Explaining Population trends in cardiovascular risk: A comparative analysis of health transitions in South Africa and England
A Research Dissemination and Knowledge Exchange Event

Stellenbosch Institute for Advanced Study (Stias)
Wallenberg Research Centre, 10 Marais Road, Stellenbosch, South Africa
11th August 2023

CVD risk trends in South Africa and England

Findings from the ExPoSE project

Kafui Adjaye-Gbewonyo, University of Greenwich
Annibale Cois, Stellenbosch University

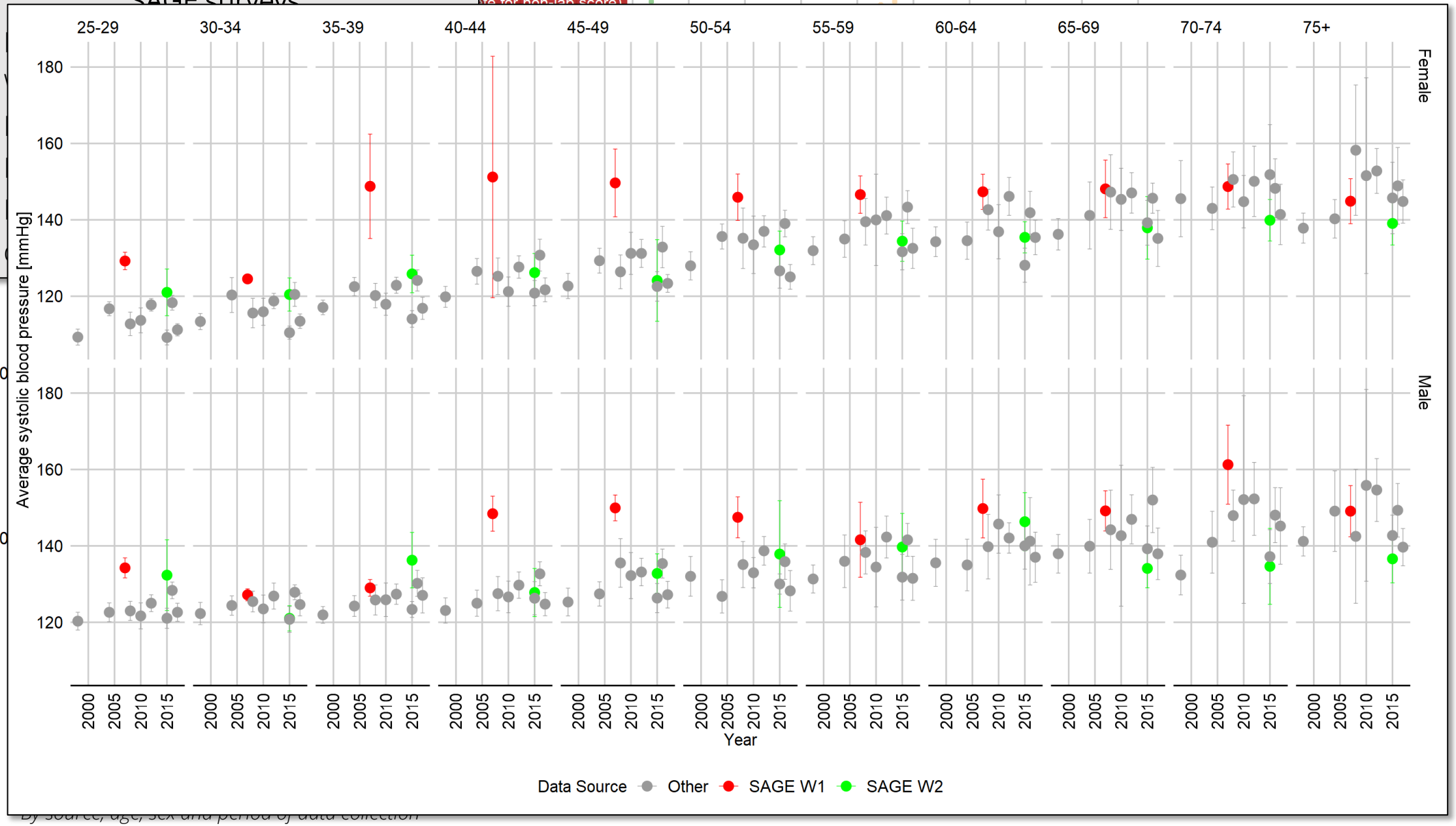
Stellenbosch University iYunivesithi Universiteit
University of Greenwich
UCL
UKRI Economic and Social Research Council

1. Methods
   - Data sources, cleaning and consolidation
   - Risk scores
   - Statistics
2. CVD risk trends in South Africa and England (1998-2017)
3. Making sense of these trends
   - Trends in major bio-behavioural risk factors, variance explained and adjusted CVD trends
   - Socio-economic patterns

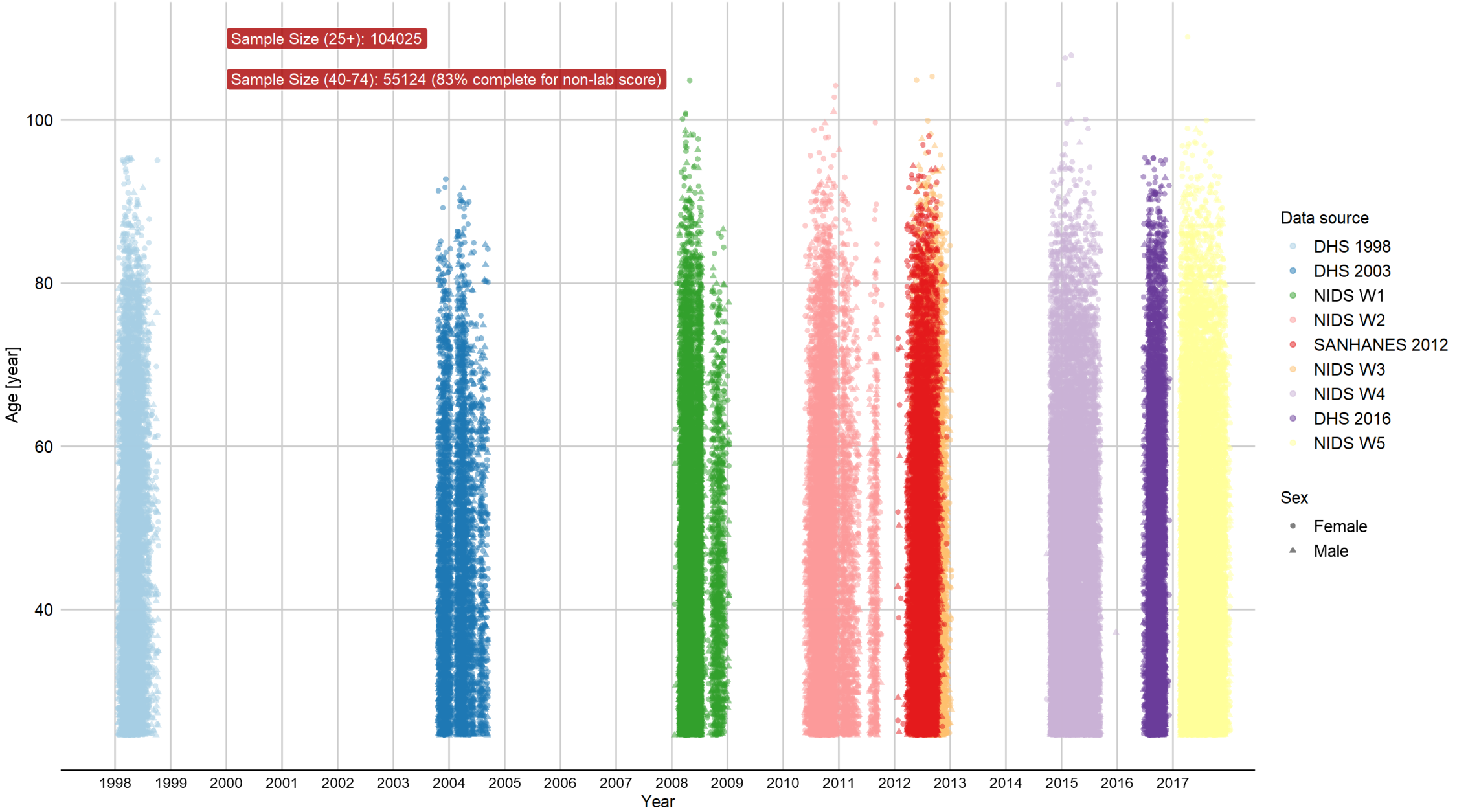
1. Methods

Sample Size (25+): 110786

SAGE surveys



By source, age, sex and period of data collection



Data points used for the main analyses

By source, age, sex and period of data collection

Cleaning

Uniform recording

Calibration

Geography

Wealth Index

Excluded records with missing data on basic demographic and location

Age Range: 25+

Age groups

Categorical variables

Unit of measurement

Calibration to consistent demographic series

mdb
municipal demarcation board

IPUMS DHS

Statistics South Africa
Preferred supplier of quality statistics

Main outcome

10-year risk of fatal and non-fatal cardiovascular disease (myocardial infarction and stroke)

Model

Cox hazard model fitted on a pooled cohort from 85 prospective studies (10+ years follow-up, CVD free participants at baseline, followed until the first myocardial infarction, fatal coronary heart disease, or stroke event

Predictors

pressure, history of diabetes, and total cholesterol.

Calibration using age-specific and sex-specific incidences and risk factor values available from 21 global regions.

Non-laboratory model

age, smoking status, systolic blood pressure, body mass index.

Calibration using age-specific and sex-specific incidences and risk factor values available for individual countries

Wolters Kluwer Health | Lippincott Williams & Wilkins

EUROPEAN SOCIETY OF CARDIOLOGY®

Original Scientific Paper

Predicting the risk of cardiovascular disease in HIV-infecte patients: the Data collection on Adverse Effects of Anti-HIV Drugs Study

Nina Friis-Møller[a], Rodolphe Thiébaut[b], Peter Reiss[d], Rainer Weber[e], Antonella D'Arminio [illegible]orte[f], Stephane De Wit[g], Wafaa El-Sadr[h], Eric Fontas[c], Signe [illegible] Kirk[a], Andrew Phillips[i], Caroline A. Sabin[i], Jens D. Lundgren [illegible][j]; for the DAD study group

Curr HIV/AIDS Rep. 2021 August ; 18(4): 271–279. doi:10.1007/s11904-021-00567-w.

