Potentially modifiable risk factors for low cognition and dementia:

Could Canada reduce dementia by 50%?

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October 24, 2024

CLSA Webinar Series

Schulich MEDICINE & DENTISTRY

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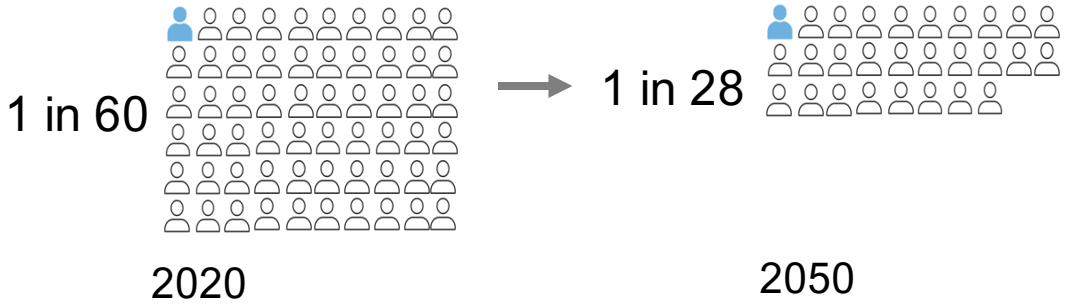
Dementia Epidemiology in Canada

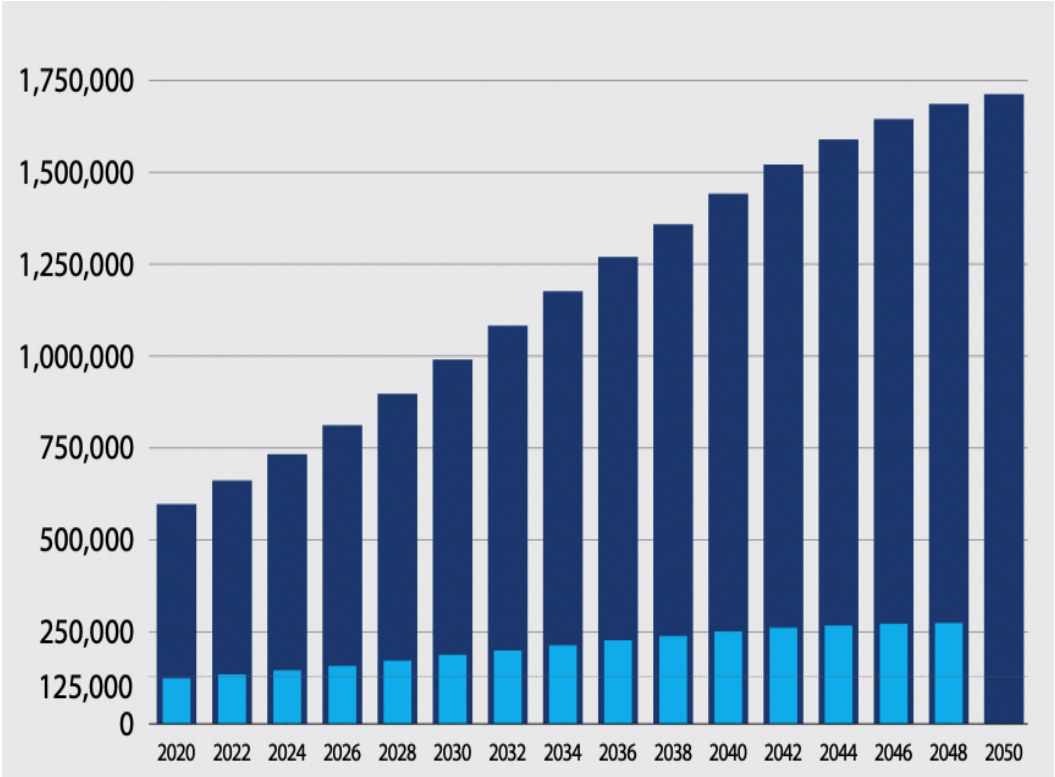
Prevalence (All dementia cases)

- Number of Canadians living with dementia is expected to **triple** from 0.6 million in 2020 to 1.7 million by 2050



Incidence (New dementia cases)

- 124,000 new dementia cases in 2020 (=**15 cases every hour**) and expected to have 187,000 new cases a year by 2030 (=**21 cases every hour**)

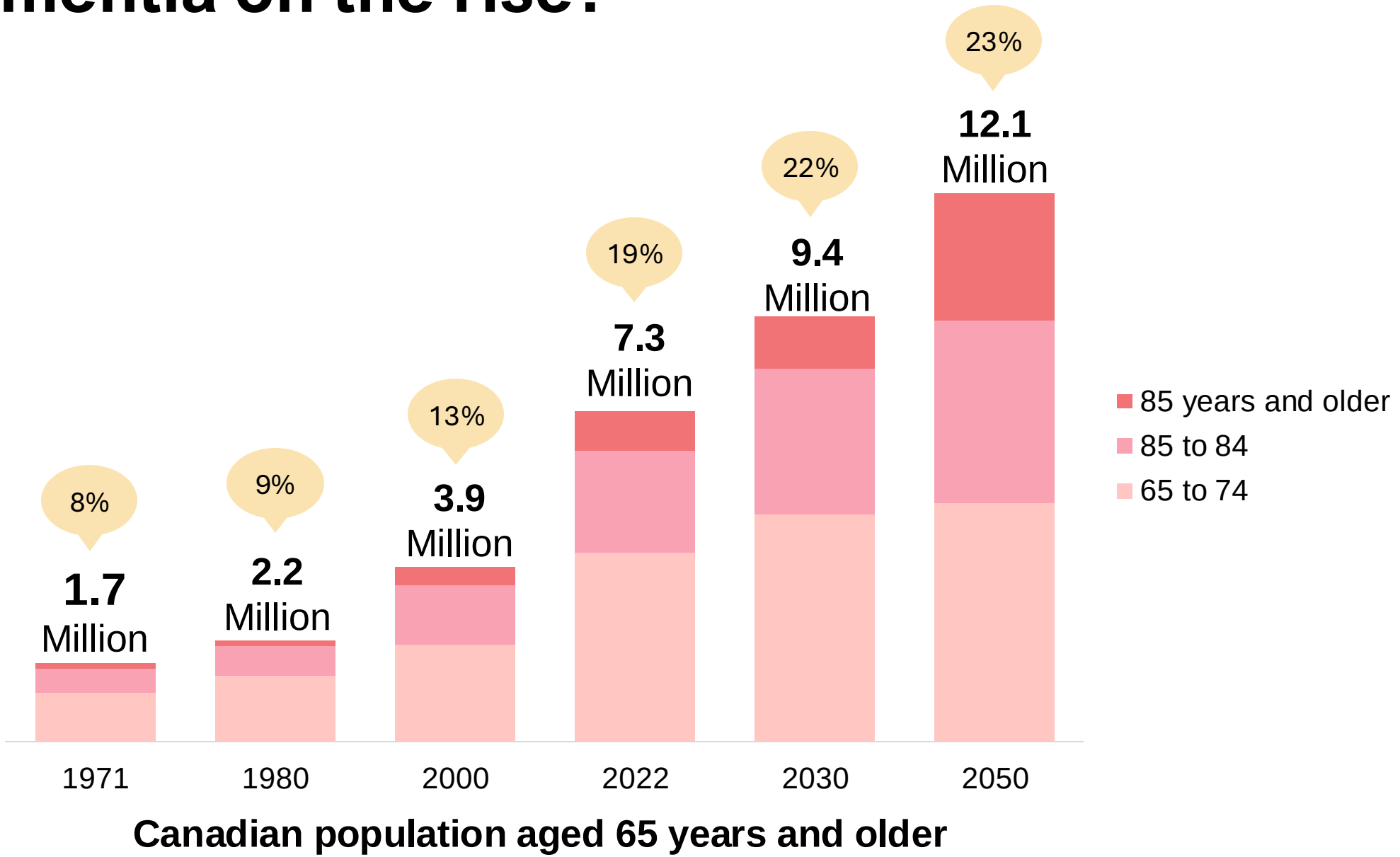


Estimated dementia prevalence and incidence in Canada, 2020 to 2050

From Alzheimer Society of Canada (2022).

Alzheimer Society of Canada (2022). Navigating the path forward for Dementia in Canada

Why is Dementia on the rise?

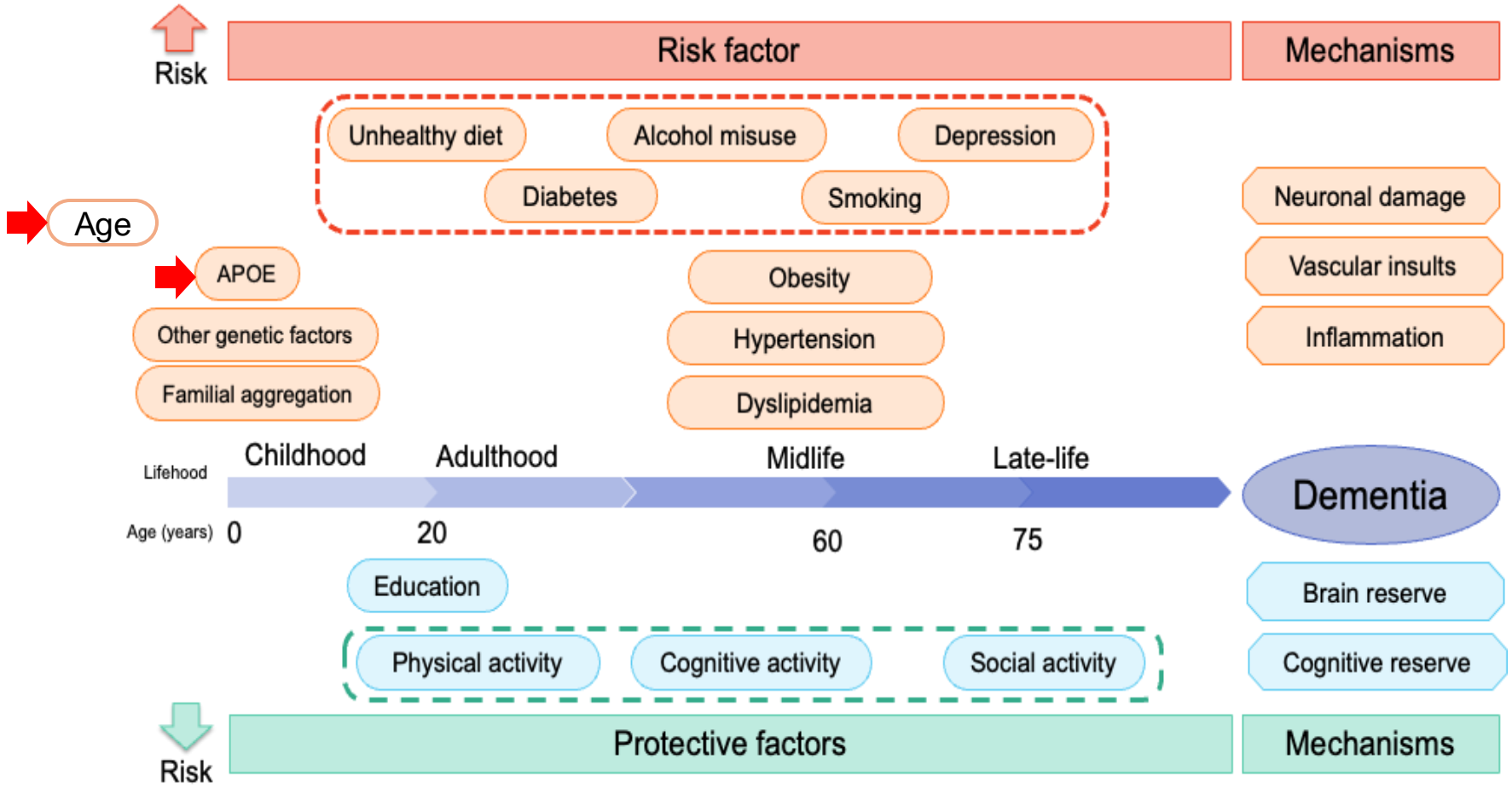


Canadian population aged 65 years and older

Source: Statistics Canada. Population estimates (1991 to 2023) and projections (2024 to 2073), Canada, total – gender, 100 years and over.

