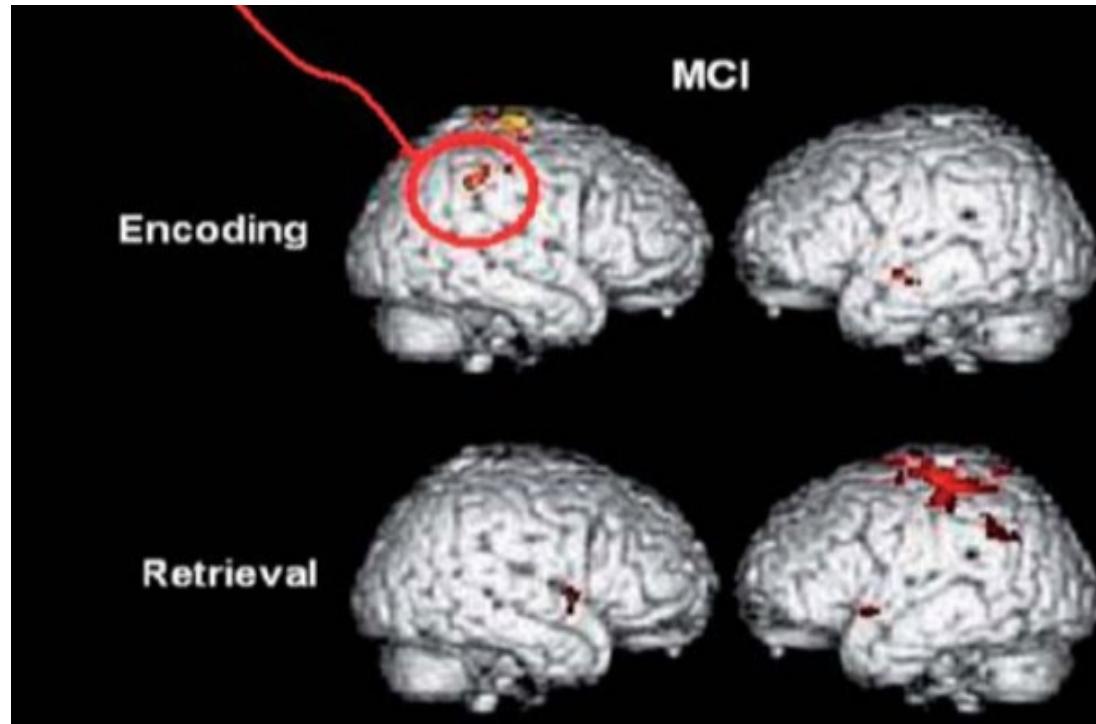
Sylvie Belleville, PhD, * Carol Hudon, PhD, † Nathalie Bier, PhD, * Catherine Brodeur, MD, * Brigitte Gilbert, PhD, * Sébastien Grenier, PhD, * Marie-Christine Ouellet, PhD, † Chantal Viscogliosi, PhD, ‡ and Serge Gauthier, MD*

BENEFITS REMAIN 5 YEAR LATER



- Cognitive Training
- Psychosocial Intervention
- No-Contact Control
- B Booster
- sCOG** Optional Short Cognitive Training

MOREACTIVATION IN BRAIN REGIONS THAT ARE INVOLVED IN THE STRATEGIES LEARNED



More activation in parietal, temporal, and frontal lobes and central gray nuclei and cerebellum

