Webinar, 12 May 2022

EPIDEMIOLOGY OF OBESITY IN SOUTH AFRICA

where we are, where we are going and why we must take action

Stellenbosch
UNIVERSITY
IYUNIVESITHI
UNIVERSITEIT

forward together
sonke siya phambili
saam vorentoe

Annibale Cois, MEng, MPH, PhD
Division of Health Systems and Public Health
Department of Global Health
Stellenbosch University

- What is obesity?
- “Measuring” obesity
- Obesity patterns and trends in the South African (adult) population
- Why should we take action?

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At population level, from a public health (rather than clinical) perspective

- What is obesity?
- "Measuring" obesity
- Obesity **patterns** and **trends** in the South African (adult) population
- Why should we take action?

by gender, age,...

between 1998 and 2017

- What is obesity?
- "Measuring" obesity
- Obesity patterns and trends in the South African (adult) population
- Why should we take action?

"Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health."

WHO, https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

abnormal
excessive

DISEASE

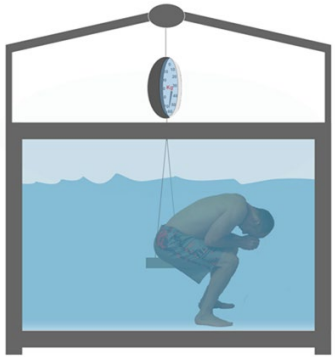
Metabolic alterations (insulin homeostasis mechanism, lipid and liver metabolism)
"Mechanical" effects

- Oesophageal, Colorectal, Liver, Gallbladder and biliary tract, Pancreatic, Kidney, Thyroid, Ovarian, Uterine, Breast cancers; Non-Hodgkin's lymphoma, Multiple myeloma, Leukaemia
- Hypertensive heart disease, Ischaemic heart disease, Ischaemic and Haemorrhagic stroke, Atrial fibrillation
- Type 2 diabetes mellitus, Chronic kidney disease
- Asthma, Gallbladder and bile tract disease, Gout, Alzheimer's disease and other dementias, Cataracts
- Low back pain Osteoarthritis of the hip and knee Respiratory problems

Purnell JQ. Definitions, classification, and epidemiology of obesity. *Endotext* [Internet]. 2018 Apr 12.

How can we measure fat accumulation?

Direct measurement

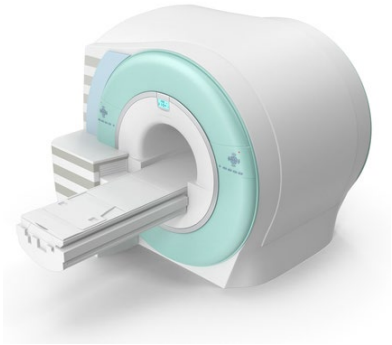


Underwater weighting

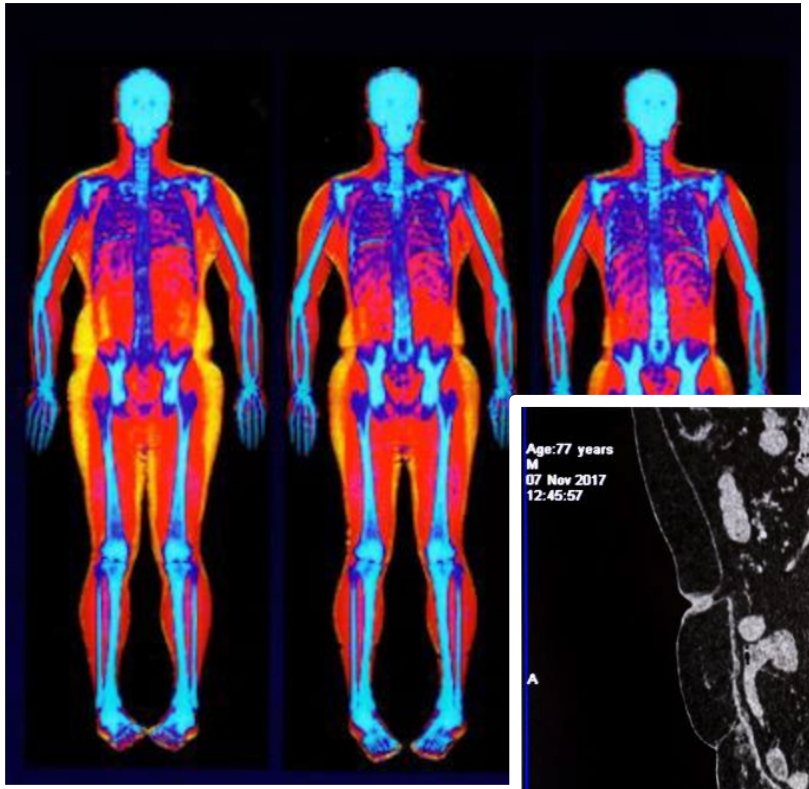
Dual-energy X-ray absorptiometry(DEXA, DXA)

Bioimpedance

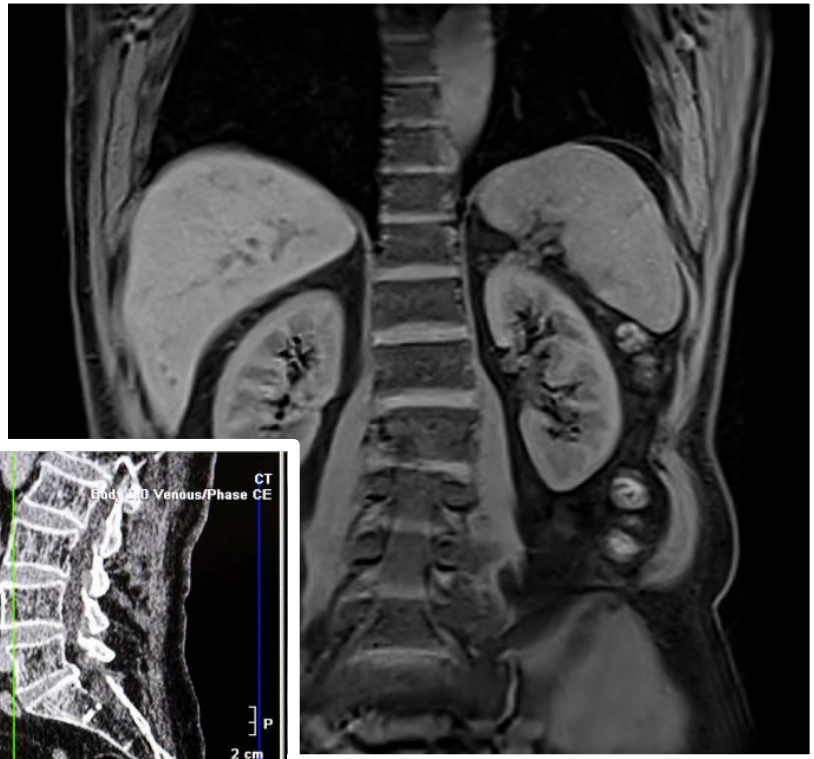
Air-displacement plethysmography (BodPod)



MRI and CT scans



DEXA

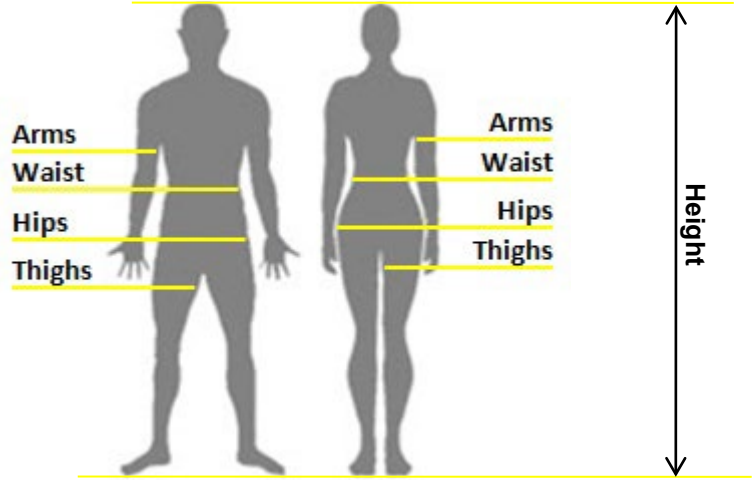


MRI

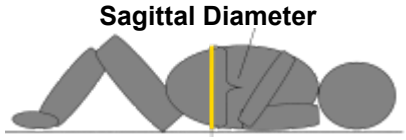

Age:77 years
M
07 Nov 2017
12:45:57
CT
Body 3D Venous/Phase CE
A
P
2 cm
kVP:120
mA:148
msec:500
mAs:74
Thk:2 mm
W/L:459/61
Sagittal
Value: 85
(10.0, 38.3, 1257.7)
MIP
2.0

CT

Anthropometric Indices



- Body Mass Index
- Waist Circumference
- Waist-hip ratio
- Skinfold Thickness
- Waist/thigh ratio
- Abdominal height
- .....

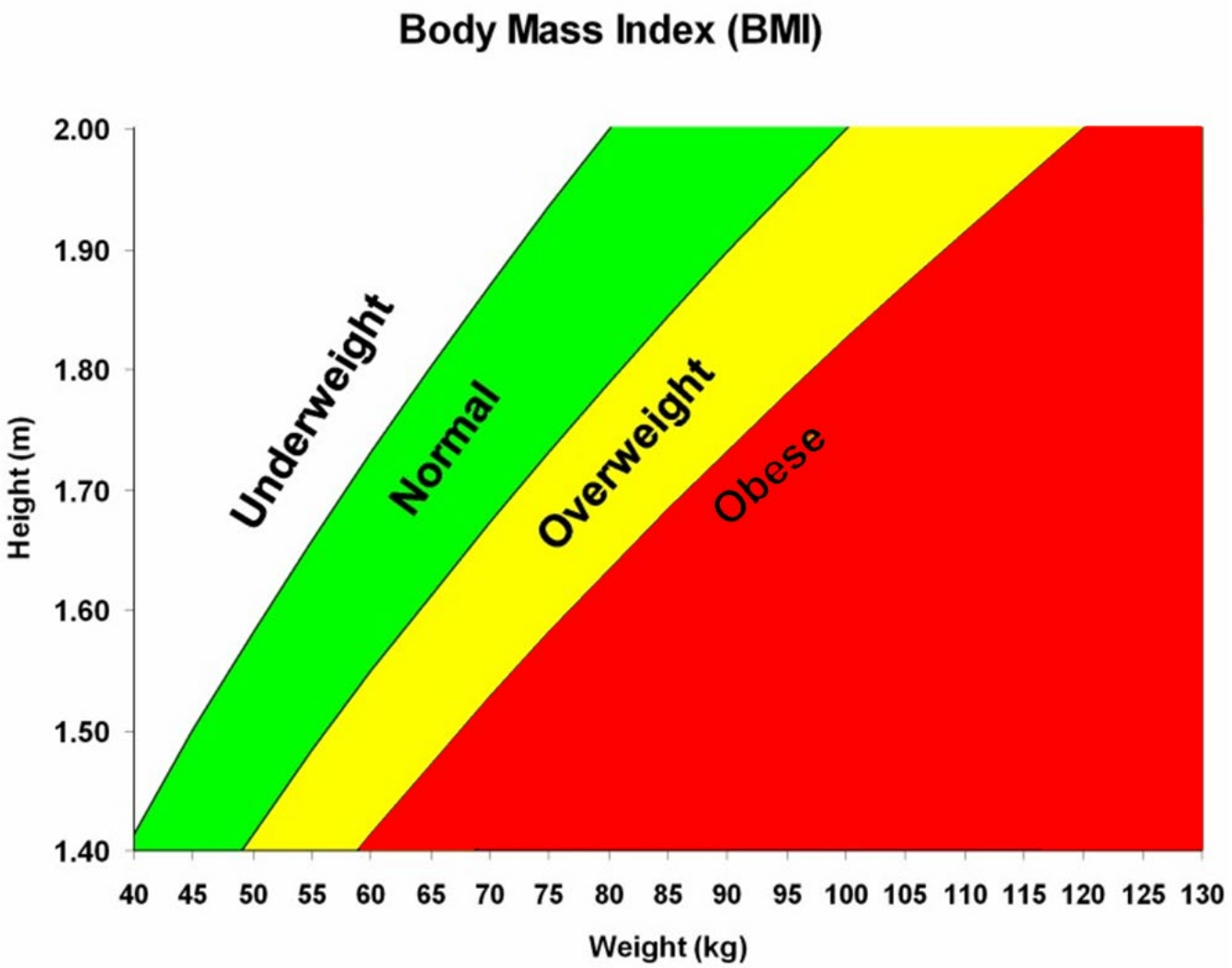


Oshaug, 1995. *International archives of occupational and environmental health 67*: 359-366.