Multifactorial Etiology of Dementia

- A multifactorial condition involving multiple non-modifiable and modifiable risk factors throughout the lifespan



Risk factors for dementia across the lifespan

Adapted from: Nature Reviews Neurology. 2018;14:653-666

Nature Reviews Neurology. 2018; 14:653-666

The Lancet Commissions

Dementia prevention, intervention, and care: 2020 report of the *Lancet* Commission

Gill Livingston, Jonathan Huntley, Andrew Sommerlad, David Ames, Clive Ballard, Sube Banerjee, Carol Brayne, Alistair Burns, Jiska Cohen-Mansfield, Claudia Cooper, Sergi G Costafreda, Amit Dias, Nick Fox, Laura N Gitlin, Robert Howard, Helen C Kales, Mika Kivimäki, Eric B Larson, Adesola Ogunniyi, Vasiliki Orgeta, Karen Ritchie, Kenneth Rockwood, Elizabeth L Sampson, Quincy Samus, Lon S Schneider, Geir Selbæk, Linda Teri, Naaheed Mukadam

Over **40%** of dementia cases worldwide can be prevented by **modifying 12 risk factors** throughout the lifespan

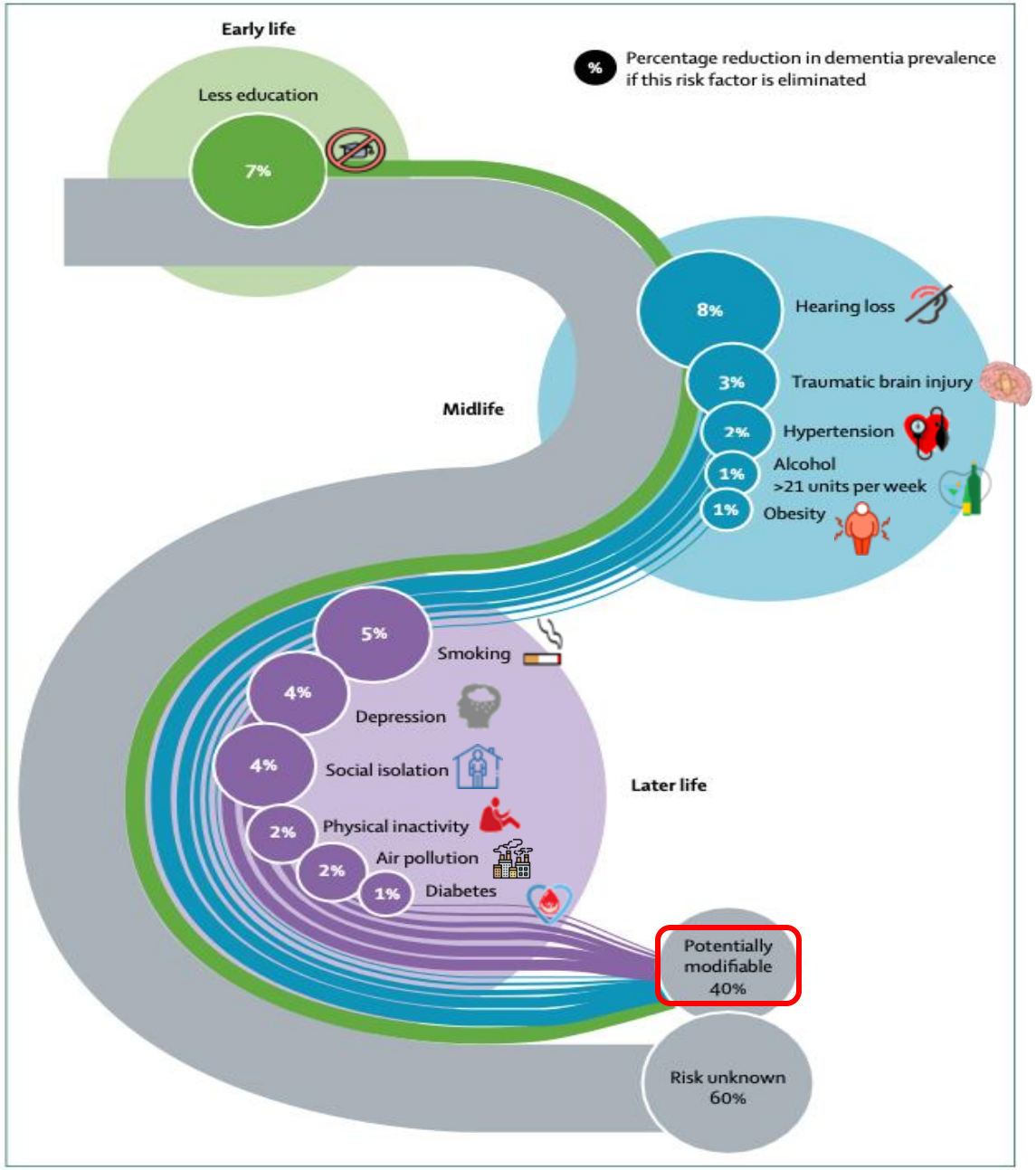


Figure 7: **Population attributable fraction of potentially modifiable risk factors for dementia**

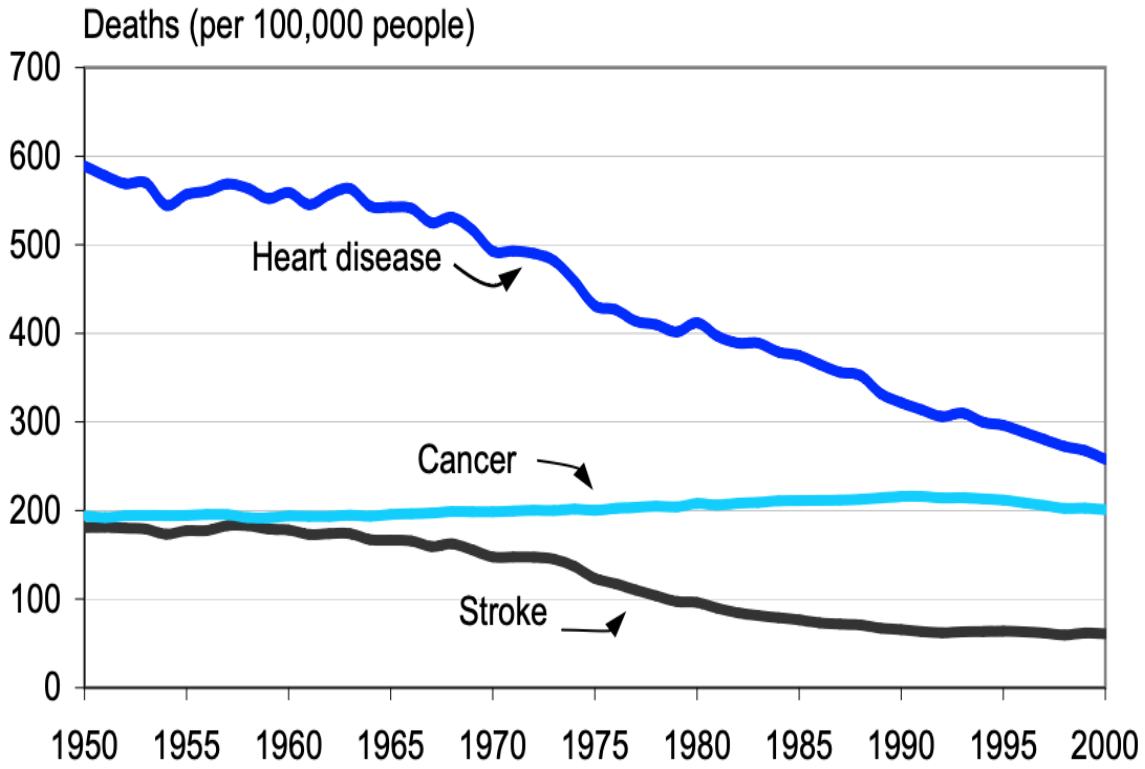
Life-course model of dementia prevention

Livingston et al. Lancet. 2020; 396: 413-46.

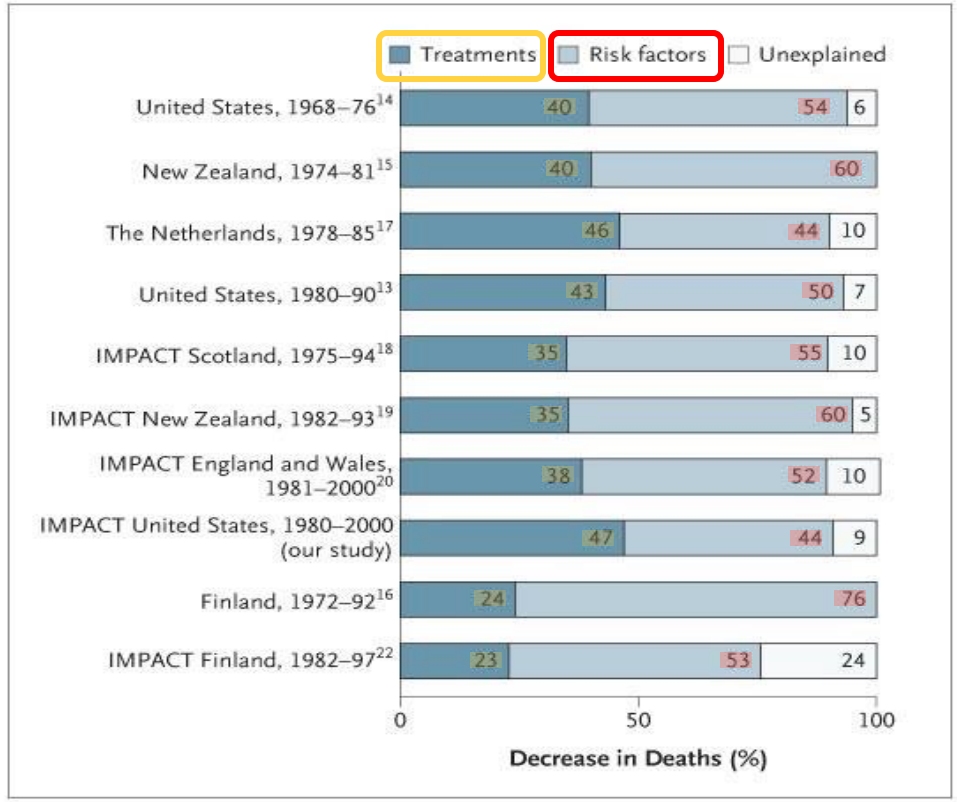
Can CHANGES in these RISK FACTORS PREVENT or REDUCE dementia risk?

We can learn from a century of progress in Cardiovascular Disease Prevention

Lifestyle Changes Explained



Source: AmeriStat, analysis of data from the National Center for Health Statistics.



Percentage of the Decrease in Deaths from Coronary Heart Disease Attributed to Treatments and Risk-Factor Changes

Nearly HALF of enormous reductions in heart disease &stroke mortality,
while the remaining 20-50% was explained by medical and surgical treatments

Ford et al. N Engl J Med. 2007; 356:2388-2398.

Although prevalence and incidence are expected to increase due to growing number of older adults,

- **Age-specific prevalence** reported **stable or declining** in high income countries
- **Age-specific incidence** are **declining** in high income countries

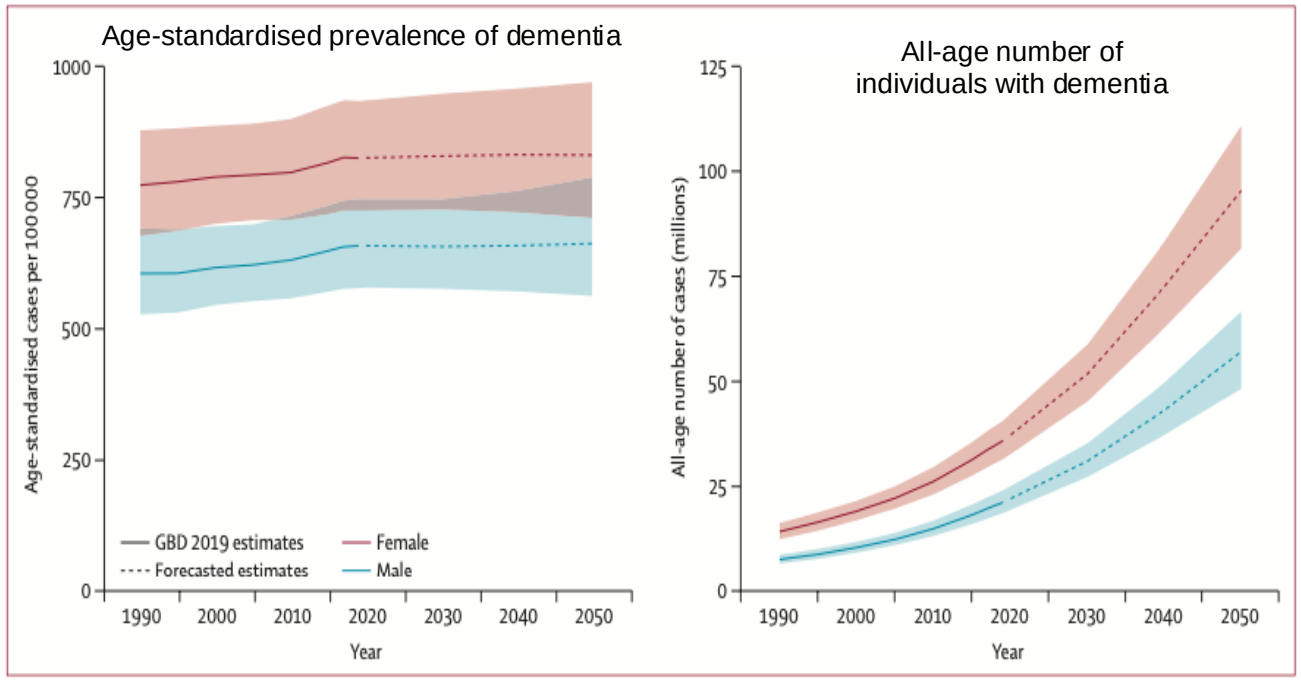


Figure 2: **Estimated trends in the global age-standardised dementia prevalence (A) and all-age number of cases (B), with 95% uncertainty intervals, 2019–50**
GBD=Global Burden of Diseases, Injuries, and Risk Factors Study.

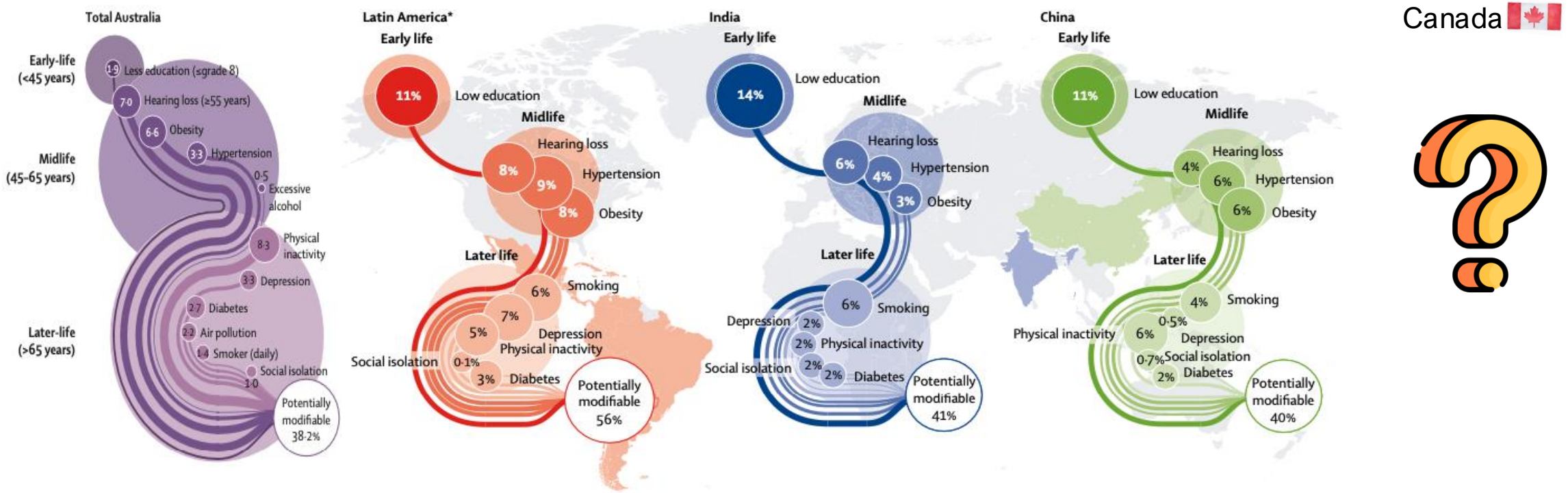
This attenuated prevalence and incidence could be explained by the improvements in

- Lifestyle changes and nutrition
  - Cardiovascular prevention strategies
  - Smoking cessation campaign
- Educational level
  - Compulsory education
- Health care

GBD 2019 Dementia Forecasting Collaborators. Lancet Public Health. 2022; 7:e105-125. Mukadam et al. Lancet Public Health. 2024; 9:e443-460. Wu et al. Nat Rev Neurol. 2017; 13: 327-339.