Assessing Cardiovascular Risk in People Living with HIV: Current Tools and Limitations

Amit C. Achhra[1], Asya Lyass[2], Leila Boro[illegible]y[3], Milana Bogorodskaya[4], Jo[illegible], Virginia A. Triant[1,3], Joseph M. Massaro[2], Ralph B. D'A[illegible]

Contents available at PubMed
www.clinicalandtranslationalinvestigation.com

Check for updates

ORIGINAL ARTICLE

Rev Invest Clin. 2022;74(1):23-30

Cardiovascular Risk Prediction Models in People Living with HIV in Colombia

Angel A. García-Peña[1,2,3,4,*], Esther De-Vries[2], Jairo Aldana-Bitar[3], Edward Cáceres[3], Juan Botero[4], Juan Vásquez-Jiménez[4], Roberto Tamara[5], and Peter Olejua[6]

[1]PhD Program in Clinical Epidemiology and [2]Department of Clinical Epidemiology and Biostatistics, Faculty of Medicine, Pontificia Universidad Javeriana, Bogotá; [3]Cardiology Division; [4]Department of Internal Medicine, [5]Infectious Diseases Division; and [6]Research Office, Hospital Universitario San Ignacio, Pontificia Universidad [illegible]iana, Bogotá, Colombia

global R eports

Research Articles

Kintu A, Sando D, Guwatudde D, et al. Quantifying the burden of cardiovascular diseases among people living with HIV in sub-Saharan Africa: findings from a modeling study for Uganda. *Journal of Global Health Reports*. 2020;4:e2020076. doi:10.29392/001c.14377

Quantifying the burden of cardiovascular diseases among people living with HIV in sub-Saharan Africa: findings from a modeling study for Uganda

Alexander Kintu[1], David Sando[1], David Guwatudde[2], Silver Bahendeka[3], Peter C Kawungezi[4], Gerald M[illegible] Muyindike[6], Nicolas Menzies[1], Samson Okello[7], Goodarz Danaei[8,a], Stéphane Verguet[1,b]

HIV/AIDS - Research and Palliative Care

Volume 13, 2021, Pages 605-615

Comparison of predicted cardiovascular risk profiles by different cvd risk-scoring algorithms between hiv-1-infected and uninfected adults: A cross-sectional study in Tanzania(Article) (Open Access)

Msoka, T., Rogath, J., Van Guilder, G., Kapanda, G., Smulders, Y., van Furth, M.T., Bartlett, J., van Agtmael, M.

[a]Kilimanjaro Christian Medical Centre, Moshi, Tanzania
[b]High Altitude Exercise Physiology, Western Colorado University, Gunnison, CO, United States
[c]VU University Medical Centre, Amsterdam, Netherlands

Assessment of cardiovascular disease risks using Framingham risk scores (FRS) in HIV-positive and HIV-negative older adults in South Africa

Makandwe Nyirenda[a,b,*]

[a] South African Medical Research Council, Burden of Disease Research Unit, Francie Van Zijl Drive, Cape Town, South Africa
[b] University of KwaZulu-Natal, School of Public Health and Nursing, Howard Campus, Durban, South Africa

Age and sex-specific trends in CVD risk and risk factors between 1998 and 2017

Adjusted CVD risk trends

Observed and counterfactual BP distributions over time

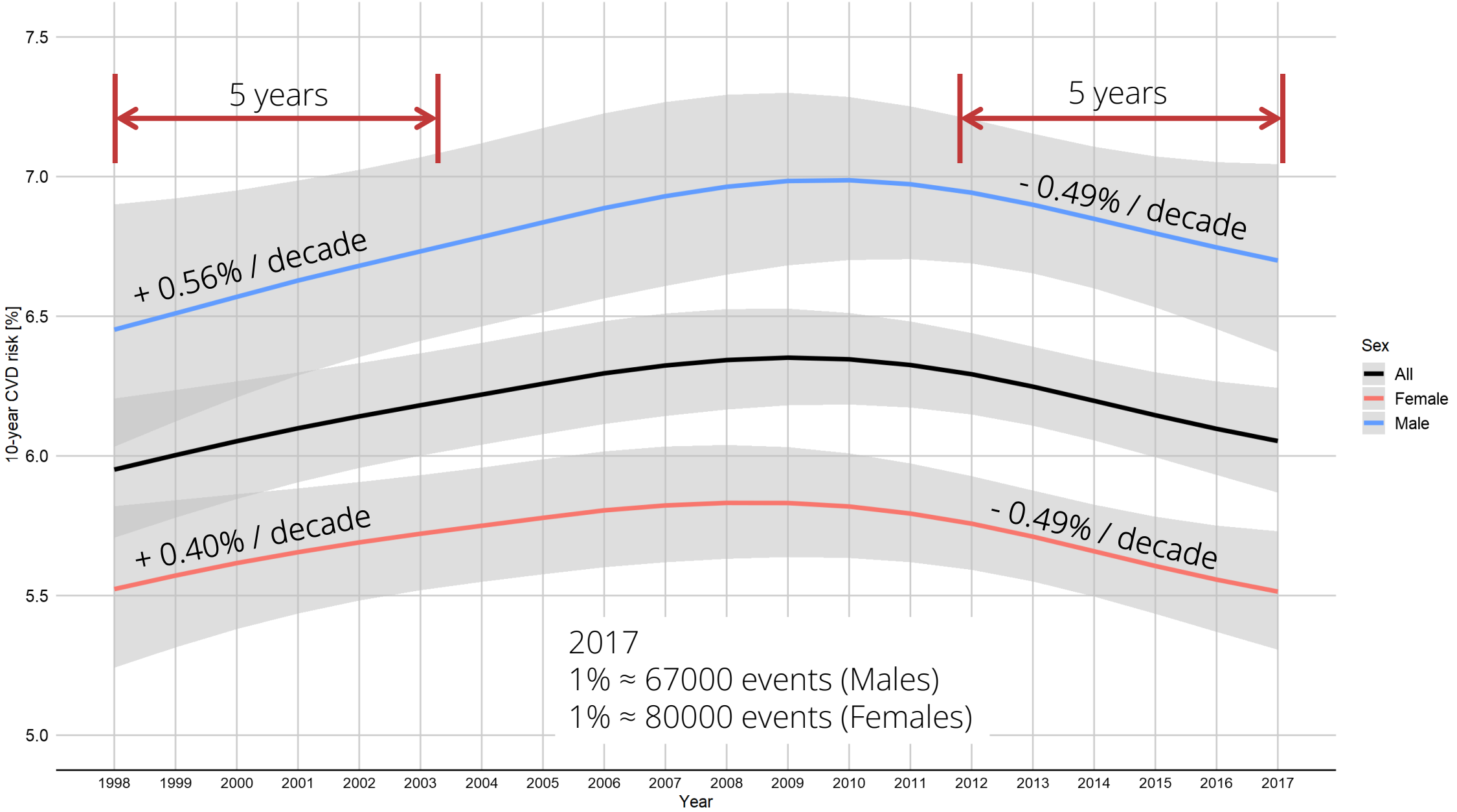
Variance Decomposition

Multiple Imputation for missing data (n = 20)

Adjustment for seasonality

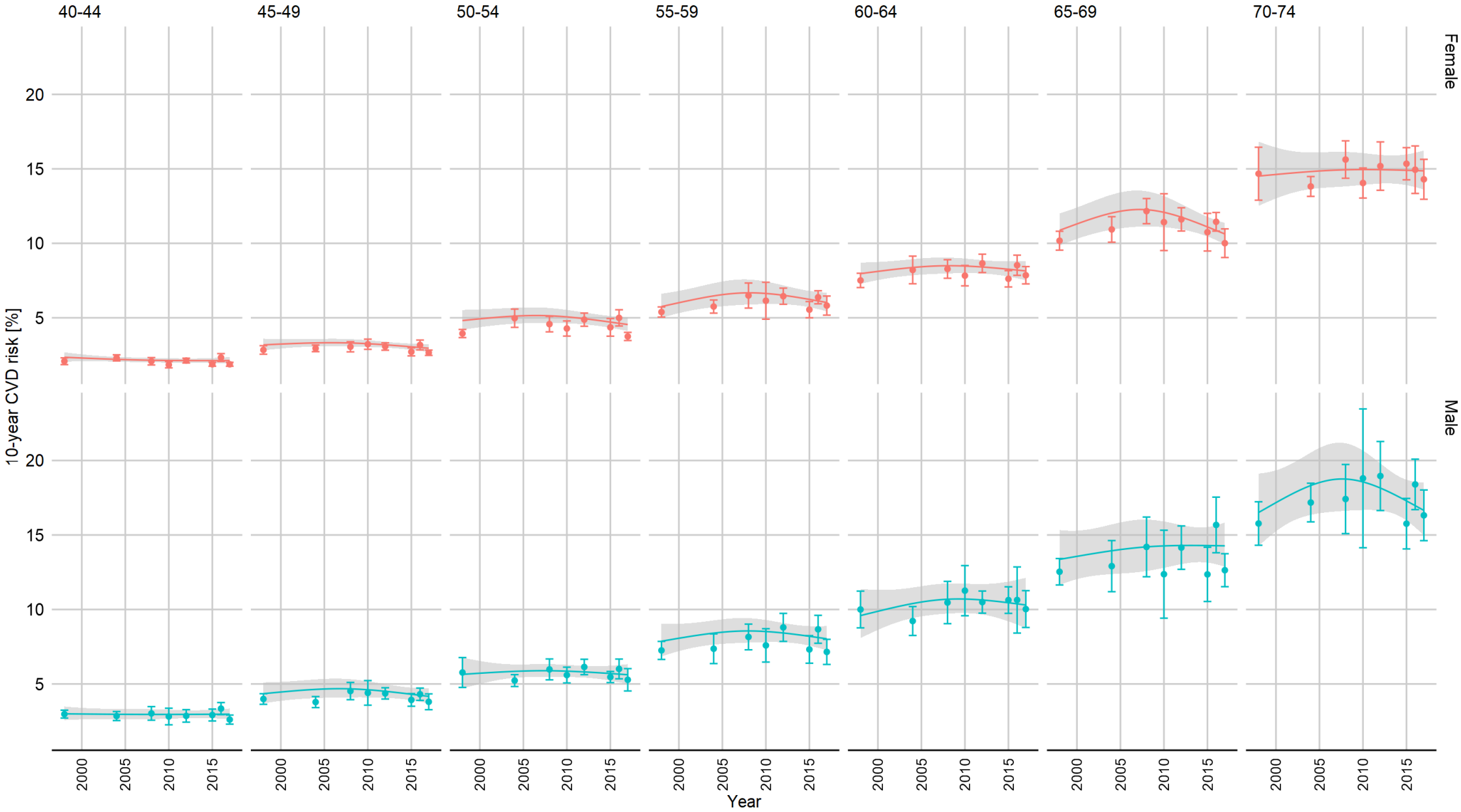
Adjustment of standard errors for survey design

2. CVD Trends in South Africa…



Estimated trend in CVD Risk. South African population 40-74 years. By sex.

WHO non-laboratory risk score. Estimates and 95% confidence intervals/bands.



Estimated trend in CVD Risk. South African population 40-74 years. By sex and age group.

