

# Obesity, psychological well-being related measures, and risk of seven non-communicable diseases: evidence from longitudinal studies of UK and US older adults

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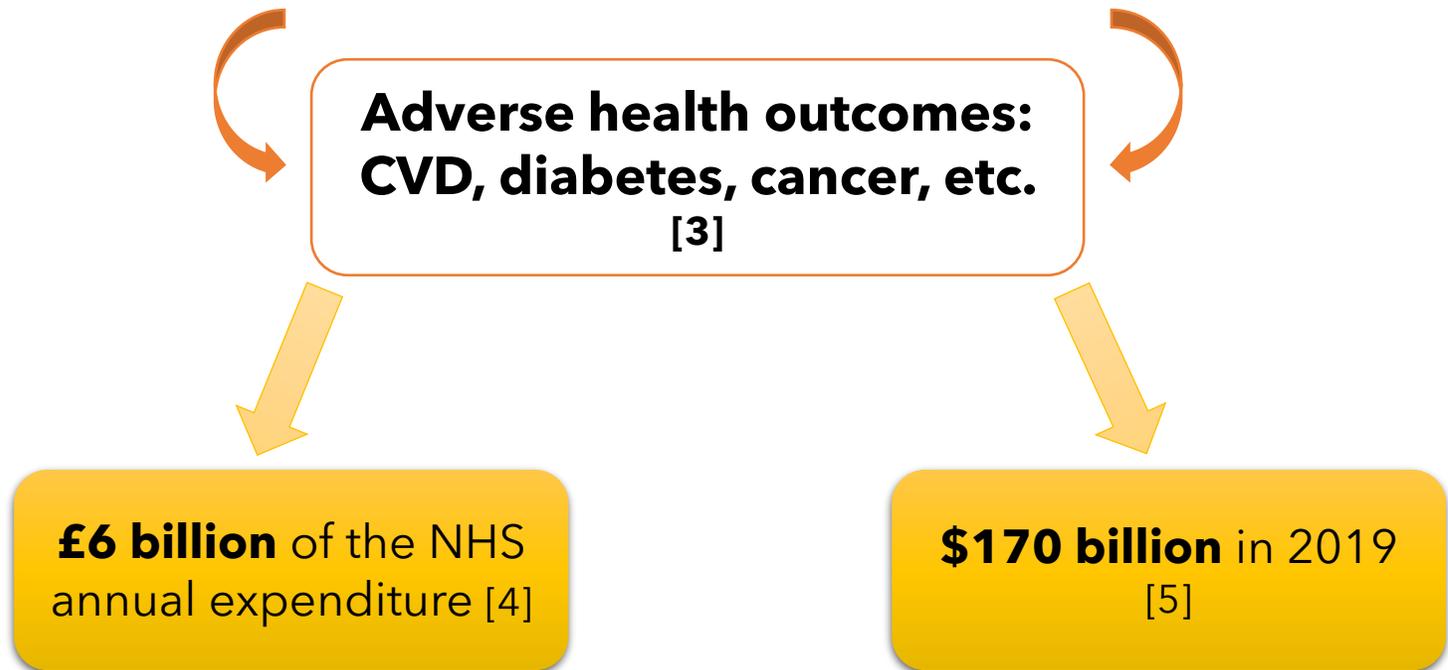
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# Living with obesity...



The prevalence of obesity almost doubled from 15% to 28% between 1993 - 2019 in England [1].

In the US, the prevalence of obesity increased from 31% in 1999-2000 to 42% in 2017-2020 [2].



1. Baker C. (2022). Research briefing: Obesity statistics: House of Commons Library.
2. Centers for Disease Control and Prevention. (2022). Overweight and Obesity: Adult Obesity Facts.
3. GBD Obesity Collaborators. (2017). Health Effects of Overweight and Obesity in 195 Countries over 25 Years. *N Engl J Med*, 377(1): 13-27.
4. Department of Health and Social Care. (2018). Consultation on mandating calorie labelling in the out-of-home sector.
5. Ward ZJ, et al. (2021). Association of body mass index with health care expenditures in the United States by age and sex. *PLoS One*, 16(3): e0247307.

