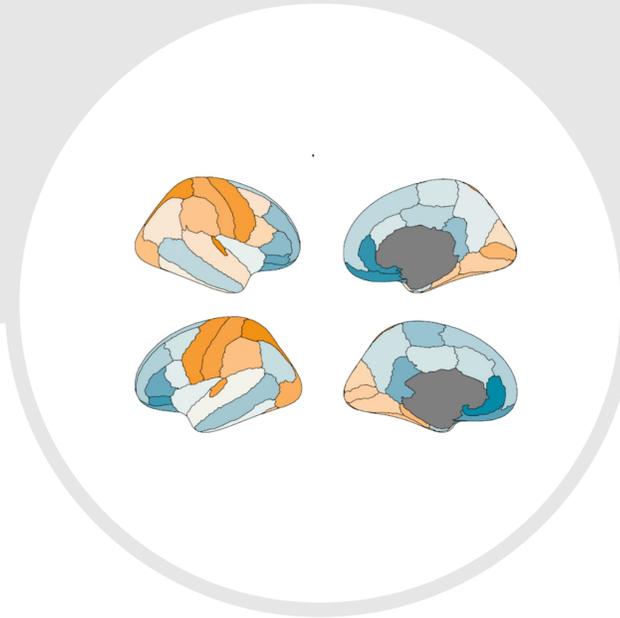


# Mindful of your Waistline: The Relationship Between Obesity, Brain Atrophy, and Cognitive Decline

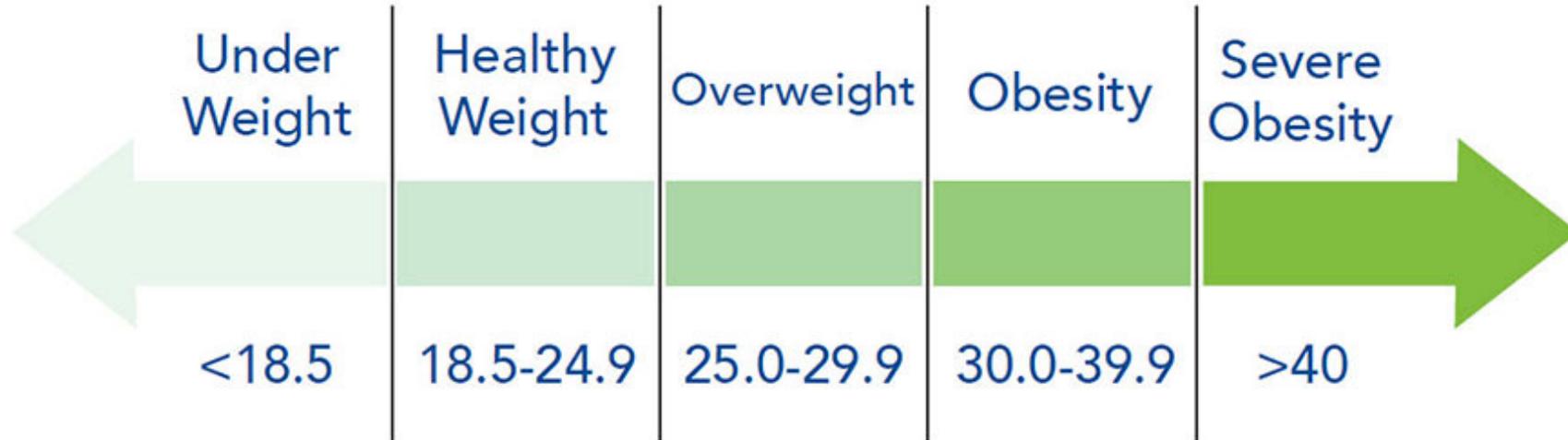


Filip Morys

# What is obesity?

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## Weight Categories Based on BMI



## Poll #1

What percentage of the adult population have obesity or overweight?

- a) 13%
- b) 39%
- c) 52%

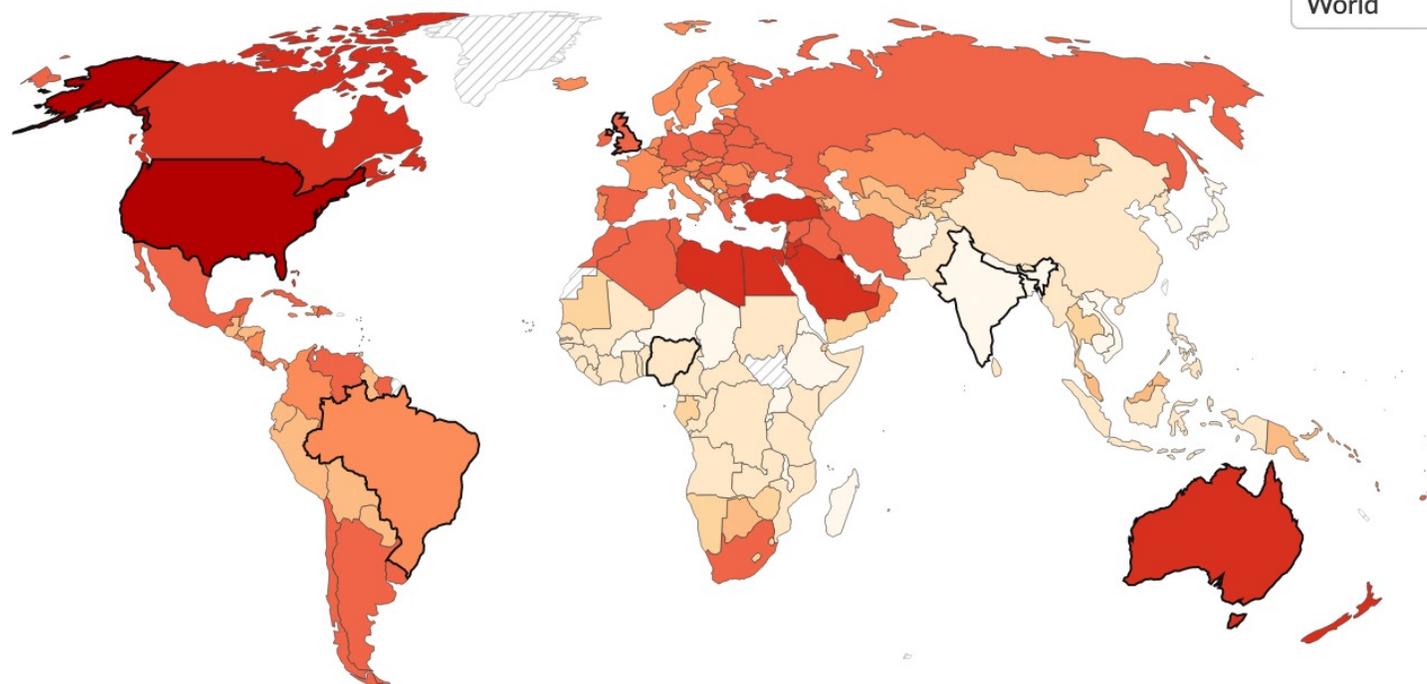
# Incidence and health consequences of obesity

## Obesity in adults, 2016

Estimated prevalence of obesity, based on general population surveys and statistical modeling.