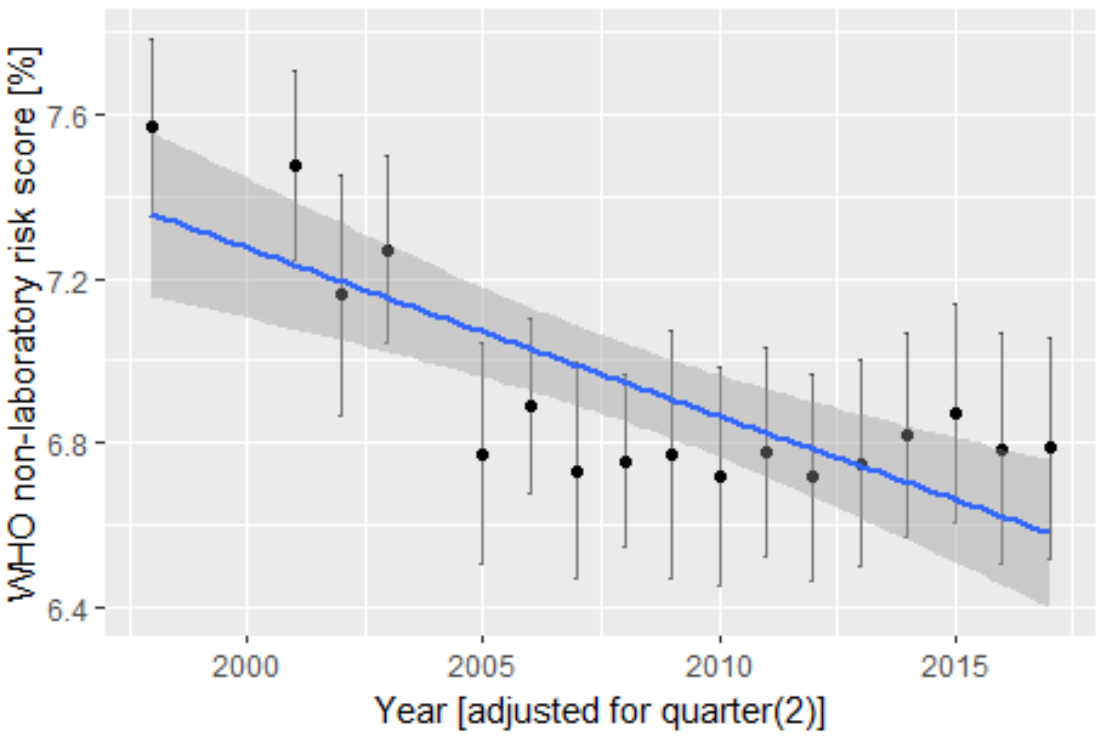
WHO non-laboratory risk score. Estimates and 95% confidence intervals/bands.

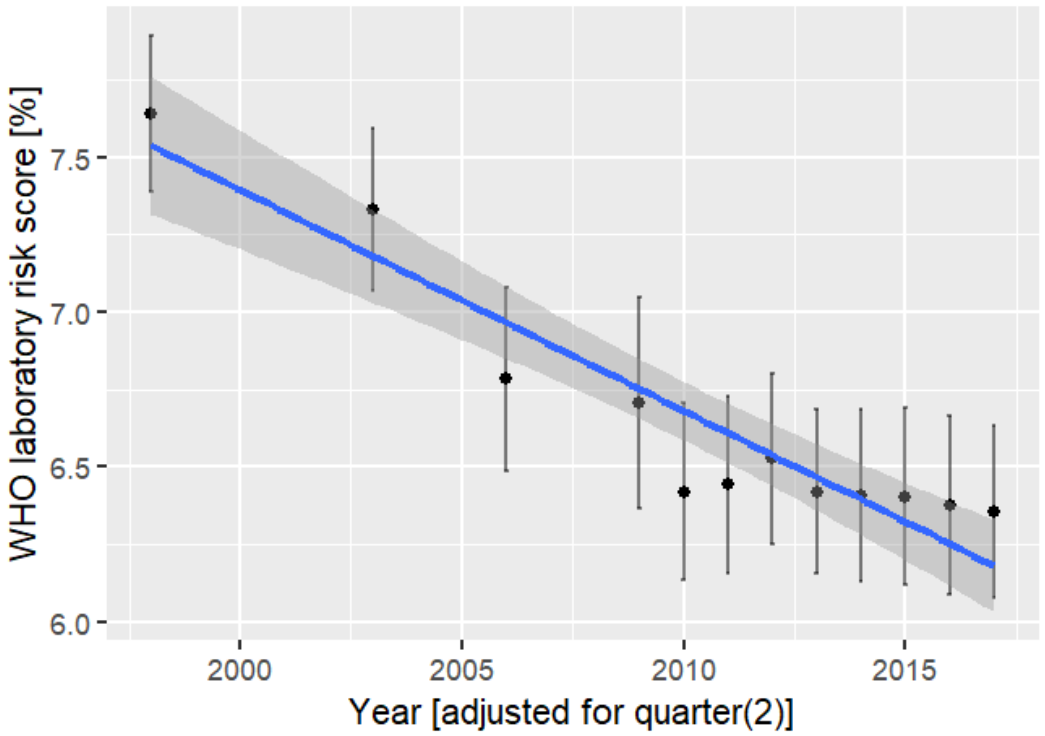
… and in England

Health Survey England Dataset v0.1

- Individuals: 168,415, age 16+
- Variables: ~140
  - Socio-demographics & administrative
  - Height, weight, blood pressure, cholesterol, waist & hip circumference, BMI, smoking, reported long-standing illnesses & diagnoses, general health, antihypertensives, etc…

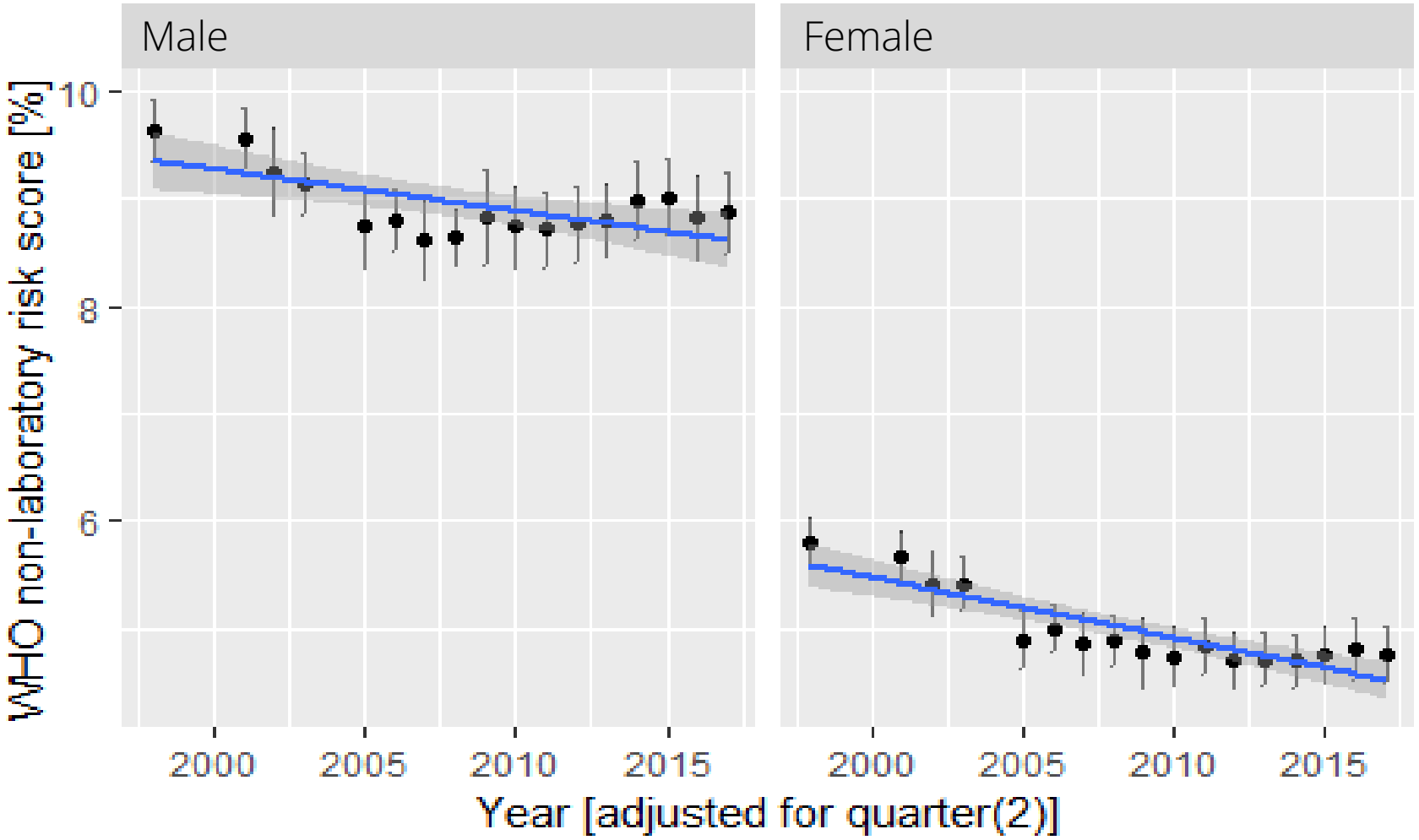
	Year	Sample
1	1998	15,908
2	2001	15,647
3	2002	7,393
4	2003	14,836
5	2005	7,630
6	2006	14,142
7	2007	6,882
8	2008	15,098
9	2009	4,645
10	2010	8,420
11	2011	8,610
12	2012	8,290
13	2013	8,795
14	2014	8,077
15	2015	8,034
16	2016	8,011
17	2017	7,997





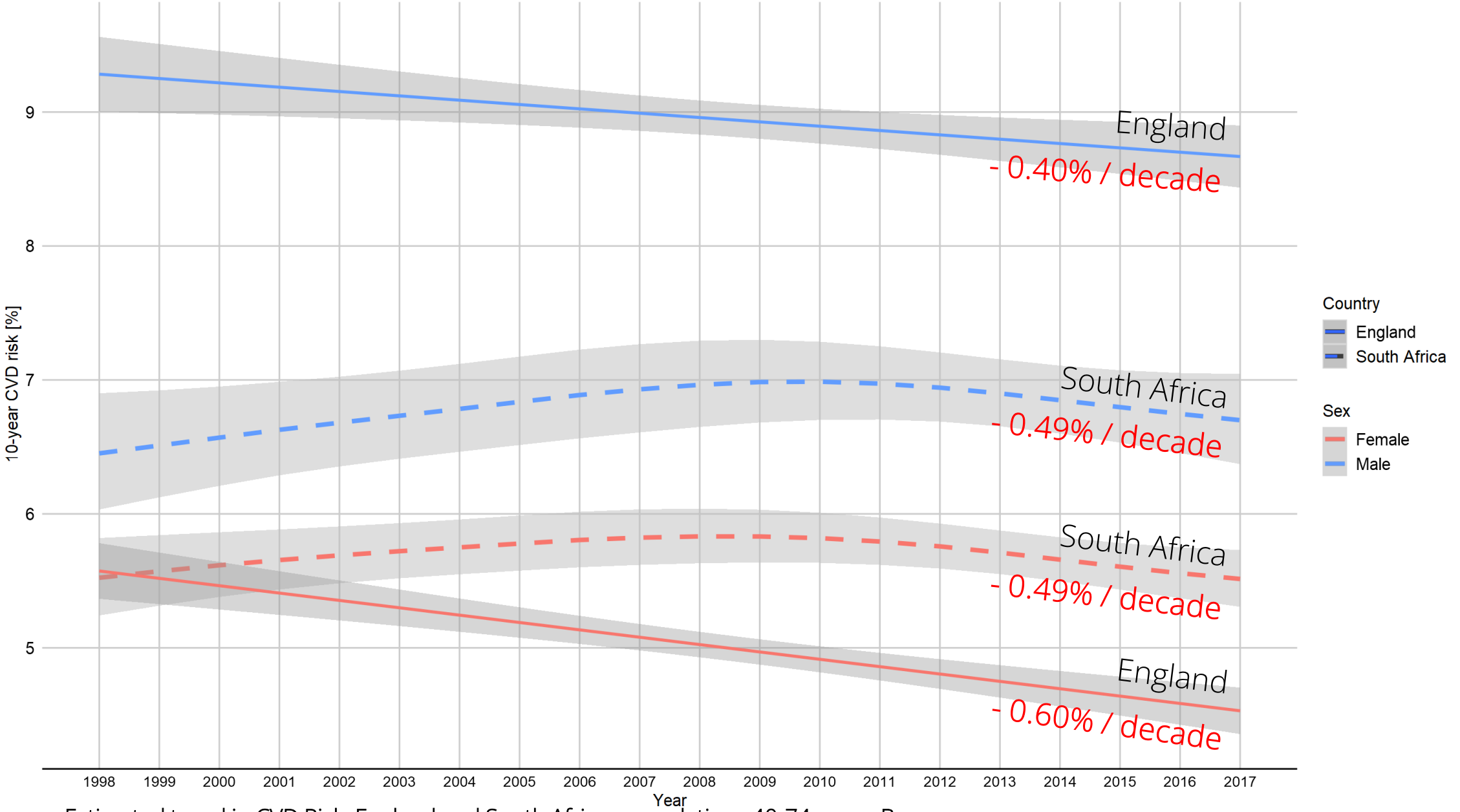
Estimated trend in CVD Risk. England population 40-74 years.