# Evidence of the psychological burden of obesity...

## PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B

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### Section

#### Abstract

##### 1. Introduction

2. Is high body weight associated with good or poor psychological wellbeing?

3. Longitudinal studies of associations between body weight and psychological distress

4. Mechanisms linking high

Review articles

## Obesity and psychological distress

Andrew Steptoe and Philipp Frank

Published: 04 September 2023 | <https://doi.org/10.1098/rstb.2022.0225>

### Abstract

The relationship between high body weight and mental health has been studied for several decades. Improvements in the quality of epidemiological, mechanistic and psychological research have brought greater consistency to our understanding of the links. Large-scale population-based epidemiological research has established that high body weight is associated with poorer mental health, particularly depression and subclinical depressive symptoms. There is some evidence for bidirectional relationships, but the most convincing findings are that greater body weight leads to psychological distress rather than the reverse. Particular symptoms of depression and distress may be specifically related to greater body weight. The psychological stress induced by weight stigma and discrimination contributes to psychological distress, and may in turn handicap efforts at weight control. Heightened systemic inflammation and dysregulation of the hypothalamic-pituitary-adrenal axis are biological mechanisms that mediate in part the relationship of greater body weight with poorer mental health. Changing negative societal attitudes to high body weights would improve the wellbeing of people living with obesity, and promote more effective weight-inclusive attitudes and behaviours in society

“There is some evidence for bidirectional relationships, but **the most convincing findings** are that **greater body weight leads to psychological distress** rather than the reverse”.

Steptoe, A., & Frank, P. (2023). Obesity and psychological distress. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 378(1888), 20220225. <https://doi.org/doi:10.1098/rstb.2022.0225>

# The role psychological well-being in explaining obesity-related outcomes

Research article | [Open access](#) | [Published: 16 November 2023](#)

## The psychological legacy of past obesity and early mortality: evidence from two longitudinal studies

[I Gusti Ngurah Edi Putra](#) , [Michael Daly](#), [Angelina Sutin](#), [Andrew Steptoe](#) & [Eric Robinson](#)

*BMC Medicine* **21**, Article number: 448 (2023) | [Cite this article](#)

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### Abstract

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#### Background

We test a novel ‘weight scarring’ hypothesis which suggests that past obesity is associated with impairments in current psychological well-being and this increases risk of negative physical health outcomes associated with obesity. Across two nationally representative studies, we tested whether past obesity is associated with current psychological outcomes and whether these psychological outcomes explain the association between past obesity and subsequent early mortality.

Putra, I.G.N.E., Daly, M., Sutin, A., Steptoe, A., Robinson, E. (2023). The psychological legacy of past obesity and early mortality: evidence from two longitudinal studies. *BMC Medicine*, 21, 448. <https://doi.org/10.1186/s12916-023-03148-3>

Having obesity in the past is associated with **a range of current negative psychological outcomes**, independently of current weight status.

Current negative psychological outcomes (e.g., depressive symptoms) associated with past obesity **may explain** why obesity is associated with increased risk of mortality.

# The role psychological well-being in explaining obesity-related outcomes

## Psychological Pathways Explaining the Prospective Association Between Obesity and Physiological Dysregulation

I Gusti Ngurah Edi Putra ✉ ✉, Michael Daly, Angelina Sutin, Andrew Steptoe, Eric Robinson

Author Affiliations ▶

Putra, I G. N. E., Daly, M., Sutin, A., Steptoe, A., & Robinson, E. (2023). Psychological pathways explaining the prospective association between obesity and physiological dysregulation. *Health Psychology, 42*(7), 472–484. <https://doi.org/10.1037/hea0001284>