Since 2020 Lancet Commission Report,

- Similar studies have been conducted in other countries (including Brazil, US, India, China) to identify country-specific risk factor profiles and the preventable burden of dementia associated with risk factors
- The impact of modifiable risk factors differed across the world, but it hasn't been done in Canada.



Canada

Mukadam et al. Lancet Glob Health. 2019; 7:e596-603. See et al. Lancet Public Health. 2023; 8:e717-725.

How is the preventable burden of dementia due to risk factor estimated?

Population Attributable Fraction (PAF)

- Epidemiological measure widely used to assess the public health impact of risk factors in population.
- Indicates the proportion of dementia in the population that would be removed it the exposure/risk factor (i.e. physical inactivity) was eliminated.
- Initially developed to estimate the burden of lung cancer due to smoking.

$$PAF = \frac{P_{exp}\left(RR_{exp-1}\right)}{\left[1 - P_{\exp}(RR_{exp} - 1)\right]}$$

P_{exp}: prevalence of the exposure

RR_{exp}: risk ratio of exposure

Greater PAF = Greater contribution to outcome, greater prevention potential

Mansournia. BMJ. 2018;360:k757.

Emerging risk factor – Sleep disturbance

ORIGINAL ARTICLE

Sleep, Cognitive impairment, and Alzheimer's disease: A Systematic Review and Meta-Analysis

Omonigho M. Bubu, MD, M
Yi Wen, MS[3]; Skai Schwart

Contents lists available at ScienceDirect

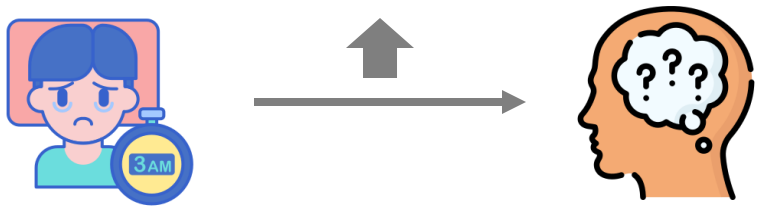
Sleep Medicine Reviews

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

CLINICAL REVIEW

Sleep disturbances increase the risk of dementia: A systematic re and meta-analysis

Le Shi [a, b], Si-Jing Chen [b], Meng-Ying Ma [c], Yan-Ping Bao [a], Ying Han [a], Yu-Mei Wan
Jie Shi [a], Michael V. Vitiello [e], Lin Lu [b, a, *]



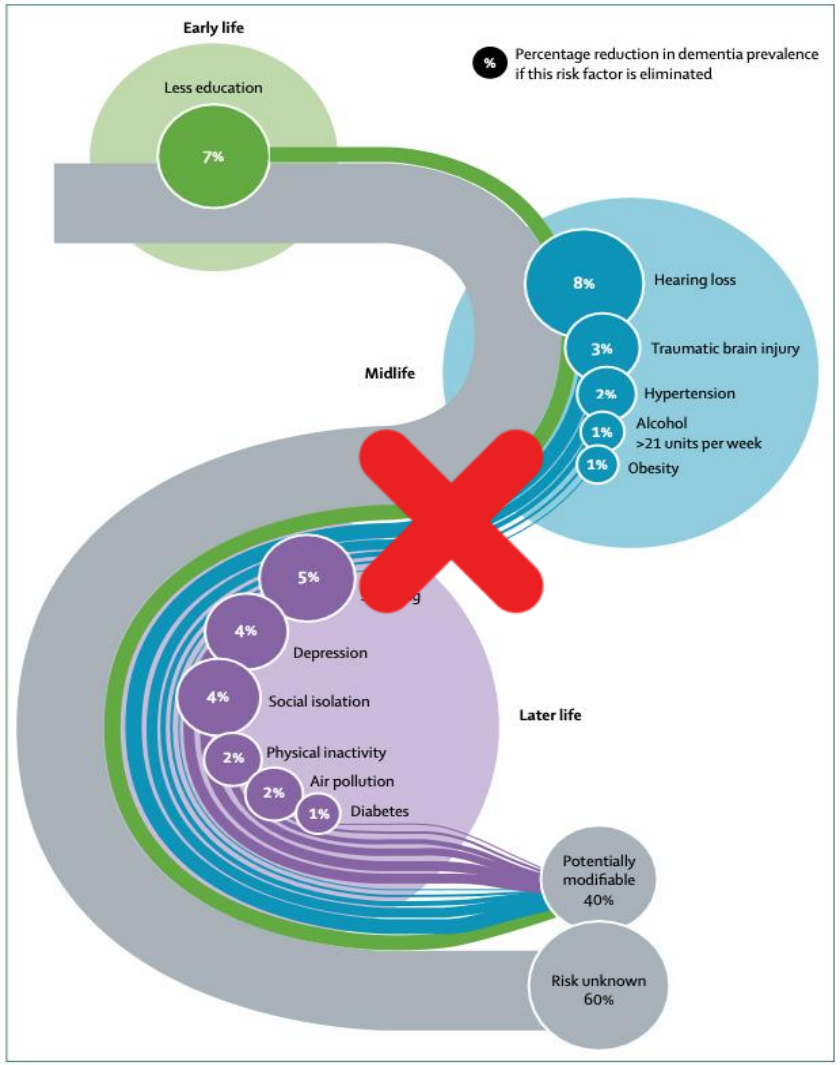


Figure 7: **Population attributable fraction of potentially modifiable risk factors for dementia**

Emerging Multidomain Lifestyle Intervention Trials

A 2 year multidomain intervention of diet, exercise, cognitive training, and vascular risk monitoring versus control to prevent cognitive decline in at-risk elderly people (FINGER):

Effect of long-term omega 3 polyunsaturated fatty acid supplementation with or without multidomain intervention on cognitive function in elderly adults with memory complaints (MAPT): a randomised, placebo-controlled trial

Effectiveness of a 6-year multidomain vascular care intervention to prevent dementia (preDIVA):

Around world

The Japan-Multimodal Intervention Trial for Prevention of Dementia (J-MINT): The Study Proto
Multicenter

Original Research | Published:
Volume 8, pages 465–476, (20

Clinical Trial

Online

SYNERGIC-2 Trial (SYNchronizing, Exercises and Remedies to GaIn Cognition@ho

What is this Study about?

The goal of the proposed SY
(SYNchronizing Exercises, an
Cognition@home) is to evalu
from personalized multidom
multiple dementia risk factor
adults with Mild Cognitive Im

Observational Study

Online & In-Person

The Lifestyle, Exercise and Diet Study: A Virtual, Lifestyle Approach to Improve Cognitive Function

udy about?

his study is to assess whether a virtually-
y lifestyle intervention (over Zoom) is
iduals who feel that their memory or
ning.

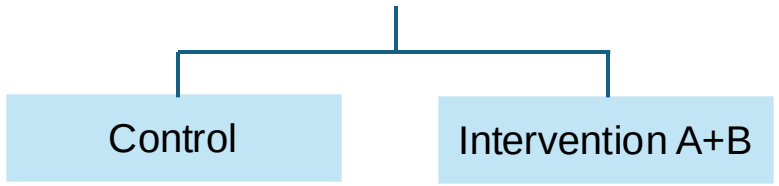
Protocol for the Brain Health Support Program Study of the Canadian Therapeutic Platform Trial for Multidomain Interventions to Prevent Dementia (CAN-THUMBS UP): A Prospective 12-Month Intervention Study

H.H. Feldman[1,2], S. Belleville[3,4], H.B. Nygaard[5], M. Montero-Odasso[6,7], J. Durant[1,2], J.-L. Lupo[1,2], C. Revta[1,2], S. Chan[8], M. Cuesta[3], P.J. Slack[5], S. Winer[9], P.W.H. Brewster[9], S.M. Hofer[9], A. Lim[10], A. Centen[10], D.M. Jacobs[1,2], N.D. Anderson[8], J.D. Walker[11], M.R. Speechley[12], G.Y. Zou[12], H. Chertkow[8] for the Canadian Consortium on Neurodegeneration in Aging (CCNA), CAN-THUMBS UP Study Group

Canada

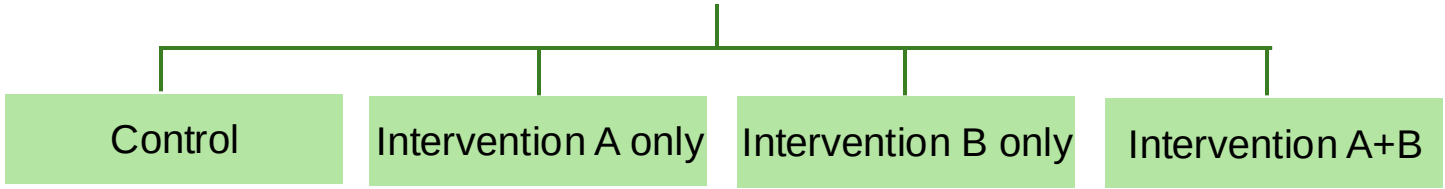
Intervention Study Design Choice

Standardly Tailored Design



- Randomize people with 1+ risk factor to intervention or control groups
- Objective is to lower number of risk factors AND level of cognitive impairment in Intervention group
- Does not permit inferences about specific combinations or interaction effects (synergistic)

2x2 Factorial Trial Design

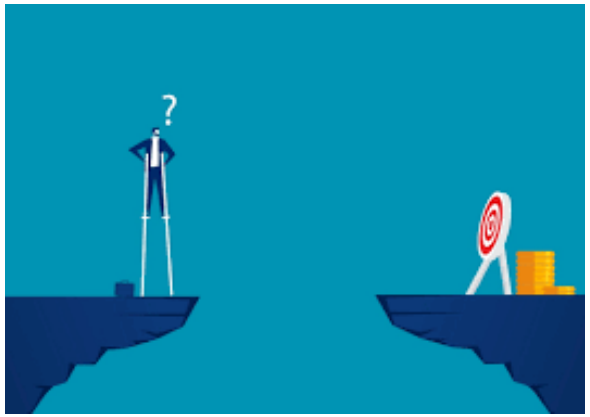


- Randomize people with 2 risk factors (A and B) to 4 groups
- If there is a strong interaction:
  - Modifying A will reduce its main effect on outcome AND its interaction effect with B
- Question: Which 2 risk factors should we start with?

Montero-Odasso & Speechley et al. Alzheimer's Research & Therapy. 2022; 14:94

Gaps in the Literature

- The distribution of risk factors **differs** across individuals and populations and risk factors can also **cluster in individuals**.
- Little is known about the **dementia risk factor profile** within our population.
- The potential population impact of sleep **disturbance** is unknown.
- The most effective combination of risk factors to target is still in question.



Study Objective

- To estimate the preventable burden of dementia related to the modifiable risk factors in Canada

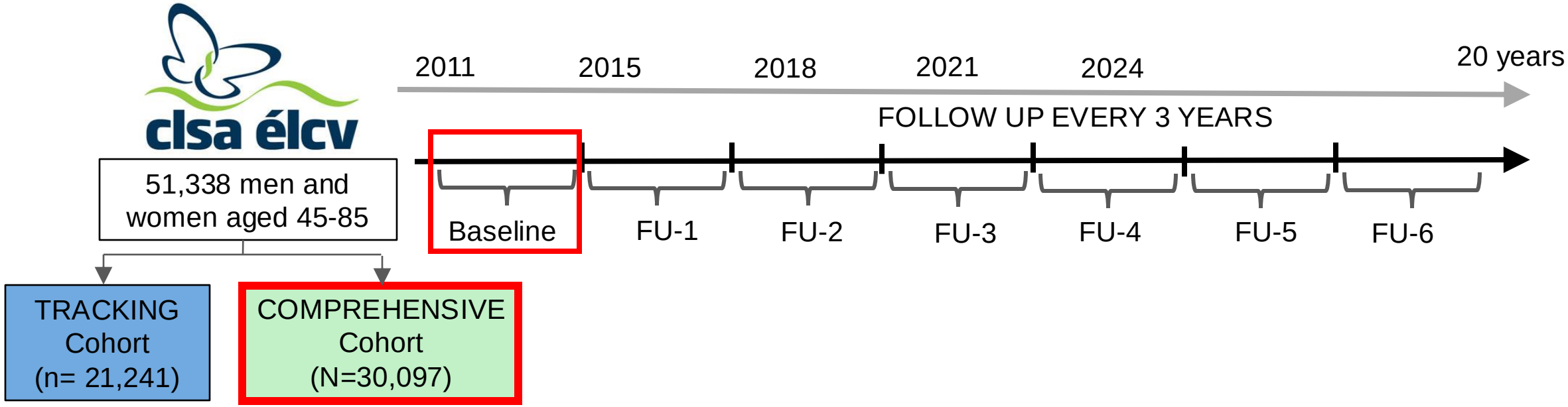
- To explore which **combinations** of modifiable risk factors have the **highest prevalence** and **strongest association with cognitive change** in middle-aged and older adults in Canada

Study 1

- To estimate the **prevalence** and **potential population impact** of **12 modifiable risk factors including sleep disturbance**
- To assess how the prevalence and potential population impact **differ across sex and age groups**
- To **compare** the prevalence and potential population impact **with other countries**