Our World  
in Data

World



<https://ourworldindata.org/obesity#what-share-of-adults-are-obese>

# Incidence and health consequences of obesity

## Obesity is highly prevalent in Canada.

**3x**

**Three-fold**  
increase in self-reported  
prevalence from 1985<sup>5</sup>



**1 in 4**  
Canadian adults  
were obese as  
of 2013<sup>6</sup>



**1 in 9**  
Canadian adults had  
class II or III obesity (BMI  
 $\geq 35$  kg/m<sup>2</sup>) as of 2013<sup>6</sup>

## Studies have shown various health consequences of class II obesity:<sup>10-12</sup>

Health Examinations and Nutrition Survey data from 2003-10.

**A**

**5-8 times**

greater prevalence of  
type 2 diabetes<sup>10</sup>

**B**

**2-fold**

greater prevalence of  
hypertension<sup>10</sup>

**C**

**2-3 times**

greater prevalence of  
coronary heart disease<sup>10</sup>

**D**

**1.3 times**

greater prevalence of  
dyslipidemia<sup>10</sup>

**E**

**5-fold**

greater risk of major  
depression<sup>11</sup>

**F**

**>17 times**

greater prevalence of  
sleep apnea<sup>12</sup>

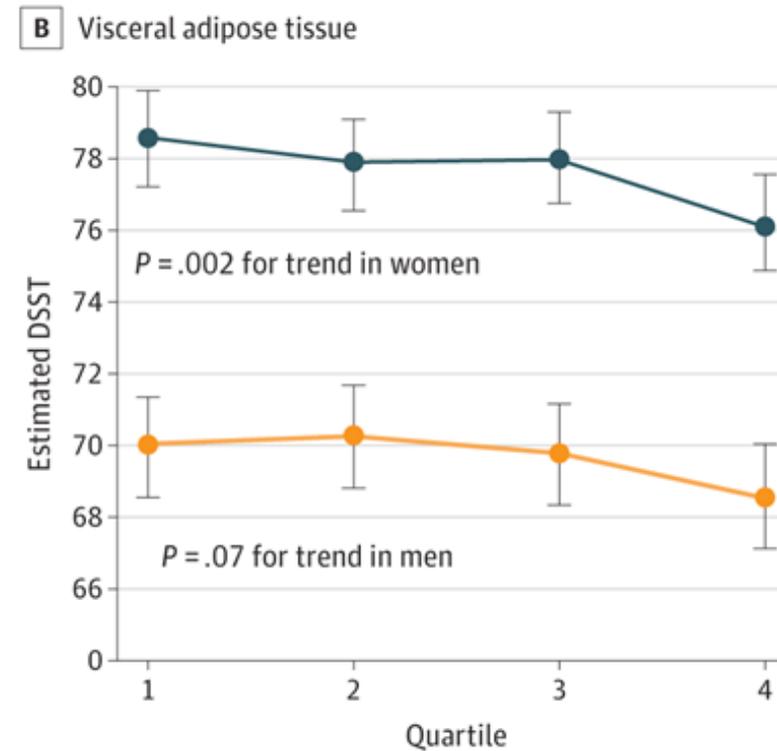
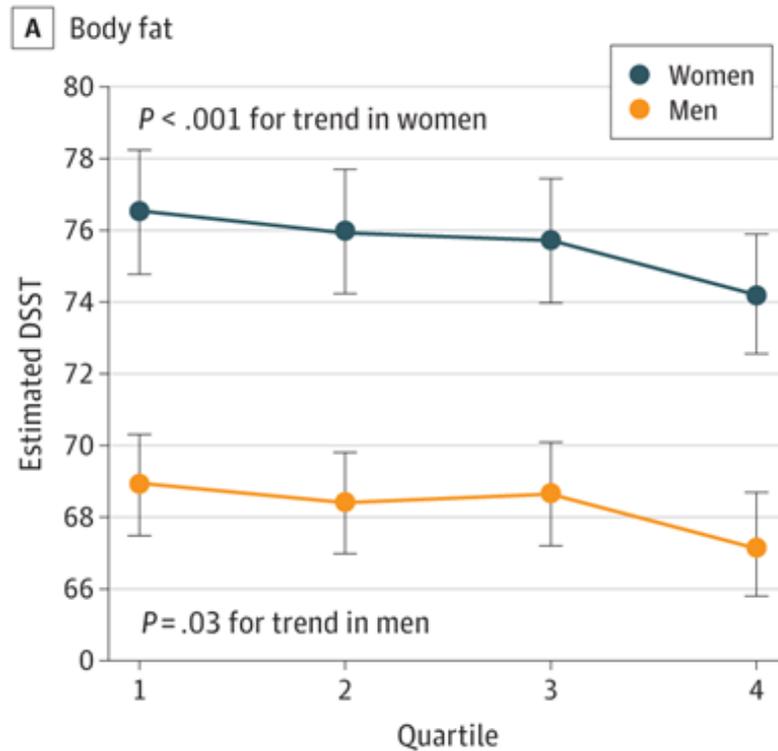
**G**

**2-3 times**

greater prevalence of  
osteoarthritis<sup>10</sup>

Multiple chronic diseases are associated with obesity.<sup>13</sup>

# Obesity in adults is related to cognitive decline

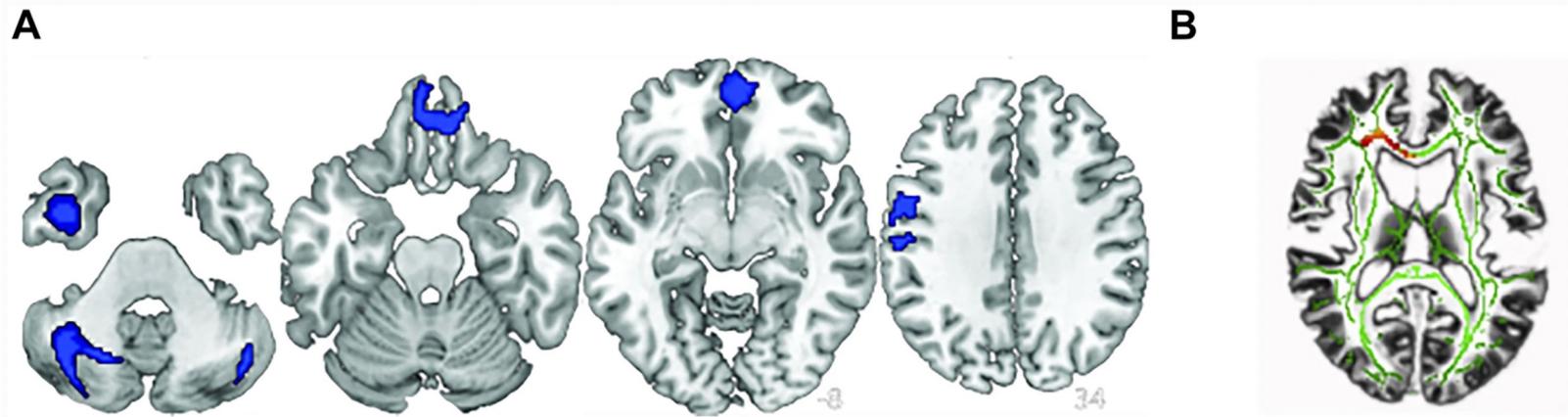


Variable	Bioimpedance total body adiposity				P value for trend <sup>b</sup>	Visceral adipose tissue				P value for trend <sup>b</sup>
	Percentage of BF sex-specific quartiles					Visceral adipose tissue sex-specific quartiles				
	1	2	3	4		1	2	3	4	
MoCA score	27.1 (27.0-27.1)	27.0 (26.9-27.1)	27.0 (26.9-27.1)	26.8 (26.7-26.9)	.003	27.2 (27.1-27.3)	27.2 (27.1-27.3)	27.1 (27.0-27.2)	27.1 (27.0-27.2)	.19