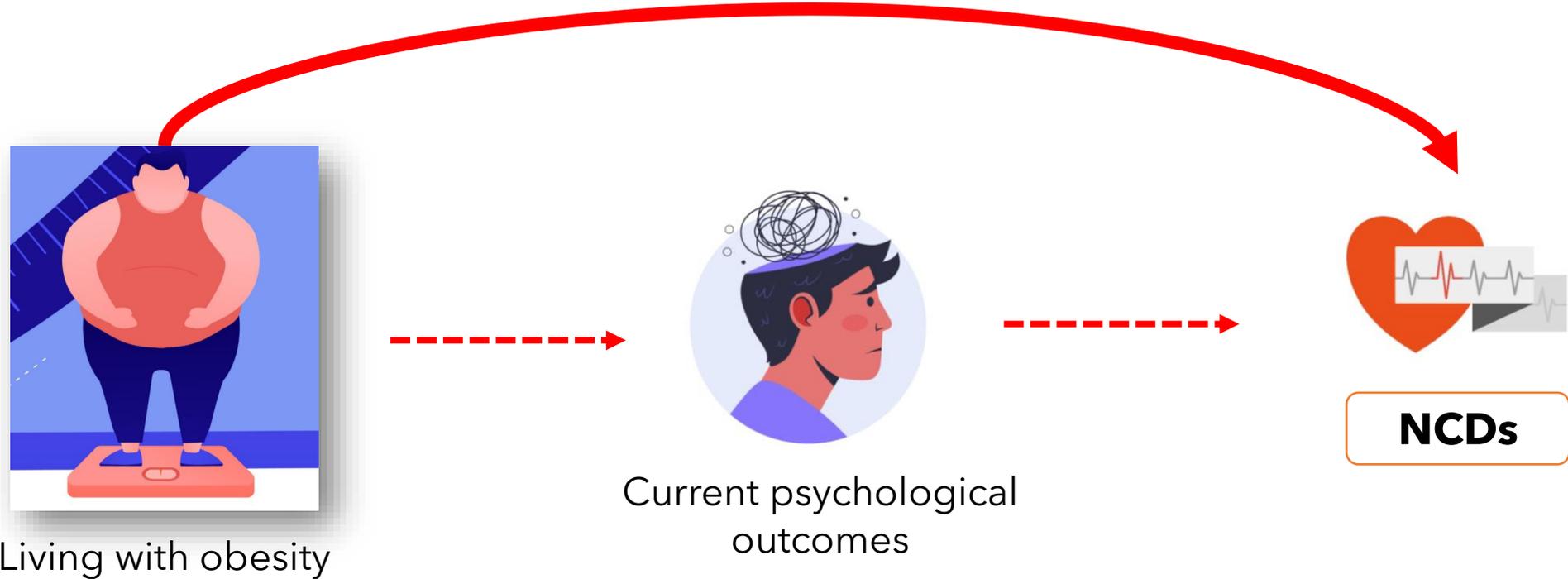
### Abstract

**Objective:** Obesity is associated with a range of negative psychological conditions that may also affect physiological health. Across two studies, we tested whether a range of psychological measures explain why obesity is prospectively associated with physiological dysregulation, measured via clinical indicators of [cardiovascular](#), [immune system](#), and metabolic function. **Method:** We used comparable 4-year follow-up representative [longitudinal](#) data of U.K. and U.S. older adults ( $\geq 50$  years) from the English Longitudinal Study of Ageing (2008/2009–2012/2013; Study 1;  $n = 6,250$ ) and the Health and Retirement Study (2008/2010–2012/2014; Study 2;  $n = 9,664$ ). A diverse range of psychological measures (e.g., depressive symptoms, life satisfaction, weight stigma, [positive affect](#)) were tested as candidate

Putra, I., Daly, M., Sutin, A., Steptoe, A., & Robinson, E. (2023). Psychological pathways explaining the prospective association between obesity and physiological dysregulation. *Health Psychology, 42*(7), 472–484. <https://doi.org/10.1037/hea0001284>

“The prospective association between obesity and physiological dysregulation **was largely not explained by psychological factors.**”