doi: 10.1093/brain/awr037

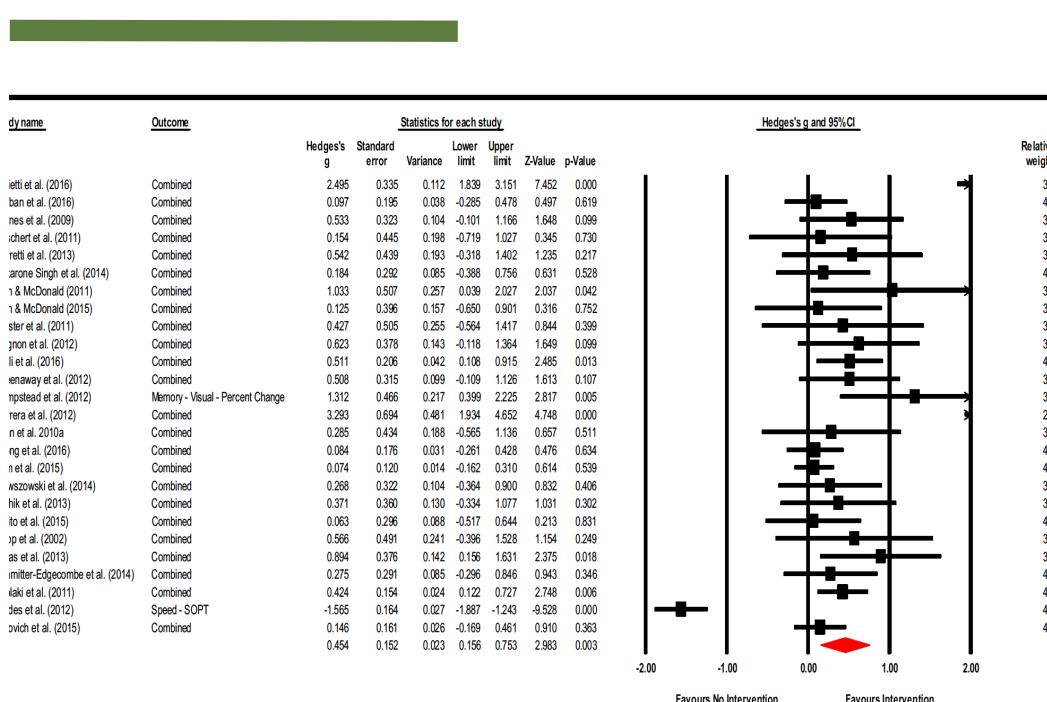
BRAIN
A JOURNAL OF NEUROLOGY

Brain 2011; Page 1 of 12 | 1

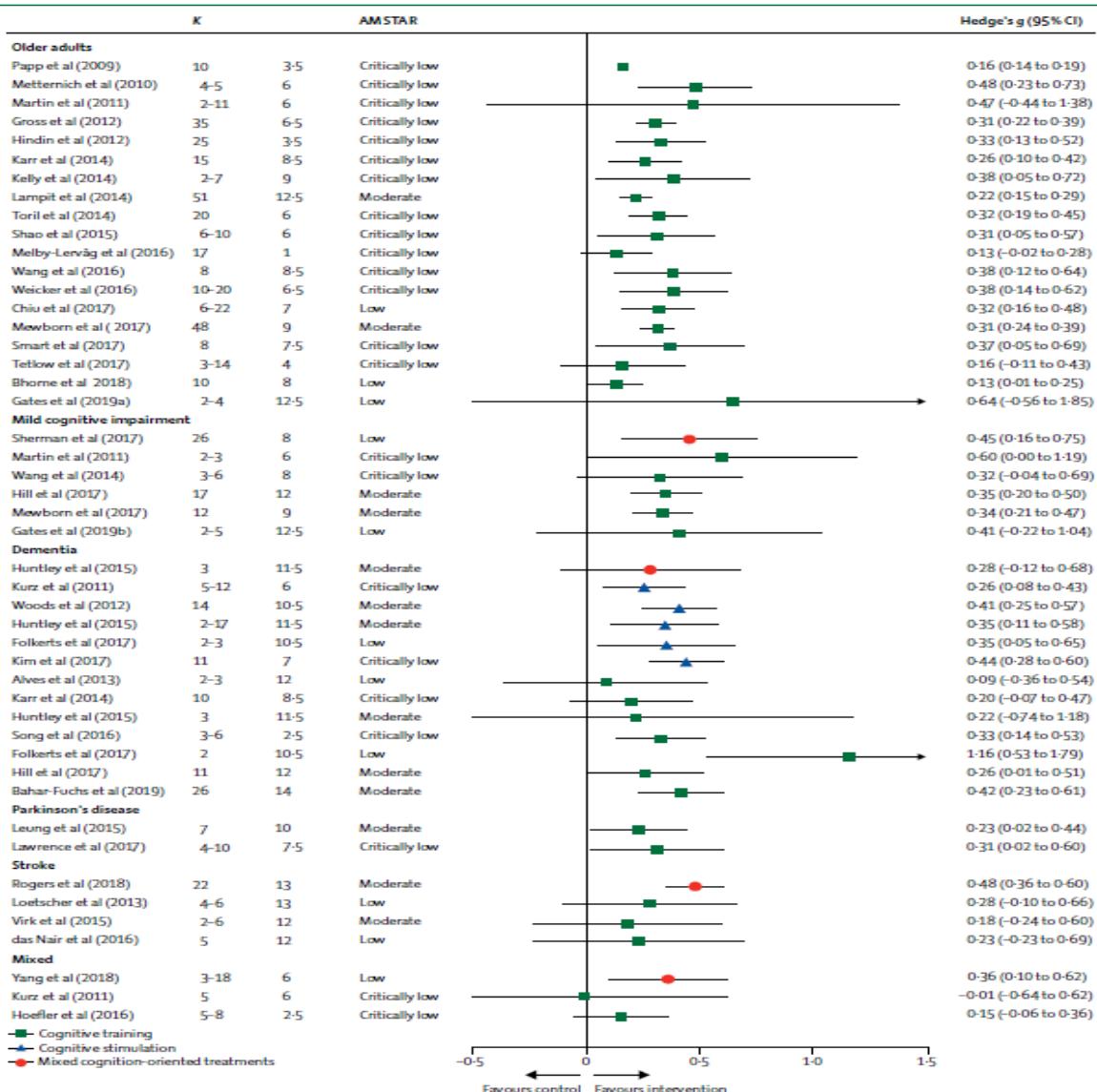
Training-related brain plasticity in subjects at risk of developing Alzheimer's disease