Anand et al., 2022

# Obesity in adults is related to brain changes

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Garcia-Garcia et al., 2022

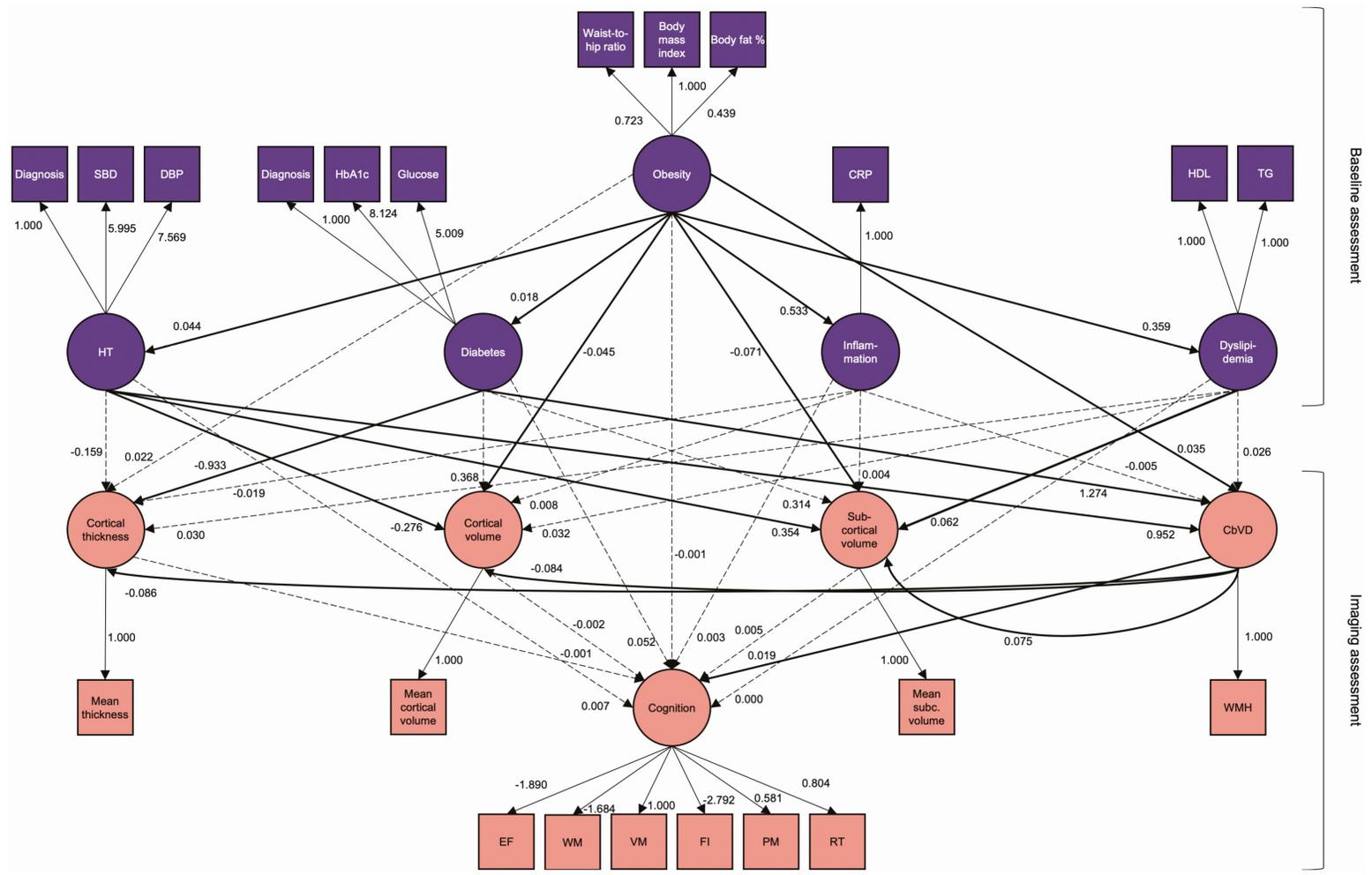
## Poll #2

What factors link obesity and cognitive decline?

- a) Changes in brain vasculature
- b) Neuroinflammation
- c) Changes in the blood brain barrier
- d) Dyslipidemia
- e) All of the above