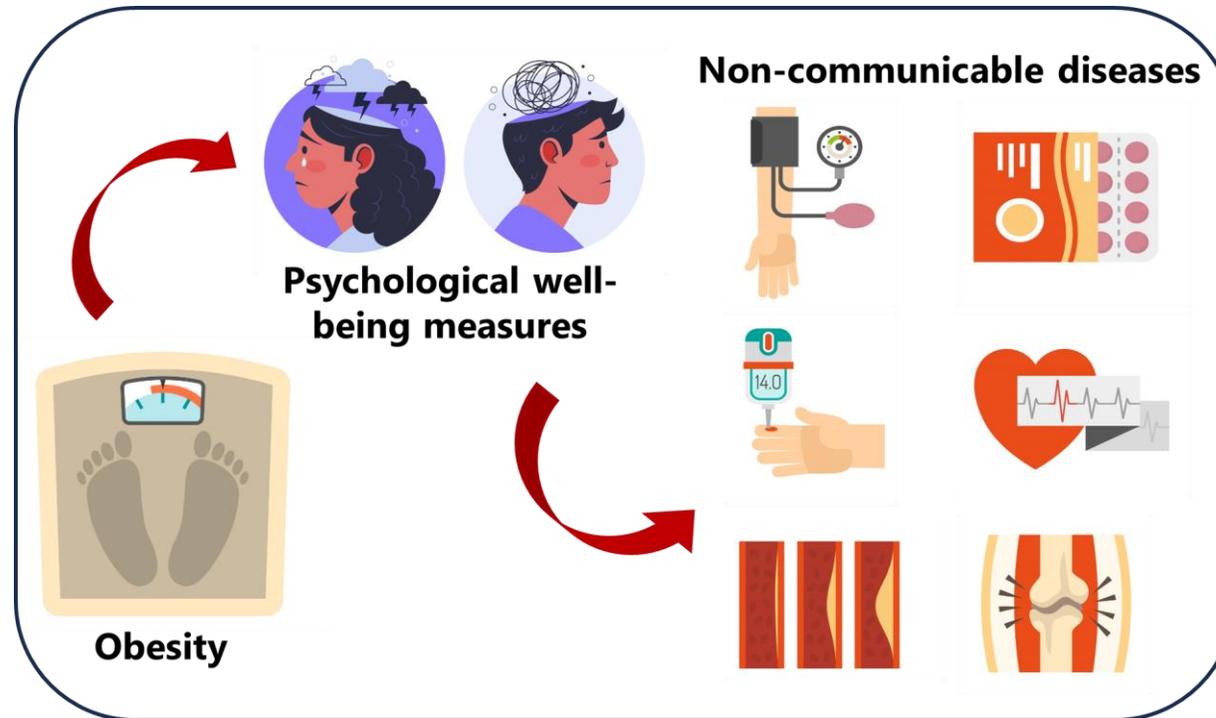
# What we don't know ...



**To what extent do psychological well-being related measures explain the associations between obesity and increased risk of NCDs?**

# Hypothesis

**Psychological well-being related measures may explain why obesity is associated with increased risk of NCDs**



# Methods

## Study 1

### English Longitudinal Study of Ageing (ELSA), UK

Wave 4 (2008/2009) → baseline  
 $n = 8,127$  participants

### 7 baseline psychological well-being measures

- Depressive symptoms\*
- Enjoyment of life\*
- Eudemonic well-being\*
- Life satisfaction\*
- Loneliness\*
- Social support
- Social strain

5 psychological measures (\*) were combined as an index of psychological distress.

## Study 2

### Health and Retirement Study (HRS), US

Wave 9 & 10 (2008/2010) → baseline  
 $n = 12,477$  participants

### 15 baseline psychological well-being measures

- Depressive symptoms\*
- Life satisfaction\*
- Loneliness\*
- Social support
- Social strain
- Positive affect\*
- Negative affect\*
- Purpose in life\*
- Anxiety\*
- Optimism
- Pessimism\*
- Hopelessness\*
- Cynical hostility
- Personal constrain\*
- Mastery

10 psychological measures (\*) were combined as an index of psychological distress.

Participants aged  $\geq 50$  years with up to 10 years of follow-up in each study