Sylvie Belleville,¹ Francis Clément,¹ Samira Mellah,¹ Brigitte Gilbert,² Francine Fontaine² and Serge Gauthier³

METAANALYSES IN OLDER ADULTS WITH OR WITHOUT COGNITIVE IMPAIRMENT



MCI: Sherman et al., 2017



Cochrane Review. Bahar-Fuch, 2022

ENGAGE: COMBINING COGNITIVE TRAINING WITH STIMULATING LEISURE ACTIVITIES



To make the intervention more **enjoyable** and **engaging**.

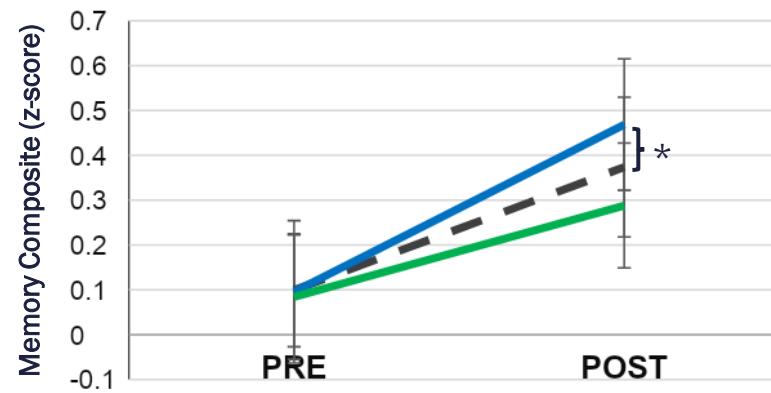
Cognitive training (memory and attention) +
leisure activities known to be neuroprotective:
Music or Spanish learning.

128 older adults with subjective complaints or MCI.