Agbo, 2020. *Front. Cardiovasc. Med.* 7:522123. doi: 10.3389/fcvm.2020.522123

Czernichow, 2011. *Obes Rev* 12(9): 680–687. doi:10.1111/j.1467-789X.2011.00879.x.

$$\text{BMI} = \frac{\text{Weight(kg)}}{\text{Height(cm)} \times \text{Height(m)}}$$

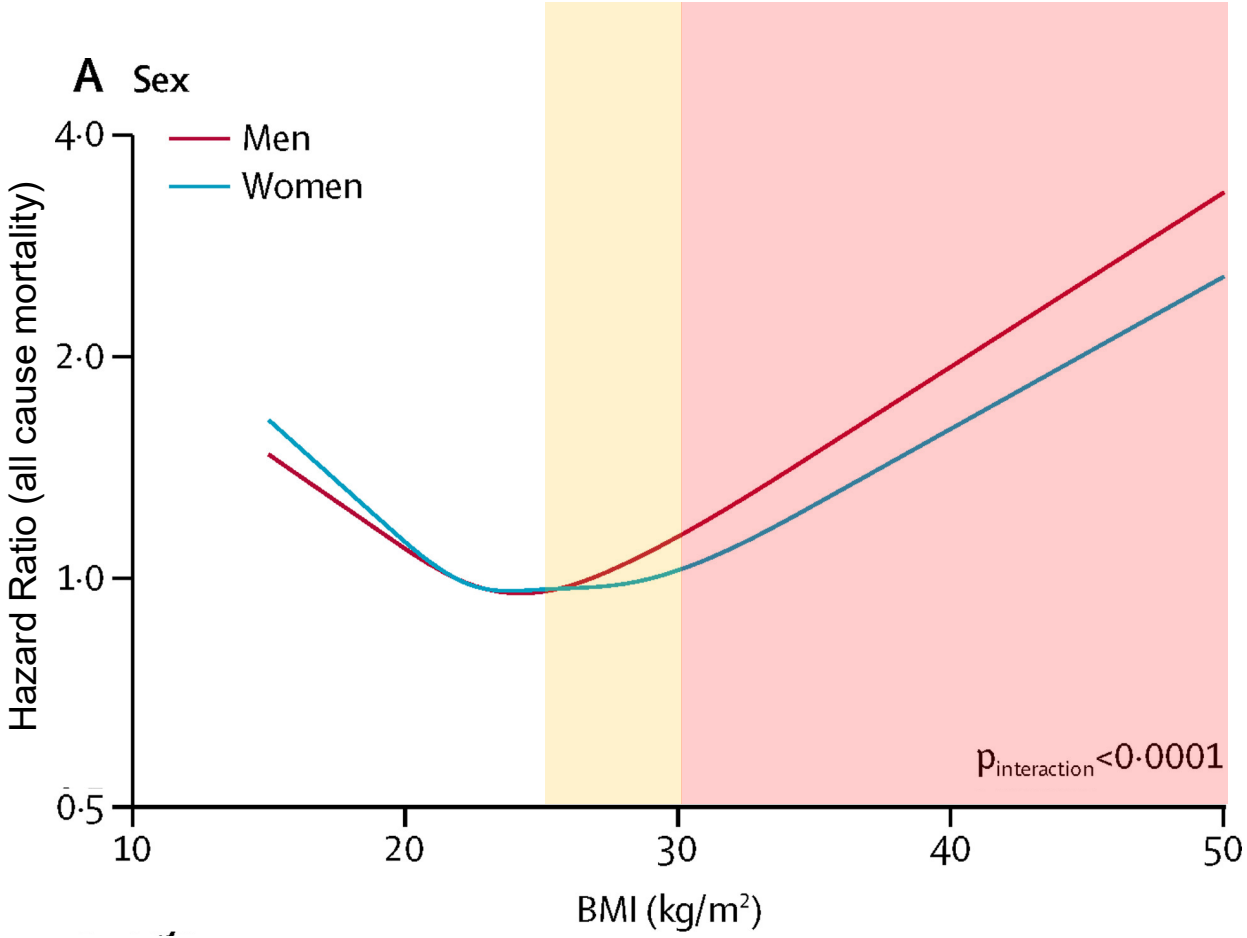


< 18.5

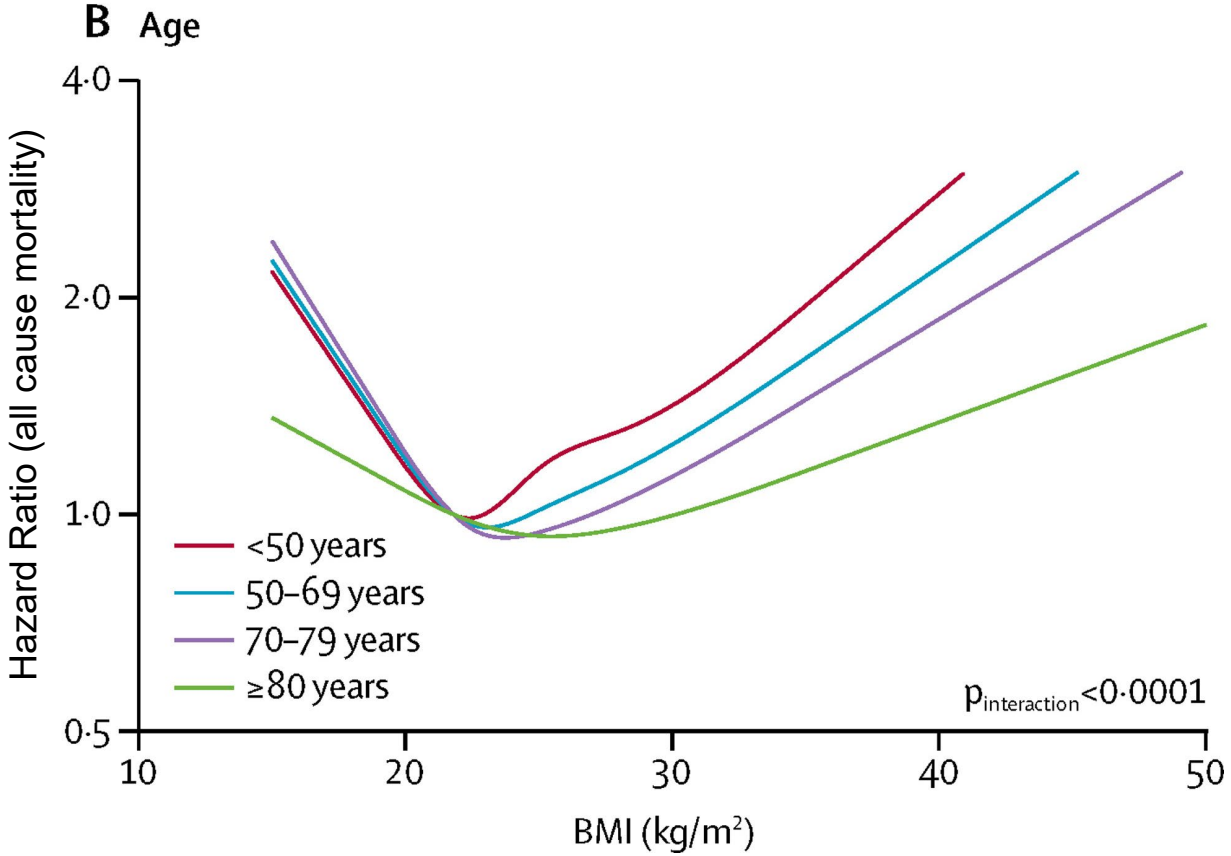
18.5 - < 25

25 - < 30

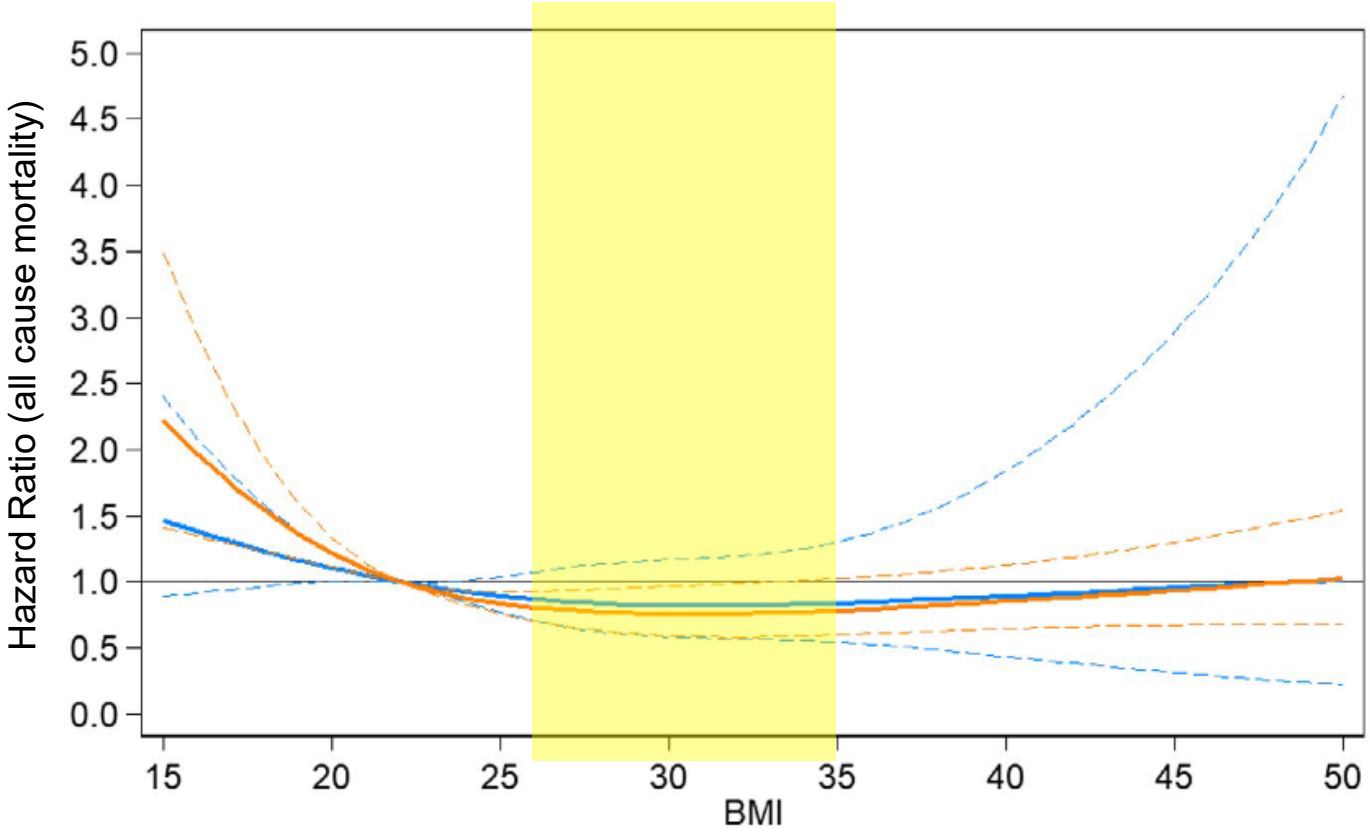
30 +



Bhaskaran K et al. Association of BMI with overall and cause-specific mortality: a population-based cohort study of **3·6 million adults in the UK.** *Lancet Diabetes & Endocrinology* . 2018;6(12)



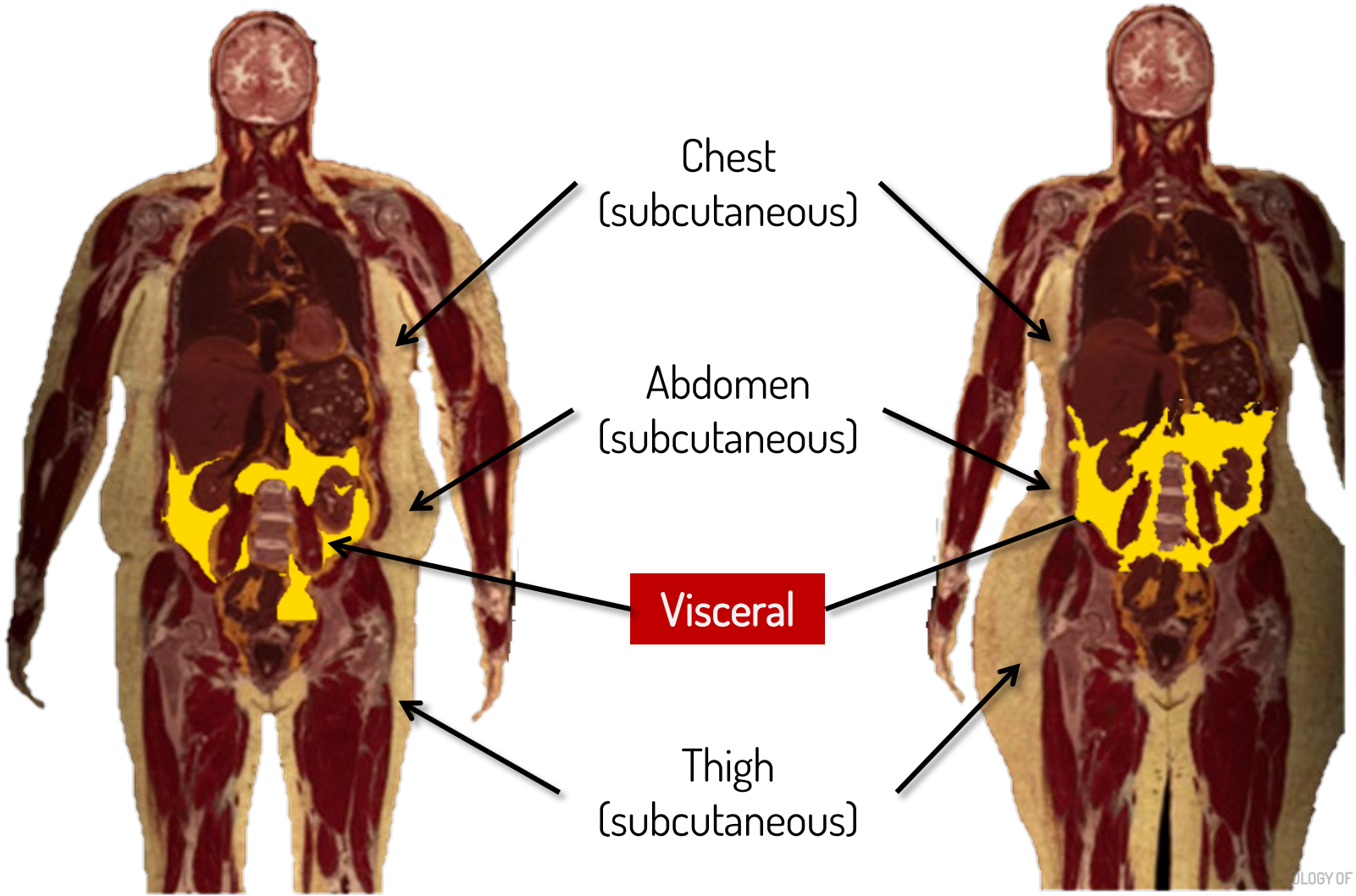
Bhaskaran K et al. Association of BMI with overall and cause-specific mortality: a population-based cohort study of **3·6 million adults in the UK.** *Lancet Diabetes & Endocrinology* . 2018;6(12)