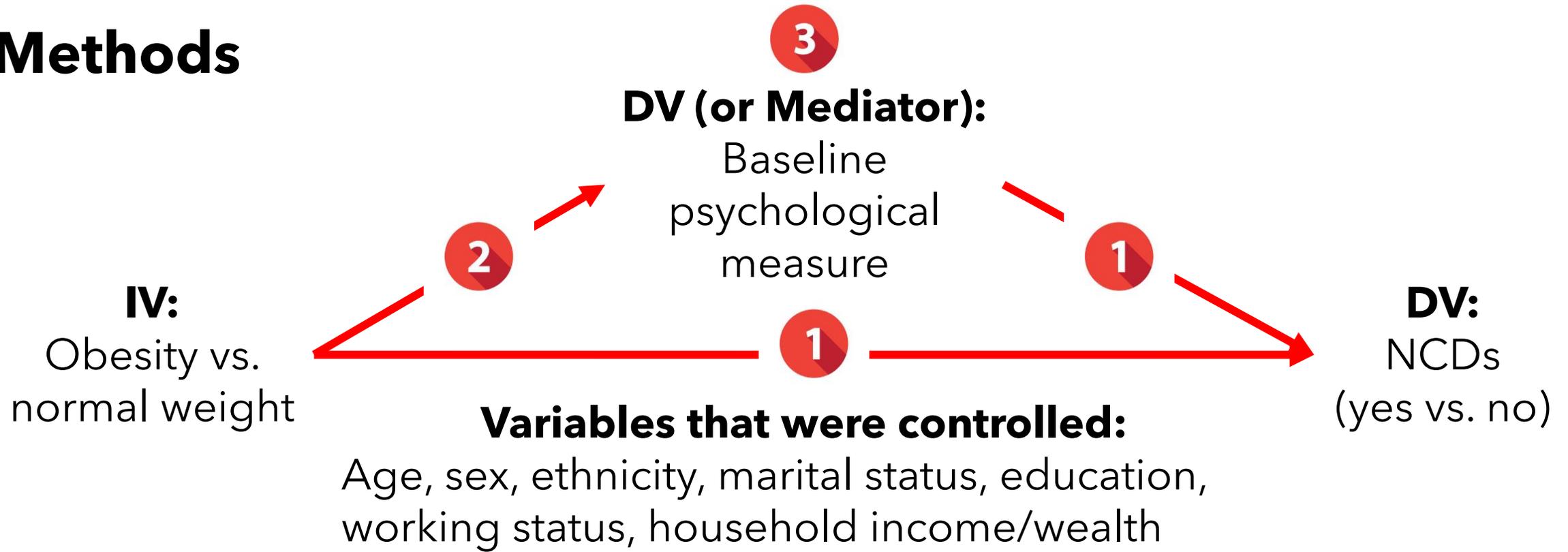
### Baseline objective weight status

Obesity (BMI  $\geq 30$ ) vs. Normal weight (BMI 18.5–24.9)

### 7 follow-up NCDs

- Hypertension (*self-report & biomarker*)
- Heart disease (*self-report*)
- Stroke (*self-report*)
- Diabetes (*self-report & biomarker*)
- Arthritis (*self-report*)
- Cancer (*self-report*)
- Memory disease (*self-report & interview*)

# Methods



**1** Cox proportional hazard model

**2** Linear regression model

**3** Causal mediation analysis with survival outcome

Additional analyses:

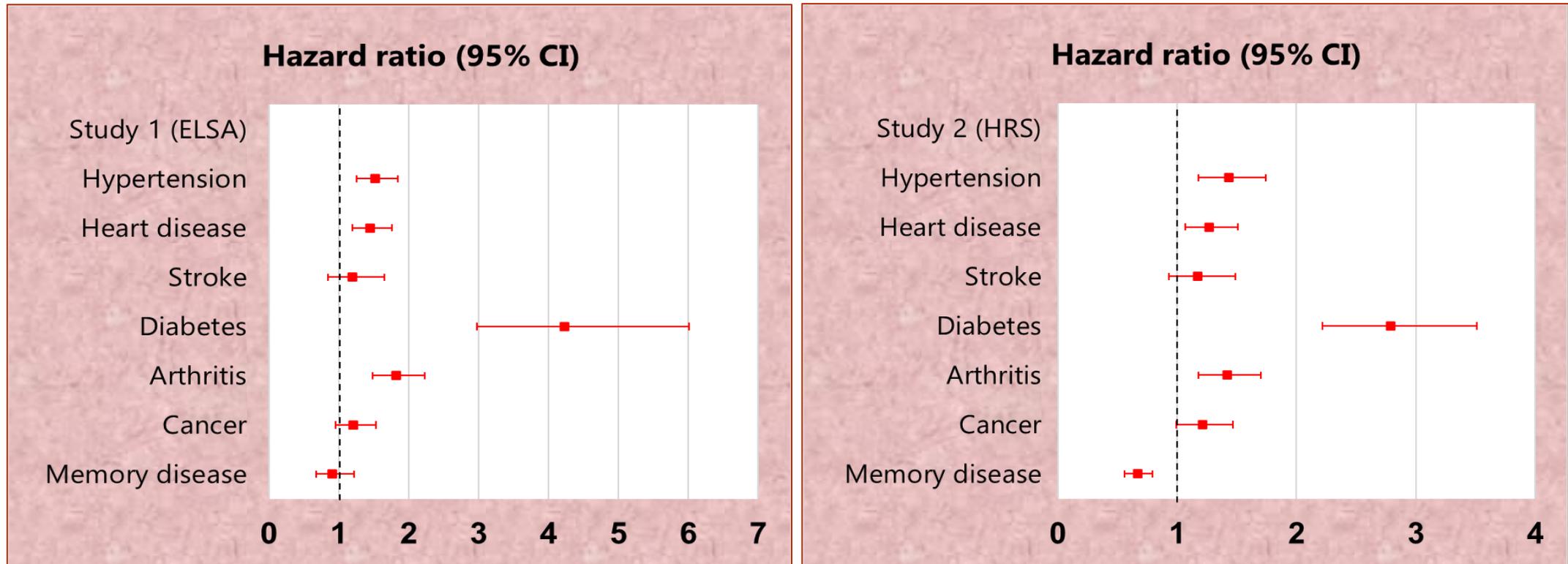
- In both studies, risk of cumulative NCDs was estimated using Poisson regression
- In Study 1 (ELSA), NCDs were also derived from hospital admissions data (Hospital Episode Statistics)

# Findings

**Table 1.** Baseline characteristics of the participants

Variables	ELSA (n=8,127)			HRS (n=12,477)		
	n	Mean (SD)	%	n	Mean (SD)	%
<i>Baseline characteristics</i>						
<b>Age (years)</b>	8,127	65.92 (10.67)		12,477	65.99 (10.15)	
<b>Sex</b>	8,127			12,477		
Female			53.45			54.85
Male			46.55			45.15
<b>Ethnicity</b>	8,124			12,472		
Non-White			3.76			13.09
White			96.24			86.91
<b>BMI baseline (kg/m<sup>2</sup>)</b>	7,768	28.44 (5.30)		10,906	29.65 (5.98)	
Normal weight			25.97			21.67
Overweight			41.79			36.37
Class I obese			21.54			25.05
Class II & III obese			10.70			16.91
<i>The incidence of NCDs during the follow-up period</i>						
<b>Hypertension</b>	3,097			3,113		
Yes			31.19			35.48
<b>Heart disease</b>	5,891			8,404		
Yes			17.42			18.20
<b>Stroke</b>	7,168			10,719		
Yes			4.61			6.91
<b>Diabetes mellitus</b>	6,524			8,571		
Yes			7.57			13.61
<b>Arthritis</b>	4,530			3,889		
Yes			21.28			33.16
<b>Cancer</b>	6,848			9,820		
Yes			9.08			11.99
<b>Memory disease</b>	7,422			10,773		
Yes			7.69			11.12