WHO non-laboratory and WHO laboratory risk score. Estimates and 95% confidence intervals/bands.



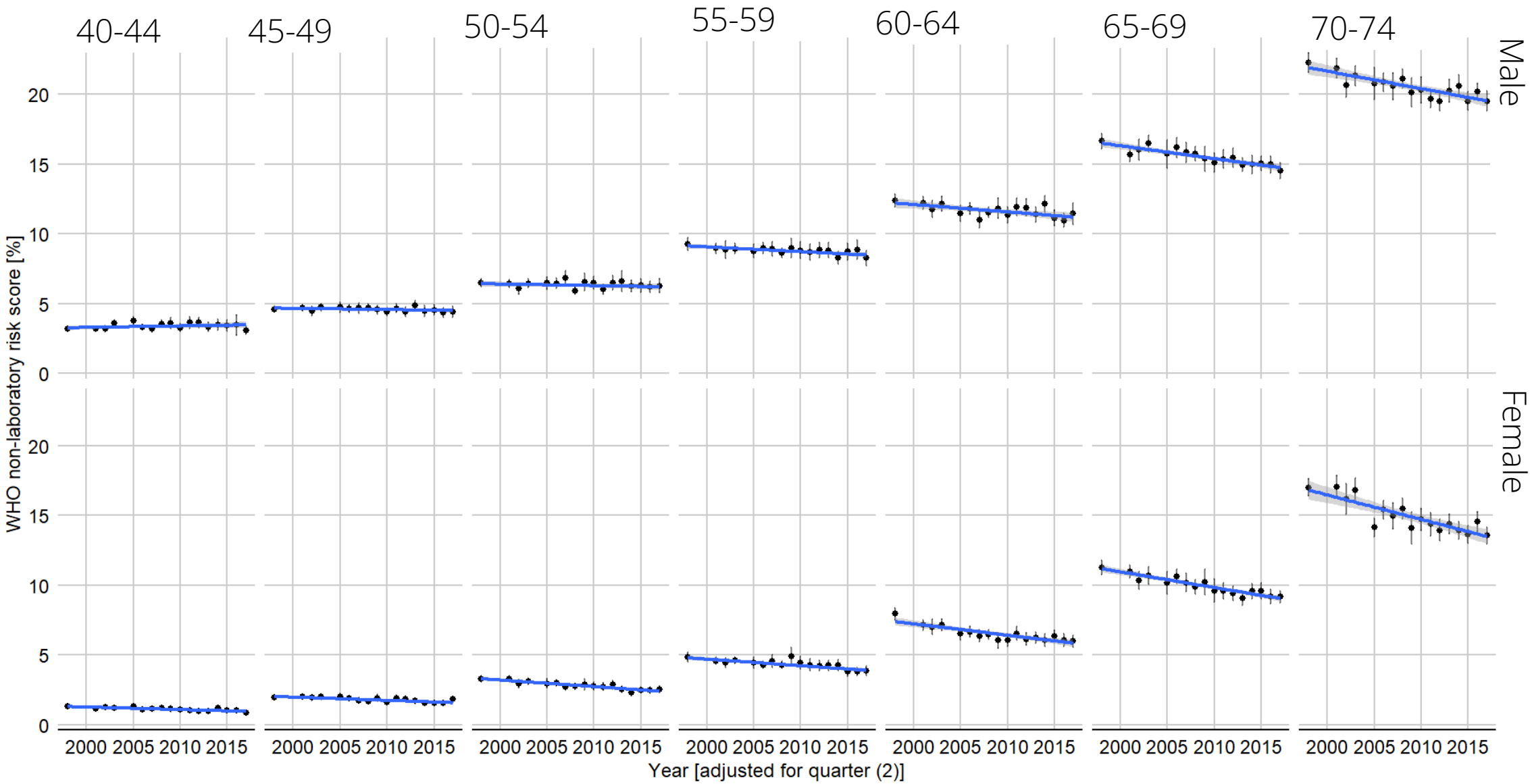
Estimated trend in CVD Risk. England population 40-74 years. By sex

WHO non-laboratory risk score. Estimates and 95% confidence intervals/bands.



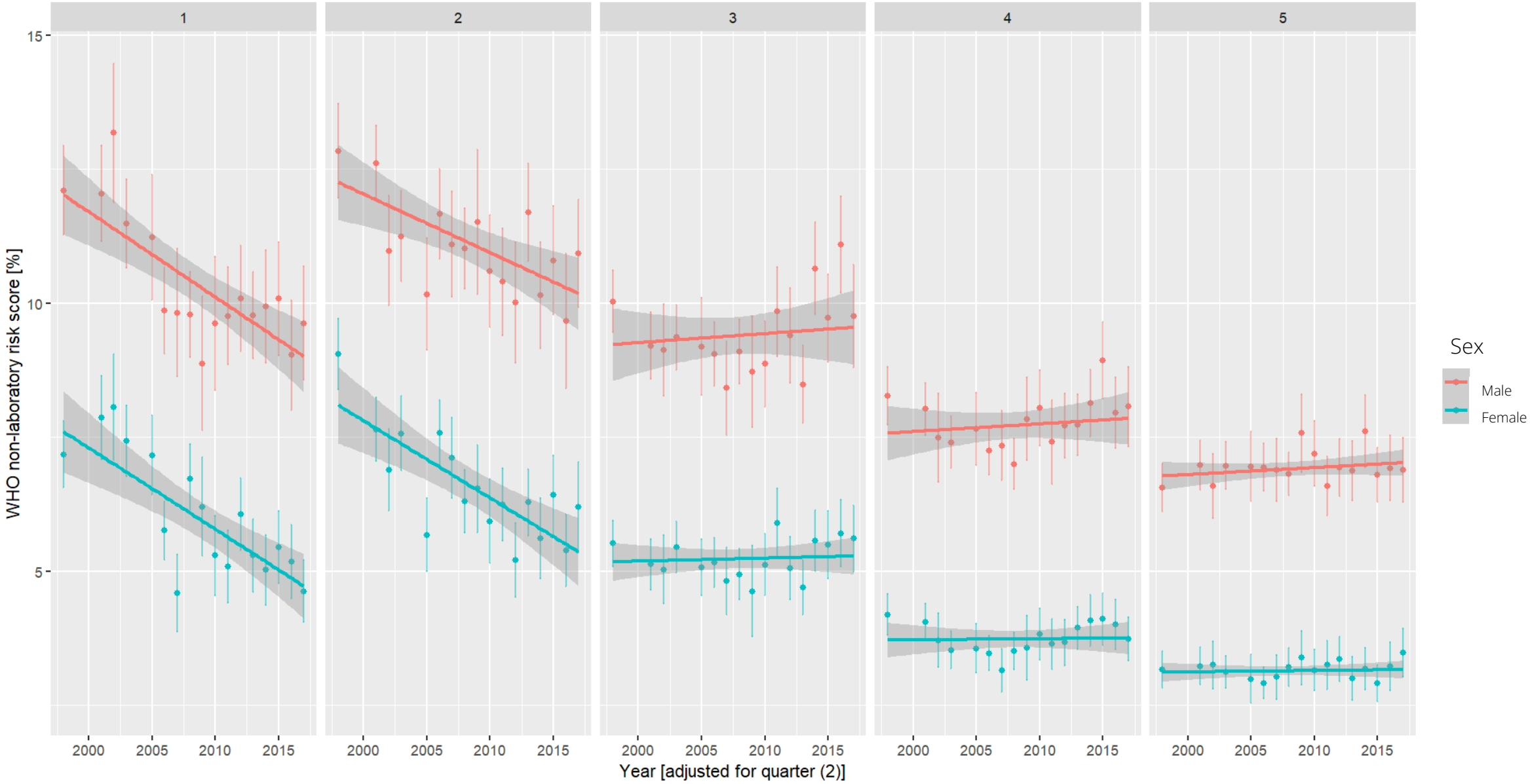
Estimated trend in CVD Risk. England and South African populations 40-74 years. By sex

WHO non-laboratory and WHO laboratory risk score. Estimates and 95% confidence intervals/bands.



Estimated trend in CVD Risk. England population 40-74 years. By age and sex.

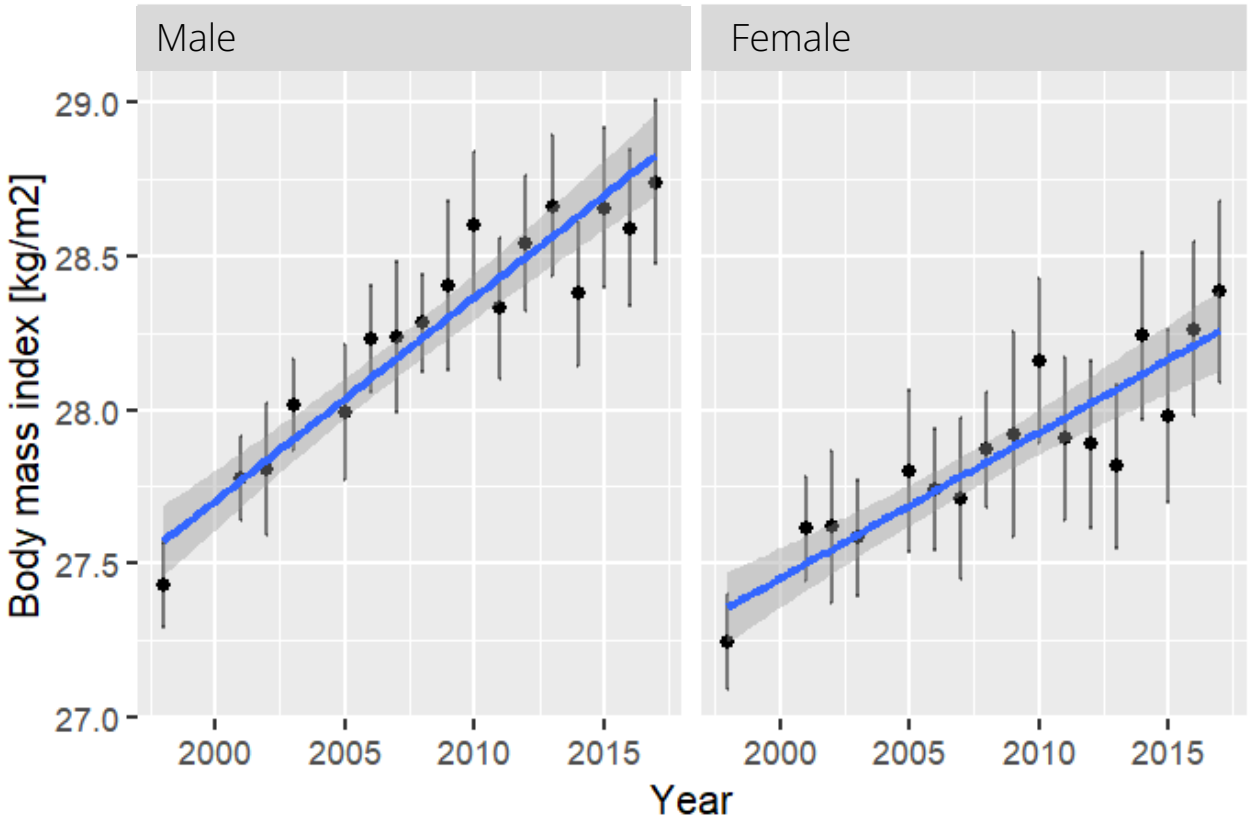
WHO non-laboratory risk score. Estimates and 95% confidence intervals/bands.