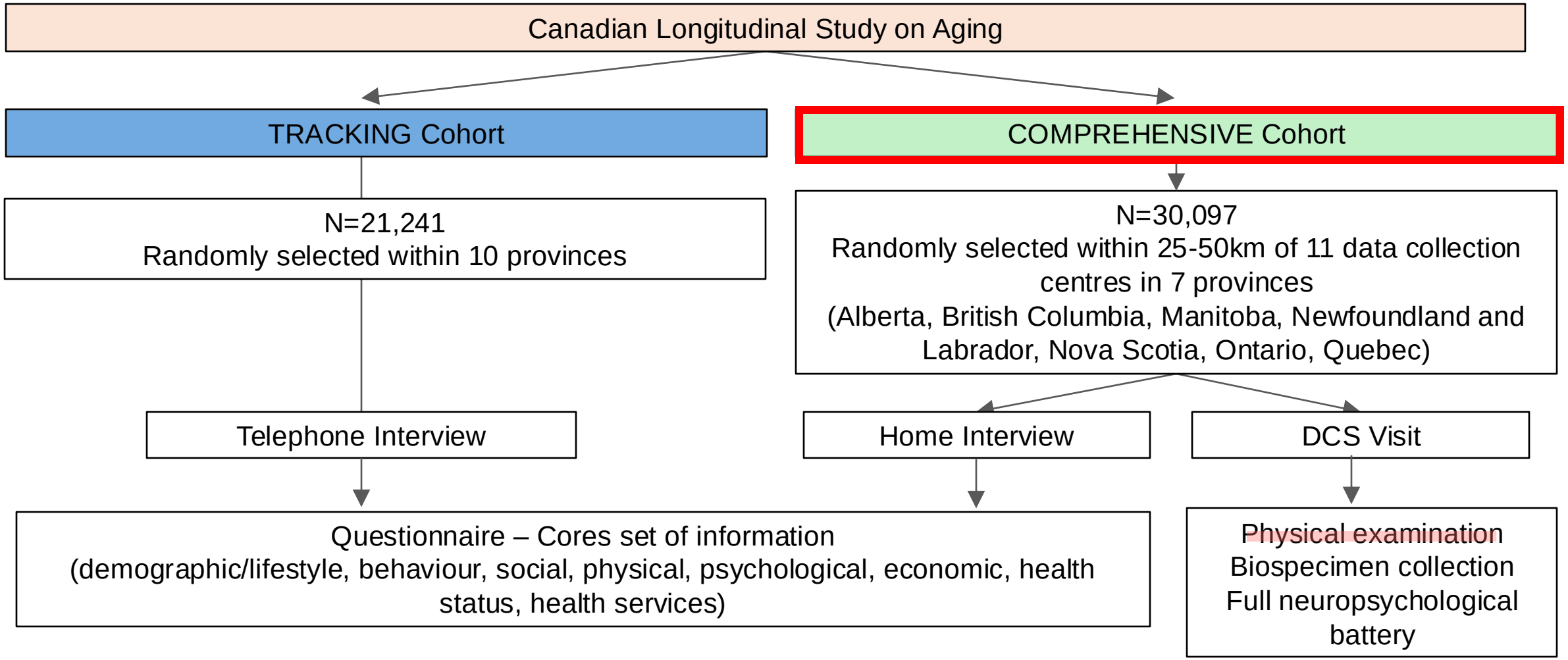
Canadian Longitudinal Study on Aging

- A large national longitudinal study following 51,388 men and women, who were aged between 45 and 85 when recruited, for at least 20 years
- Participants were recruited from all 10 Canadian provinces.
- Baseline data from the Comprehensive cohort



Raina et al. Can J Aging. 2009; 28(3): 221-229

Canadian Longitudinal Study on Aging



Raina et al. Can J Aging. 2009; 28(3): 221-229

12 Modifiable Risk Factors

Sleep disturbance
Self-reported poor sleep quality, insomnia, sleep apnea, daytime sleepiness, restless leg syndrome

Less Education
Less than secondary school graduation

Hearing Loss
Threshold of >25 dB at 500, 1000, 2000 and 4000 Hz in the better ear using unaided pure tone hearing

Traumatic Brain Injury
A head injury resulted in losing consciousness

Hypertension
Systolic blood pressure >140 mmHg (average of 5 measurements) or self-reported diagnosis of hypertension

Alcohol Consumption
>21 unit of alcohol per week (number of standard drinks was converted using UK National Health Service formula)

Obesity
BMI of ≥30 kg/m^2

Smoking
Current cigarette smoker (in past 30 days)

Depression
Self-reported diagnosis of clinical depression

Social Isolation
Less than one social contact within a month with family, friends, or neighbours

Physical Inactivity
<150 mins of moderate-to-vigorous or <75 mins of vigorous activity (frequency and duration of physical activity reported in PASE was converted to the total hours of physical activity per week)

Diabetes
Self-reported diagnosis of type 2 diabetes

Livingston et al. Lancet. 2020; 396: 413-46.

Data Analysis

- Prevalence and Population Attributable Fraction (PAF) of individual risk factors were calculated.
  - Greater Prevalence: Greater risk factor is **more common** in our population
  - Greater PAF: Greater **contribution** to dementia – **greater prevention potential**

$$PAF = \frac{P_{exp}\left(RR_{exp-1}\right)}{\left[1 - P_{\exp}(RR_{exp} - 1)\right]}$$

- The **same analytic technique and relative risk** used in the Lancet Commission 2020 Report was used to calculate the PAF
  - This includes weighting for risk factor overlapping using Principal Component Analysis.
- Prevalence estimates were weighted with inflation weight

Livingston et al. Lancet. 2020; 396: 413-46.

Data Analysis

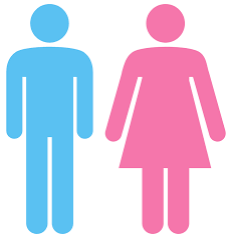
- To build the **life-course model**, prevalence was estimated by lifespan
  - Early life | <18 years but we included all ages (45 to 85 years)
  - Midlife | 55 to 64 years
  - Later life | 65 to 85 years
- To explore how risk factor profile **differ** by **sex** and **age** groups, prevalence and PAF were stratified by 4 age groups (45-54, 55-64, 65-74, 75-85) and sex (men, women).
- To compare our results to global estimates and other countries, the results were **qualitatively compared** to the Lancet 2020 report (**global**) and other six studies that employed the same methodologies (a total of **8 countries**)

Livingston et al. Lancet. 2020; 396: 413-46.

Participant Characteristics

39% 45-54 years
31% 55-64 years
18% 65-74 years
12% 75-85 years

mean
59.7 (10.3) years



52% Women
48% Men

6% Non-white
94% White

9% Single
74% Married
17% Widowed/ Divorced/ Separated

7% <$20K
23% $20-50K
33% $50-100K
20% $100-150K
17% >$150K

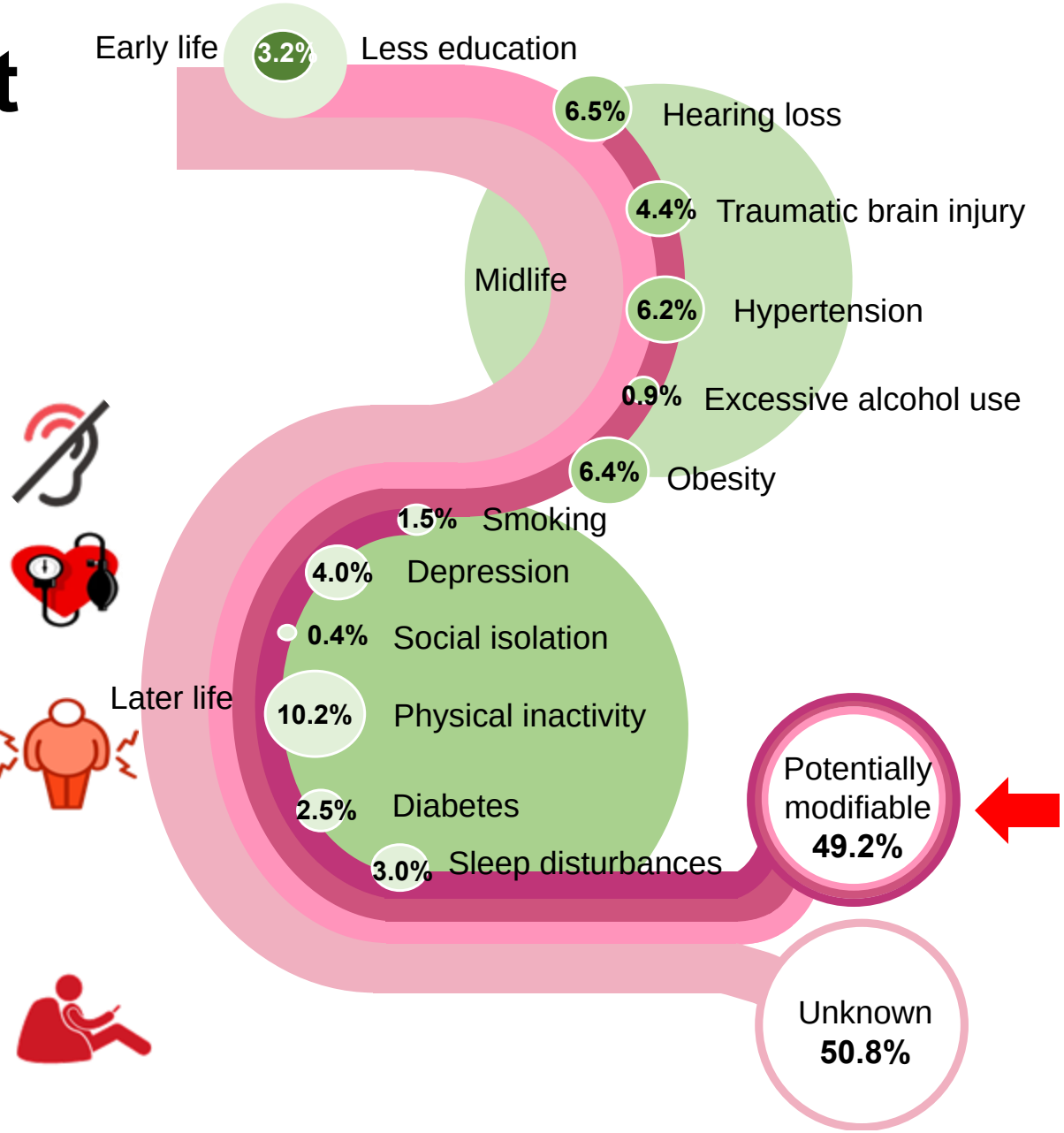
28% Pacific
18% Prairie
48% Central
6% Atlantic

Risk Factor Prevalence

	RR	Prevalence
Early life (age <18 years)		
Less Education	1.6	14.0%
Midlife (age 45-65 years)		
Hearing loss	1.9	21.0%
Traumatic brain injury	1.8	15.0 %
Hypertension	1.6	30.0%
Excessive alcohol use	1.2	11.0%
Obesity	1.6	31.0%
Later life (age >65 years)		
Smoking	1.6	6.2%
Depression	1.9	12.0%
Social isolation	1.6	1.6%
Physical inactivity	1.4	83.0%
Diabetes	1.5	13.0%
Sleep disturbance	1.2	40.0%

Potential Population Impact

	RR	Prevalence	Weighted PAF (95% CI)
Early life (age <18 years)			
Less Education	1.6	14.0%	3.2% (1.9, 4.3)
Midlife (age 45-65 years)			
Hearing loss	1.9	21.0 %	6.5% (3.7, 9.3)
Traumatic brain injury	1.8	15.0 %	4.4% (3.3, 5.4)
Hypertension	1.6	30.0 %	6.2% (2.7, 9.3)
Excessive alcohol use	1.2	11.0 %	0.9% (0.5, 1.1)
Obesity	1.6	31.0 %	6.4% (4.1, 7.7)
Later life (age >65 years)			
Smoking	1.6	6.2 %	1.5% (0.6, 2.4)
Depression	1.9	12.0 %	4.0% (3.2, 4.8)
Social isolation	1.6	1.6 %	0.4% (0.2, 0.5)
Physical inactivity	1.4	83.0 %	10.2% (6.8, 13.0)
Diabetes	1.5	13.0 %	2.5% (2.4, 3.3)
Sleep disturbance	1.2	40.0 %	3.0% (1.8, 3.8)
			49.2 % (31.1, 64.9)



Weighted population attributable fraction for 12 potentially modifiable risk factors for dementia in Canada