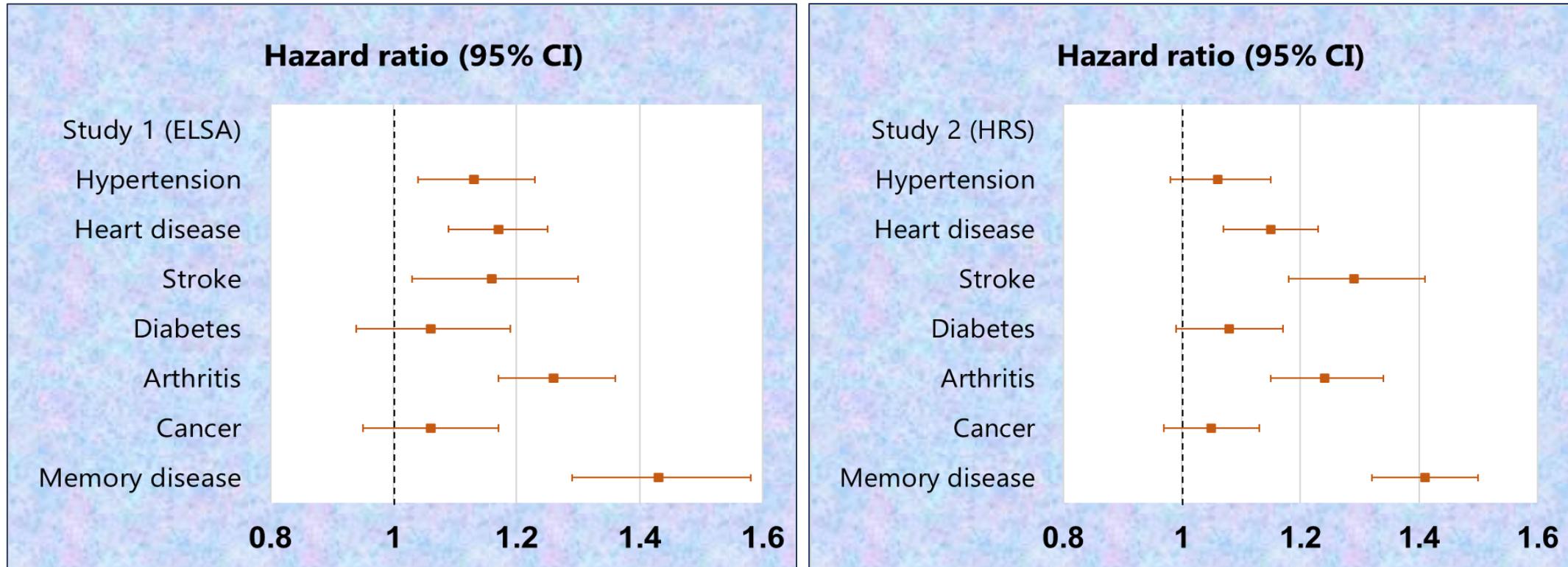
# Findings 1



**Figure 1 (a & b).** Longitudinal associations between obesity (vs. normal weight) and NCDs in ELSA and HRS

Obesity (vs. normal weight) increased risk of hypertension, heart disease, diabetes, and arthritis (Figure 1). *Stronger associations for NCDs were reported when Obesity II & III was compared to normal weight (e.g., stroke in HRS).*

# Findings 1



**Figure 2 (a & b).** Longitudinal associations between the index of psychological distress and NCDs in ELSA and HRS

The index of psychological distress was associated with heart disease, stroke, arthritis, and memory disease (Figure 2). *Some individual psychological measures were also associated with NCDs in each study.*

# Findings 2

**Table 2 (a & b).** Cross-sectional associations between obesity and psychological well-being related measures in HRS in ELSA and HRS.

Outcomes	n	Obesity vs. normal weight <sup>a</sup>		Class II & III obesity vs. normal weight <sup>b</sup>	
		$\beta$	95% CI	$\beta$	95% CI
Depressive symptoms	7,583	0.07	0.01, 0.13*	0.16	0.06, 0.26**
Enjoyment of life	6,866	-0.05	-0.12, 0.02	-0.10	-0.20, -0.01*
Eudemonic well-being	6,857	-0.08	-0.14, -0.01*	-0.18	-0.27, -0.09***
Life satisfaction	6,864	0.02	-0.05, 0.09	-0.02	-0.11, 0.07
Loneliness	6,856	0.03	-0.04, 0.09	0.17	0.07, 0.27**
Social support	6,937	-0.06	-0.13, 0.01	-0.12	-0.21, -0.02*
Social strain	6,931	0.16	0.09, 0.23***	0.24	0.14, 0.34***
Index of psychological distress	6,874	0.05	-0.02, 0.11	0.16	0.06, 0.25**