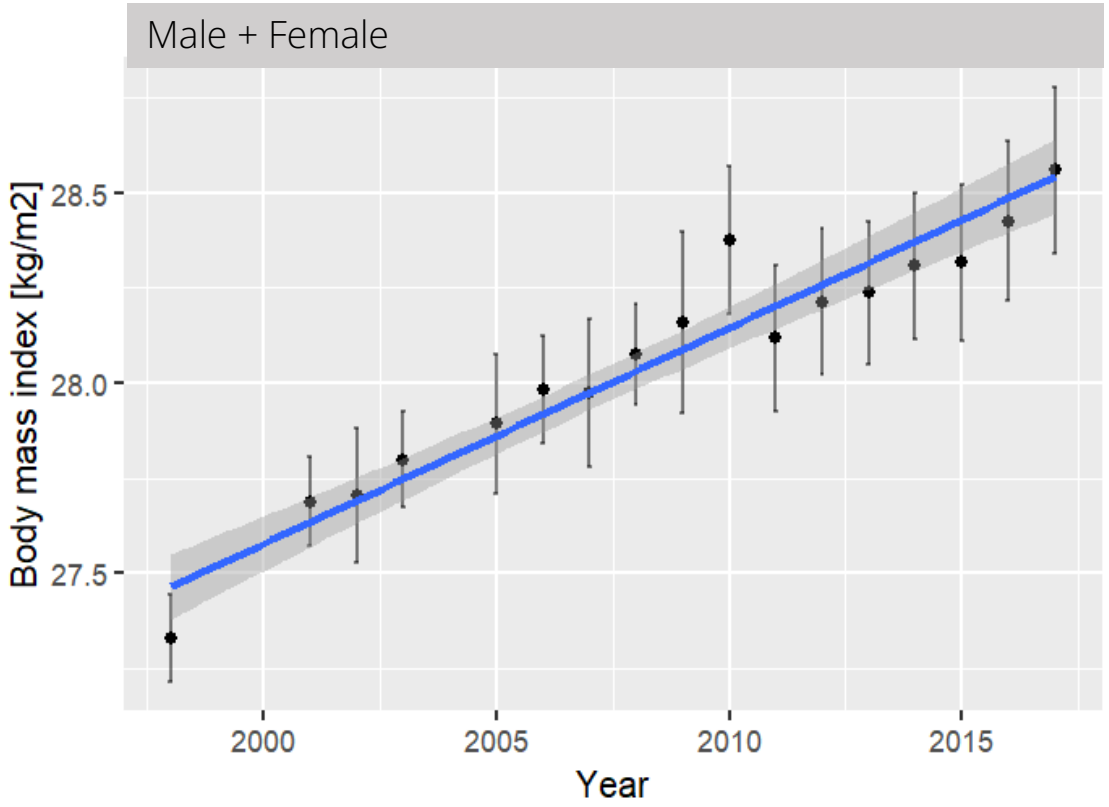


Estimated trend in CVD Risk. England population 40-74 years. By household Income quintile and sex.

WHO non-laboratory risk score. Estimates and 95% confidence intervals/bands.

Trends in risk score components



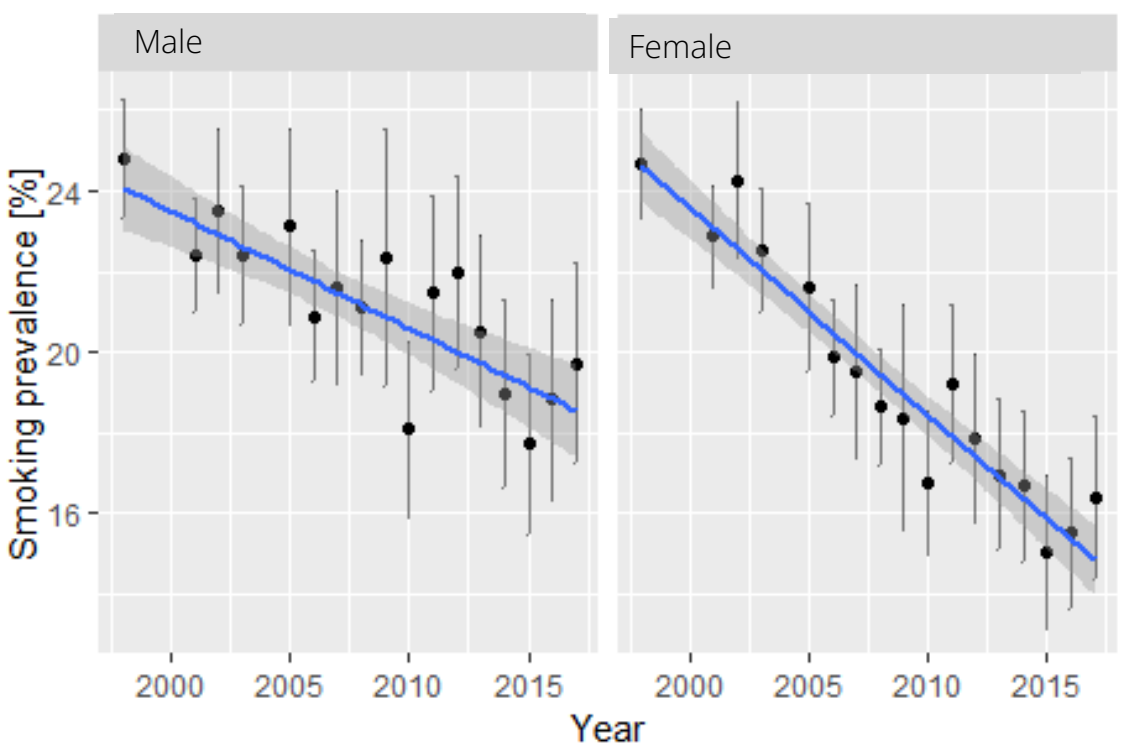


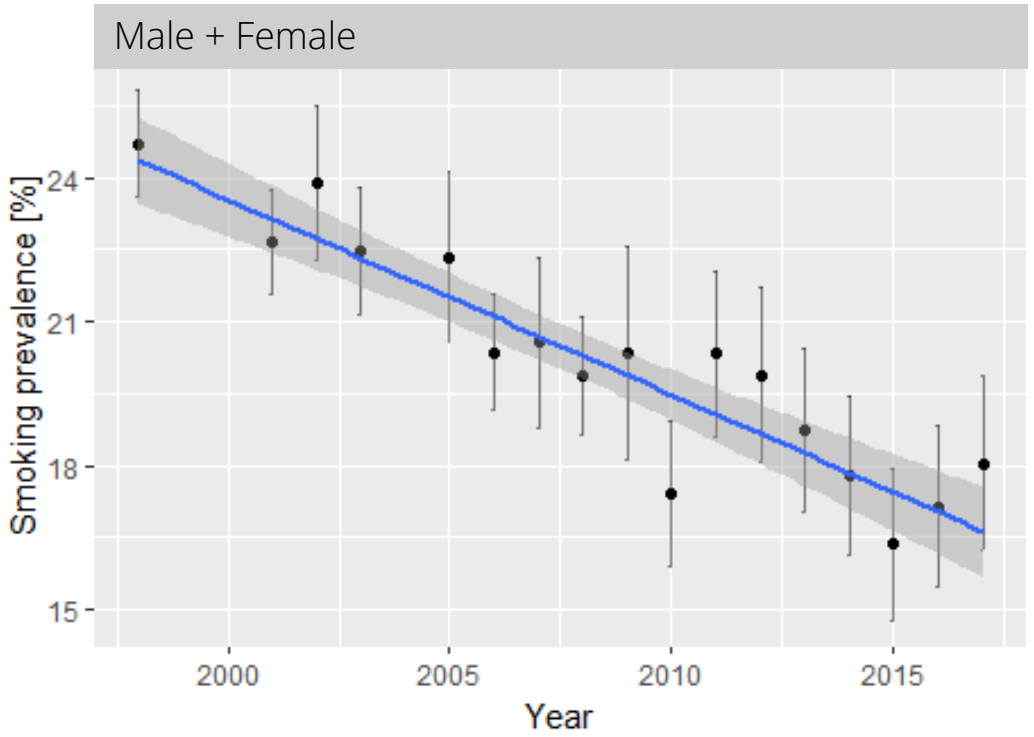
Estimated trend in Body Mass Index. England population 40-74 years. By Sex.

Estimates and 95% confidence intervals/bands.

Estimated trend in Systolic Blood Pressure. England population 40-74 years. By Sex.

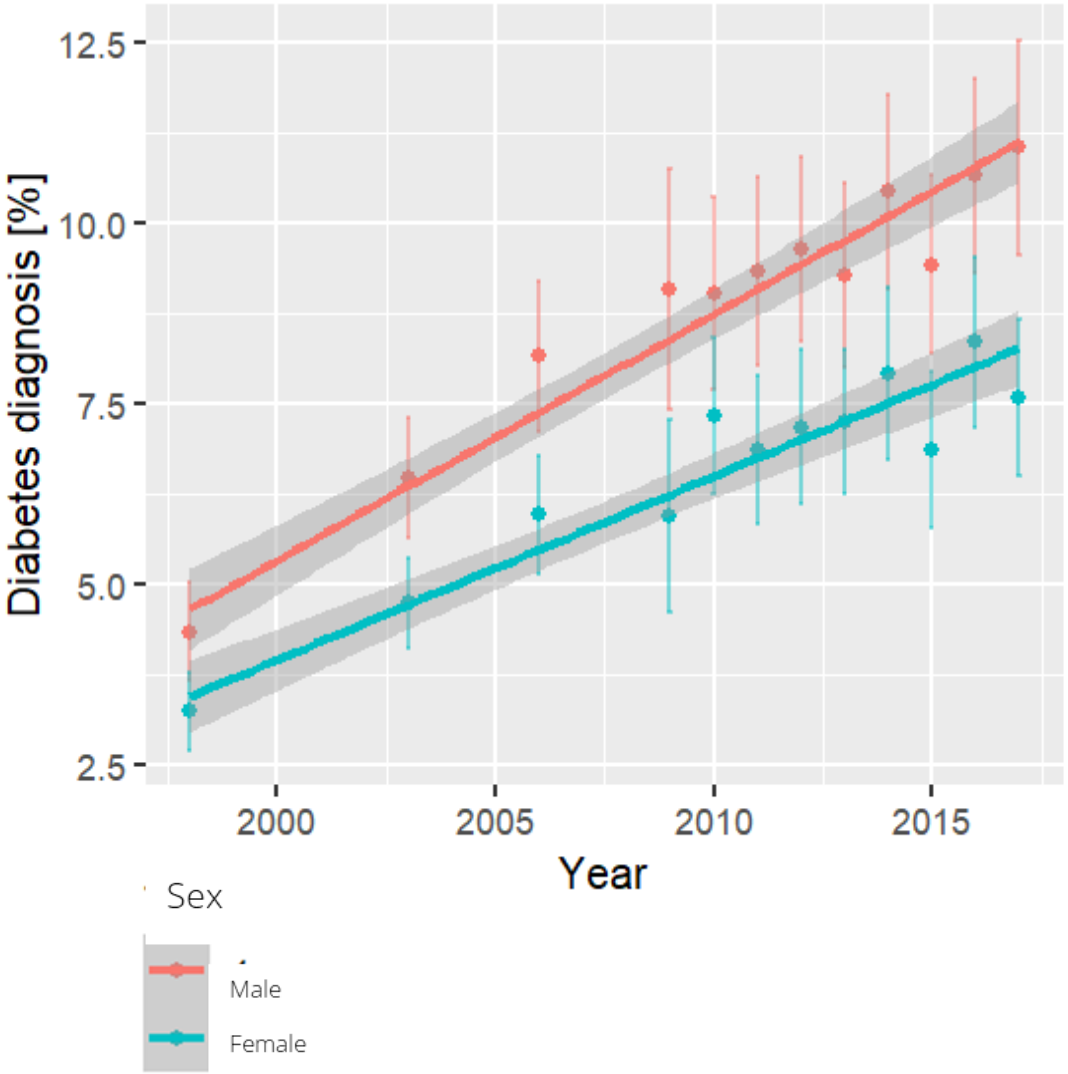
Estimates and 95% confidence intervals/bands.