# Association Between Midlife Obesity and Its Metabolic Consequences, Cerebrovascular Disease, and Cognitive Decline

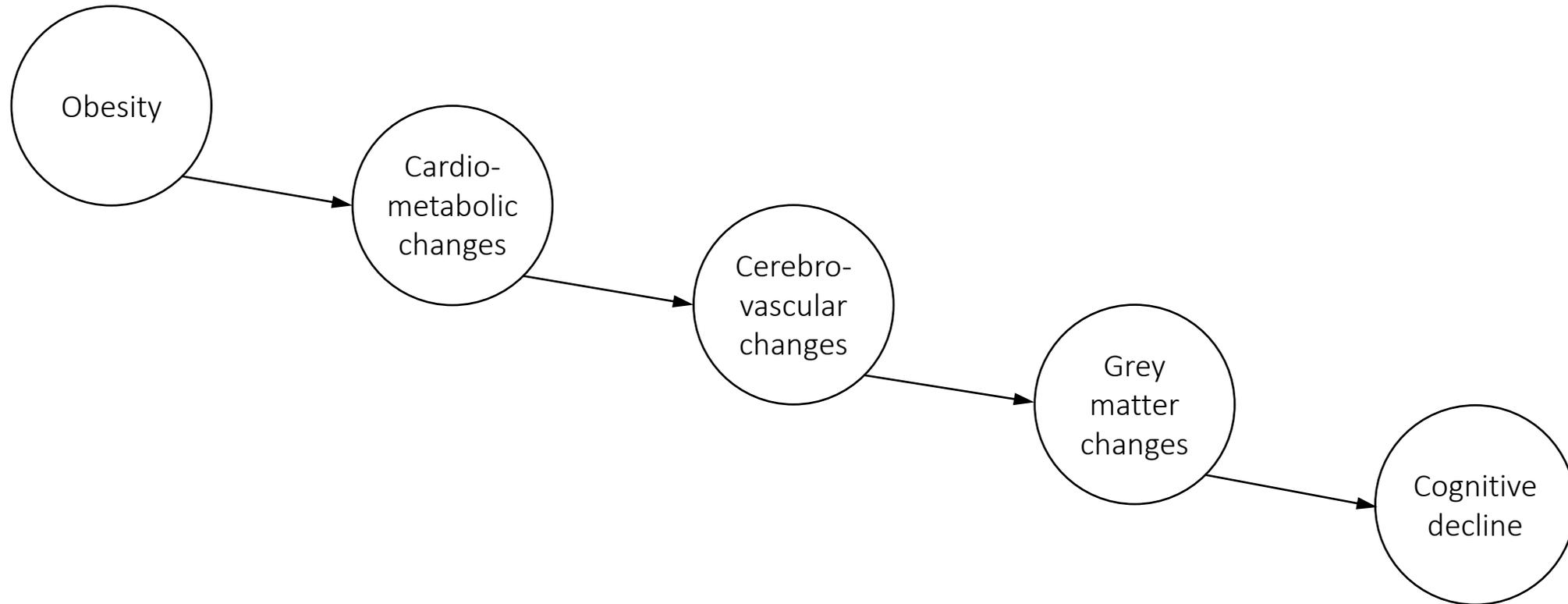
Filip Morys, Mahsa Dadar, Alain Dagher



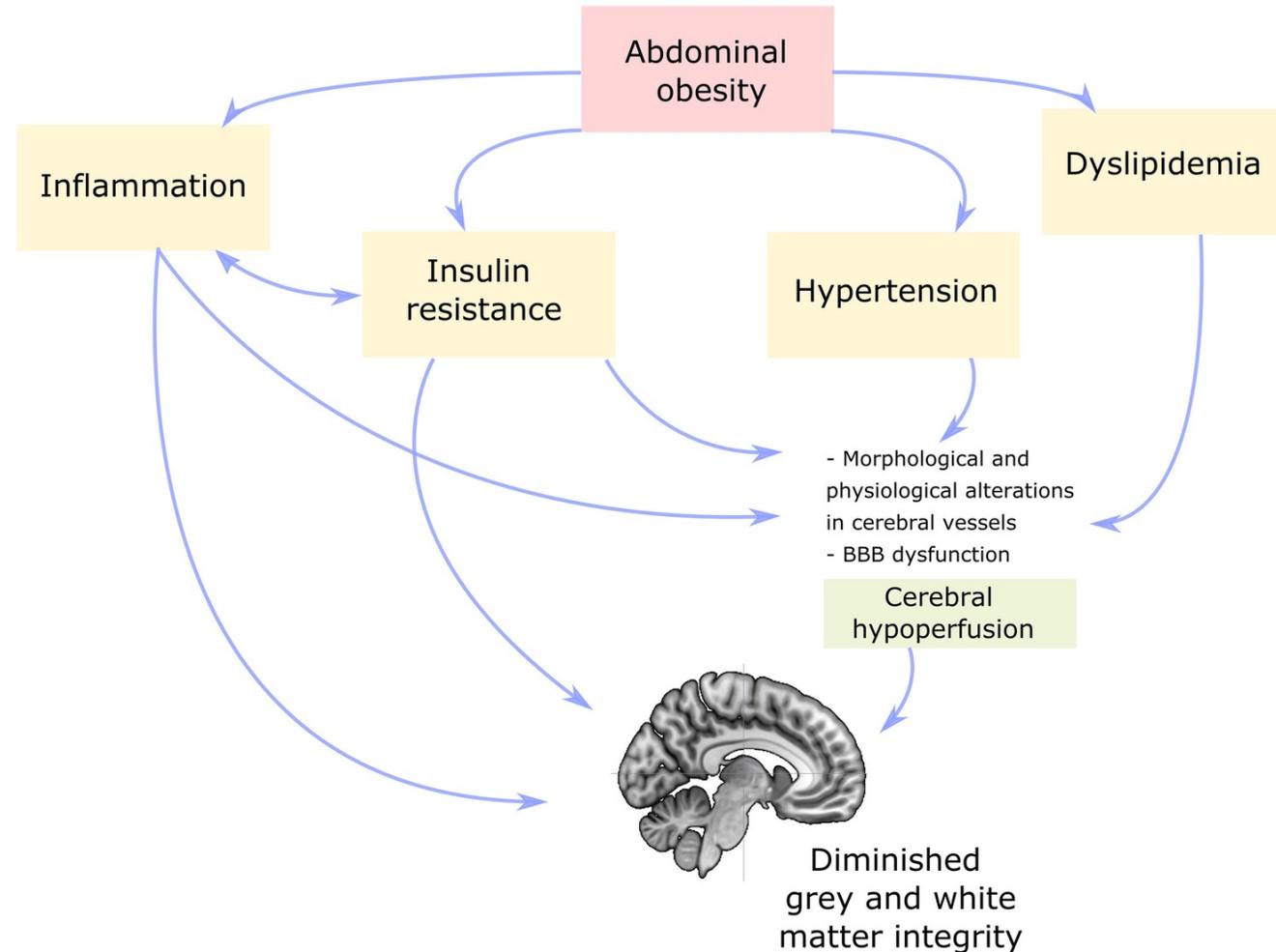
# Association Between Midlife Obesity and Its Metabolic Consequences, Cerebrovascular Disease, and Cognitive Decline 🗝️

Filip Morys ✉️, Mahsa Dadar, Alain Dagher

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# Summary of mechanisms relating obesity to brain changes