Outcomes	n	Obesity vs. normal weight <sup>a</sup>		Class II & III obesity vs. normal weight <sup>b</sup>	
		$\beta$	95% CI	$\beta$	95% CI
Depressive symptoms	10,860	0.02	-0.03, 0.08	0.08	0.01, 0.15*
Life satisfaction	10,742	-0.02	-0.08, 0.03	-0.07	-0.14, 0.01
Loneliness	10,677	0.05	-0.02, 0.10	0.14	0.06, 0.21***
Social support	10,816	-0.07	-0.13, -0.02*	-0.13	-0.21, -0.06**
Social strain	10,807	0.09	0.04, 0.15**	0.14	0.07, 0.22***
Positive affect	10,684	-0.04	-0.10, 0.01	-0.08	-0.15, -0.01*
Negative affect	10,691	-0.02	-0.08, 0.04	0.01	-0.07, 0.08
Purpose in life	10,629	-0.06	-0.12, -0.01*	-0.11	-0.18, -0.04**
Anxiety	10,682	0.01	-0.05, 0.06	0.04	-0.03, 0.12
Hopelessness	10,746	0.06	0.01, 0.12*	0.13	0.06, 0.20***
Optimism	10,688	0.01	-0.05, 0.07	0.01	-0.07, 0.08
Pessimism	10,676	0.09	0.03, 0.15**	0.19	0.12, 0.26***
Cynical hostility	10,490	0.17	0.11, 0.22***	0.24	0.17, 0.30***
Perceived constraint	10,726	0.01	-0.04, 0.07	0.04	-0.03, 0.11
Perceived mastery	10,732	0.03	-0.03, 0.09	-0.01	-0.08, 0.06
Index of psychological distress	10,802	0.05	-0.01, 0.10	0.13	0.05, 0.20**

# Findings

3

**Table 3 (a & b).** Mediation by an index of psychological distress in the longitudinal associations between obesity and the incidence of NCDs in ELSA and HRS.

Outcomes	Mediation by an index of overall psychological well-being measures					
	Obesity vs. normal weight			Obesity class II & III vs. normal weight		
	n	Estimate	95% CI	n	Estimate	95% CI
Hypertension	1,532	0.003	-0.018, 0.024	1,107	0.024	-0.048, 0.095
Heart disease	2,925	0.034	-0.024, 0.092	1,885	0.043	-0.008, 0.094
Diabetes	3,181	0.001	-0.003, 0.005	2,050	-0.002	-0.009, 0.005
Arthritis	2,203	0.002	-0.022, 0.027	1,452	0.026	-0.027, 0.080

Outcomes	Mediation by an index of overall psychological well-being measures					
	Obesity vs. normal weight			Obesity class II & III vs. normal weight		
	n	Estimate	95% CI	n	Estimate	95% CI
Hypertension	1,659	0.001	-0.010, 0.012	1,115	-0.077	-0.244, 0.090
Heart disease	4,742	0.003	-0.018, 0.023	2,834	0.002	-0.019, 0.023
Stroke	NA			3,611	0.065	-0.048, 0.179
Diabetes	4,687	-0.001	-0.002, 0.001	2,911	0.004	-0.004, 0.012
Arthritis	2,135	-0.039	-0.093, 0.015	1,309	-0.021	-0.079, 0.047

Estimate=the overall proportion due to mediation or the proportion mediated

**No mediation** by the index of psychological distress

# Findings

## Additional analyses

- ✓ **No evidence** of **individual** psychological measures mediated the associations between obesity and NCDs in ELSA and HRS.
- ✓ Obesity was associated with cumulative NCDs in both studies, but there was **no evidence** of mediation by index and individual psychological measures.
- ✓ In ELSA, obesity was associated with some outcomes derived from objective data (HES): hypertension, heart disease, and diabetes, but there was **no evidence** of mediation by index and individual psychological measures.

# Discussion

## **No evidence of mediation by psychological well-being related measures**

- Biological mechanisms (e.g., direct effect of adiposity)?
- The association between obesity and psychological well-being in older adults?

# Take-home messages

- The longitudinal associations between obesity and NCDs **were not explained by psychological well-being related measures.**
- Obesity and psychological well-being related measures **may independently increase risk** of NCDs.

# Thank you!



**SCAN ME**

## **PREPRINT:**

Putra IGNE, Daly M, Sutin A, Steptoe A, Scholes S, Robinson E. (2023). Obesity, psychological well-being measures, and risk of seven non-communicable diseases: evidence from longitudinal studies of UK and US older adults.

<https://psyarxiv.com/v2c4k>



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