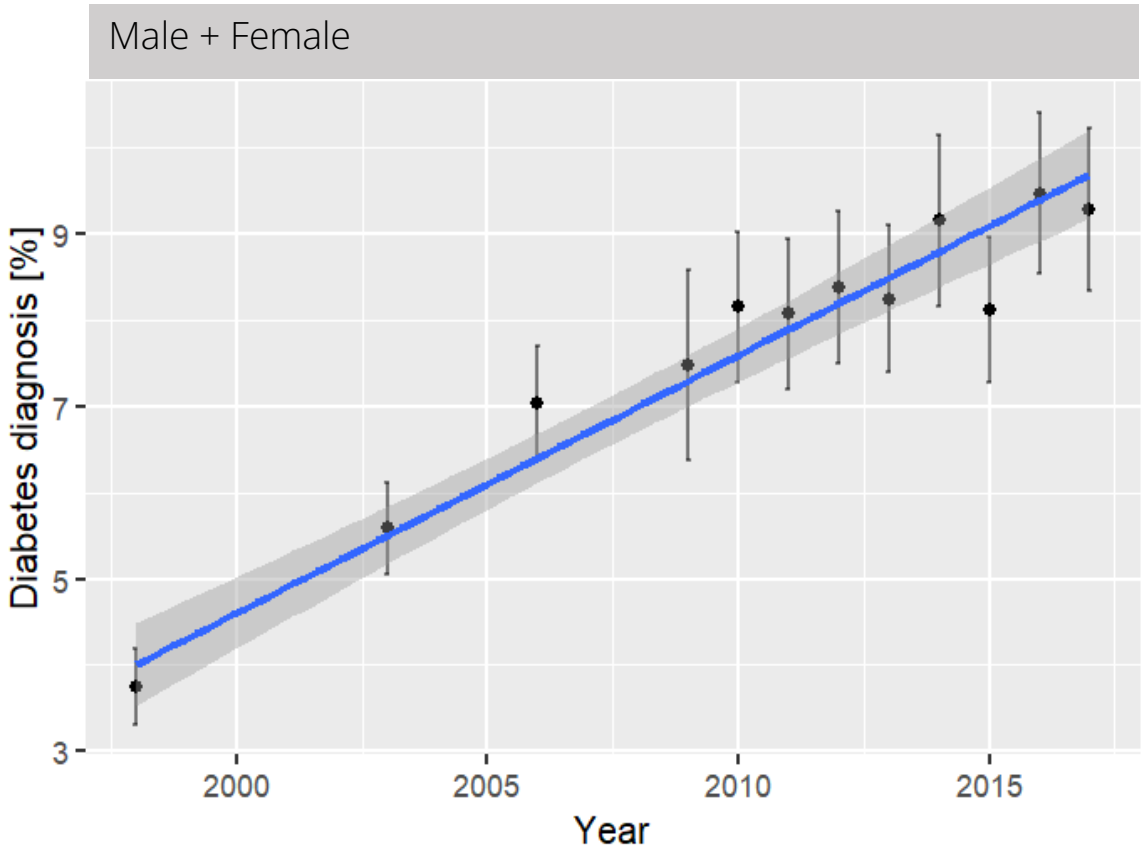




Estimated trend in smoking prevalence. England population 40-74 years. By Sex.

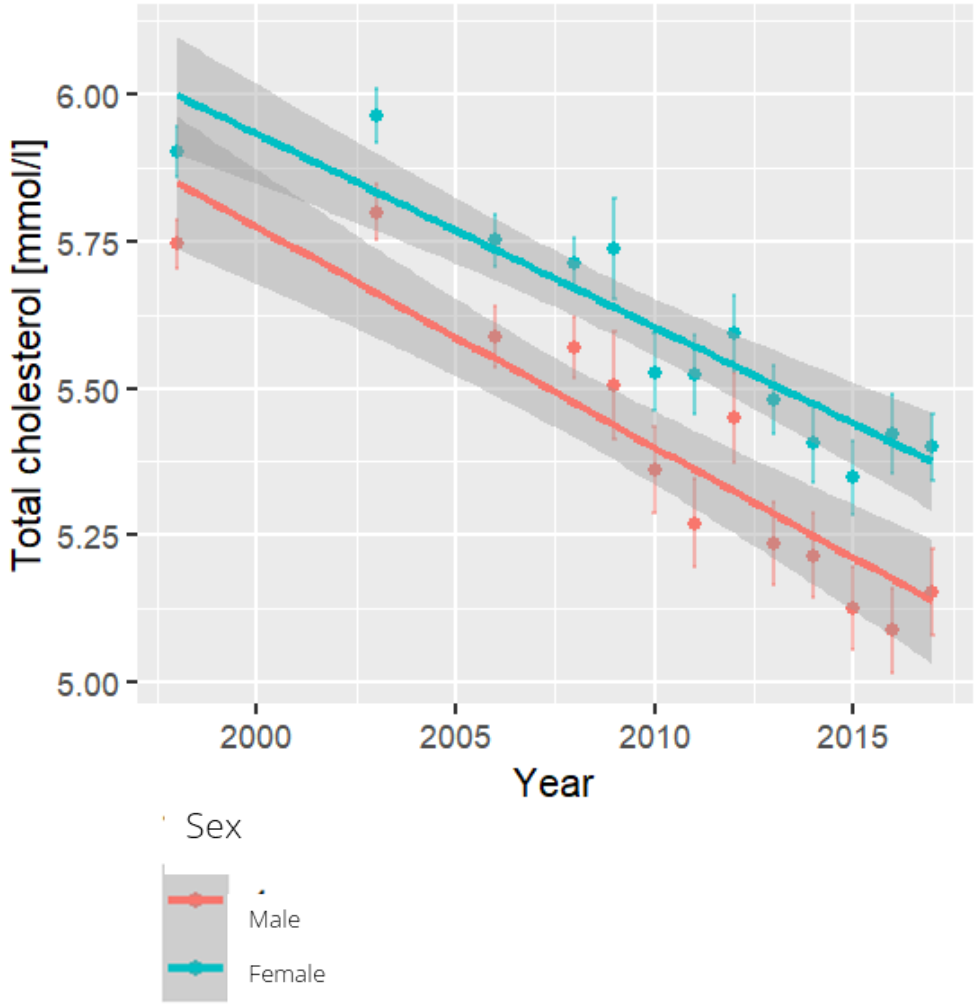
Estimates and 95% confidence intervals/bands.

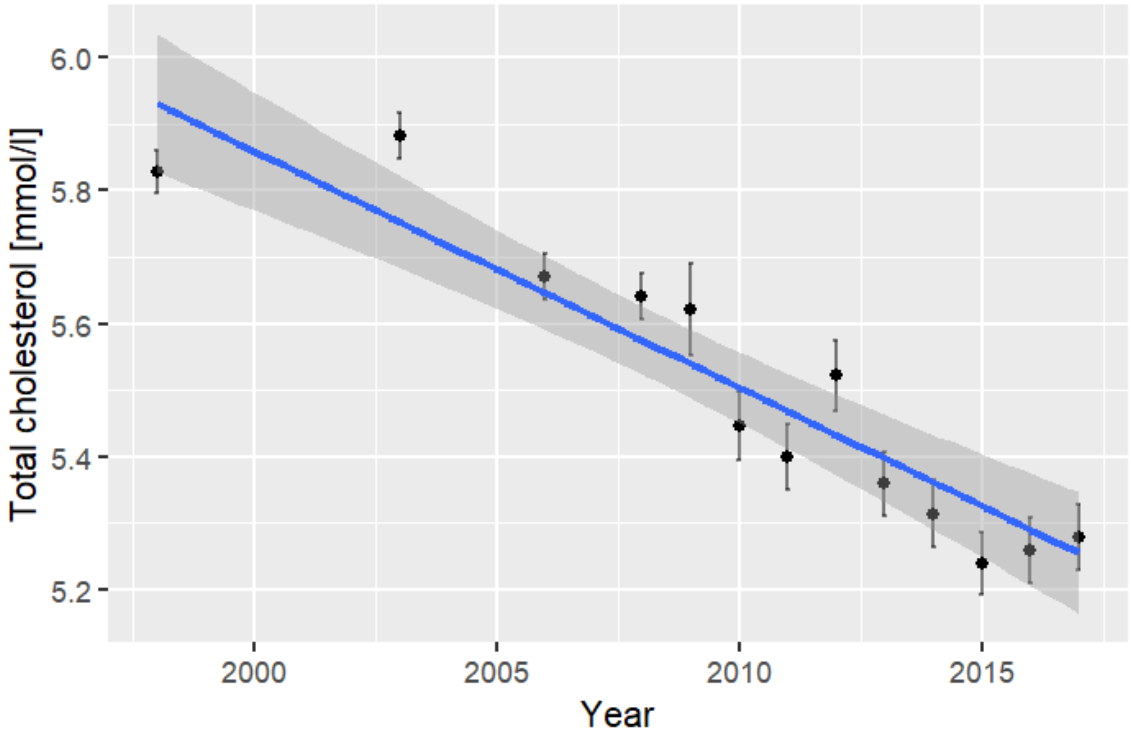




Estimated trend in self-reported diabetes. England population 40-74 years. By Sex.

Estimates and 95% confidence intervals/bands.





Estimated trend in total cholesterol. England population 40-74 years. By Sex.

Estimates and 95% confidence intervals/bands.

3. Making sense

Is it true?