Potential Population Impact

	RR	Prevalence	Weighted PAF (95% CI)
Early life (age <18 years)			
Less Education	1.6	14.0%	3.2% (1.9, 4.3)
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Hearing loss	1.9	21.0 %	6.5% (3.7, 9.3)
Traumatic brain injury	1.8	15.0 %	4.4% (3.3, 5.4)
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Physical inactivity	1.4	83.0 %	10.2% (6.8, 13.0)
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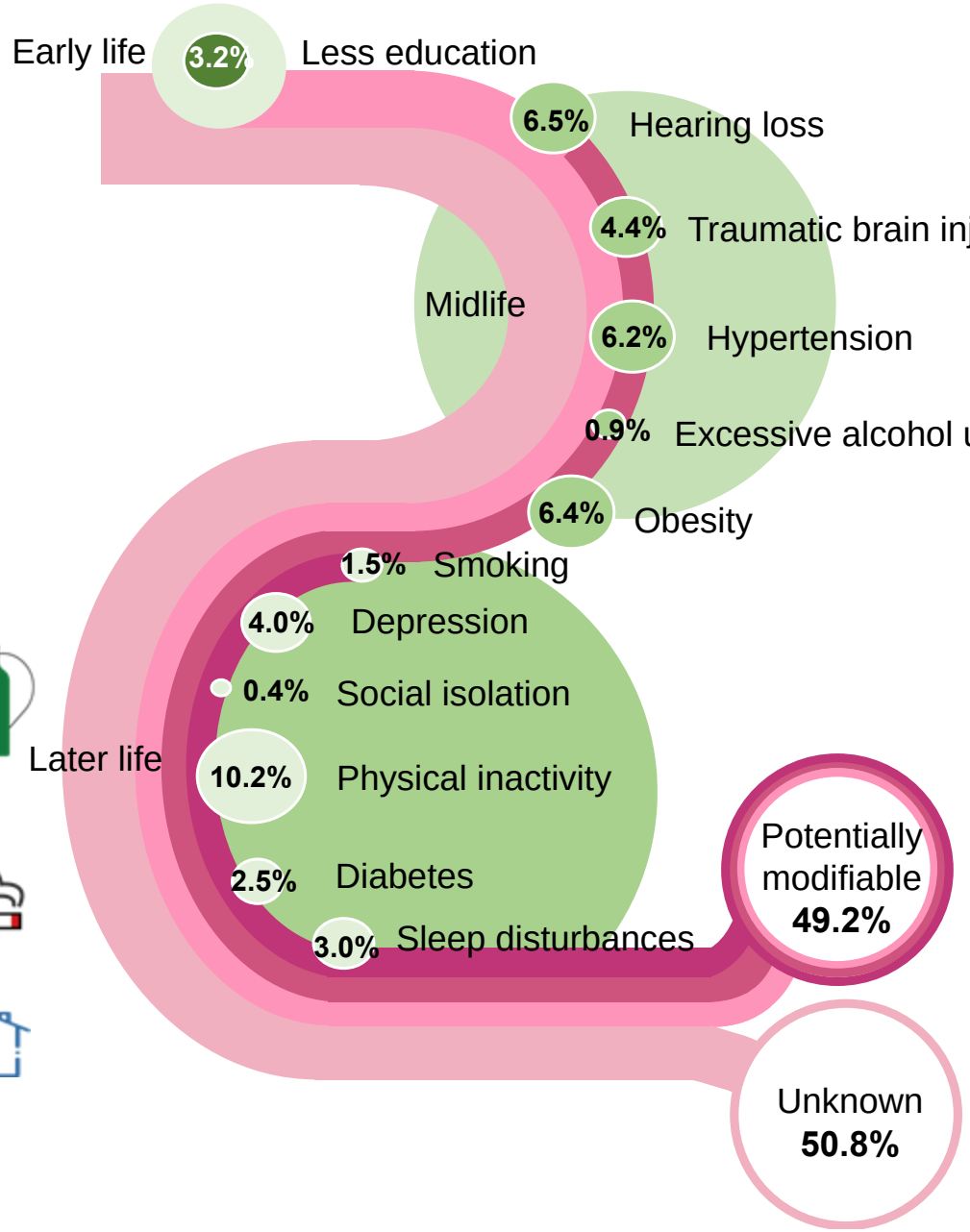
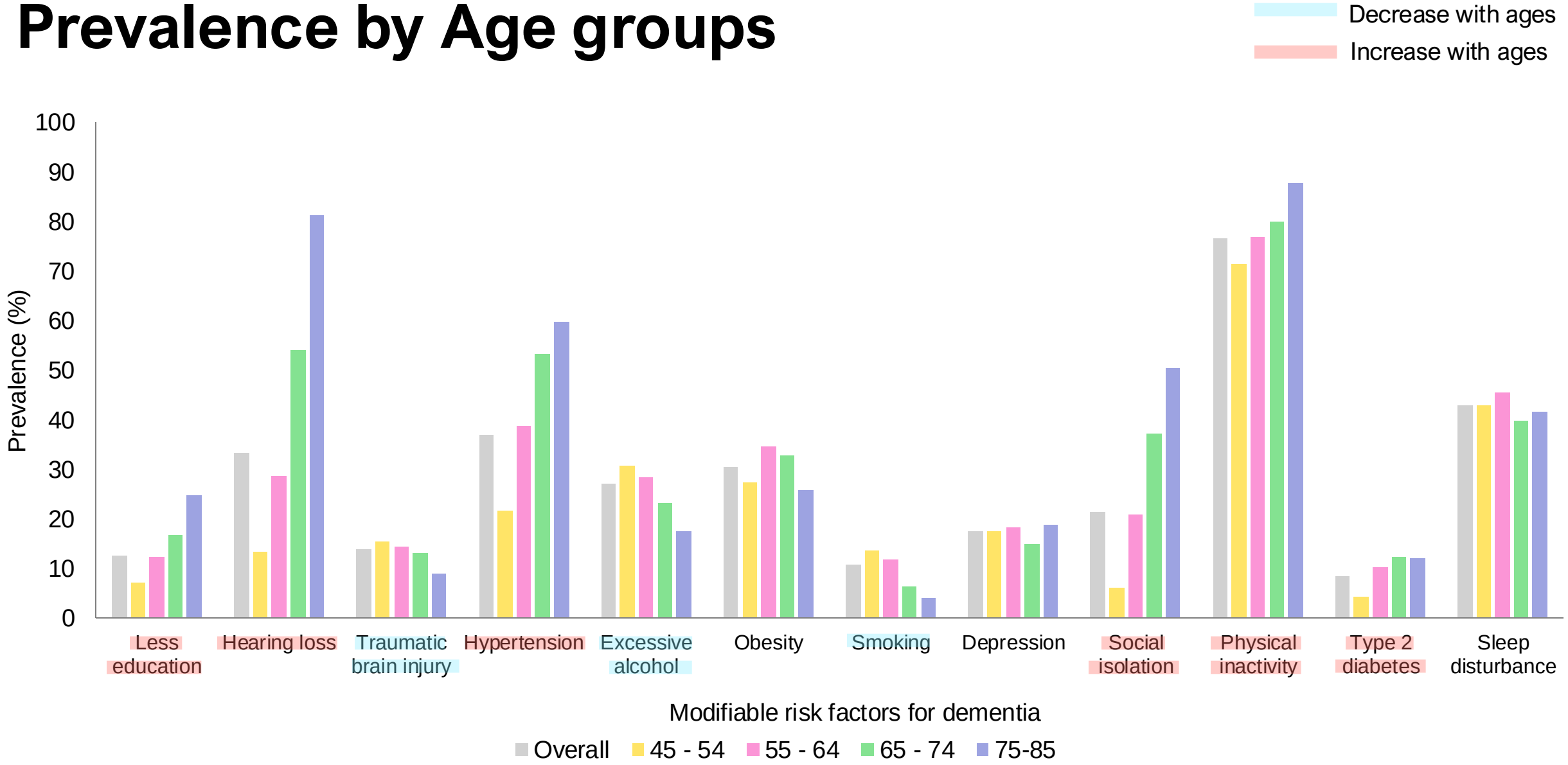
Sleep disturbance	1.2	40.0 %	3.0% (1.8, 3.8)
			49.2 % (31.1, 64.9)

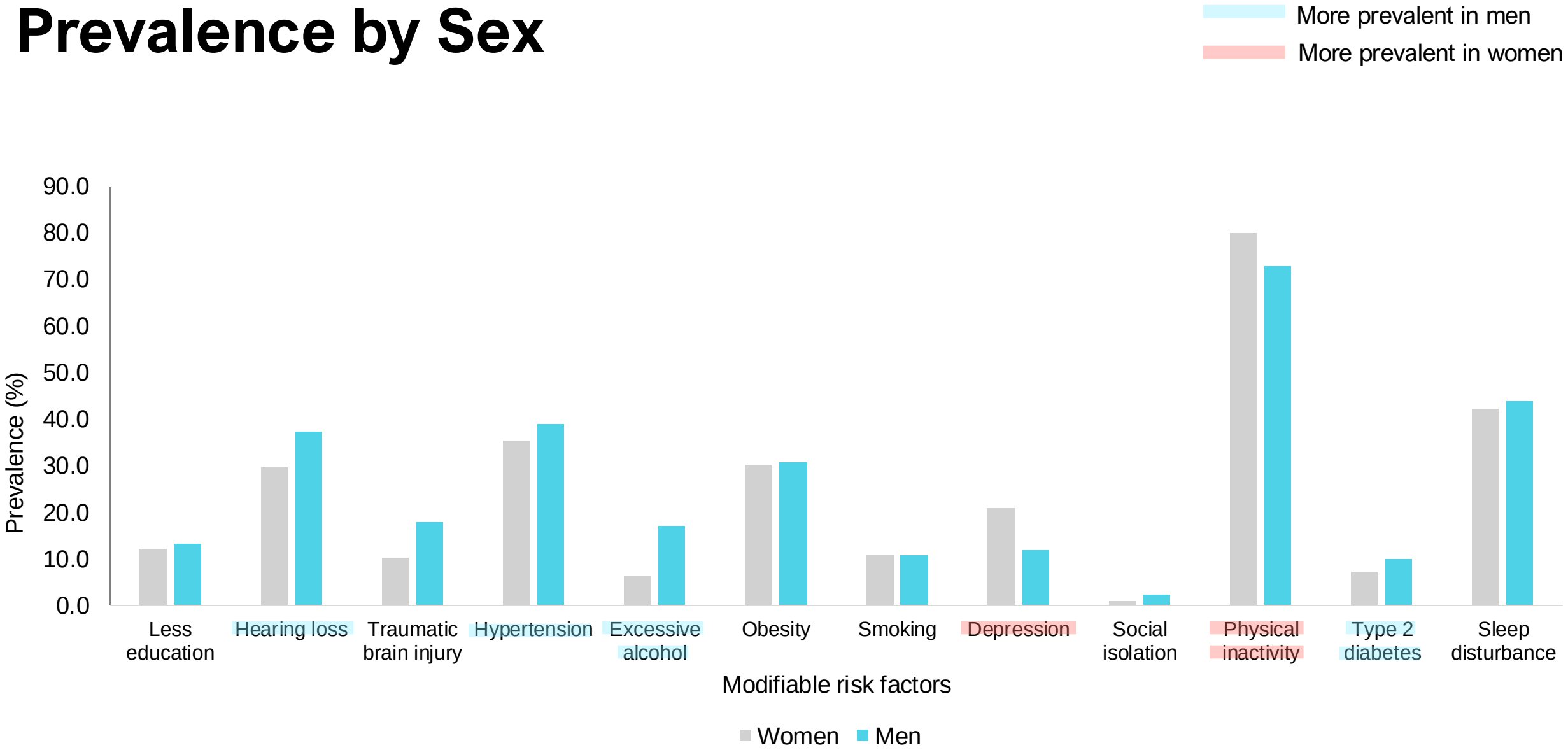


Weighted population attributable fraction for 12 potentially modifiable risk factors for dementia in Canada

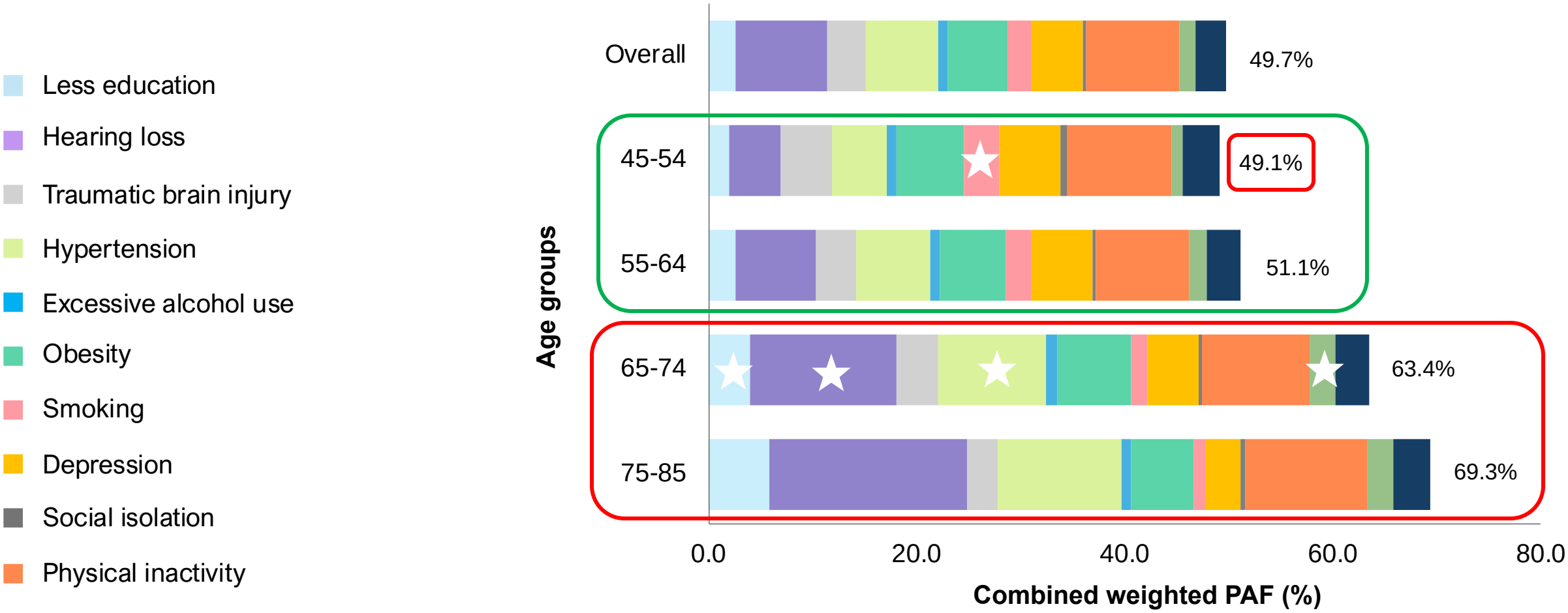
Prevalence by Age groups



Prevalence by Sex



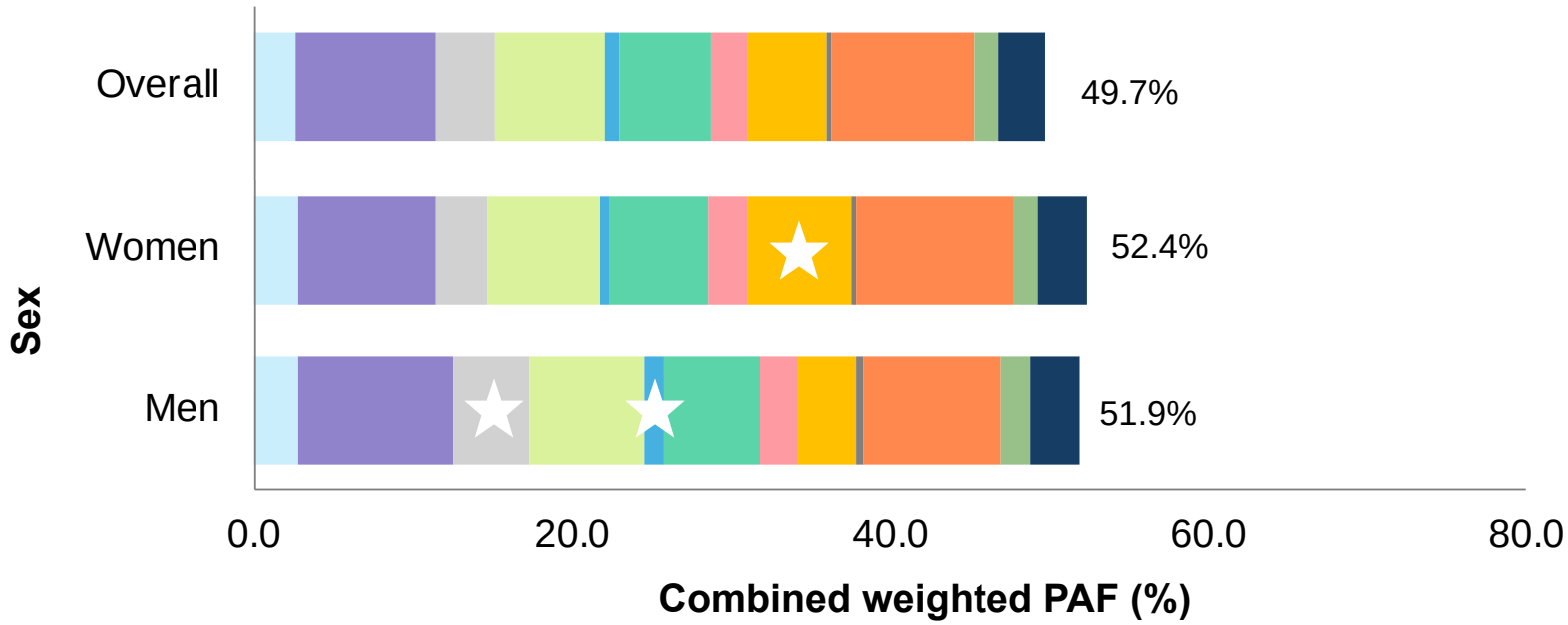
Potential Population Impact by Age groups