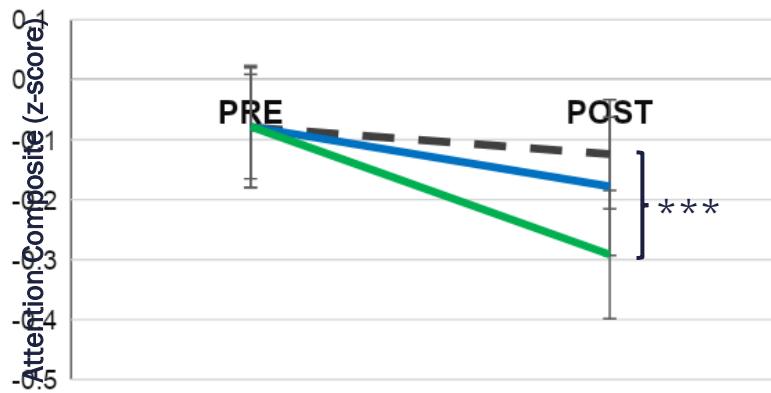


BETTER COGNITION

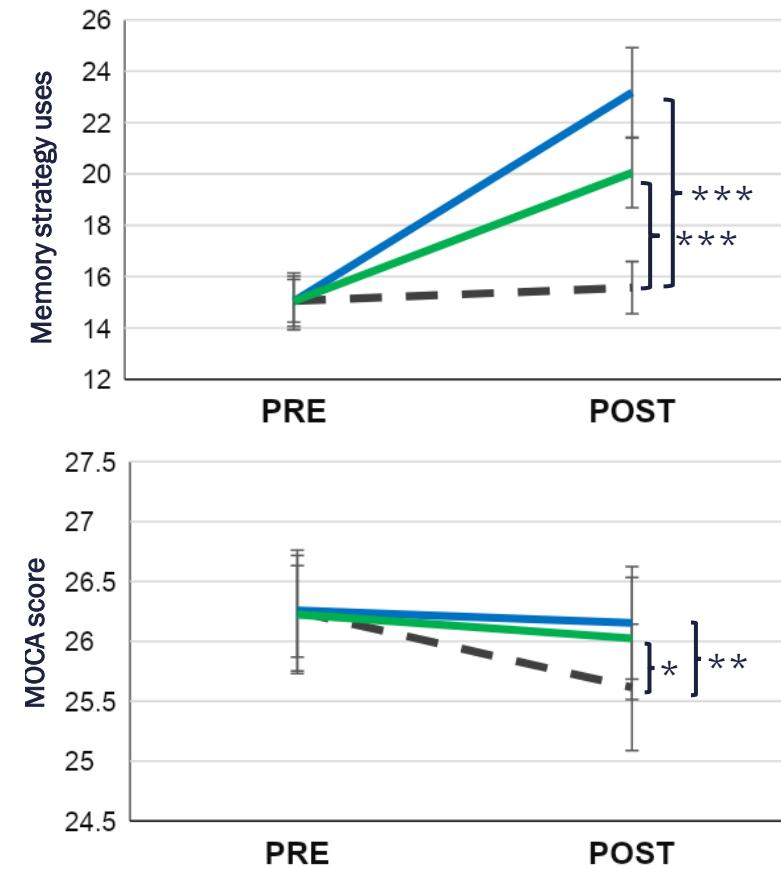
MEMORY in
ENGAGE-MUSIC



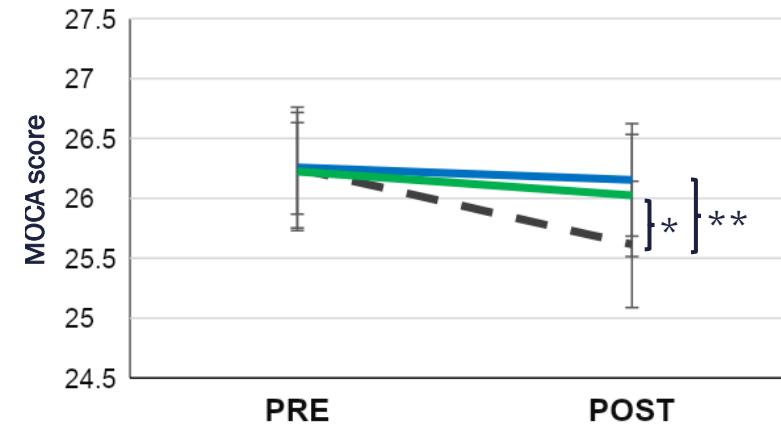
ATTENTION in
ENGAGE-SPANISH
(lower is better)