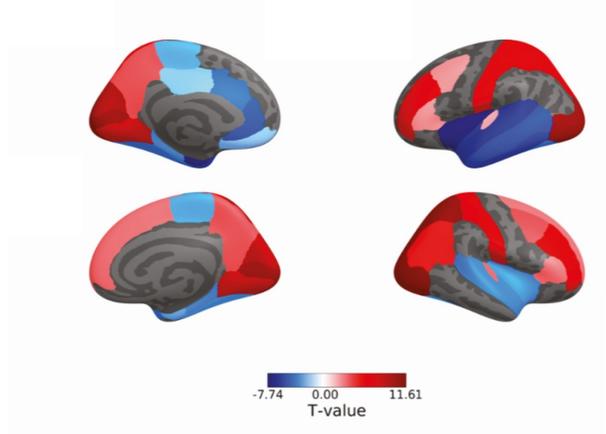


Garcia-Garcia et al., 2022

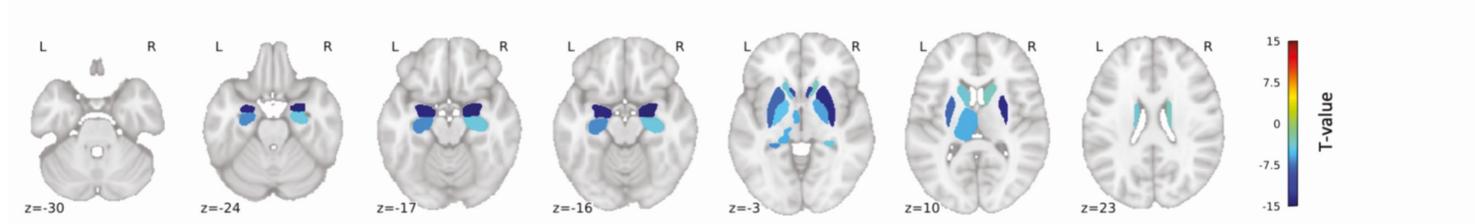
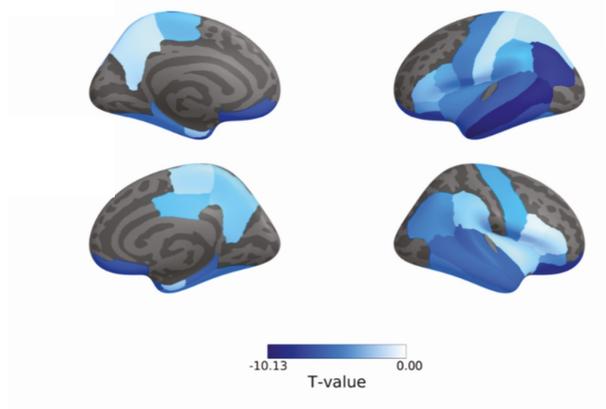
# Association Between Midlife Obesity and Its Metabolic Consequences, Cerebrovascular Disease, and Cognitive Decline

Filip Morys , Mahsa Dadar, Alain Dagher

Cortical thickness



Cortical volume

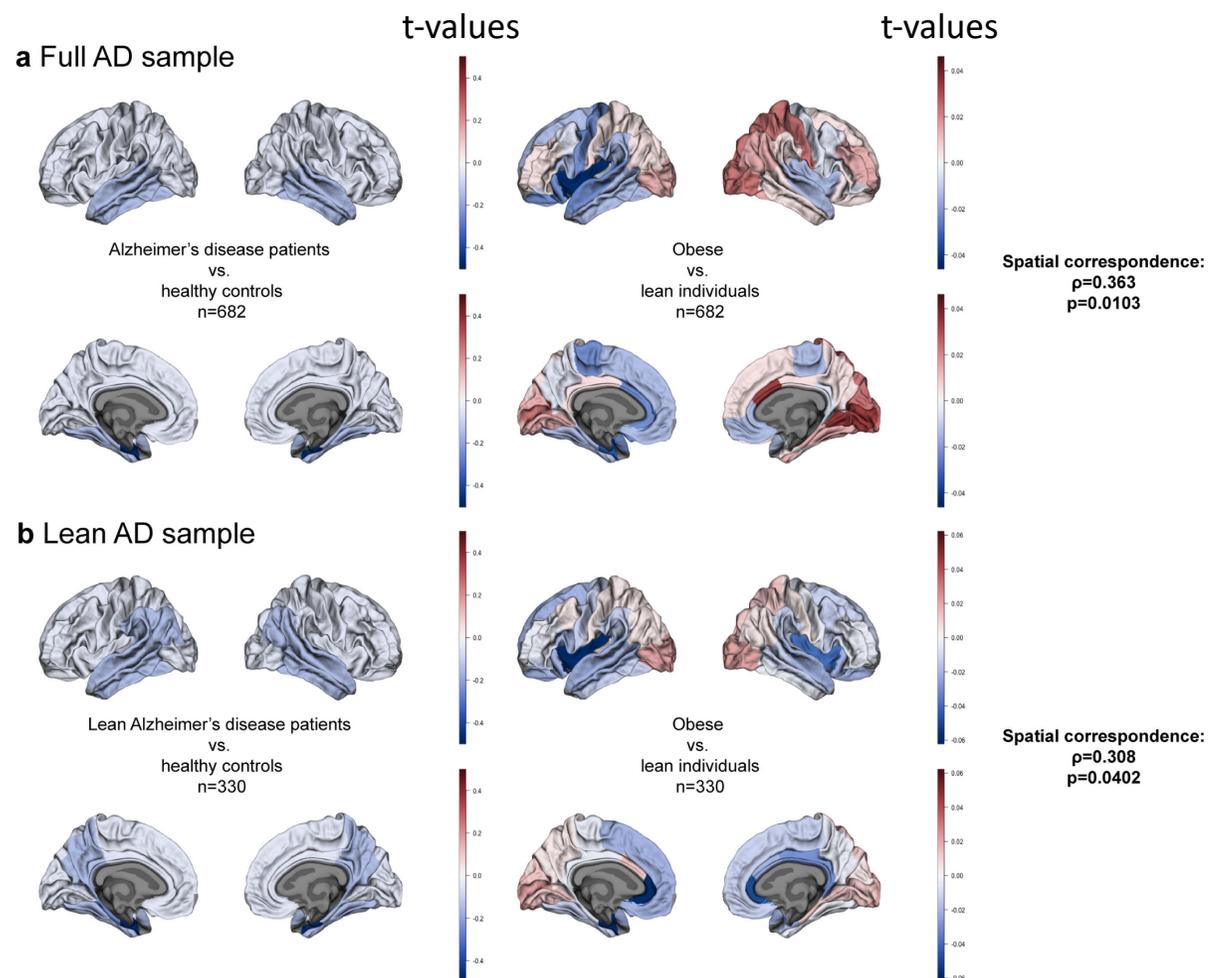


Subcortical volumes

# Obesity-Associated Neurodegeneration Pattern Mimics Alzheimer's Disease in an Observational Cohort Study

Article type: Research Article

Authors: Morys, Filip<sup>a,\*</sup> | Potvin, Olivier<sup>b</sup> | Zeighami, Yashar<sup>a,c</sup> | Vogel, Jacob<sup>a</sup> | Lamontagne-Caron, Rémi<sup>b</sup> | Duchesne, Simon<sup>b,d</sup> | Dagher, Alain<sup>a</sup> | for the Alzheimer's Disease Neuroimaging Initiative<sup>1</sup>