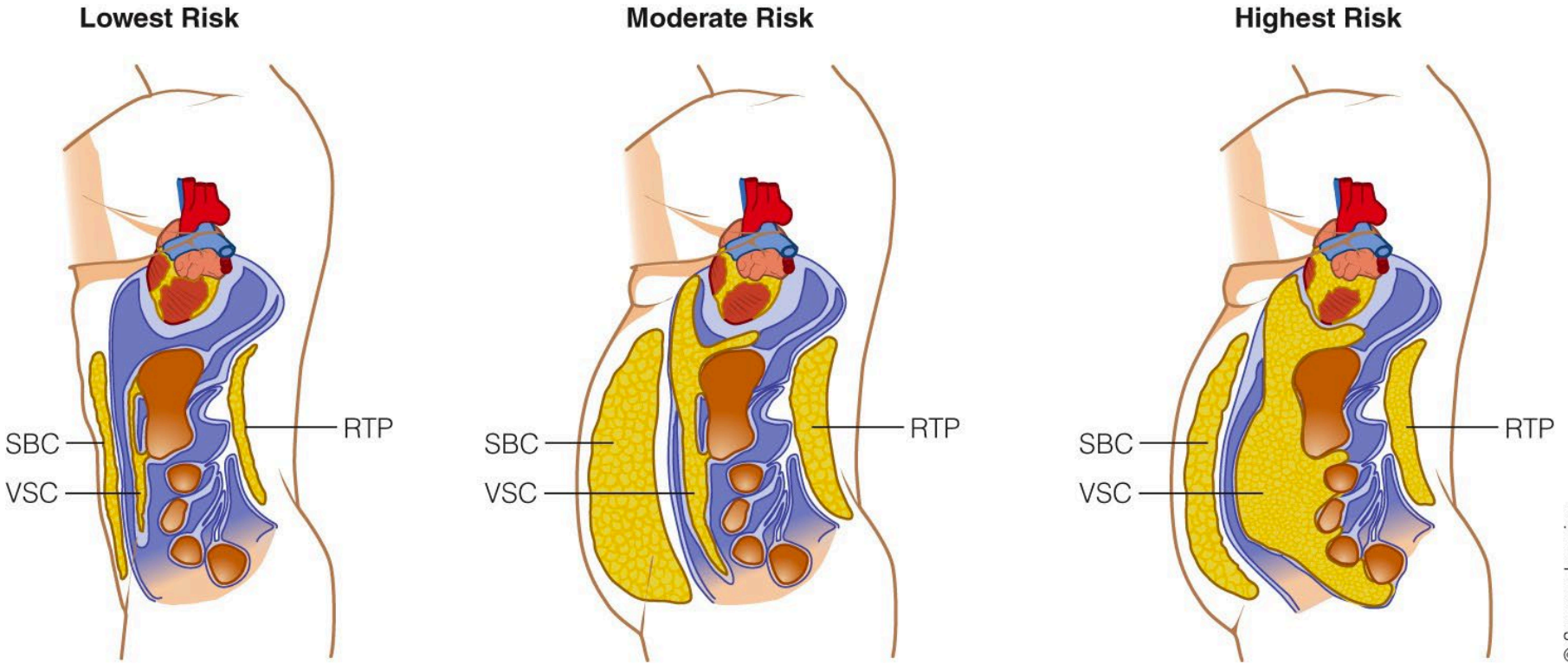


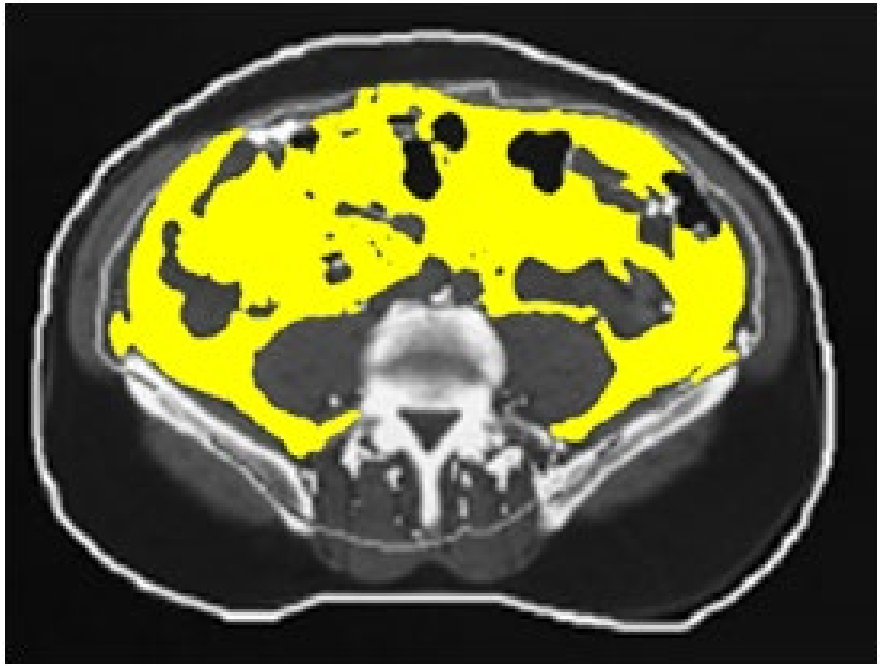
Manne-Goehler J et al.,**BMI and All-Cause Mortality in a Population-Based Cohort in Rural South Africa**. *Obesity*. 2020 Dec;28(12):2414-23.

The causal pathways linking fat accumulation with health outcomes are complex, only partially known and heavily influenced, among other factors, by fat distribution.

Not all fat is created equal!

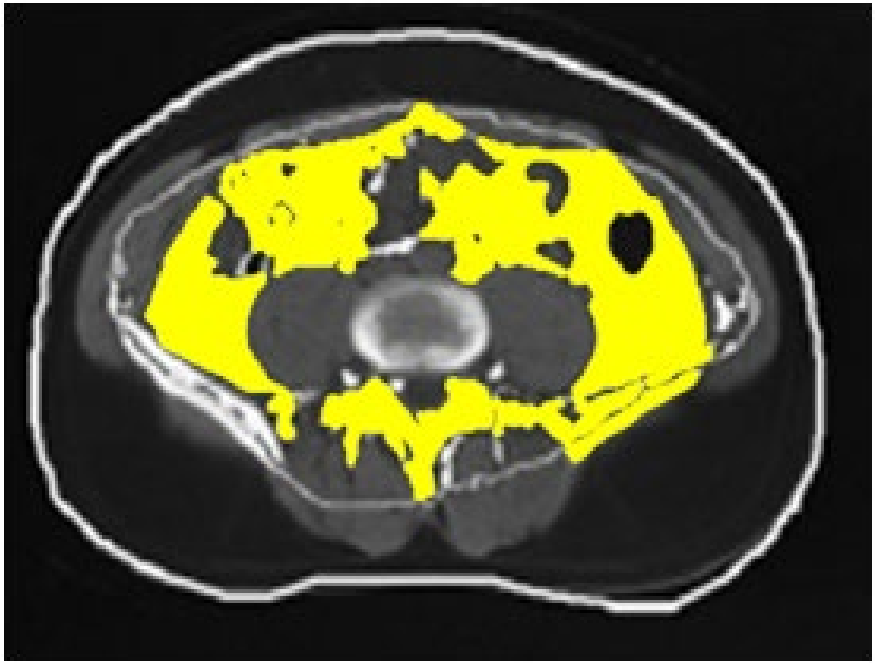

Chest
(subcutaneous)
Abdomen
(subcutaneous)
Visceral
Thigh
(subcutaneous)





Intra-abdominal obesity

Fat mass: **19.8 kg**
Visceral fat area: **155 cm^2**

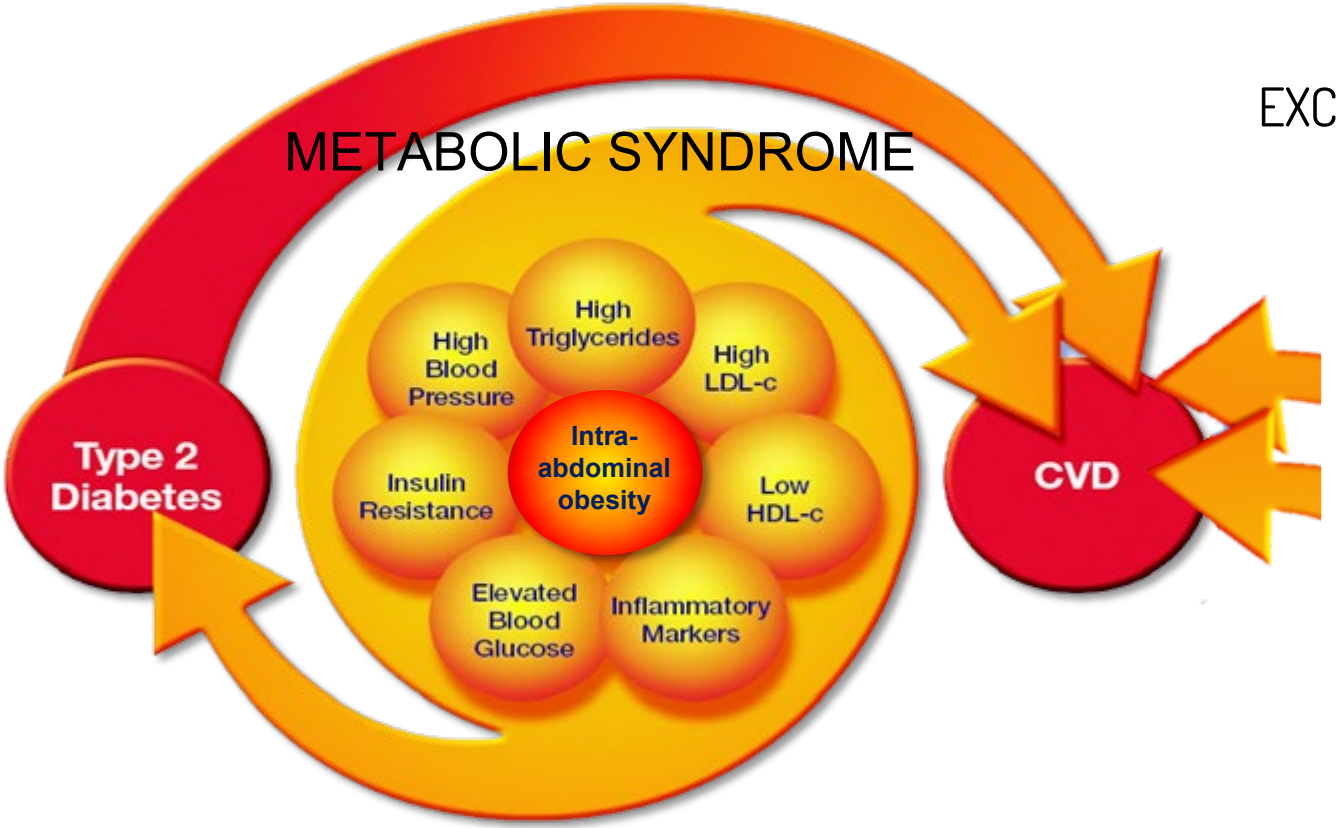


Subcutaneous obesity

Fat mass: **19.8 kg**
Visceral fat area: **96 cm^2**

Adapted from: Després JP. *Eur Heart J Suppl.* 2006;8(suppl B):B4-12.

INTRA-ABDOMINAL OBESITY
=
EXCESS OF **VISCERAL FAT**



Smoking
Age
Gender
Genetic factors

Adapted from: Mahmood DA and Sulaiman N. http://www.pitt.edu/~super1/lecture/lec39261/index.htm [visited 01/05/2022]

Baseline variables	Incident CHD status		P value
	CHD absent	CHD present	
n	125	50	
Computed tomography fat area (cm^2)			
Chest subcutaneous	92.7 ± 4.1	104.0 ± 5.6	**0.13**
Abdomen subcutaneous	129.3 ± 5.7	146 ± 7.9	**0.11**
Intra-abdominal (visceral)	108.9 ± 4.7	133.0 ± 7.6	**0.0075**
Left thigh subcutaneous	43.1 ± 1.5	40.8 ± 2.1	**0.39**

Intra-abdominal (Visceral) Fat and Coronary Heart Disease (CHD) in Japanese-American men

Adapted from: Fujimoto WY et al. Diabetes Care 1999; 22:1808-12

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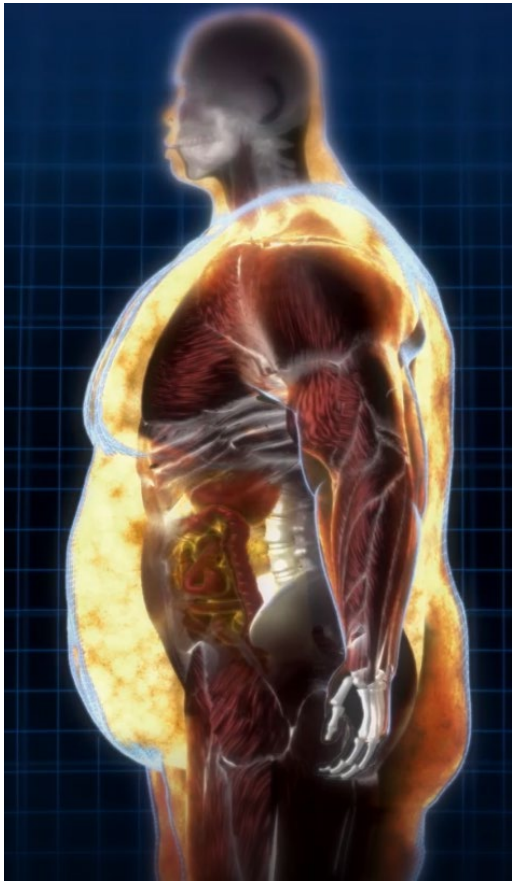
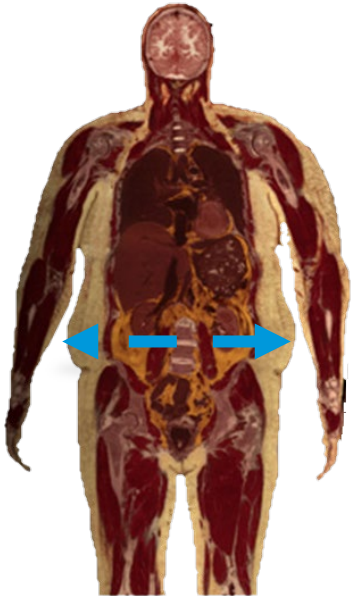