- Prevention potential increases with age
- Prevention potential was **already as high as 49% at age 45-54**
  - **Importance of**
- **Less education, hearing loss, hypertension, diabetes in later life**

Potential Population Impact by Sex

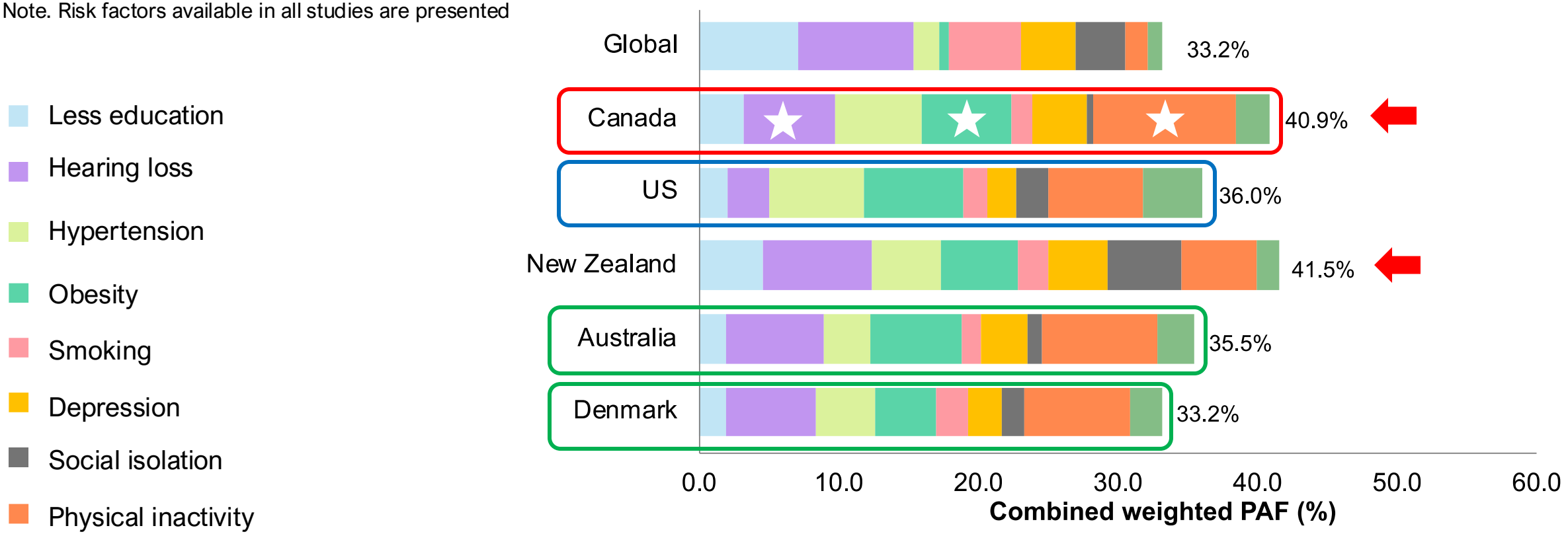
- Less education
- Hearing loss
- Traumatic brain injury
- Hypertension
- Excessive alcohol use
- Obesity
- Smoking
- Depression
- Social isolation
- Physical inactivity
- Diabetes
- Sleep disturbance



- Prevention potential was **similar** between men and women
- Depression in women
- Traumatic brain injury and excessive alcohol use in men

Potential Population Impact - vs. to High Income Countries

Note. Risk factors available in all studies are presented

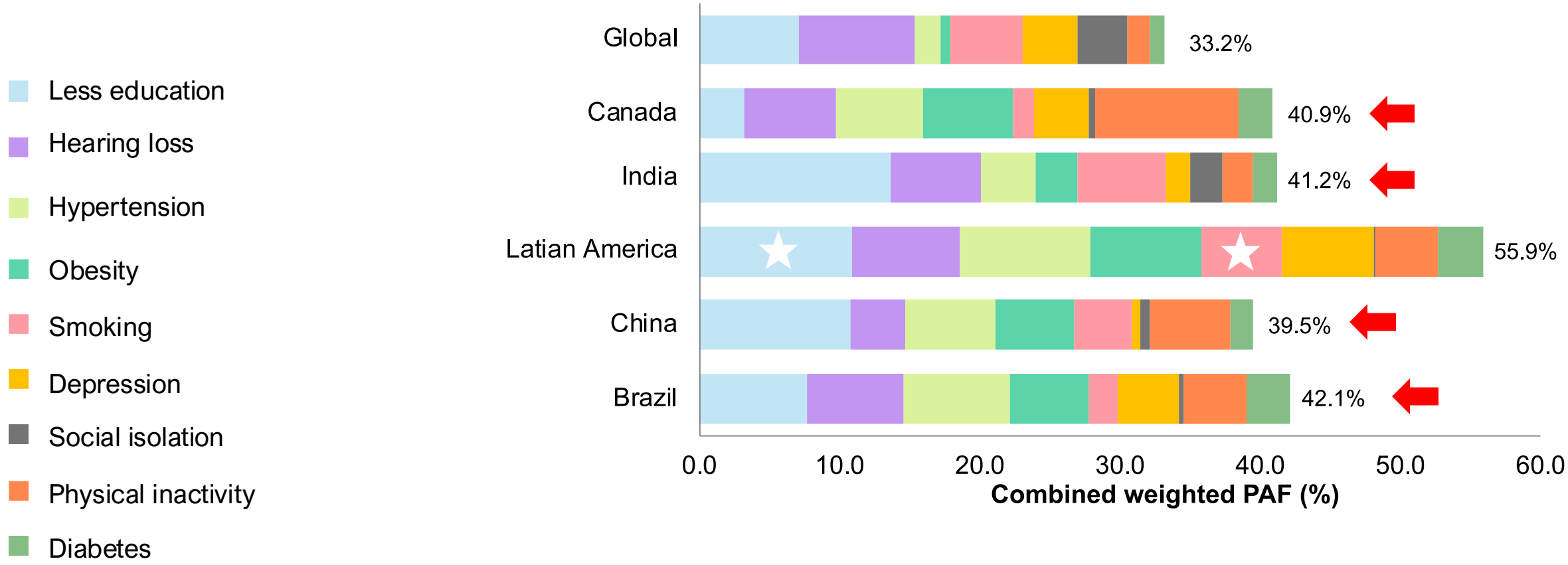


- Prevention potential was **GREATER in Canada & New Zealand**
- Risk factor profiles **varied by countries**
- Risk factor profile of Canada **differed from US**; **similar to Australia & Denmark**
- Prominent risk factors: **Hearing loss, Physical inactivity, Obesity**

Livingston et al. Lancet. 2020; 396: 413-46.
Lee et al. JAMA Netw Open. 2022; 5(7):e2219672; Ma'u et al. Lancet Reg Health West Pac. 2021; 13:100191. See et al. Lancet Public Health. 2023; 8(9):4590-4598. Jorgensen et al. Alzheimers Dement. 2023; 19(10):4590-4598.

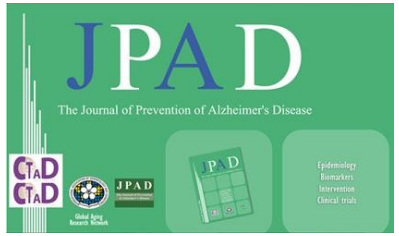
Potential Population Impact – vs. to Low- or Middle- Income Countries

Note. Risk factors available in all studies are presented



- Prevention potential was **similar to low- or middle-income countries**
- Prominent risk factor: **Less education and smoking** (vs. to Canada)

Livingston et al. Lancet. 2020; 396: 413-46. Mukadam et al. Lancet Glob Health. 2019; 7(5):e596-e603. Suemoto et al. Alzheimers Dement. 2023; 19(5):1849-2667.



J Prev Alz Dis 2024;5(11):1490-1499
Published online June 7, 2024, http://dx.doi.org/10.14283/jpad.2024.105

Original Research

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

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Abstract

BACKGROUND: It has been suggested that up to 40% of dementia cases worldwide are associated with modifiable risk factors; however, these estimates are not known in Canada. Furthermore, sleep disturbances, an emerging factor, has not been incorporated into the life-course model of dementia prevention.

OBJECTIVE: To estimate the population impact of 12 modifiable risk factors in Canadian adults including sleep disturbances, by sex and age groups, and to compare with other countries.

DESIGN: Cross-sectional analysis of Canadian Longitudinal Study on Aging baseline data.

SETTING: Community.

PARTICIPANTS: 30,097 adults aged 45 years and older.

MEASUREMMENTS: Prevalence and Population Attributable Fractions (PAFs) associated with less education, hearing loss, traumatic brain injury, hypertension, excessive alcohol, obesity, smoking, depression, social isolation, physical inactivity, diabetes, and sleep disturbances.

RESULTS: The risk factors with the largest PAF were later life physical inactivity (10.2%; 95% CI, 6.8% to 13%), midlife hearing loss (6.5%; 3.7% to 9.3%), midlife obesity (6.4%; 4.1% to 7.7%), and midlife hypertension (6.2%; 2.7% to 9.3%). The PAF of later life sleep disturbances was 3.0% (95% CI, 1.8% to 3.8%). The 12 risk factors accounted for 51.9% (32.2% to 68.0%) of dementia among men and 52.4% (32.5% to 68.7%) among women. Overall, the combined PAF of all risk factors was 49.2% (31.1% to 64.9%), and it increased with age.

CONCLUSION: Nearly up to 50% of dementia cases in Canada are attributable to 12 modifiable risk factors across the lifespan. Canadian risk reduction strategies should prioritize targeting physical inactivity, hearing loss, obesity, and hypertension.

Key words: Dementia, prevention, risk reduction, lifestyle, CLSA.

Received April 5, 2024
Accepted for publication May 17, 2024

Introduction

With rapid global population aging, the number of individuals living with dementia worldwide is expected to triple, from 57 million to 152 million, by 2050 (1). In Canada, dementia prevalence is projected to increase by 187% to 1,712,400 by 2050 (2). Dementia is a multifactorial syndrome that results from multiple pathologies, including those that cause neurodegeneration as well as vascular, metabolic, and inflammatory processes that are associated with potentially modifiable risk factors (3, 4). Lifestyle interventions offer a promising non-pharmacological approach to reducing dementia burden by tempering modifiable risk factors. Risk reduction can potentially be achieved through individual and public health approaches, which could complement emerging disease-modifying treatments directed at the pathological processes (4).

The 2020 Lancet Commission Report on Dementia Prevention, Intervention, and Care (5) indicated that up to 40% of dementia cases worldwide are attributable to 12 modifiable factors comprising health behaviours, illnesses, and environmental exposures across the lifespan, known as the life course model of dementia prevention. This conclusion was reached by estimating the weighted population attributable fraction (PAF), which quantifies the contribution of a given risk factor by combining both prevalence and the association between risk factor and disease, such as risk ratio, while adjusting for intercorrelation among risk factors.