# Interim summary

Obesity leads to brain changes and cognitive decline

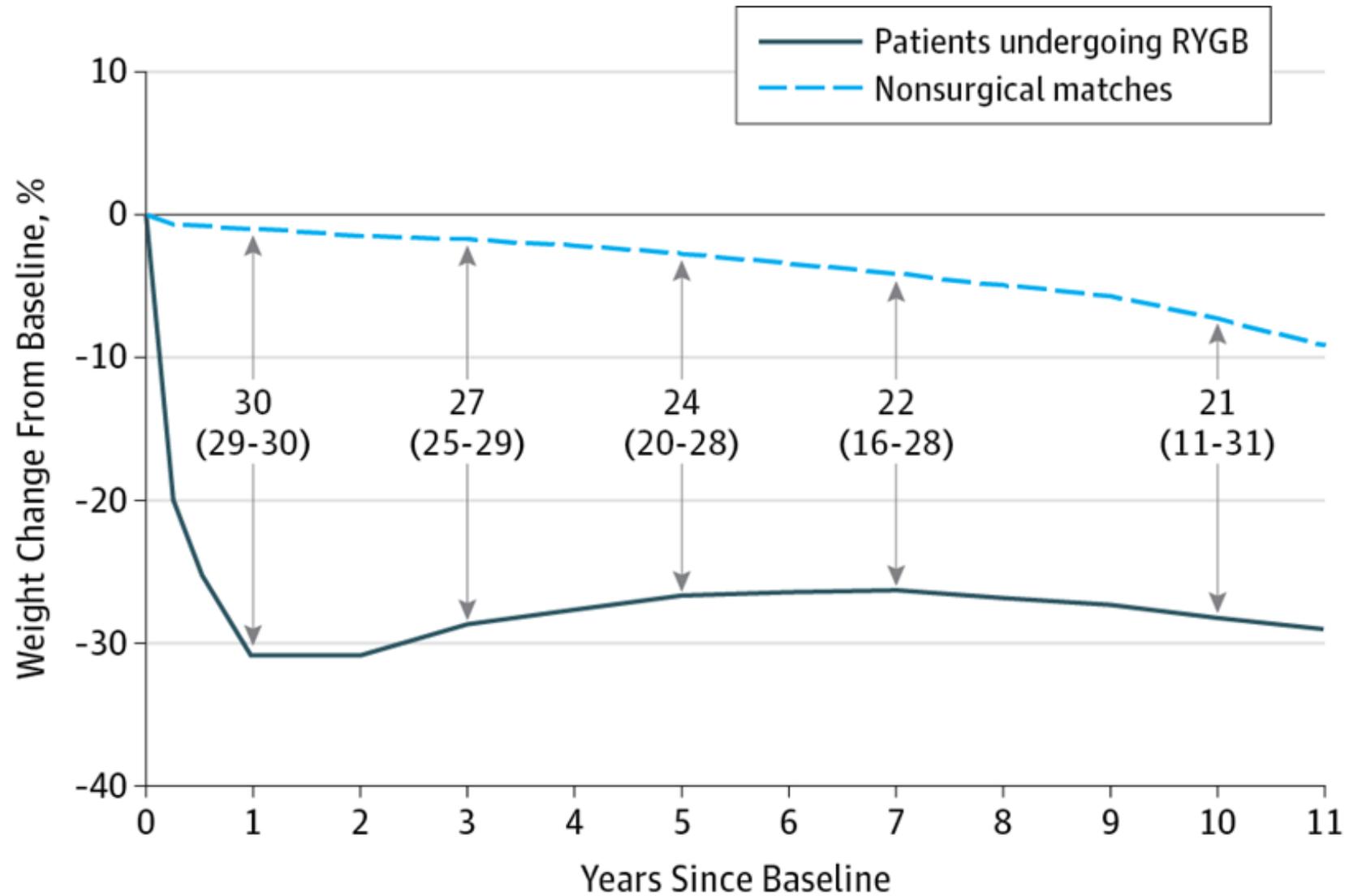
Obesity-related brain changes are similar to those in Alzheimer's disease

## Poll #3

Can weight loss lead to improvement of neurocognition?