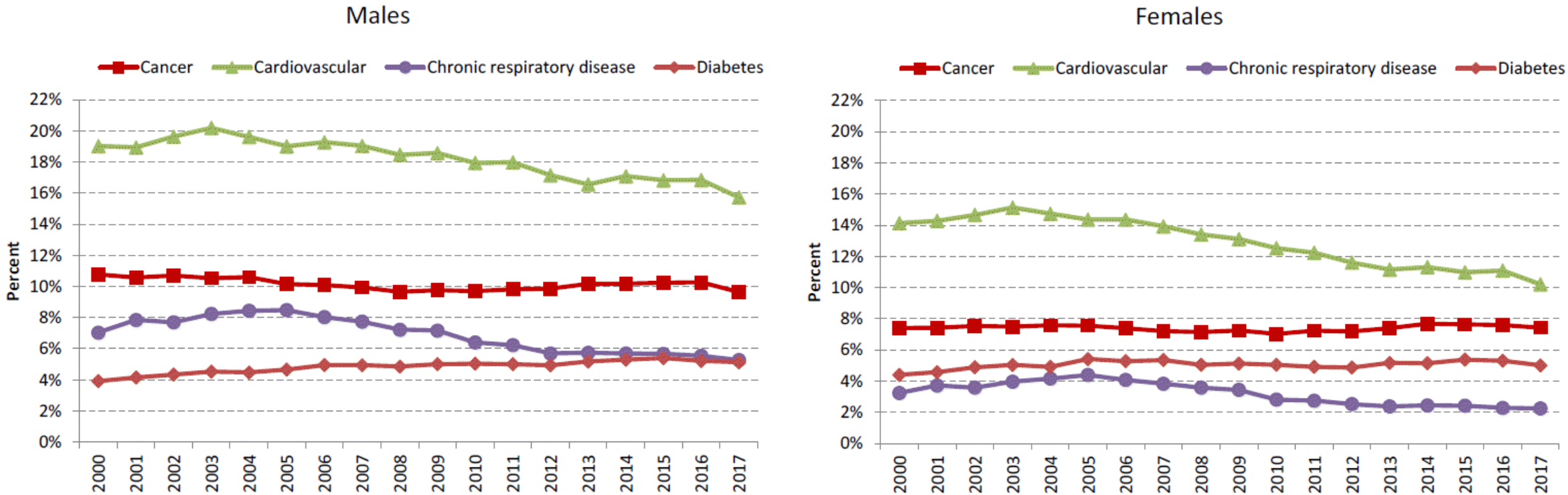


Figure 26: Trend in cause-specific ${}_{40}q_{30}$, the probability of 30-year-old dying before age 70, due to non-communicable diseases, for males and females, 2000-2017

Figure from:
Dorrington R, Bradshaw D, Laubscher R, Nannan N. Rapid mortality surveillance report 2019 & 2020. Cape Town: South African Medical Research Council.

Figure from:
Nojilana et Al. Emerging Trends in Non-Communicable Disease Mortality in South Africa, 1997-2010. SAMJ. 2016;106(5)

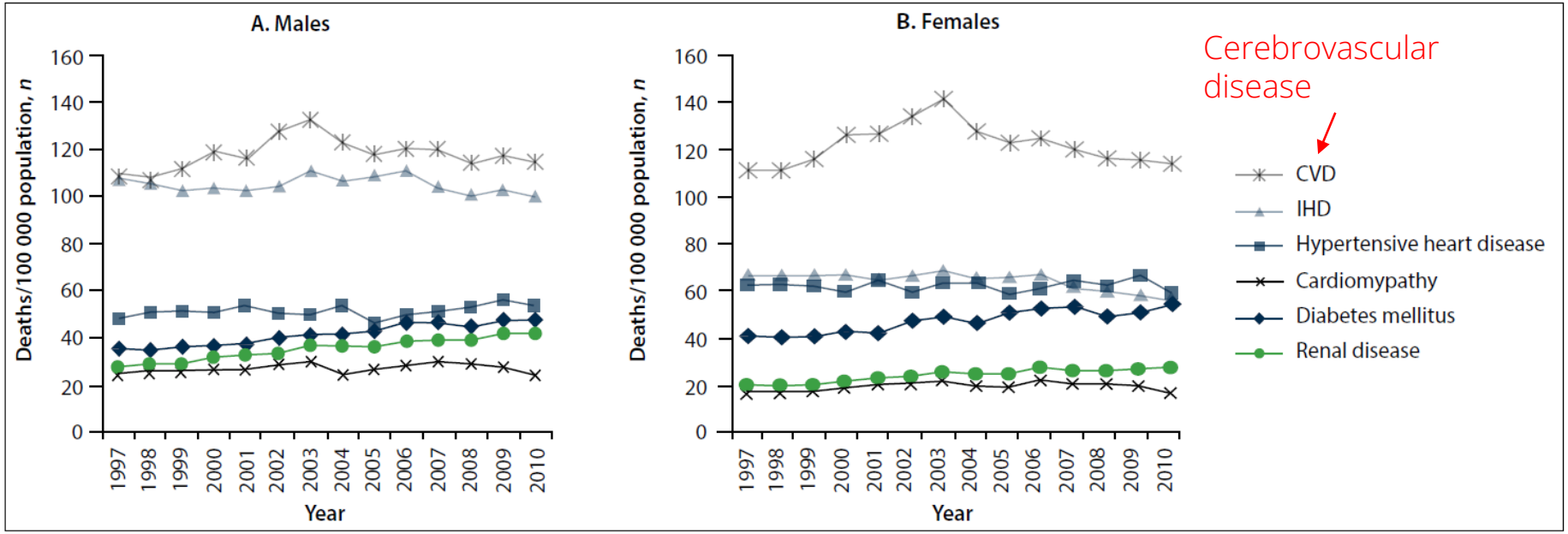


Fig. 3. ASDRs for CVDs, diabetes mellitus and renal disease for males (A) and females (B), SA 1997 - 2010.

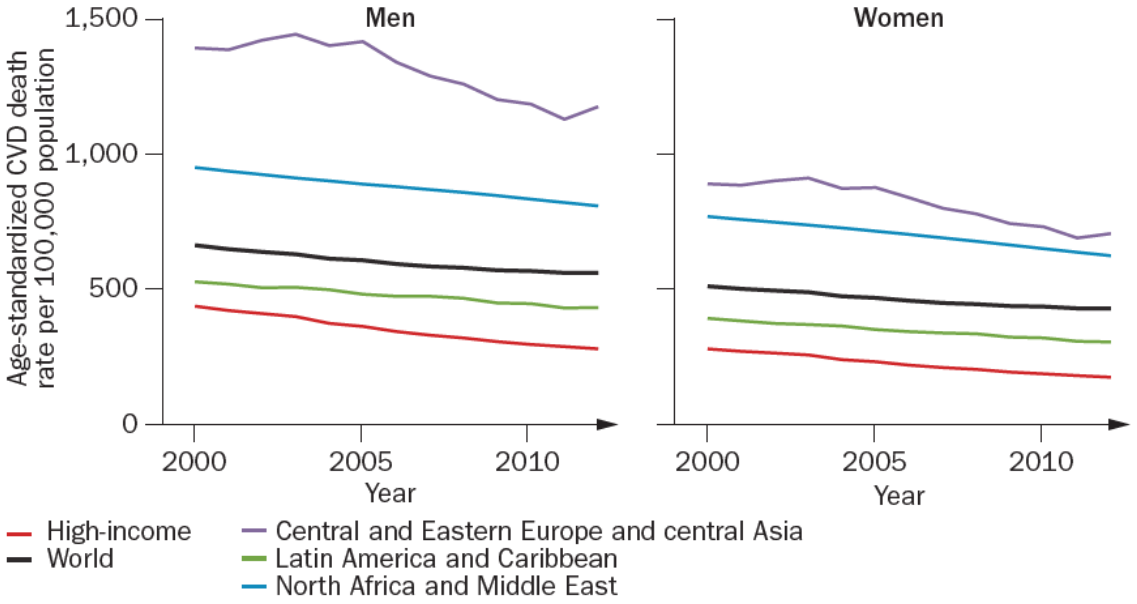
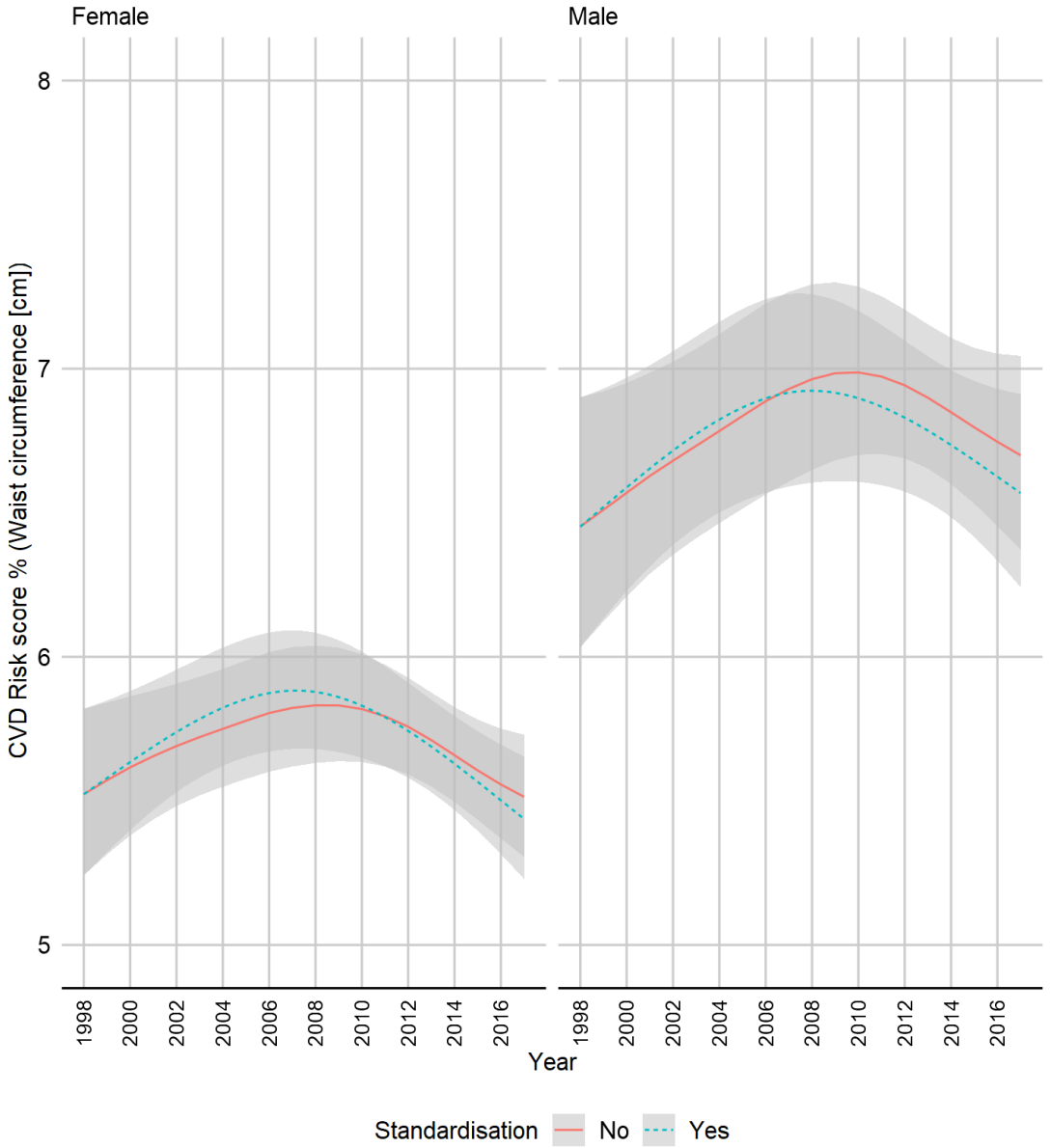