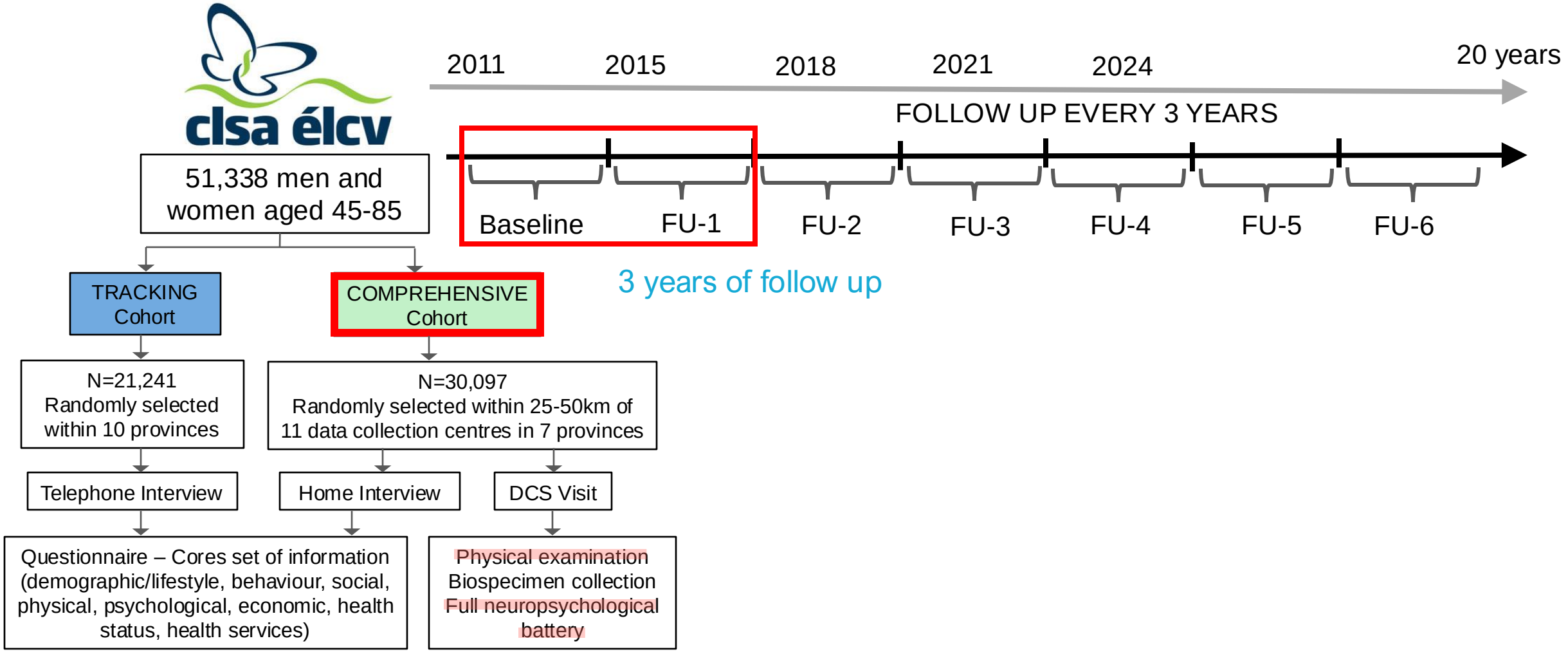
Open-access

Study 2

To identify the **combination** of dementia modifiable risk factors that are **both highly prevalent** and **responsible for greatest cognitive change** in the Canadian population

Canadian Longitudinal Study on Aging

- Baseline and the first follow up data from the Comprehensive cohort



12 Modifiable risk factors

Less Education → Less than secondary school graduation

Hearing Loss → Threshold of >25 dB at 500, 1000, 2000 and 4000 Hz in the better ear using unaided pure tone hearing

Traumatic Brain Injury → A head injury resulted in losing consciousness

Hypertension → Systolic blood pressure >140 mmHg (average of 5 measurements) or self-reported diagnosis of hypertension

Alcohol Consumption → >21 unit of alcohol per week (number of standard drinks was converted using UK National Health Service formula)

Obesity → BMI of ≥30 kg/m^2

Smoking → Current cigarette smoker (in past 30 days)

Depression → Self-reported diagnosis of clinical depression

Social Isolation → Less than one social contact within a month with family, friends, or neighbours

Physical Inactivity → <150 mins of moderate-to-vigorous or <75 mins of vigorous activity (frequency and duration of physical activity reported in PASE was converted to the total hours of physical activity per week)

Diabetes → Self-reported diagnosis of type 2 diabetes

Sleep disturbance → Self-reported poor sleep quality, insomnia, sleep apnea, daytime sleepiness, restless leg syndrome

Livingston et al. Lancet. 2020; 396: 413-46.

Risk factor combinations

- To identify **the five most prevalent dyad, triad, and tetrad combinations of 12 risk factors**, prevalence of all possible combinations were estimated, that were a total of:
  - 66 possible dyad (combination of 2 risk factors)
  - 220 possible triad (combination of 3 risk factors)
  - 495 possible tetrad (combination of 4 risk factors)

Outcome - Cognitive performance

- **Composite NTB (neuropsychological test battery) Z scores**
  - Global: 7 tests
  - Memory: RAVLT Immediate and Delayed (5 minutes) word recall
  - Executive function: Category fluency, Animal fluency, Mental Alteration test, Victoria Stroop test)
- Higher score indicates better performance
- Widely used primary outcome in dementia clinical trials

Data analysis

- Linear mixed effects model to assess the association between risk factor combinations and change in cognition
- 2 modelling strategies:

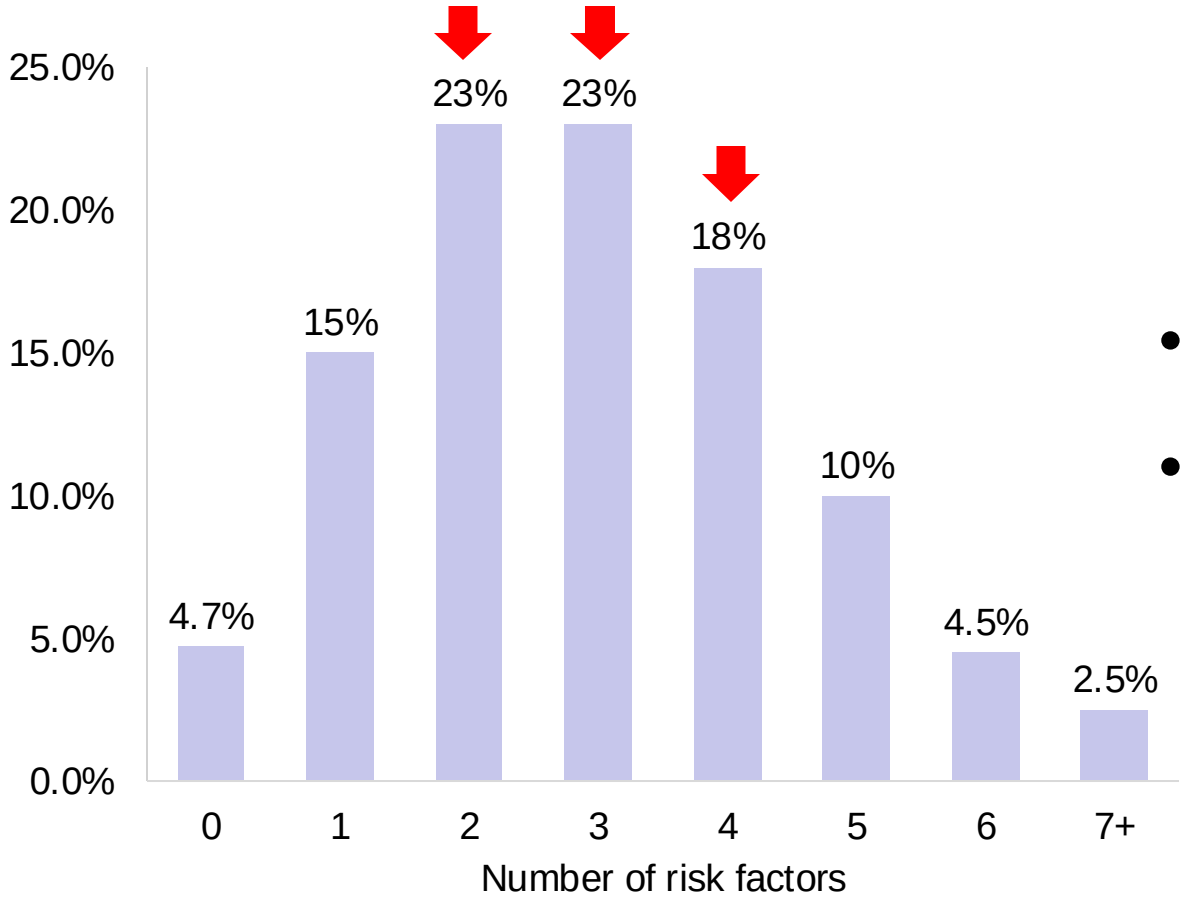
To assess **the pooled effect** of risk factor combinations → Risk factor combinations were fitted as binary indicator of the combination (yes or no) and interaction between the combination and time was also included

To assess whether the **joint effect** of risk factor combination is **greater than the sum of the individual effects** (**biological interaction**) → Each risk factor was fitted as an individual main effect and interaction between all these risk factors and time was also included

Data analysis

- Linear mixed effects model to estimate the association between risk factor combinations and change in cognition
- 2 modelling strategies:
- Analyses were limited to the top 5 most prevalent combinations
- Effect measure: **Mean difference in change in cognition between the groups** (over 3 years)
- Adjusted for age, sex, and risk factors that were not included in the combination
- Model was weighted with analytic weights

Number of risk factors



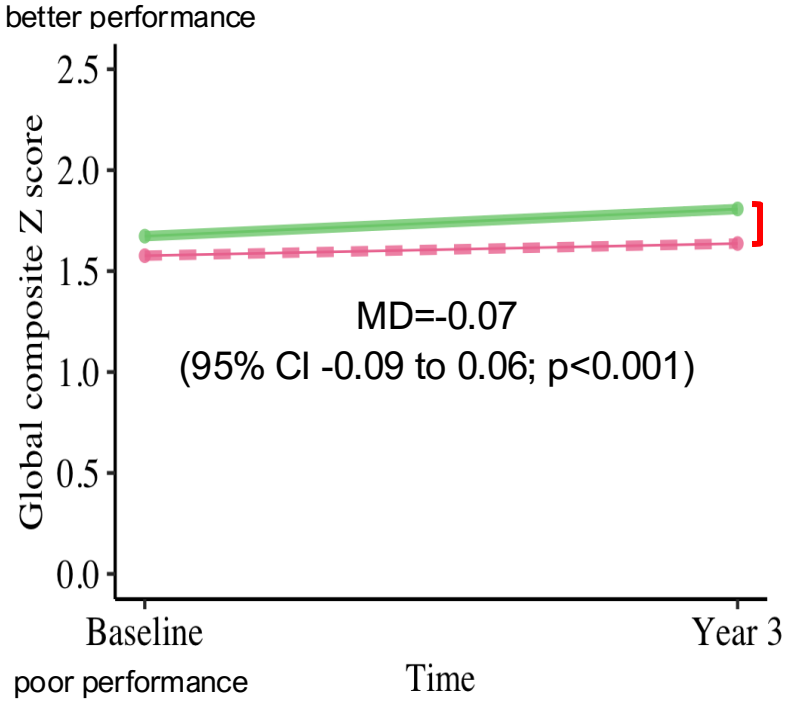
- **95%** of participants had **at least 1** risk factor
- **80%** of participants had **2 or more** risk factors

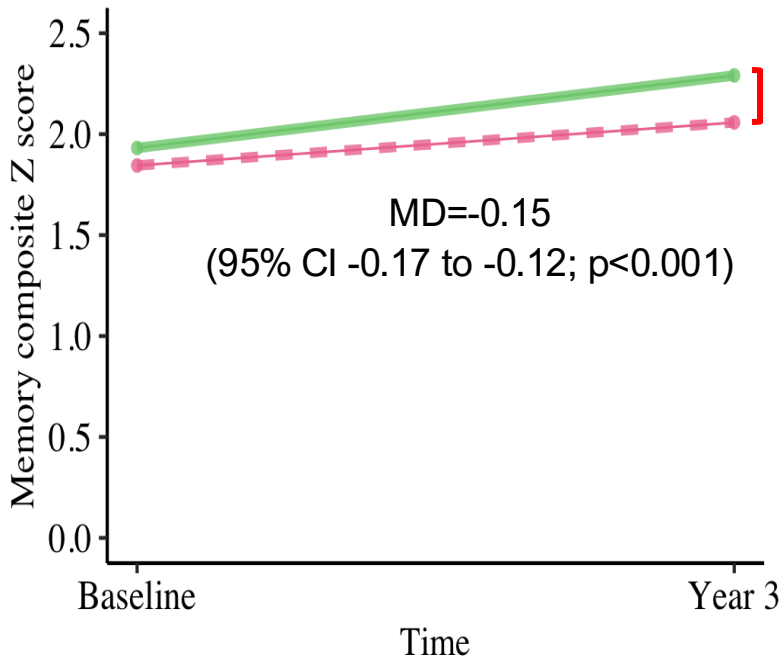
Five most prevalent combinations

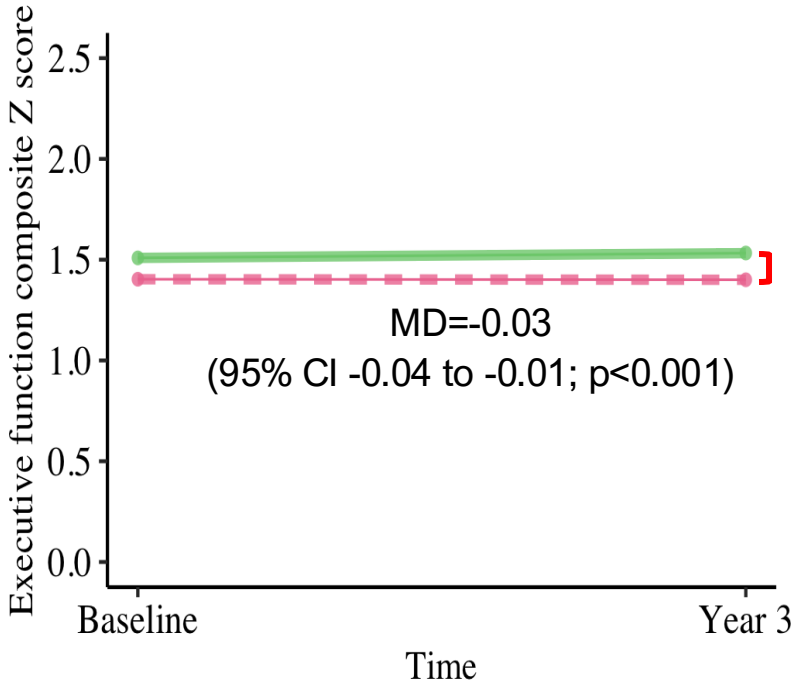
	Combination	Prevalence (%)
Dyad	**Physical inactivity + Sleep disturbance**	**35**
	Hypertension + Physical inactivity	30
	Hearing loss + Physical inactivity	27
	Obesity + Physical inactivity	25
	Hypertension + Sleep disturbance	18
Triad	**Hypertension + Physical inactivity + Sleep disturbance**	**15**
	Hearing loss + Hypertension + Physical inactivity	14
	Hypertension + Obesity + Physical inactivity	14
	Obesity + Physical inactivity + Sleep disturbance	14
	Hypertension + Obesity + Physical inactivity	14
Tetrad	**Hypertension + Obesity + Physical inactivity + Sleep disturbance**	**7.9**
	Hearing loss + Hypertension + Physical inactivity + Sleep disturbance	6.8
	Hearing loss + Hypertension + Obesity + Physical inactivity	5.9
	Hearing loss + Obesity + Physical inactivity + Sleep disturbance	5.1
	Hearing loss + Hypertension + Obesity + Sleep disturbance	3.8