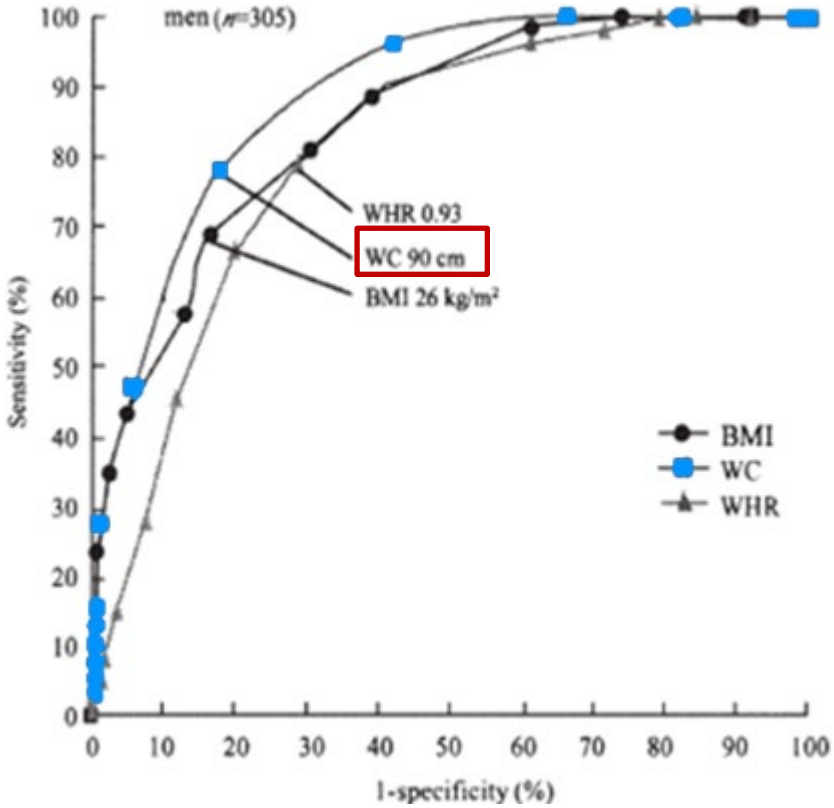
Images form: https://www.pbslearningmedia.org/resource/nvttaf-sci-fatstorage/fat-storage-and-energy-use-the-truth-about-fat/

♂
- Normal (<=102 cm)
- Abdominal obese (>102 cm)

♀
- Normal (<=88 cm)
- Abdominal obese (>88 cm)

Adult Treatment Panel (ATP III). Circulation. 2002;106:3143–3421

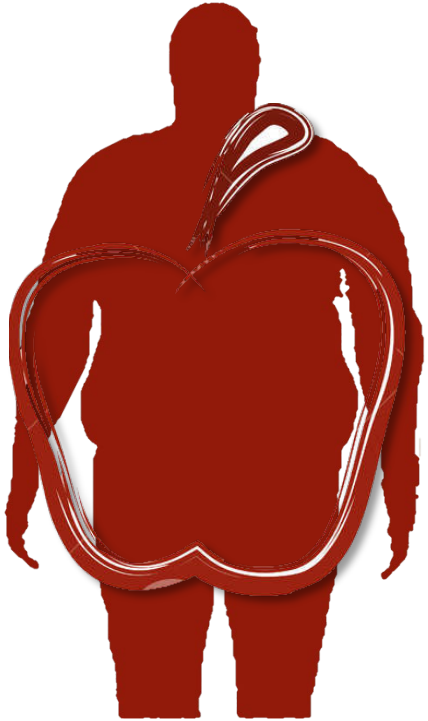




ROC curves of BMI, WC and WHR for the determination of abdominal visceral obesity (≥ 100 cm²)

Adapted from: Jia WP, Lu JX, Xiang KS, Bao YQ, Lu HJ, Chen L. 2003 Sep;16(3).

Darbandi et Al, 2020. Discriminatory Capacity of Anthropometric Indices for Cardiovascular Disease in Adults: A Systematic Review and Meta-Analysis. *Preventing Chroinic Disease 17:E131*



Trends in the distribution of total body fat and abdominal fat in the South African adult population between 1998 and 2017

Body Mass Index (BMI)

Waist circumference (WC)

PRELIMINARY RESULTS

DATA SOURCES

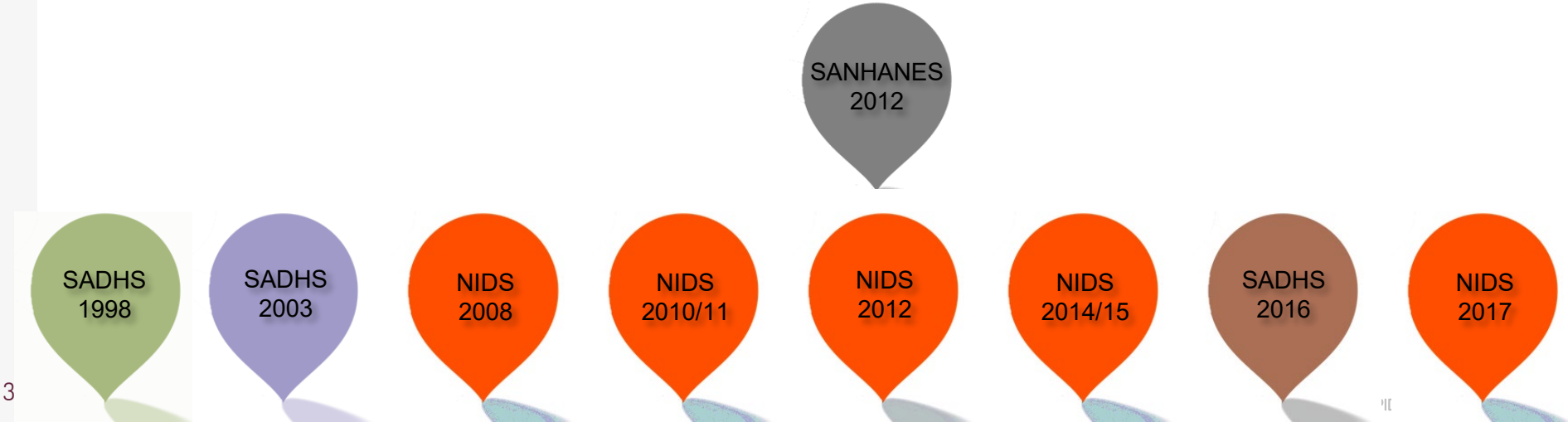
9 national surveys

Data collection between 1998 and 2017

Total (Adult 15+) sample size :

♀ 85 822

♂ 63 420



ANALYTICAL METHODS

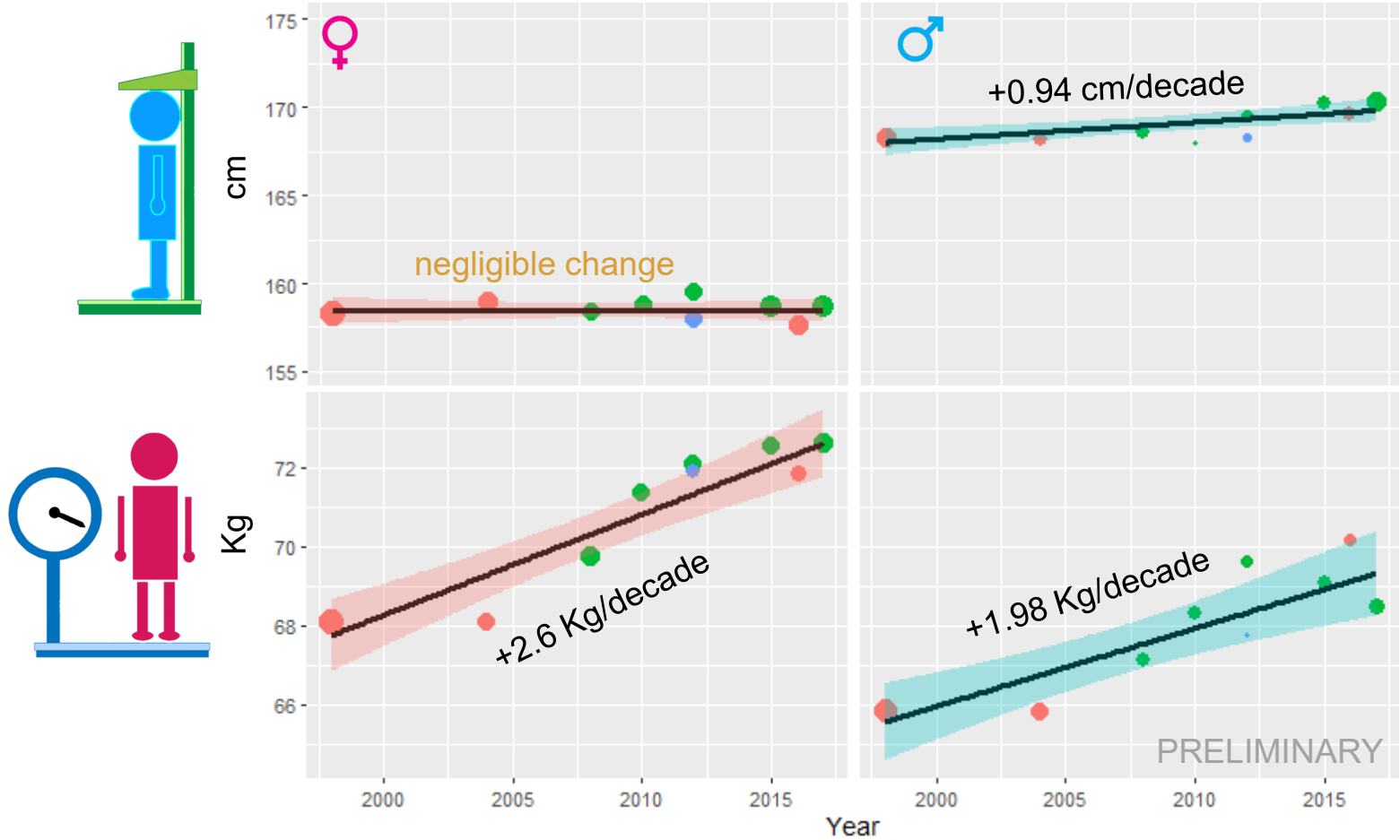
- Metaregression approach, linear trend
- Quality weighting
- Lognormal distribution of BMI in the population
- Complex sampling scheme taken into account by using sandwich estimators

RESULTS

IN BOTH SEXES, BMI AND WC HAVE INCREASED BETWEEN 1998 AND 2017

THE INCREASE WAS HIGHER AMONG WOMEN

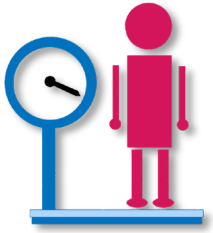
INCREASES IN WC WERE NOT COMPLETELY EXPLAINED BY INCREASES IN BMI



Trends in height of the South African adult population (15+) between 1998 and 2017

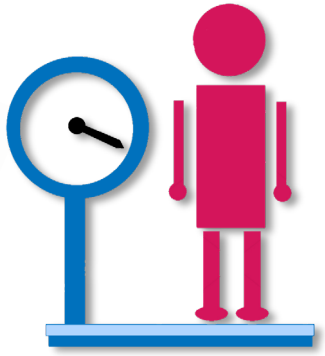
1998

2017



67.7 Kg

Female



72.6 Kg

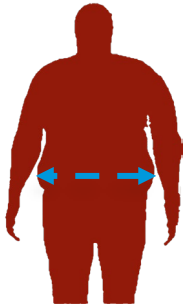
65.5 Kg

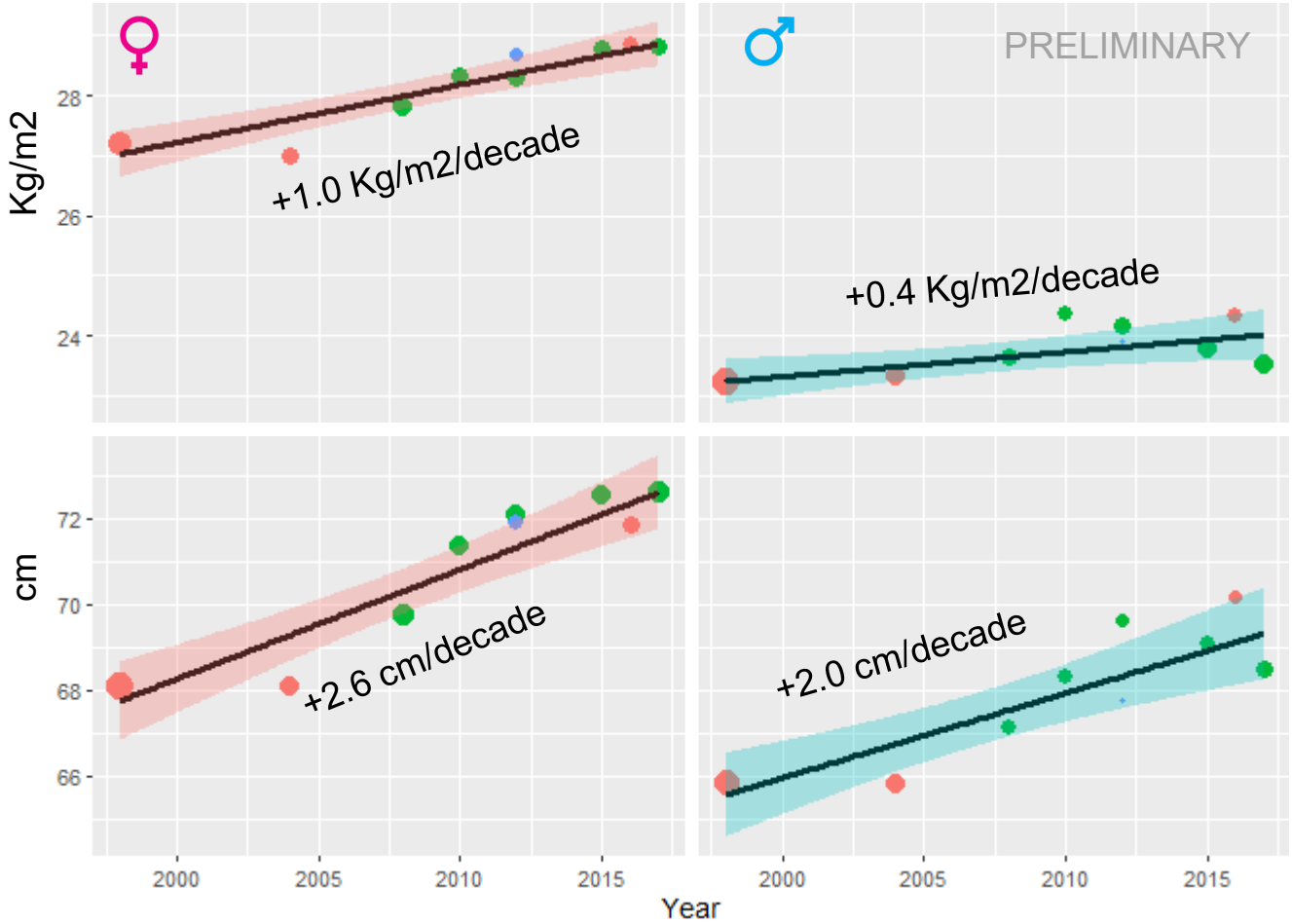
Male

69.3 Kg

Average body weight of the South African adult population (15+)