ENGAGE-MUSIC
ENGAGE-SPANISH
ACTIVE CONTROL

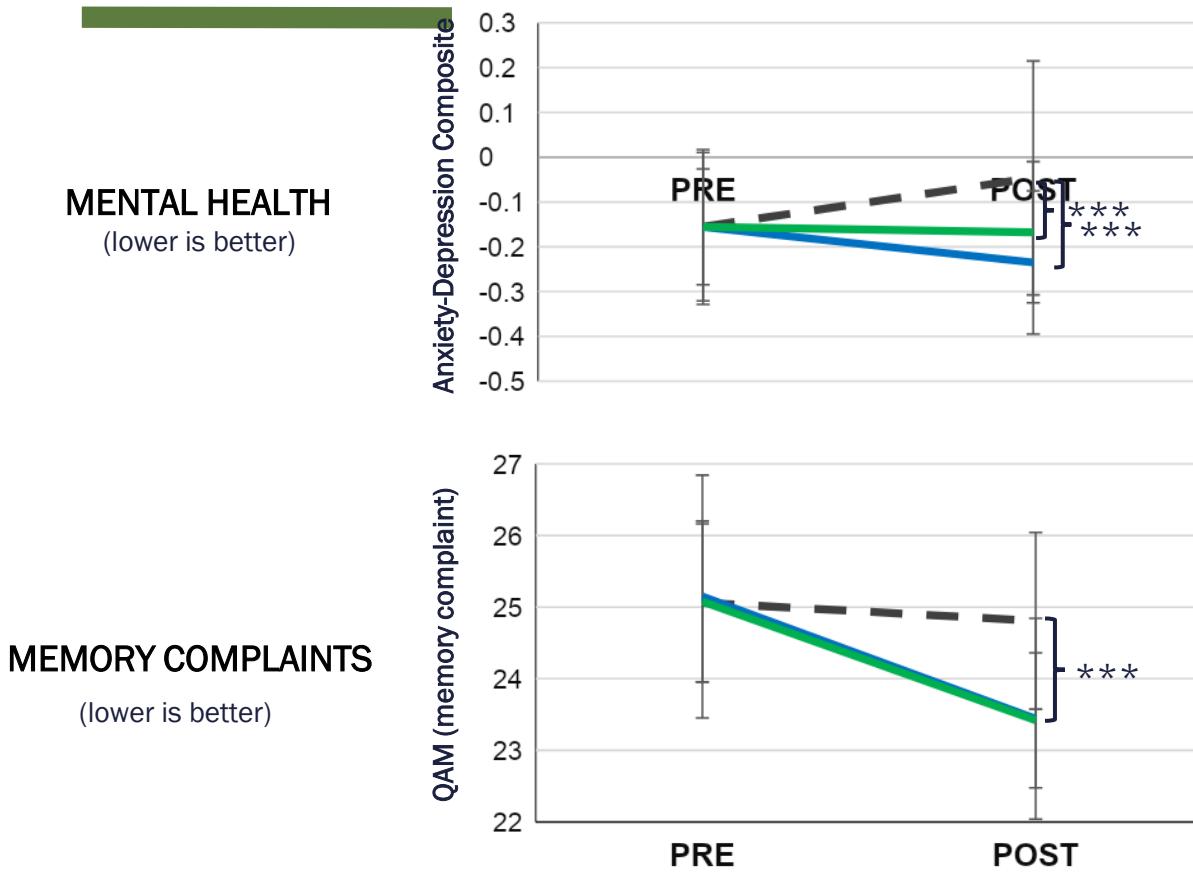


STRATEGY USE



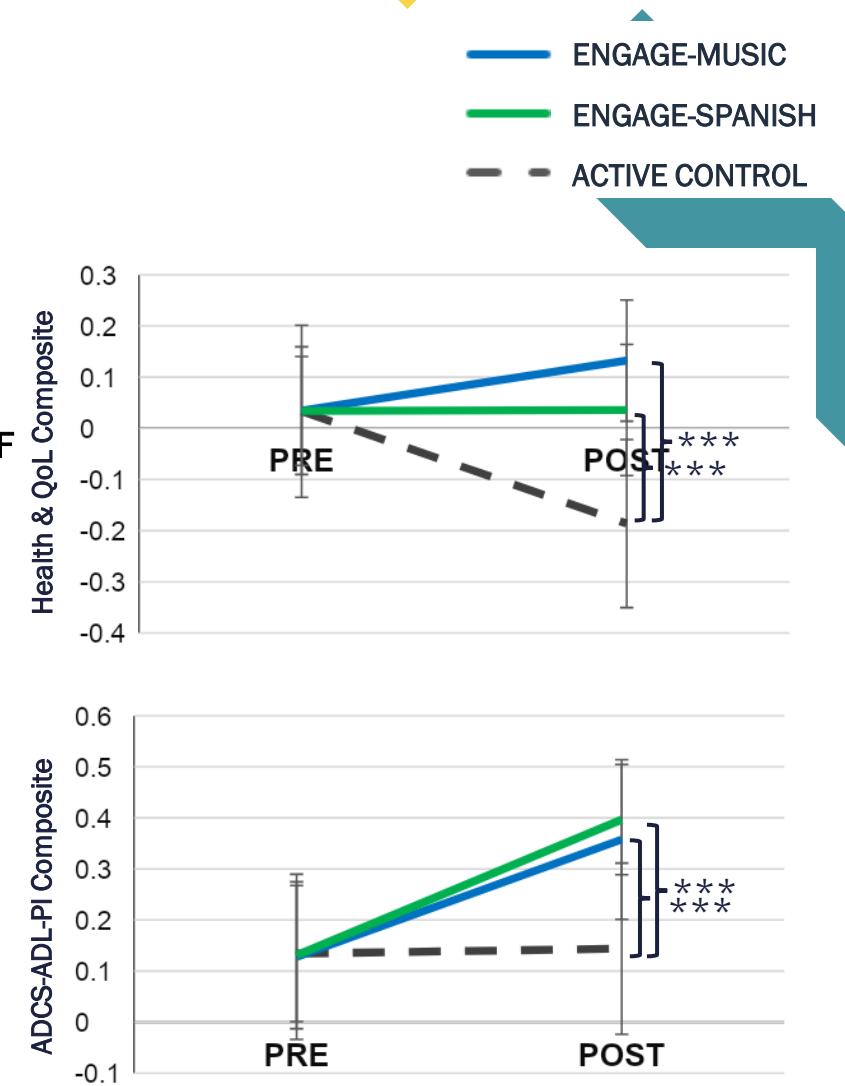
MOCA

BETTER QUALITY OF LIFE



SATISFACTION WITH
HEALTH AND QUALITY OF
LIFE

SATISFACTION IN
EVERYDAY LIFE
FUNCTIONING



HOW TO CHOOSE A COGNITIVE TRAINING PROGRAM?

- Does it rely on science?
- Has it been validated empirically? What are the claims?
- Does it fit my objectives ?
- Do I like this type of activity or its format?
- Integrate other domains if possible.



WHERE TO START? HOW TO MAINTAIN ?

- **Person-centered:** preferences, priorities, specific context.