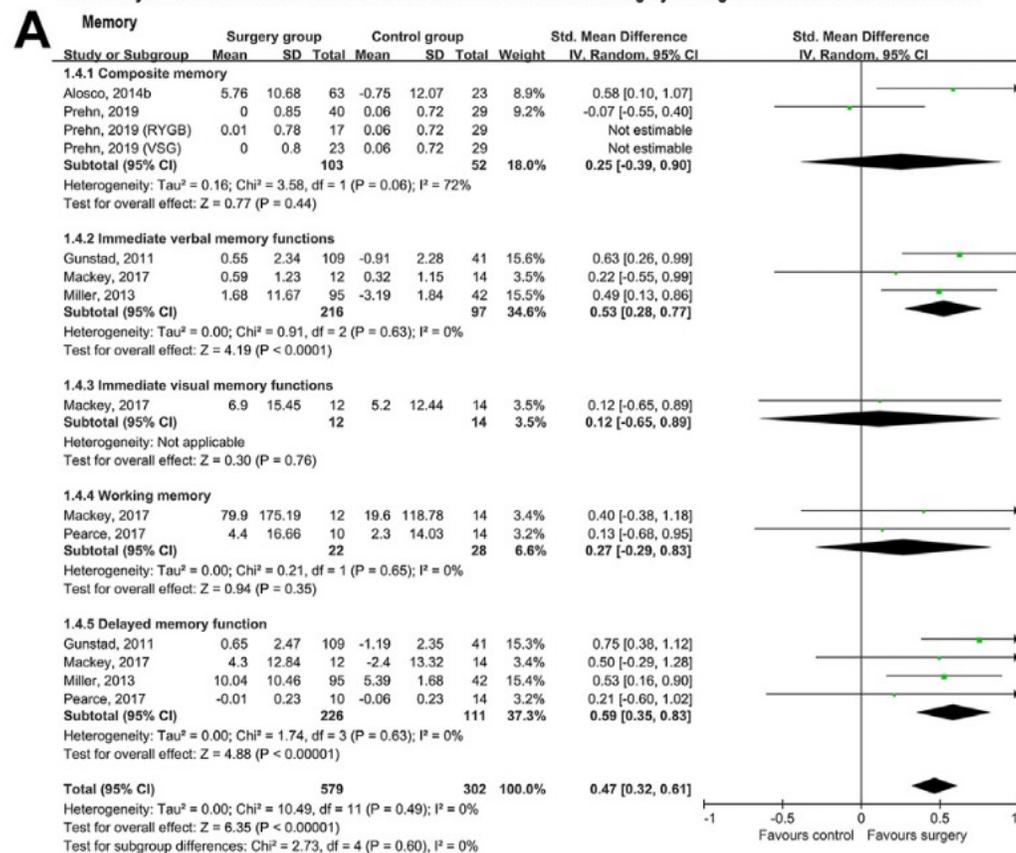
- a) Yes
- b) No

# Bariatric surgery

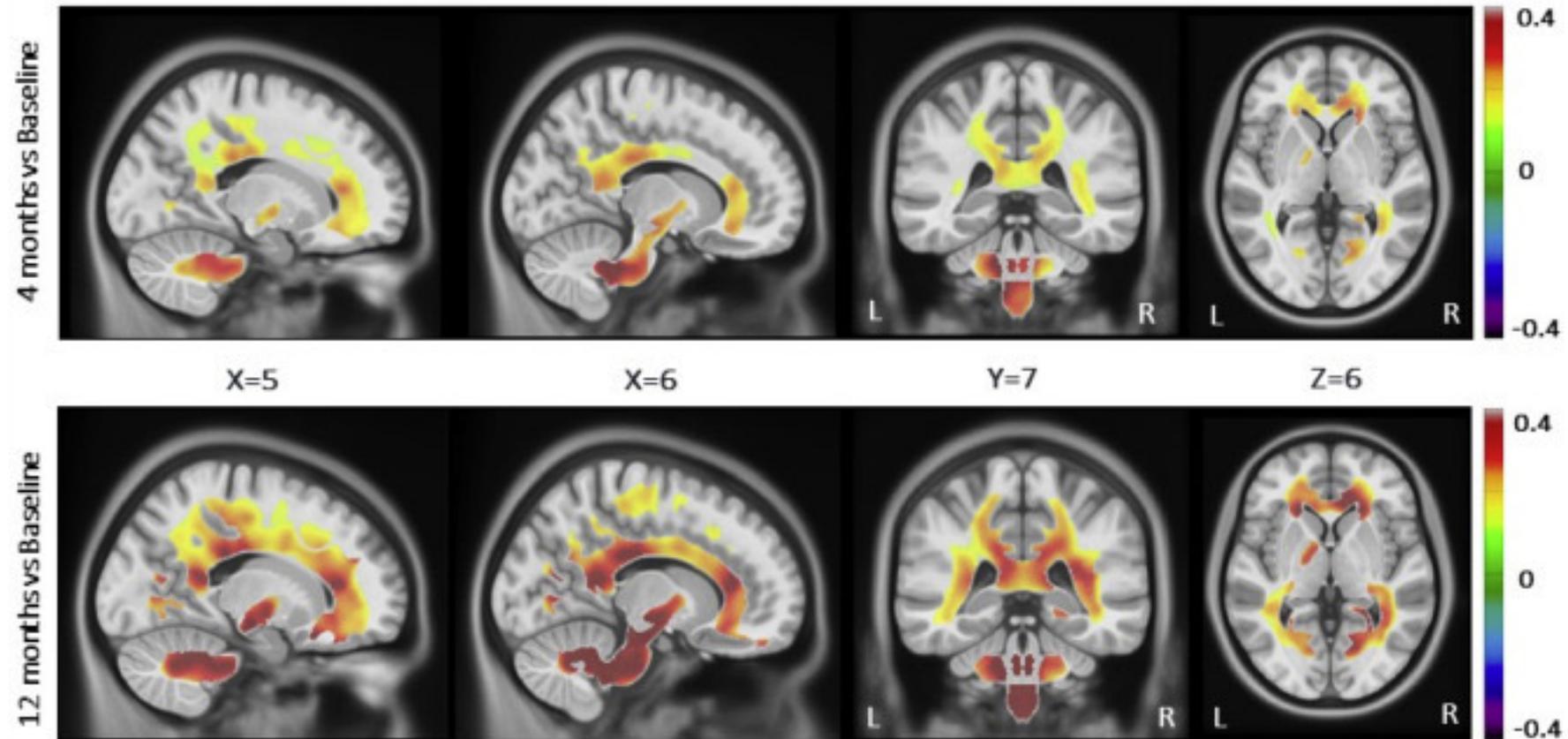


# Cognitive improvement after bariatric surgery

Meta-analysis of cohort studies about the short-term effect of bariatric surgery on cognitive domains and subdomains.