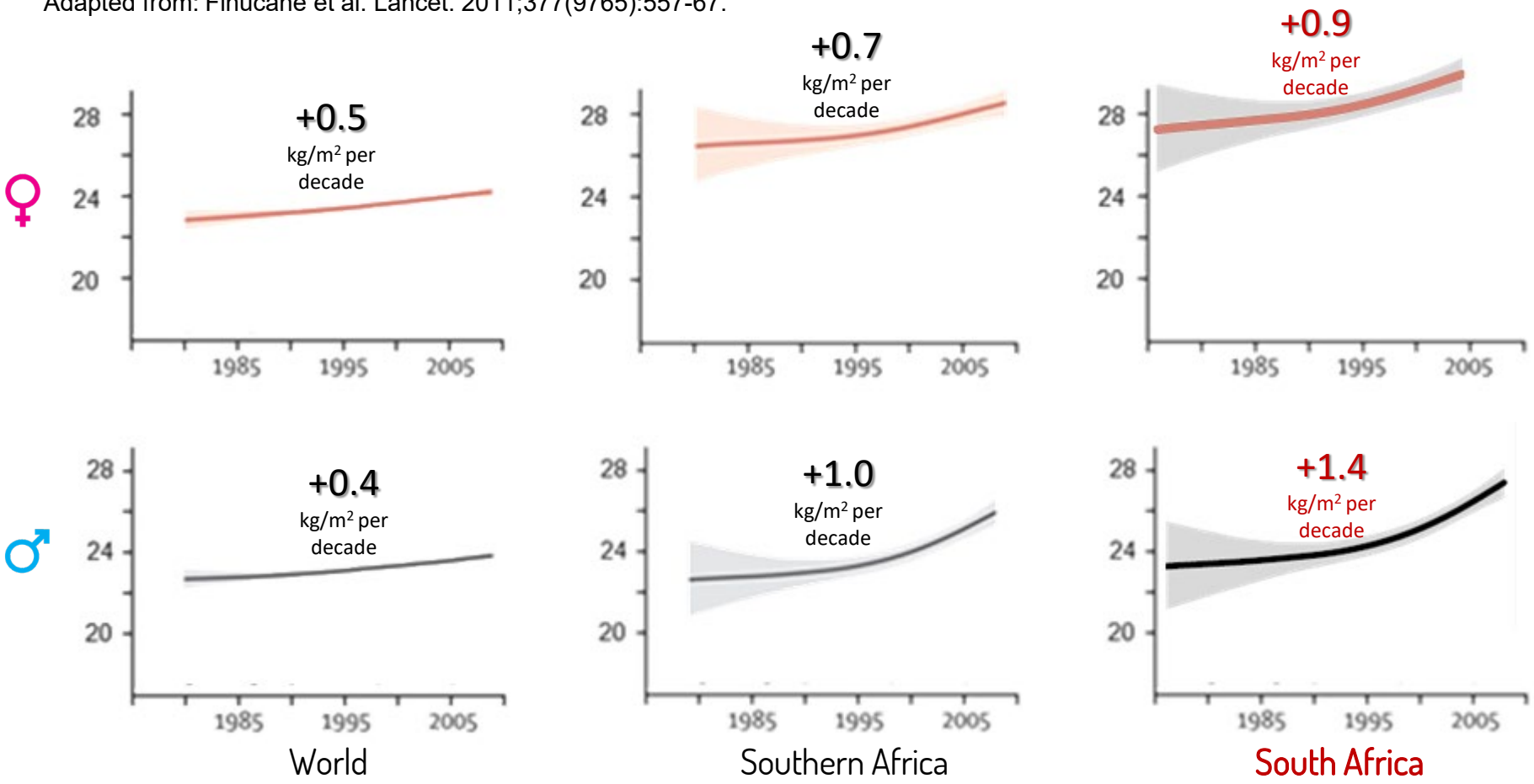
BMI



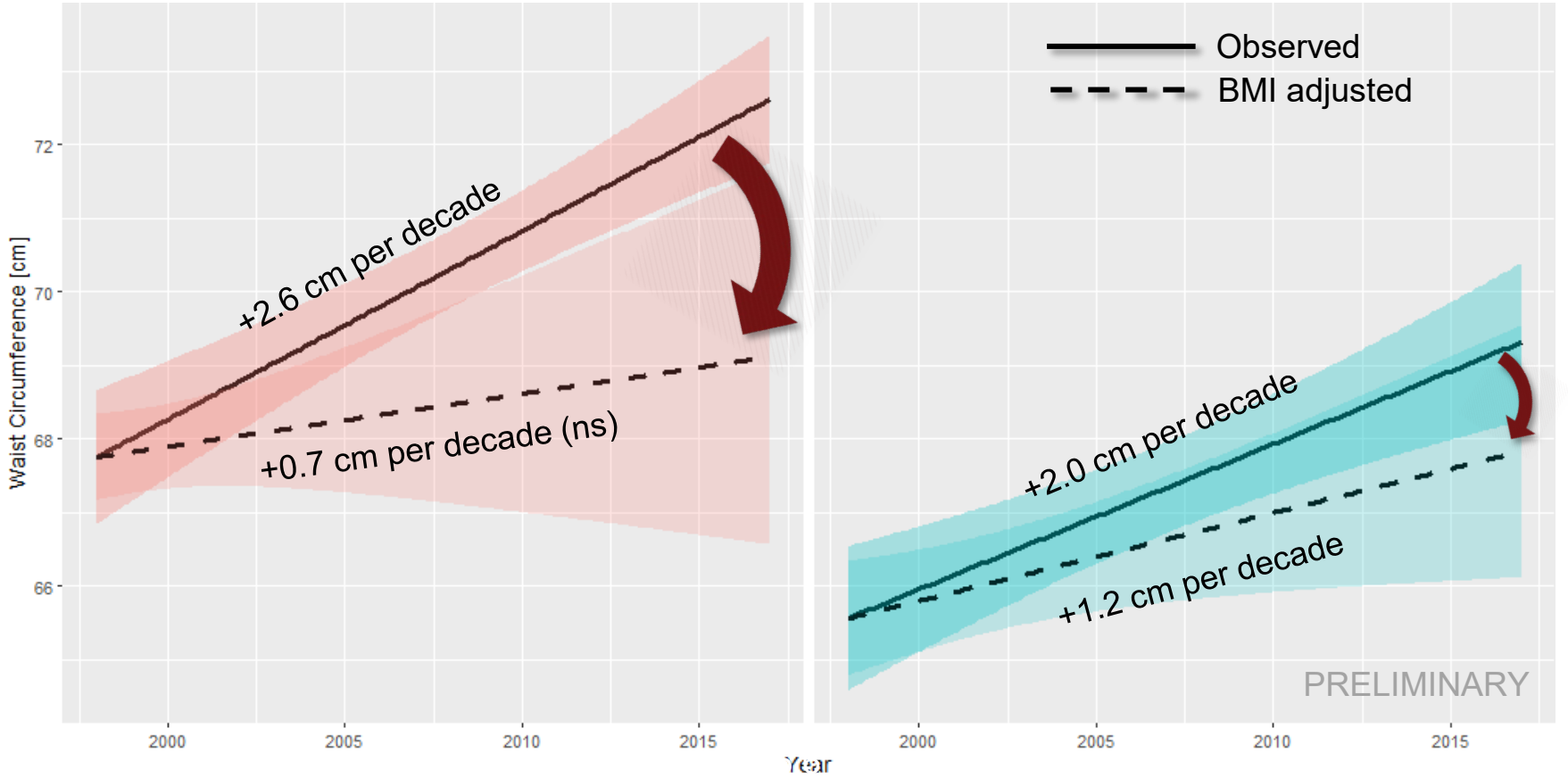


Trends in BMI and WC in the South African Adult population (15+)

Adapted from: Finucane et al. Lancet. 2011;377(9765):557-67.



Worldwide age-standardised trends in BMI 1980-2008

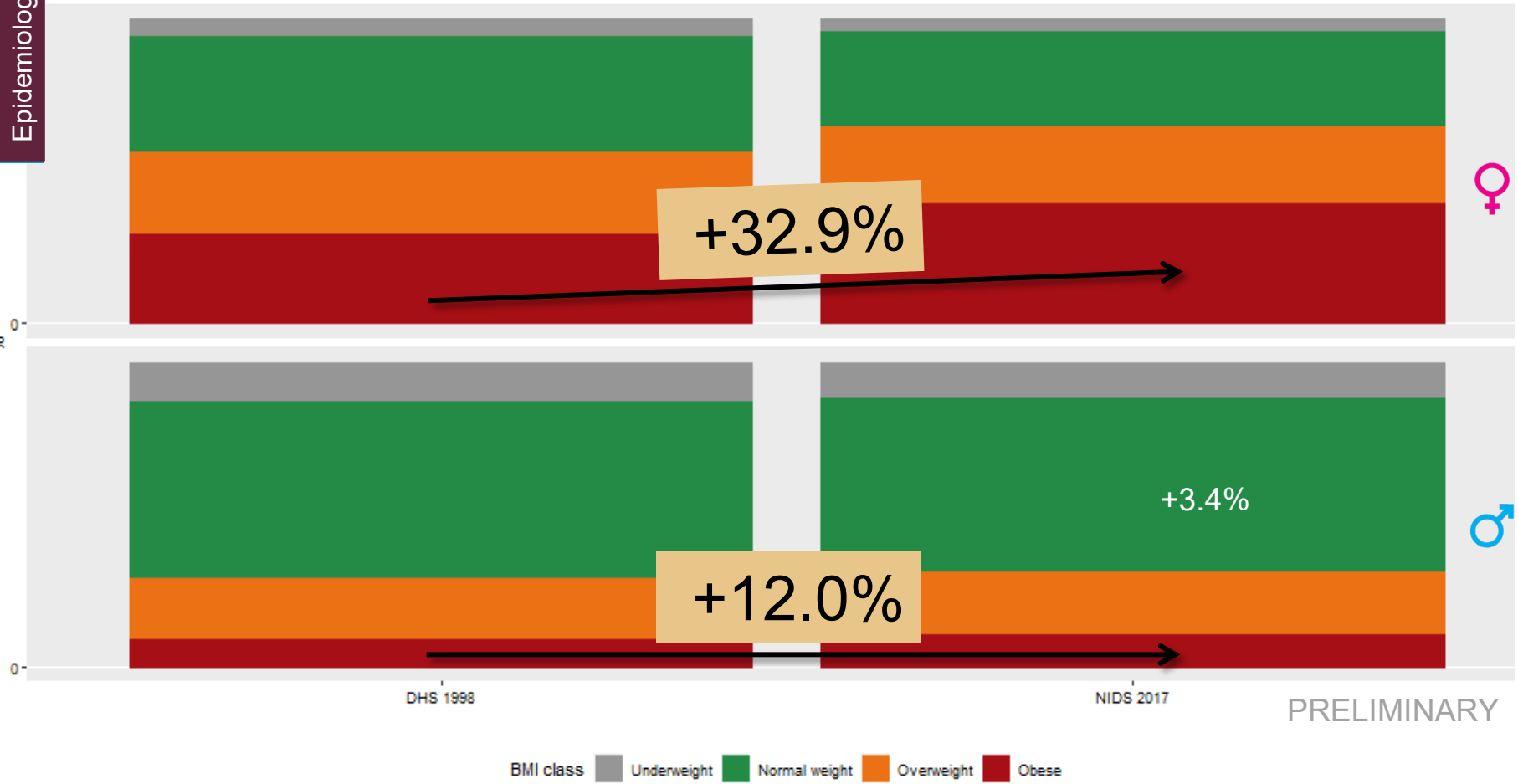


Trends in WC in the South African Adult population (15+)

Observed vs. adjusted for BMI

THE PROPORTION OF HIGH-RISK SUBJECTS IS INCREASING, MORE THAN INDICATED BY BMI ALONE....

Distribution of the South African adult population (15+) per BMI categories.