- **Intrinsic motivation** is always more rewarding: doing it for yourself.
- Take into account the **skill level**: not too easy, not too difficult.
- Take a **step-by-step approach**: simple objectives; value small improvement.
- **Identify obstacles** along the way and **try solutions**.
- Never forget **fun and pleasure**.

THINK ABOUT ACTIVITIES THAT ARE “DOUBLE OR TRIPLE COUNT”

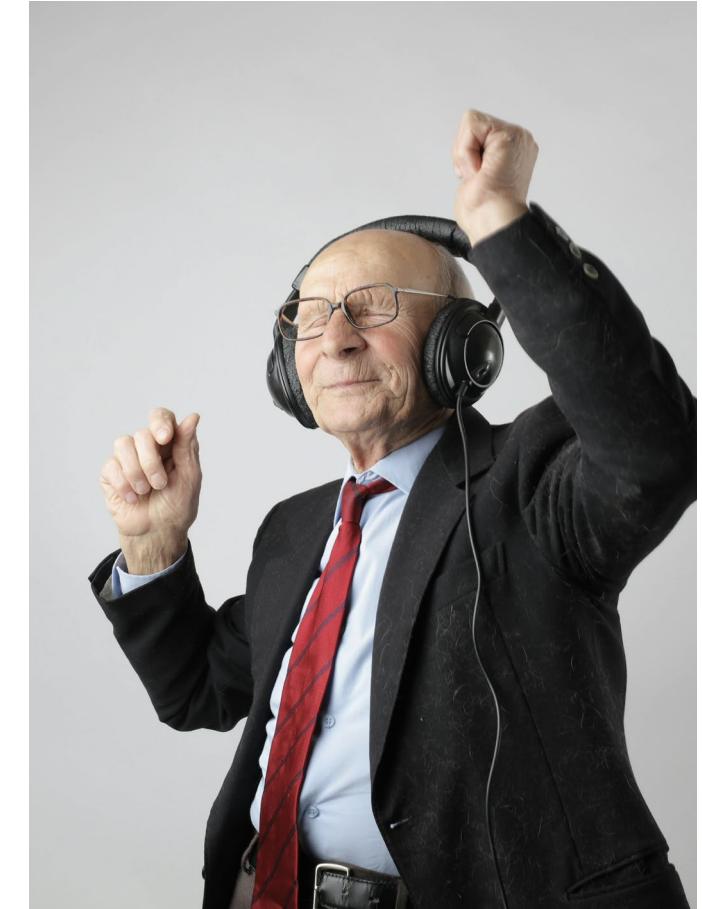
Activities that stimulate more than one domain:

- Taï chi, yoga, tango, mindfulness;
- Taking a cooking class for healthy recipes;
- Learning Spanish with your grandson;
- Gardening.