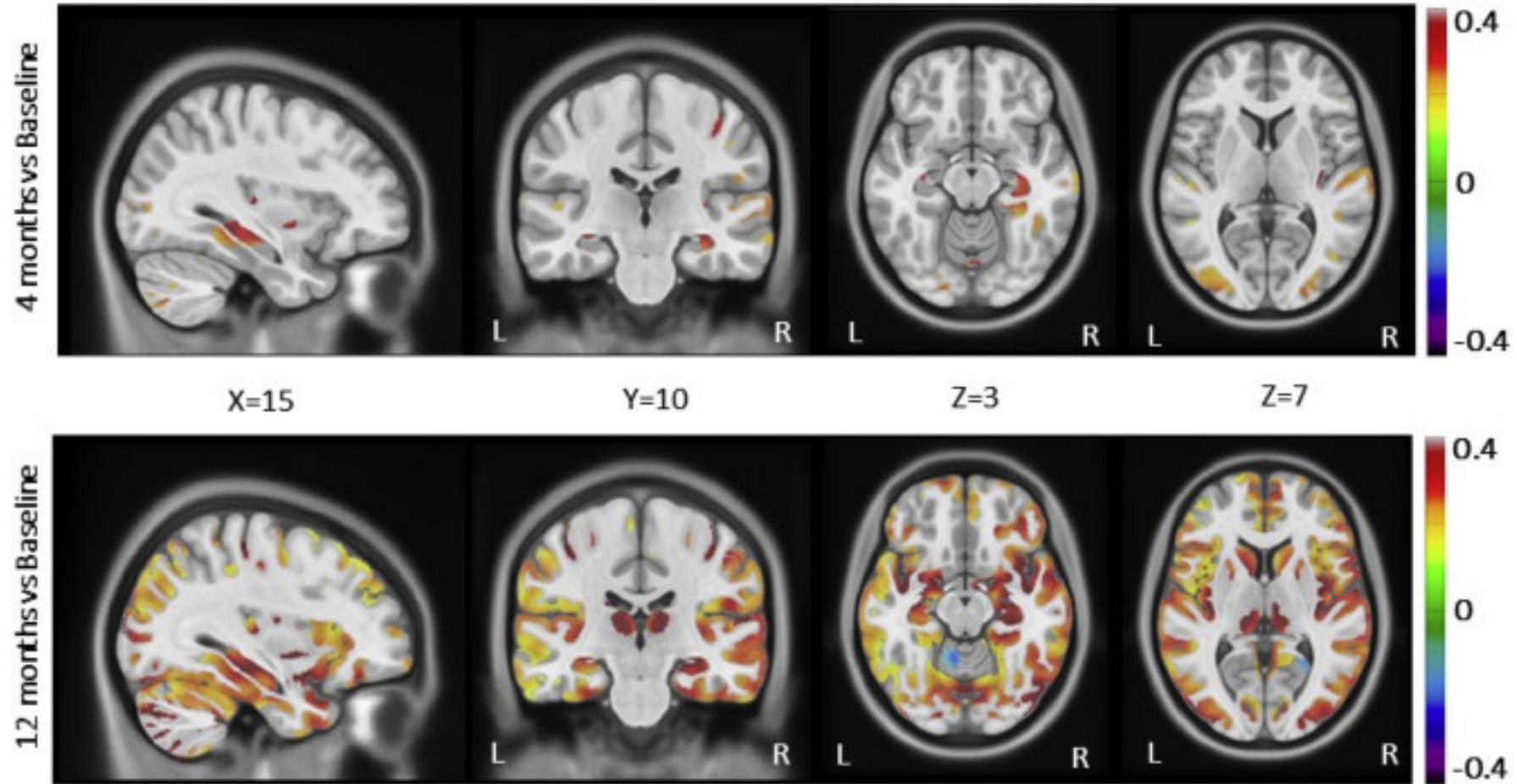


# Brain health improvement after bariatric surgery



Michaud et al., 2020

# Brain health improvement after bariatric surgery



Michaud et al., 2020

# Interim summary

Neurocognitive changes in obesity can be reversed with weight loss

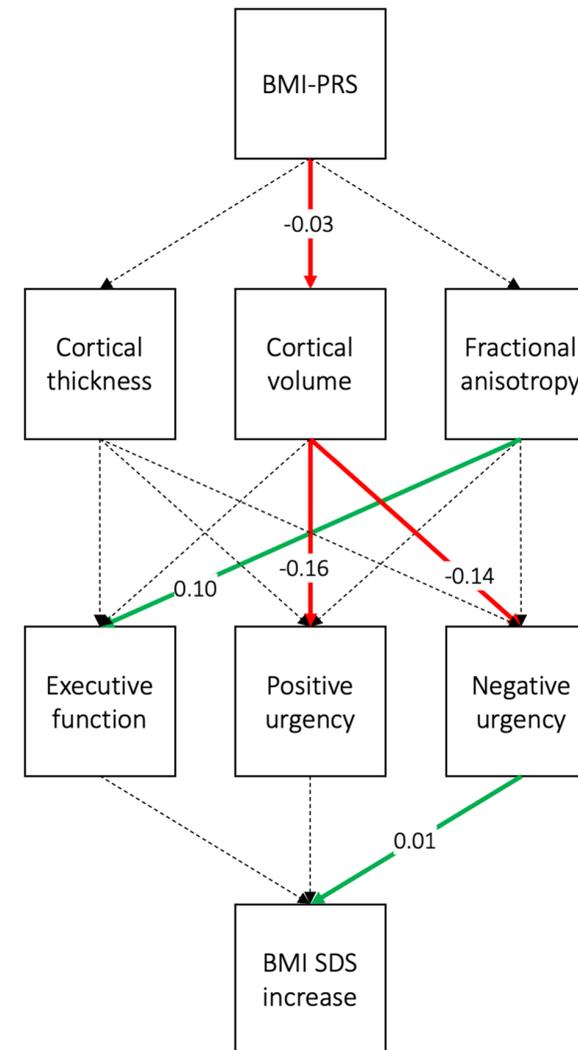
# Can cognitive and brain changes lead to obesity?

Genetic risk for obesity

Brain changes

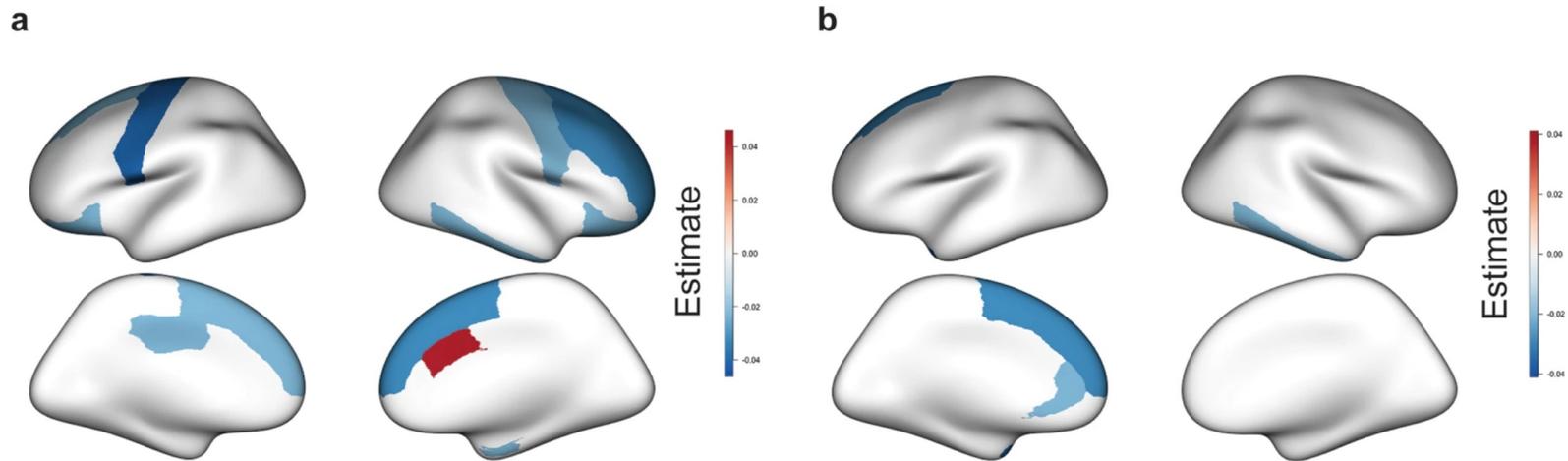
Behavioural changes

Increase in BMI



# Can cognitive and brain changes lead to obesity?

Changes in the brain reflecting genetic risk for obesity



# Summary

- Obesity is extremely prevalent in the world
- It is related to multiple chronic diseases and is a major modifiable risk factor for cognitive decline and dementia
- Mechanisms linking obesity to cognitive decline are changes in the brain occurring as effects of dyslipidemia, hypertension, diabetes, or systemic inflammation
- Obesity-related brain changes can be reversed by weight loss
- Changes in neurocognition can also lead to obesity

# Acknowledgements

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UNIVERSITÄT  
LEIPZIG



MAX PLANCK INSTITUTE  
FOR HUMAN COGNITIVE AND BRAIN SCIENCES



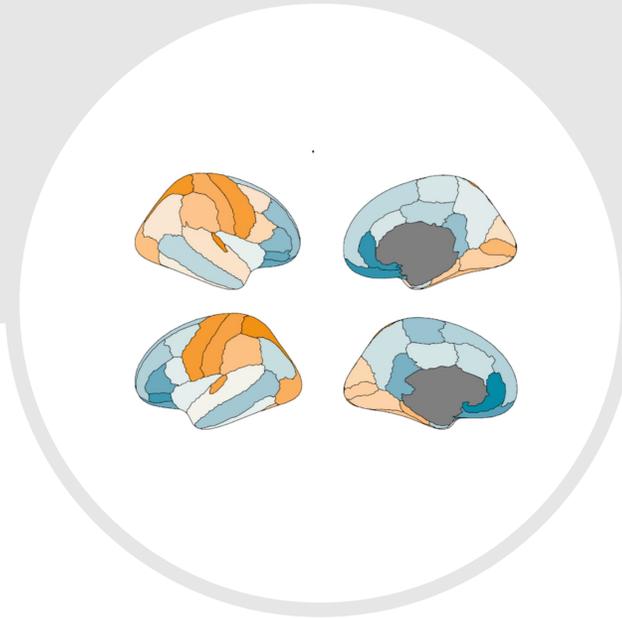
## Mentors:

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Arno Villringer  
Alain Dagher

## Main collaborators:

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Nora Mehl  
Mahsa Dadar  
Yashar Zeighami  
Mari Shishikura  
Uku Vainik  
Simon Duchesne  
Christina Tremblay  
Shady Rahayel  
Bo-Yong Park

# Thank you!



Filip Morys

Digit:

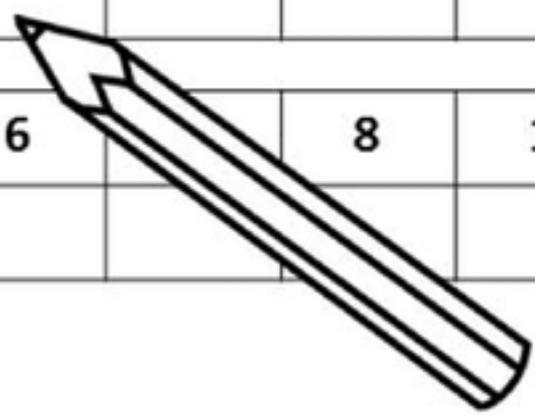
1	2	3	4	5	6	7	8	9
—	⊥	▭	└	└	○	△	×	≡

Symbol:

Samples

Test

2	5	7	1	2	1	2	9	7	3	5	4
⊥	└	△	—	⊥							
1	4	3	5	9	6		8	1	2	4	2



...