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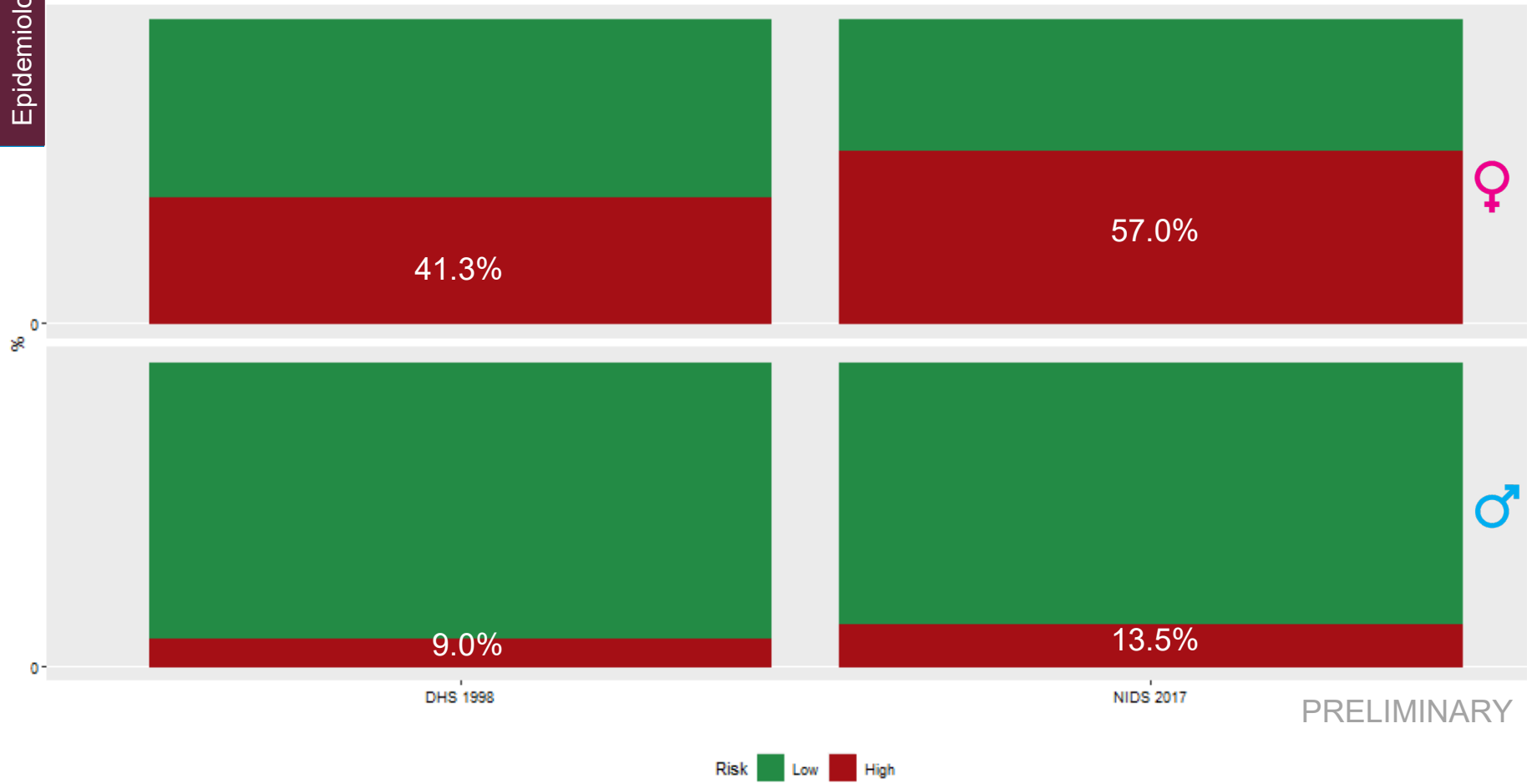
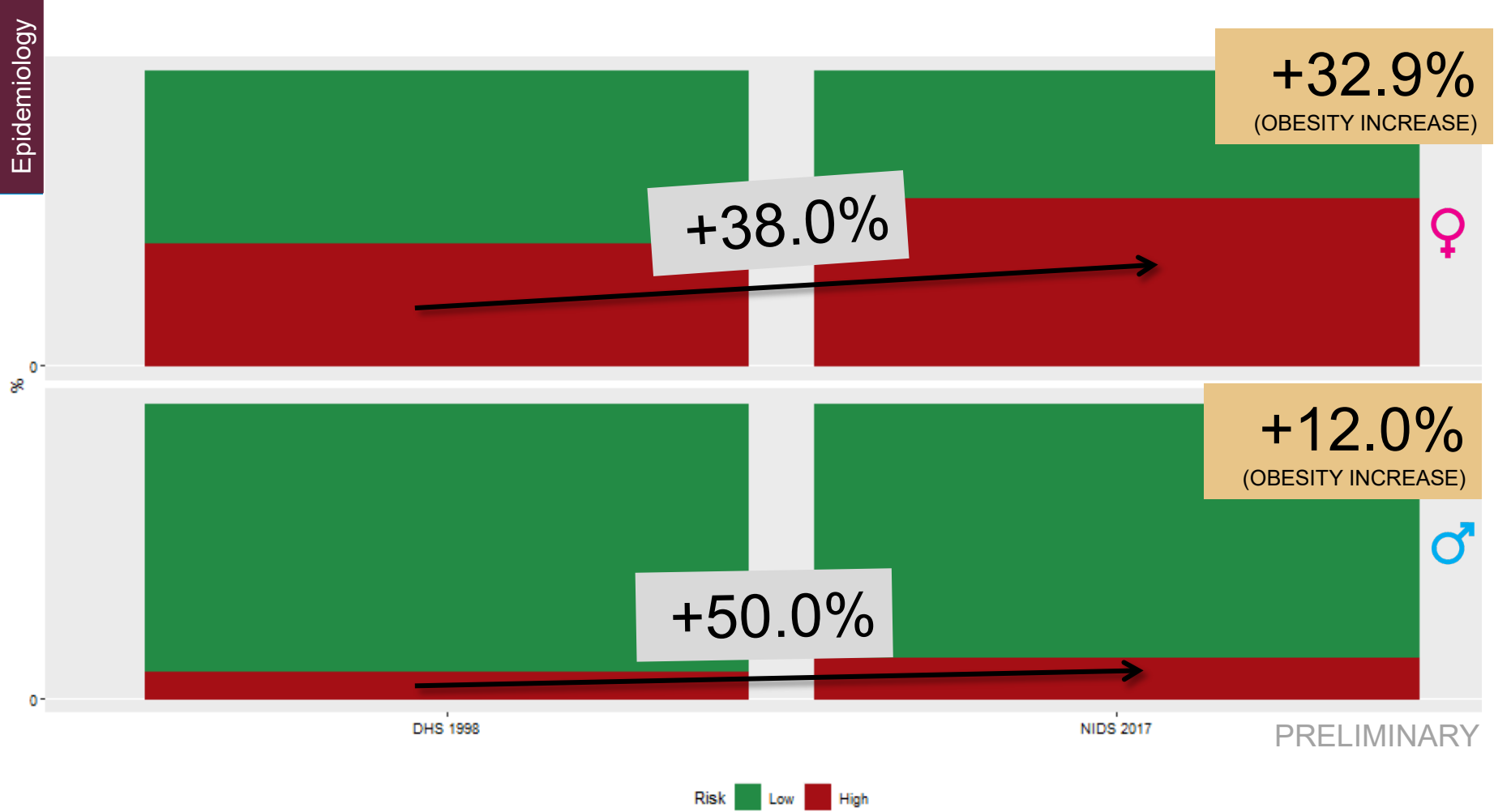


Distribution of the South African adult population (15+) per WC Risk categories.



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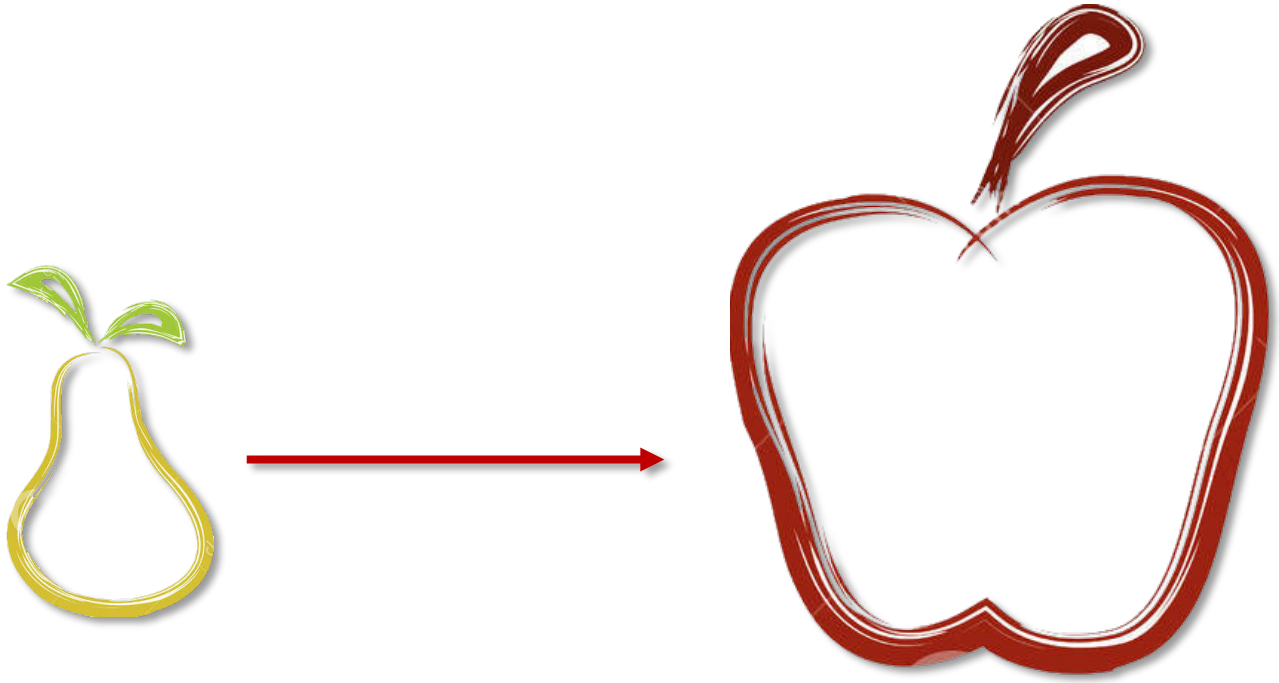
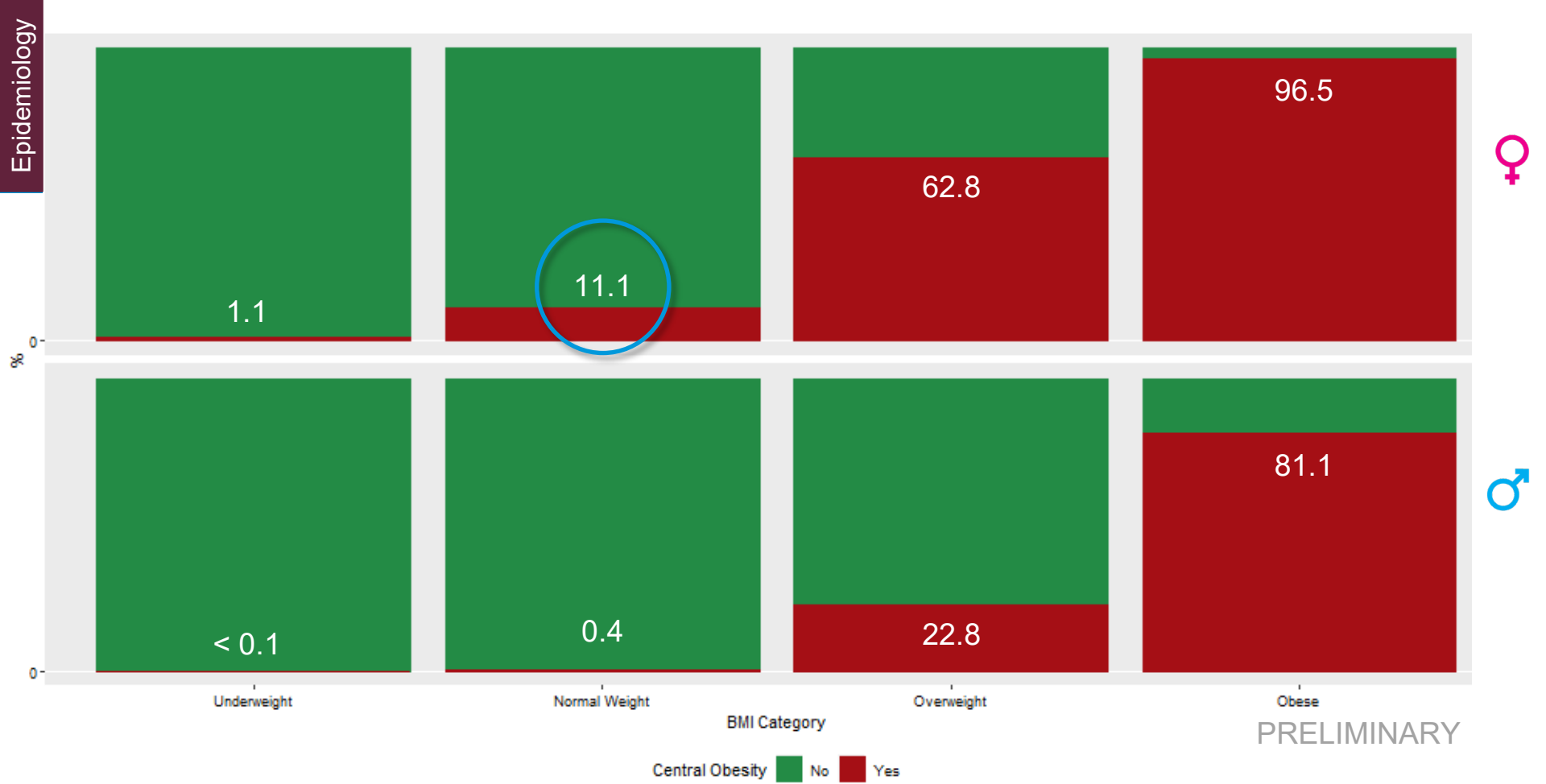


ABDOMINAL FAT IS INCREASING NOT ONLY AMONG OBESE PEOPLE…



Proportion of abdominal obese by BMI categories in the South African adult population 2017 (15+).

Age adjusted estimates form NIDS survey data

Annals of Internal Medicine ORIGINAL RESEARCH

Normal-Weight Central Obesity: Implications for Total and Cardiovascular Mortality

Karine R. Sahakyan, MD, PhD, MPH; Virend K. Somers, MD, PhD; Juan P. Rodriguez-Escudero, MD; David O. Hodge, MS; Rickey E. Carter, PhD; Ondrej Sochor, MD; Thais Coutinho, MD; Michael D. Jensen, MD; Véronique L. Roger, MD, MPH; Prachi Singh, PhD; and Francisco Lopez-Jimenez, MD, MS

Background: The relationship between central obesity and survival in community-dwelling adults with normal body mass index (BMI) is not well-known.

Objective: To examine total and cardiovascular mortality risks associated with central obesity and normal BMI.

Design: Stratified multistage probability design.

Setting: NHANES III (Third National Health and Nutrition Examination Survey).

Participants: 15 184 adults (52.3% women) aged 18 to 90 years.

Measurements: Multivariable Cox proportional hazards models were used to evaluate the relationship of obesity patterns defined by BMI and waist-to-hip ratio (WHR) and total and cardiovascular mortality risk after adjustment for confounding factors.