COGNITIVELY STIMULATING ACTIVITIES AT LATE DISEASE STAGES

- Activities can be **tailored** to individuals' **abilities**
crosswords to mystery words; bridge to simple card games.
- Activities the **person used to like**
ironing, woodwork, classification
- **The importance of art and music**
music, choir, singing, painting, theater,
- **Theater and choir adapted** to persons with dementia.
- The importance of **social contact** and **conversations**
- **Books and magazines** adapted to the level of the person.
- **Pictures and videos** of family and friends.
- **Taking a walk** and commenting on what you see.
- **Interacting with an animal**, observing birds.

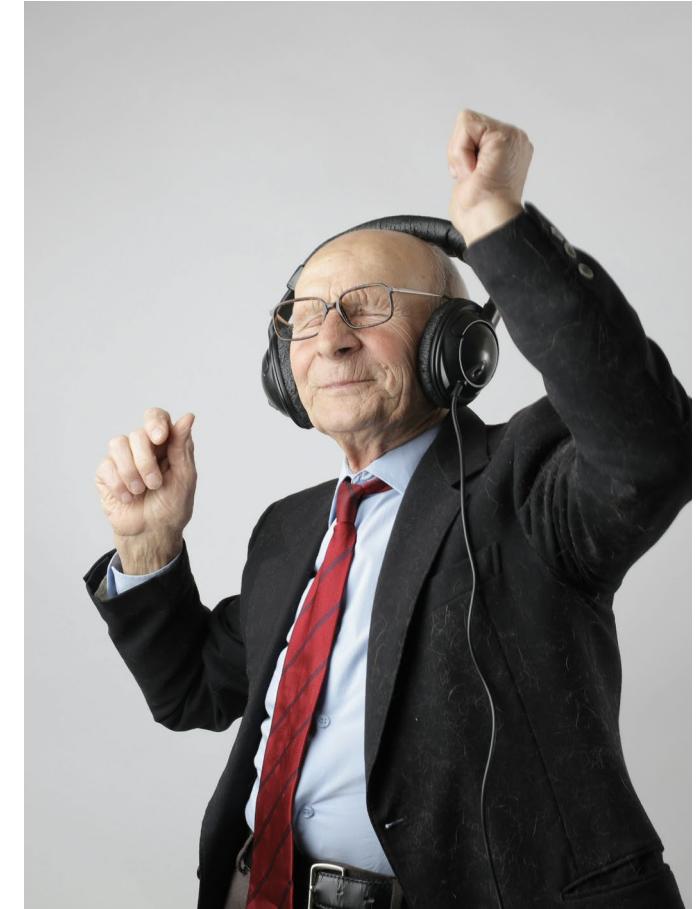


For later stages: Beneficial effects on quality of life and behavioral symptoms

COGNITIVE INTERVENTIONS AT LATER DISEASE STAGES

- Individually tailored approach.
- Focus on daily-life activities that are problematic for the patient or the family (goal-oriented).
- Rely on residual capacities and on adapting the environment.

Beneficial effects on real-life activities targeted by the intervention, on quality of life, institutionalisation



Bahar-Fuch et al, 2022; Clare et al, 2017; Amieva et al 2016

CONCLUSION

- The potential to **take action** for brain health is high.
- **The earlier the better**, the longer the better **BUT never too late** and one step is better than none.
- The approach **should be adapted** to the person's preference, context, capacities.
- **Not one magic bullet:**
 - importance to vary activities and importance to step out of comfort zone.

- Write a cookbook
- Take a package tour
- Take up Tai chi
- Keep a travel journal
- Learn photography
- Join a memory training program
- Learn woodworking
- Join a book club
- Create a family tree
- Take a watercolor painting class
- Write you biography
- Write you biography

And the list goes on...!



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BRAIN HEALTH PRO
Infographic



EN FRANÇAIS/
IN FRENCH