Dyad combination with the strongest association

- Overall cognition improved over time
- **Combination of hearing loss and physical inactivity** had the strongest detrimental effect on cognitive changes



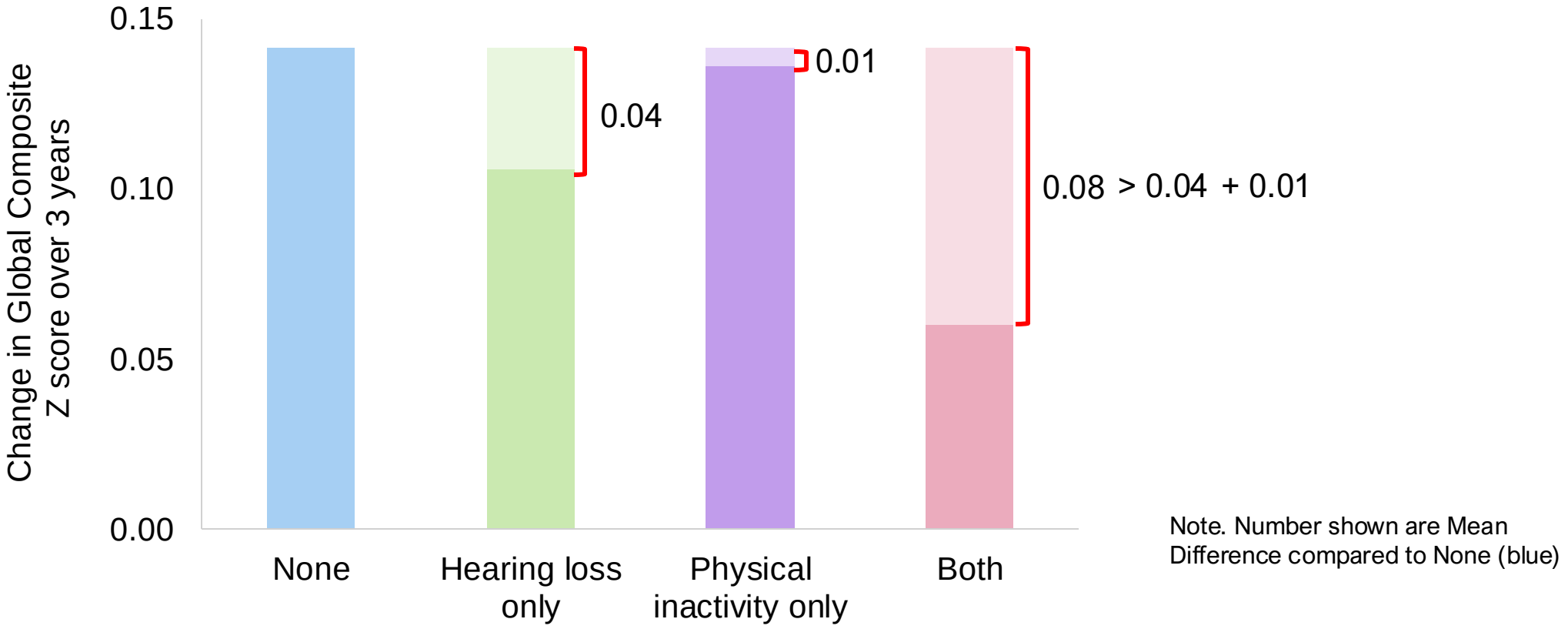




No hearing loss + Physical inactivity

Hearing loss + Physical inactivity

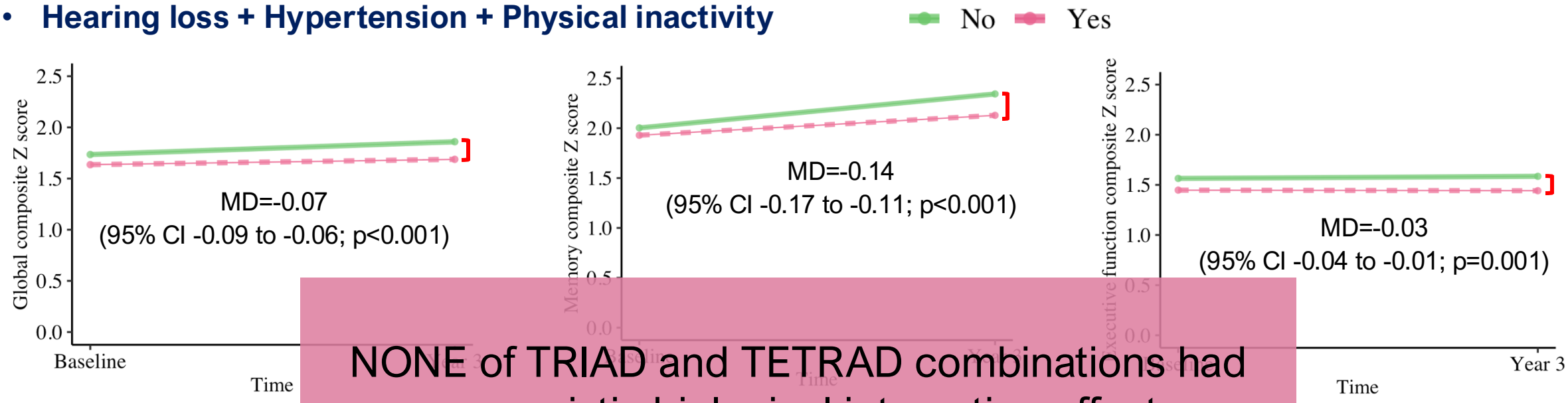
Dyad combination – Biological Interaction



- The **joint effect** of hearing loss and physical inactivity was **lager than the sum of individual effect** of **hearing loss and physical inactivity** – **synergistic effect on additive scale**
- Synergistic biological interaction was not observed among other combinations

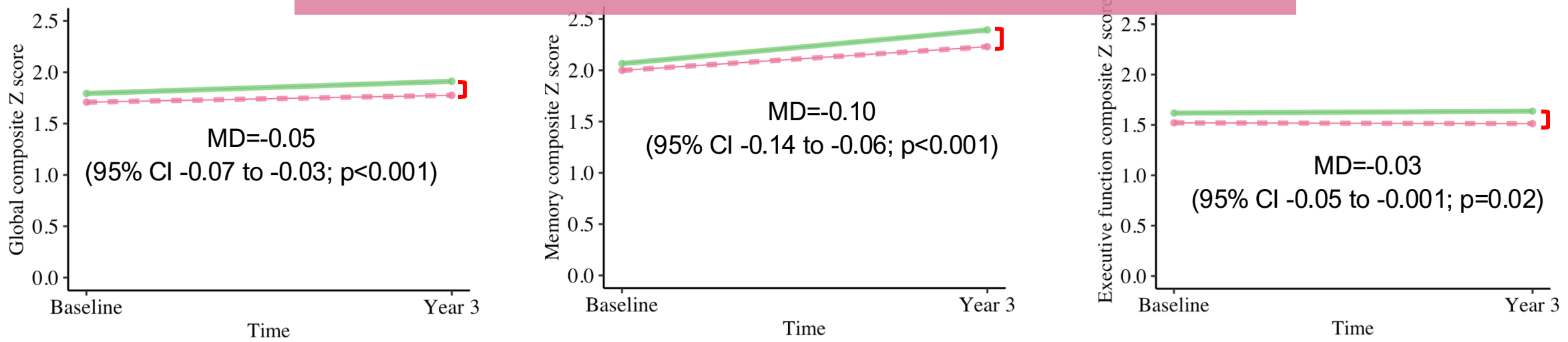
Triad and tetrad combination with strongest association

- **Hearing loss + Hypertension + Physical inactivity**



NONE of TRIAD and TETRAD combinations had synergistic biological interaction effect

- **Hearing loss + Hypertension + Physical inactivity + Sleep disturbance**



- **Up to 50%** of dementia cases in Canada are attributed to **12 modifiable risk factors** – **a great potential for dementia prevention** in Canada!
- The **prevention potential was already large at midlife** – the importance of **implementing public health strategies from midlife**, not later life
- Strategies to **increase physical activity and promote effective management of hearing health, obesity, and hypertension** have the **greatest potential** to mitigate a **large proportion of dementia cases** in Canada!
- **Targeting hearing loss and physical inactivity** in multidomain intervention trial may offer the greatest potential on reducing dementia risk compared to other combinations!

So, What's Next?

Limitation

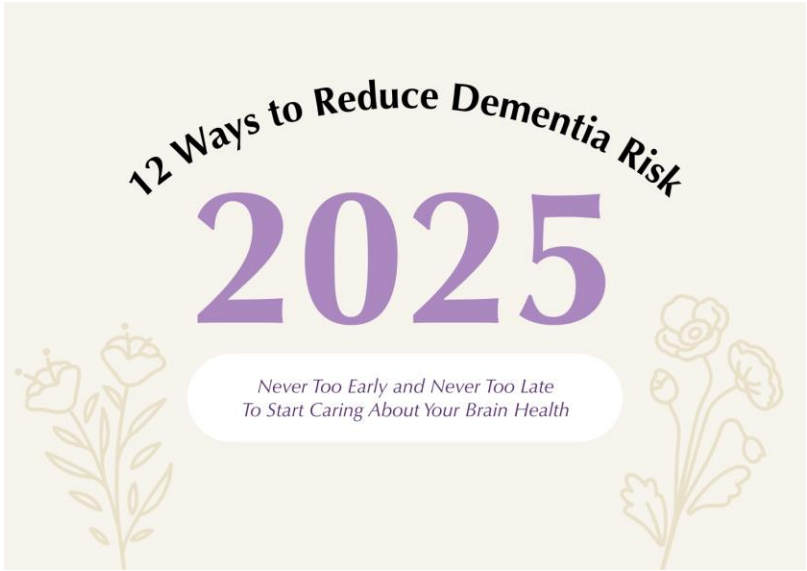
- Recently Lancet Commission added 2 new risk factors (high LDL cholesterol and visual loss) and re-classified some later life risk factors to midlife risk factors
- Relatively short follow up data to assess cognitive change and dementia risk

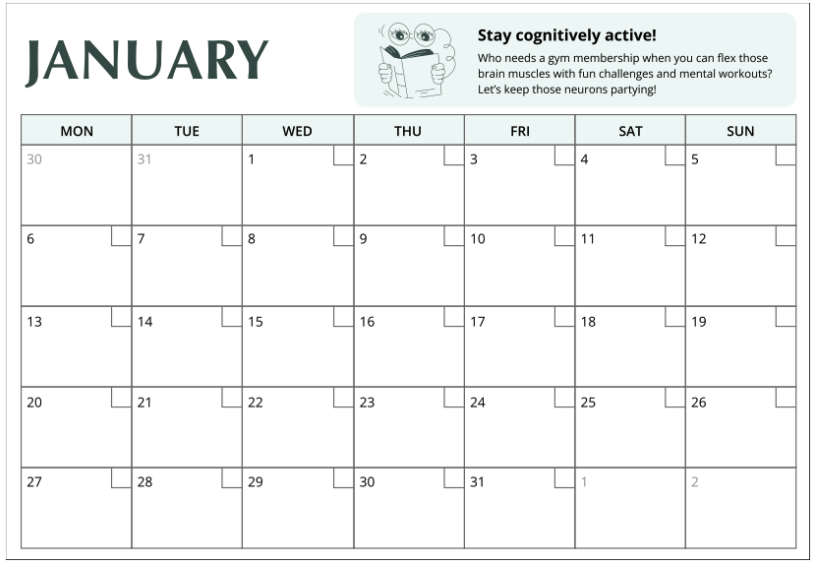
Future Research

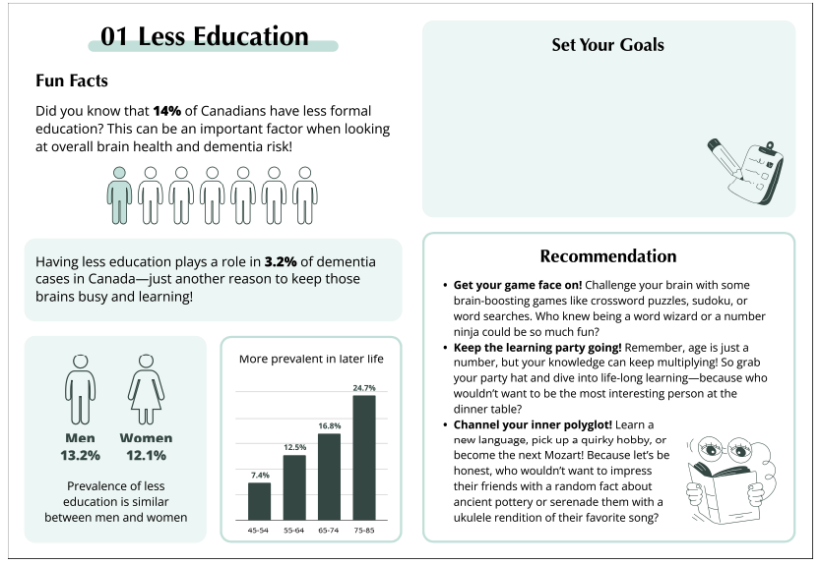
- Utilize longer follow up data and data linkage
- Use relative risk reflecting Canadian population
- Incorporate change in risk factor levels and its impact on cognition

Desk Calendar for Dementia Prevention and Risk Reduction

- Desk calendar was created using Knowledge Translation and Exchange Program Funding from the Knowledge Translation and Exchange Program of the Canadian Consortium on Neurodegeneration in Aging.







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Acknowledgement

Dr. Mark Speechley
Dr. GY Zou
Prof. Francesca Mangialasche
Dr. Howard Chertkow
Dr. Haakon Nygaard
Dr. Frederico Pieruccini-Faria
Dr. Manuel Montero-Odasso
Prof. Miia Kivipelto
Dr. Howard Feldman
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Melissa Calleja
Diana Amaris
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The present work is supported by

- Ontario Graduate Scholarship
- CCNA Synapse Funds
- Alzheimer Society London and Middlesex Scholarship
- Western Deans Research Scholarship

Thank you

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