Results: Persons with normal-weight central obesity had the worst long-term survival. For example, a man with a normal BMI (22 kg/m^2) and central obesity had greater total mortality risk than one with similar BMI but no central obesity (hazard ratio [HR], 1.87 [95% CI, 1.53 to 2.29]), and this man had twice the mortality risk of participants who were overweight or obese according to BMI only (HR, 2.24 [CI, 1.52 to 3.32] and 2.42 [CI, 1.30 to 4.53], respectively). Women with normal-weight central obesity also had a higher mortality risk than those with similar BMI but no central obesity (HR, 1.48 [CI, 1.35 to 1.62]) and those who were obese according to BMI only (HR, 1.32 [CI, 1.15 to 1.51]). Expected survival estimates were consistently lower for those with central obesity when age and BMI were controlled for.

Limitations: Body fat distribution was assessed based on anthropometric indicators alone. Information on comorbidities was collected by self-report.

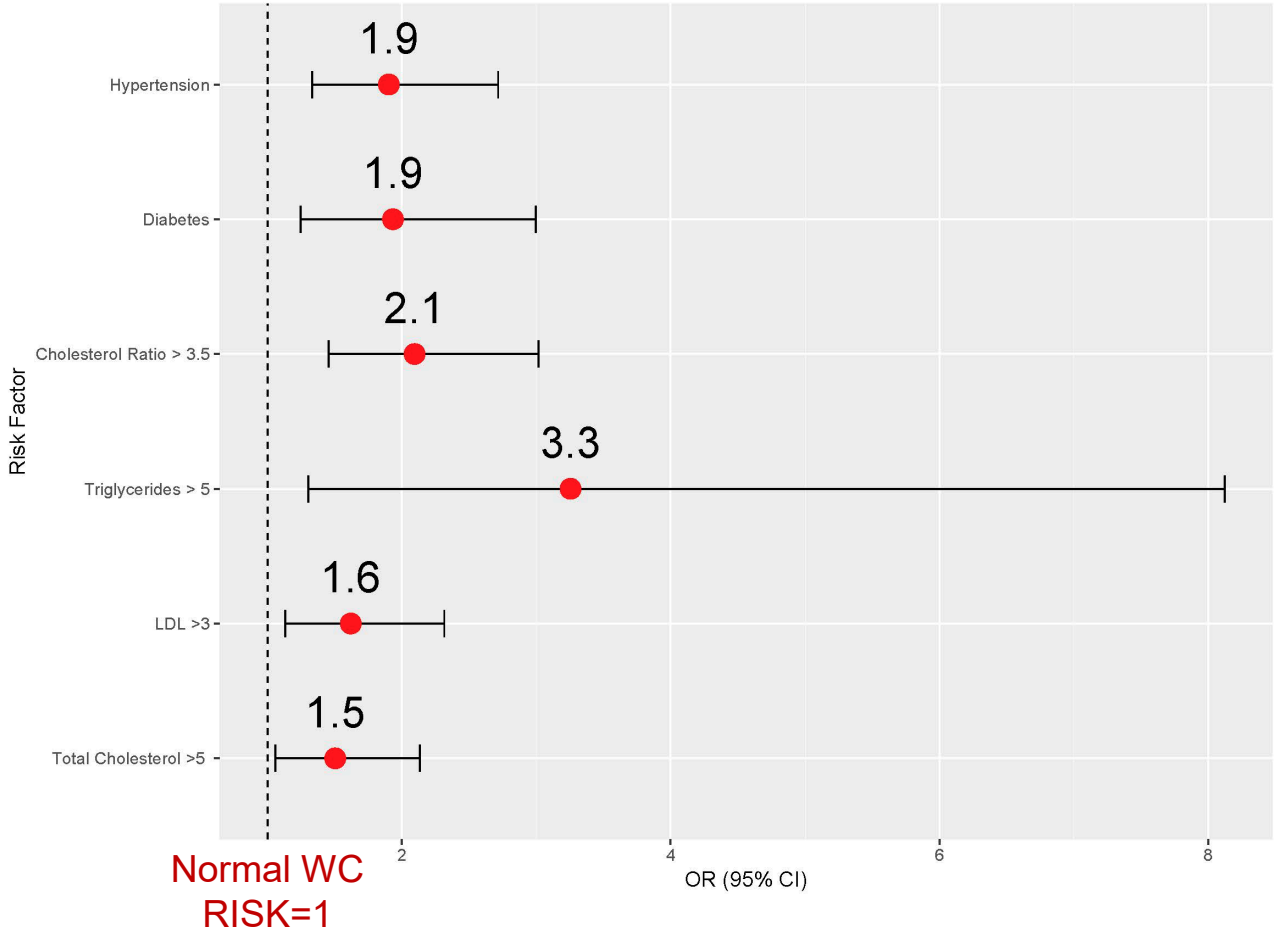
Conclusion: Normal-weight central obesity defined by WHR is associated with higher mortality than BMI-defined obesity, particularly in the absence of central fat distribution.

Primary Funding Source: National Institutes of Health, American Heart Association, European Regional Development Fund, and Czech Ministry of Health.

Ann Intern Med. 2015;163:827-835. doi:10.7326/M14-2525 **www.annals.org**

For author affiliations, see end of text.

This article was published online first at www.annals.org on 10 November 2015.



~ 4000 subjects with clinical data

SANHANES 2012

Odds Ratios for CVD risk factors among subjects centrally obese vs. subjects with normal WC.

Age, sex and BMI adjusted

TRENDS DIFFER AMONG SUBPOPULATIONS

PRELIMINARY

Trends in BMI in the South African Adult population (15+). By age category.

PRELIMINARY

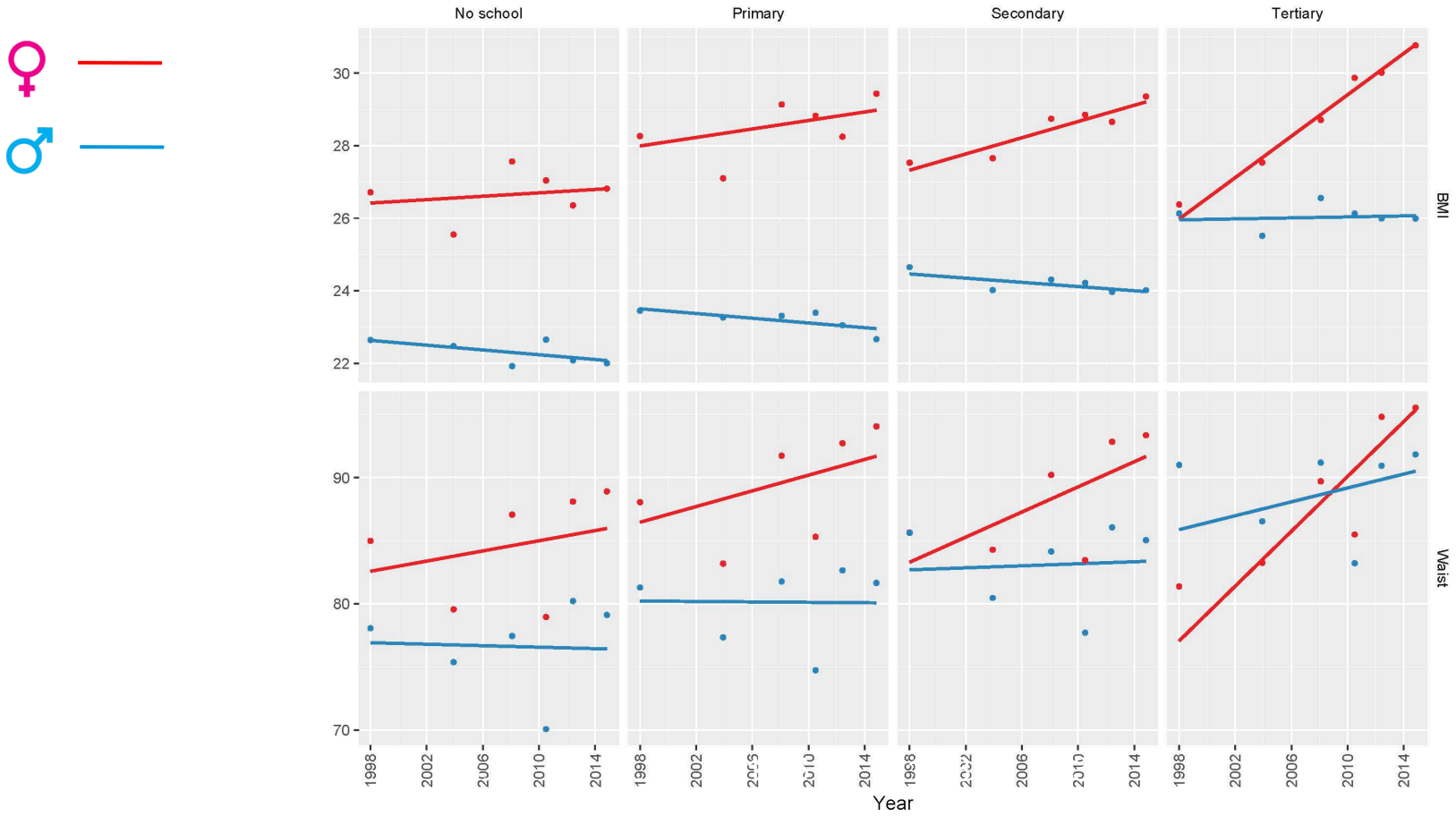
Trends in WC in the South African Adult population (15+). By age category.

International Journal of Epidemiology, 2017, 1–11
doi: 10.1093/ije/dyx263

Rapidly increasing body mass index among children, adolescents and young adults in a transitioning population, South Africa, 2008–15

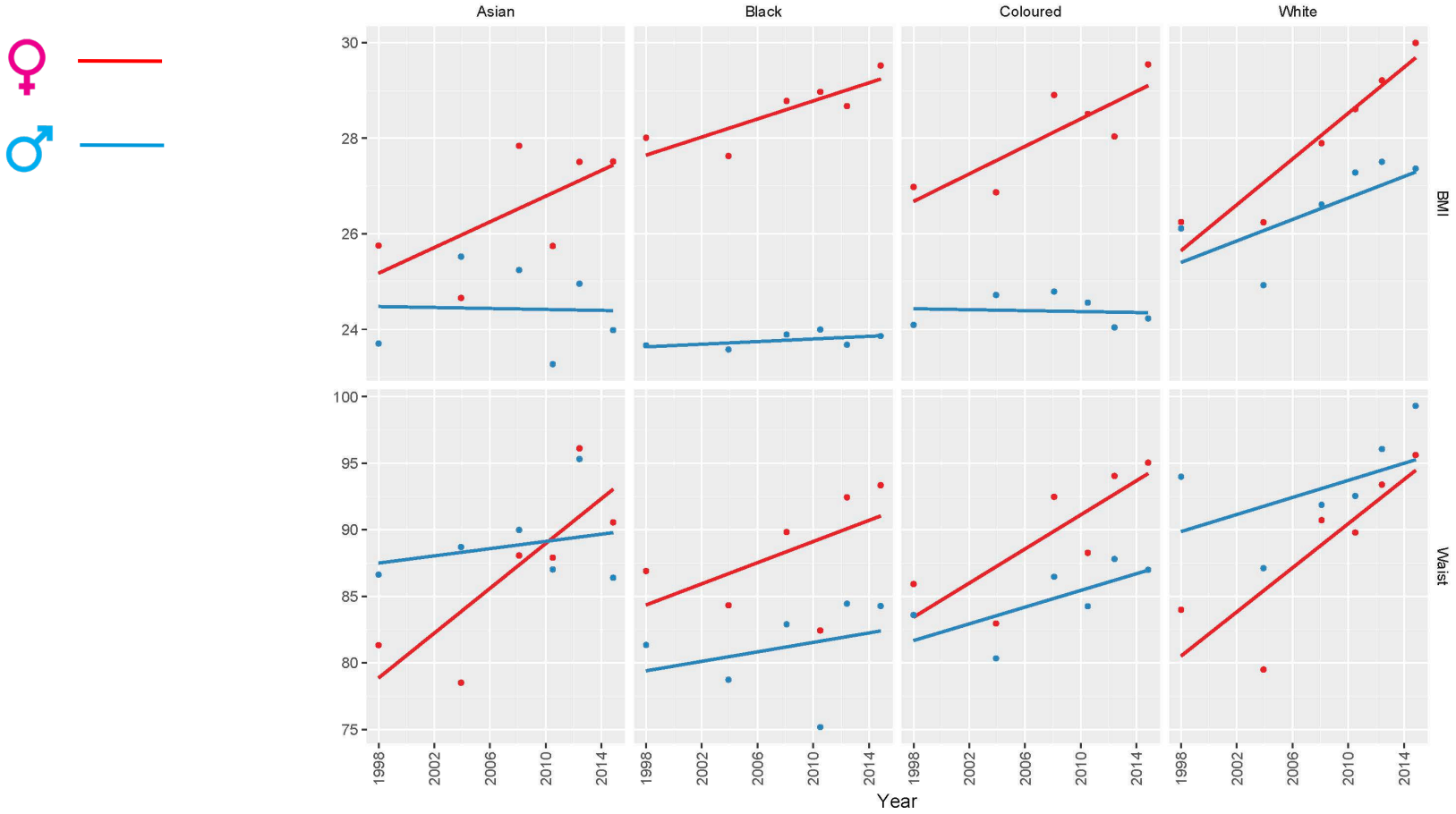
B Sartorius,[1]* K Sartorius,[1,2] M Taylor,[1] J Aagaard-Hansen,[3] N Dukhi,[1] C Day,[4] N Ndlovu,[4] R Slotow[5,6] and K Hofman[7]

Results: From 2008 to 2015, there was rapid rise in mean BMI in the 6–25 age band, with the highest risk (3–4+ BMI unit increase) among children aged 8–10 years. The increase was largely among females in urban areas and of middle-high socioeconomic standing. Prominent gains were also observed in certain rural areas, with extensive geographical heterogeneity across the country.



Trends in BMI and WC in the South African Adult population (15+). 1998-2012. By Education.

Age adjusted.



Trends in BMI and WC in the South African Adult population (15+). 1998-2012. By population group.

Age adjusted.

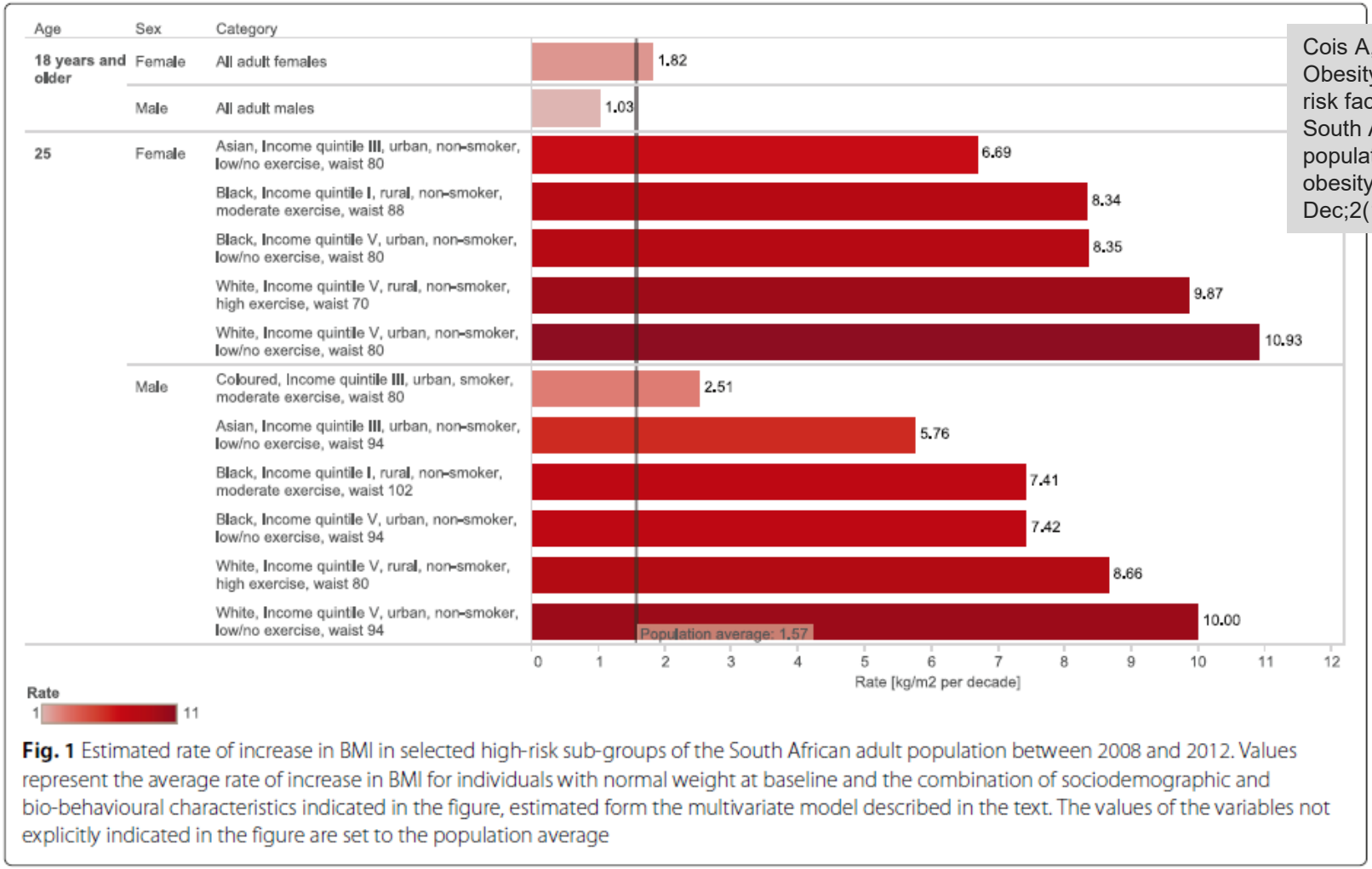
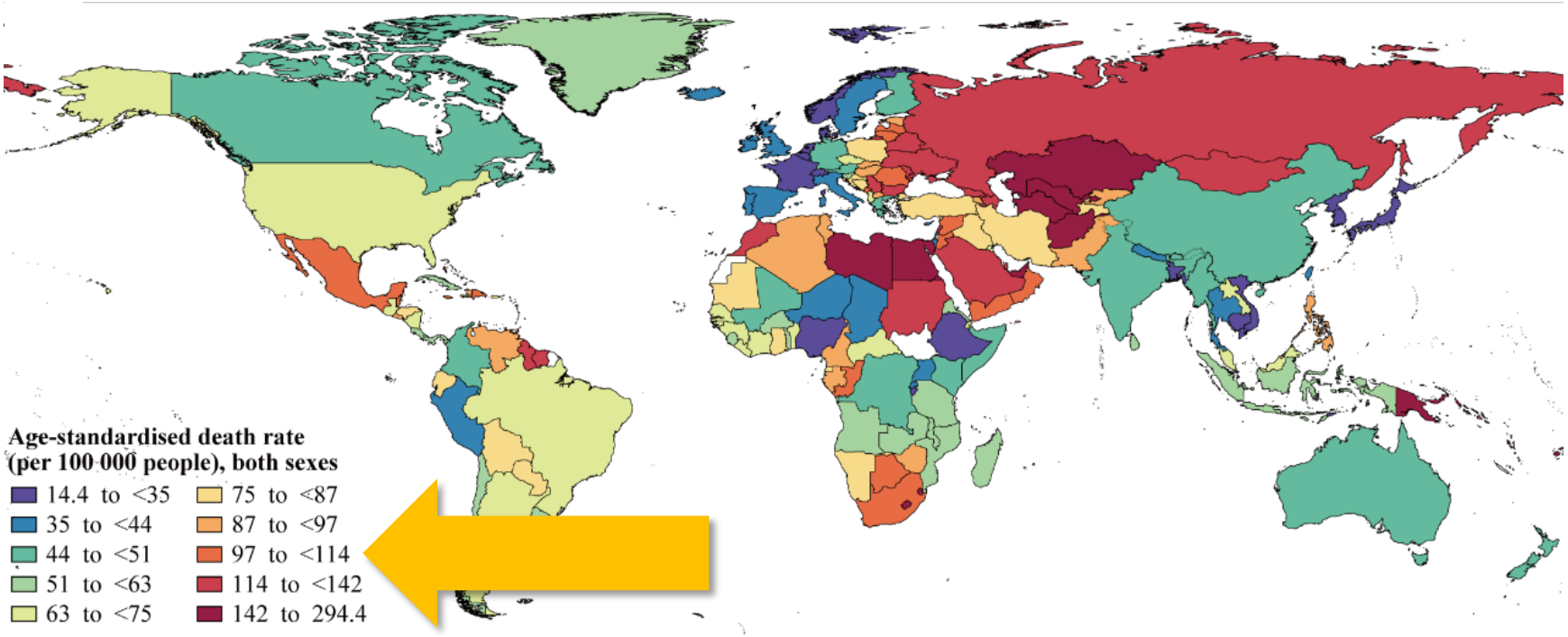


Fig. 1 Estimated rate of increase in BMI in selected high-risk sub-groups of the South African adult population between 2008 and 2012. Values represent the average rate of increase in BMI for individuals with normal weight at baseline and the combination of sociodemographic and bio-behavioural characteristics indicated in the figure, estimated form the multivariate model described in the text. The values of the variables not explicitly indicated in the figure are set to the population average

Cois A, Day C. Obesity trends and risk factors in the South African adult population. BMC obesity. 2015 Dec;2(1):1-0.

why we must take action

THE BURDEN OF DISEASE ASSOCIATED WITH OBESITY IS HIGH

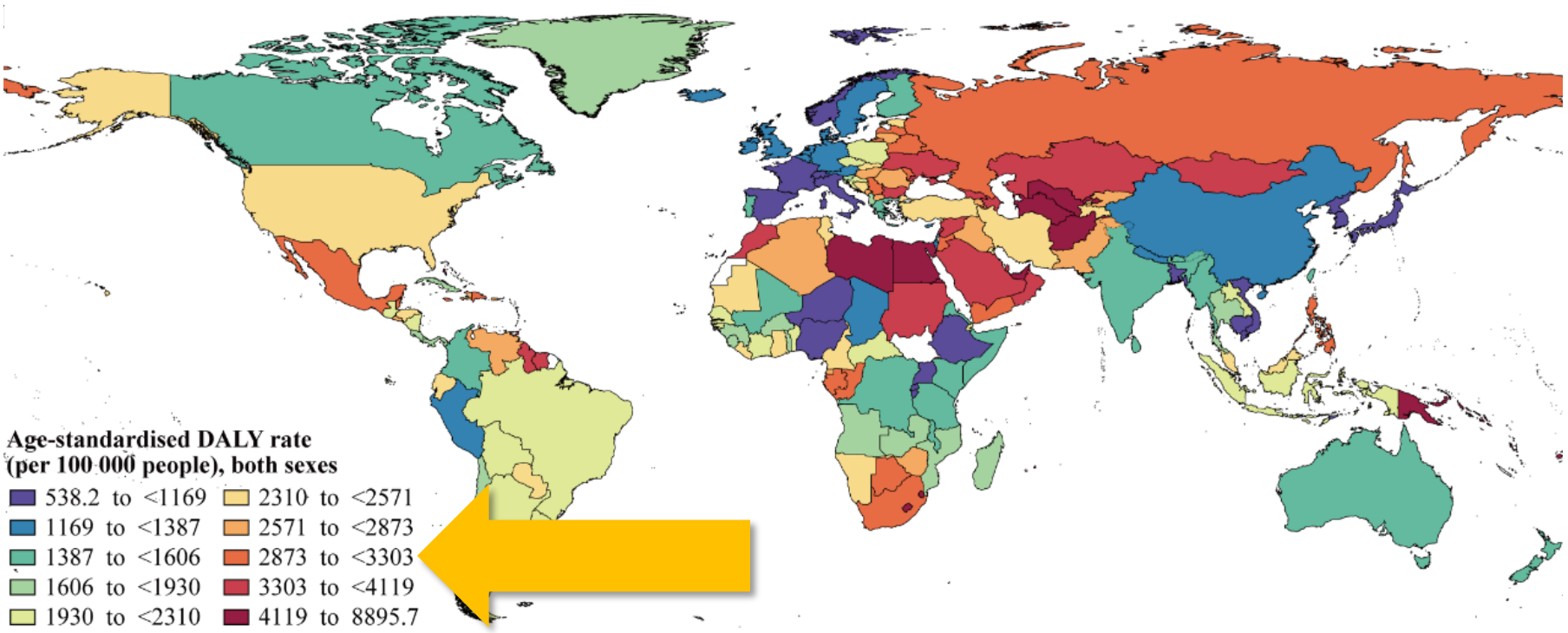


The global burden of disease attributable to high body mass index in 195 countries and territories, 1990–2017: An analysis of the Global Burden of Disease Study

Haijiang Dai, Tariq A. Alsalhe, Nasr Chalghaf, Matteo Riccò, Nicola Luigi Bragazzi, Jianhong Wu

Published: July 28, 2020 • https://doi.org/10.1371/journal.pmed.1003198

	2017	
	Death rates [x 100 000]	PAF
Global	60.1 (37.9, 85.5)	8.2% (5.1, 11.6)
South Africa	108.8 (78.7, 138.8)	10.5% (7.6, 13.5)



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	2017	
	DALY rates [x 100 000]	PAF
Global	1816.9 (1211.2, 2494.9)	5.5% (3.7, 7.5)
South Africa	3079.6 (2316.5, 3852.2)	6.8% (5.2, 8.4)

THE OBESITY EPIDEMIC IS COSTLY

Global Health Action, 15:1, 2045092, DOI: 10.1080/16549716.2022.2045092

Estimating the healthcare cost of overweight and obesity in South Africa

Micheal Kofi Boachie, Evelyn Thsehla, Mustapha Immurana, Ciaran Kohli-Lynch & Karen J Hofman

Methods: Using a bottom-up gross costing approach, this study draws data from multiple sources to estimate the direct healthcare cost of overweight and obesity in South Africa. Population Attributable Fractions (PAF) were calculated and multiplied by each disease's total treatment cost to apportion costs to overweight and obesity. Annual costs were estimated for 2020.

Results: The total cost of overweight and obesity is estimated to be ZAR33,194 million in 2020. This represents 15.38% of government health expenditure and is equivalent to 0.67% of GDP. Annual per person cost of overweight and obesity is ZAR2,769. The overweight and obesity cost is disaggregated as follows: cancers (ZAR352 million), cardiovascular diseases (ZAR8,874 million), diabetes (ZAR19,861 million), musculoskeletal disorders (ZAR3,353 million), respiratory diseases (ZAR360 million) and digestive diseases (ZAR395 million). Sensitivity analyses show that the total overweight and obesity cost is between ZAR30,369 million and ZAR36,207 million.

MOST OBESITY RISK FACTORS ARE MODIFIABLE

PLoS ONE 10(6): e0130218.
doi:10.1371/journal.pone.0130218

Determinants of Obesity and Associated Population Attributability, South Africa: Empirical Evidence from a National Panel Survey, 2008-2012

Benn Sartorius[1], Lennert J. Veerman[2], Mercy Manyema[3,4], Lumbwe Chola[3,4], Karen Hofman[3,4,5]*

Results

Obesity prevalence increased significantly from 23.5% in 2008 to 27.2% in 2012, with a significantly (p-value<0.001) higher prevalence among females (37.9% in 2012) compared to males (13.3% in 2012). Living in formal urban areas, white ethnicity, being married, not exercising and/or in higher socio-economic category were significantly associated with male obesity. Females living in formal or informal urban areas, higher crime areas, African/White ethnicity, married, not exercising, in a higher socio-economic category and/or living in households with proportionate higher spending on food (and unhealthy food options) were significantly more likely to be obese. The identified determinants appeared to account for 75% and 43% of male and female obesity respectively. White males had the highest relative gain in obesity from 2008 to 2012.

NATIONAL STRATEGIC PLAN FOR THE PREVENTION AND CONTROL OF NON-COMMUNICABLE DISEASES 2020-2025

STRATEGIC OBJECTIVE 3

Objective 3: To reduce modifiable risk factors for NCDs and its co-morbidities and underlying SDH through the creation of health promoting and enabling environments

Key actions:

- Creation of an enabling fiscal, legal and legislative **environment** and provision of a leading role in management of the behavioural risk factors
- Implementation of **policies** for prevention and control of NCDs at all levels including work place; community, public and private institutions, schools and workplaces;
- implementation of the WHO recommendations on the **marketing of foods and non-alcoholic beverages** to children and adolescents
- advocating for policy and regulations for improved **urban design** conducive for **physical activity**

THANK YOU

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advancing life