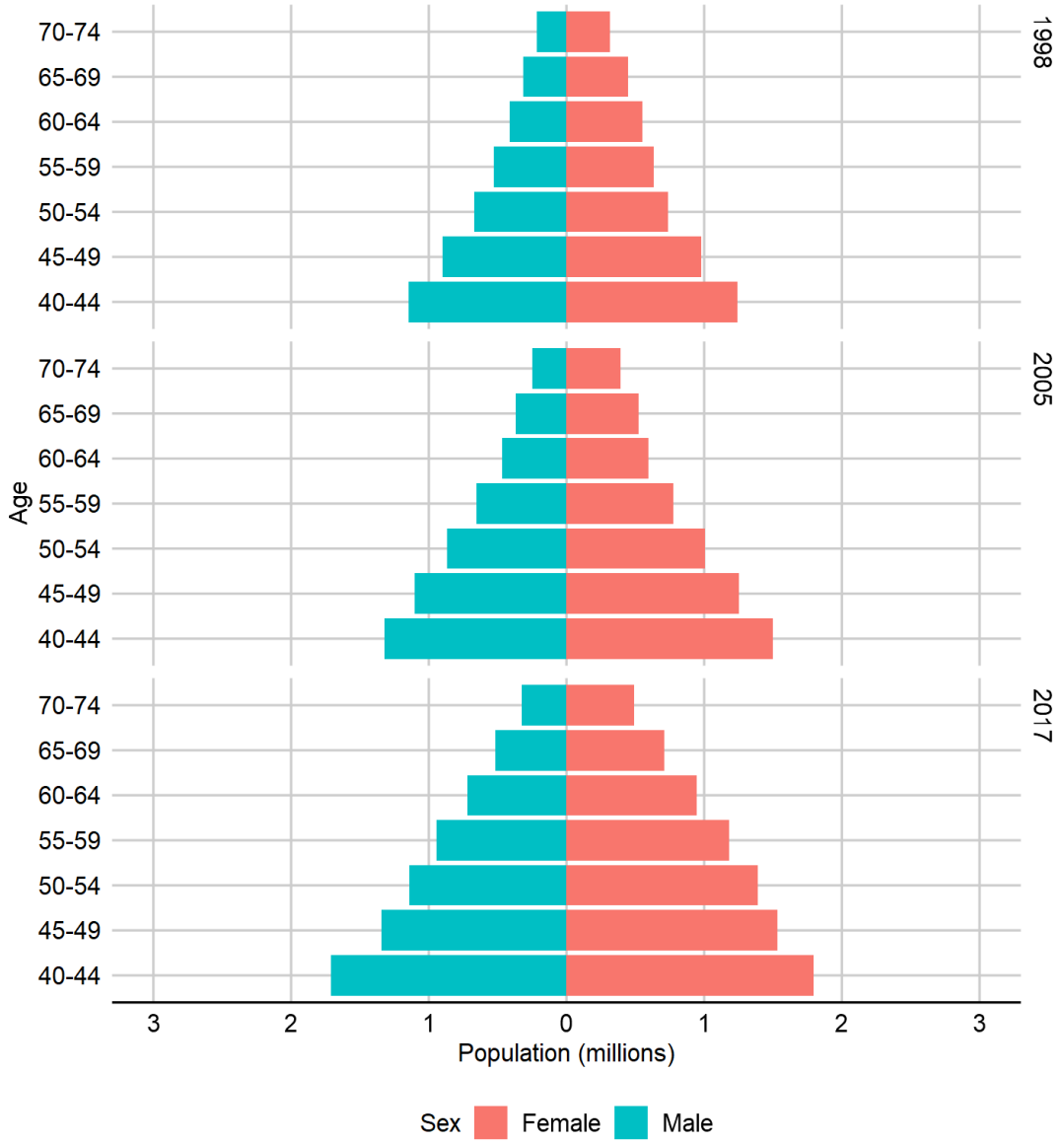
Figure from:
Ezzati M et Al Contributions of risk factors and medical care to cardiovascular mortality trends. Nat Rev Cardiol. 2015;12(9)

Demography, physiology and behaviour



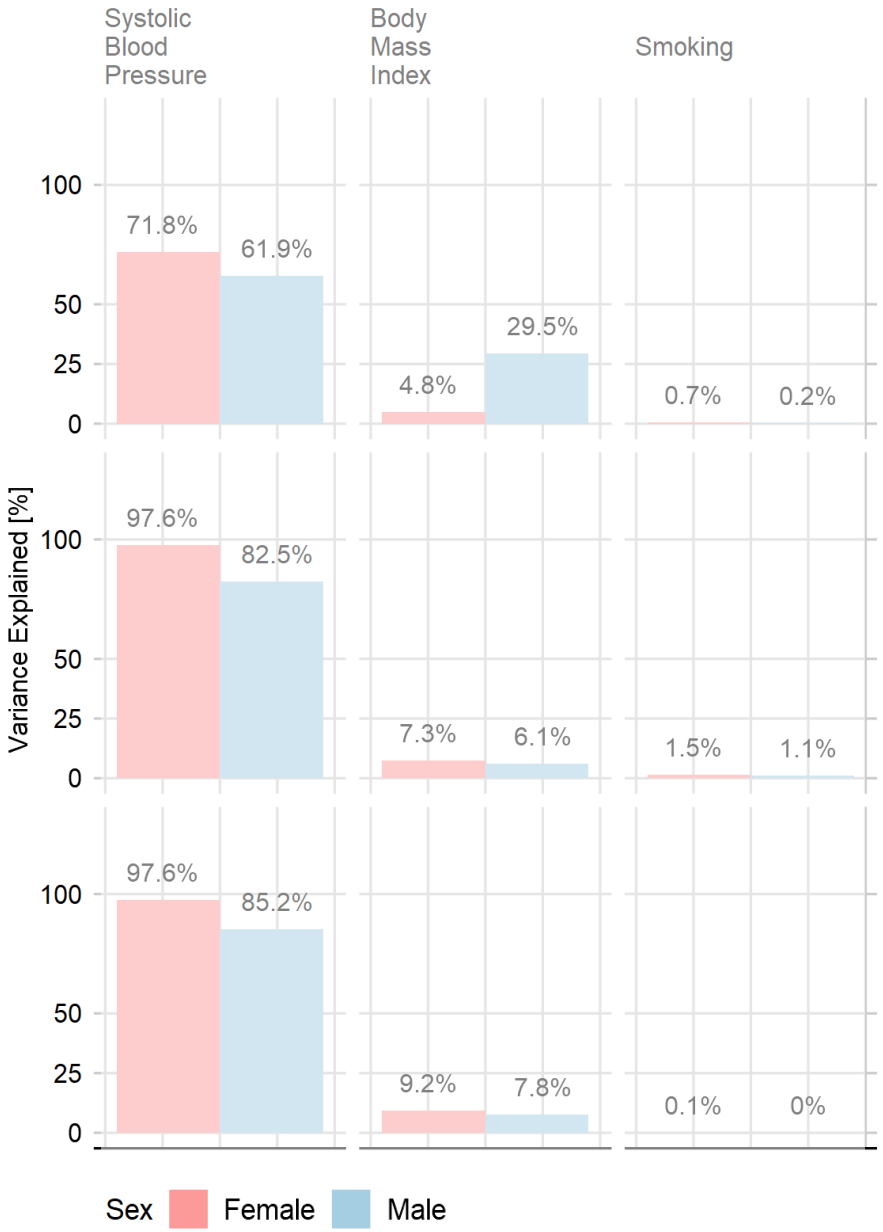
Estimated trend in CVD Risk. South African population 40-74 years. Standardised vs observed.

WHO non-laboratory risk score. Estimates and 95% confidence intervals/bands.

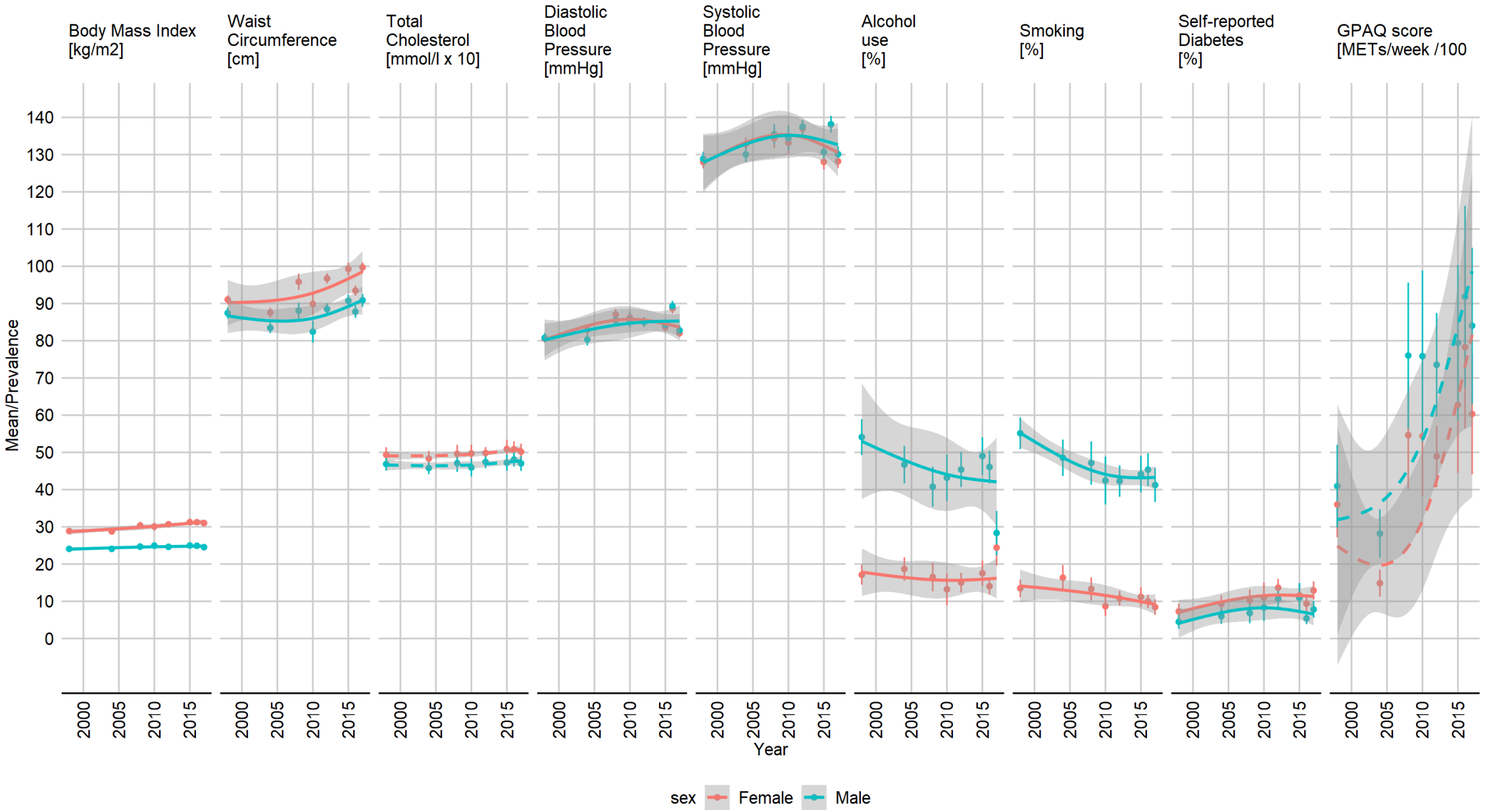


Population distribution, South African population 40-74 years. Years 1998, 2005, 2017

WHO non-laboratory risk score. Estimates and 95% confidence intervals/bands.

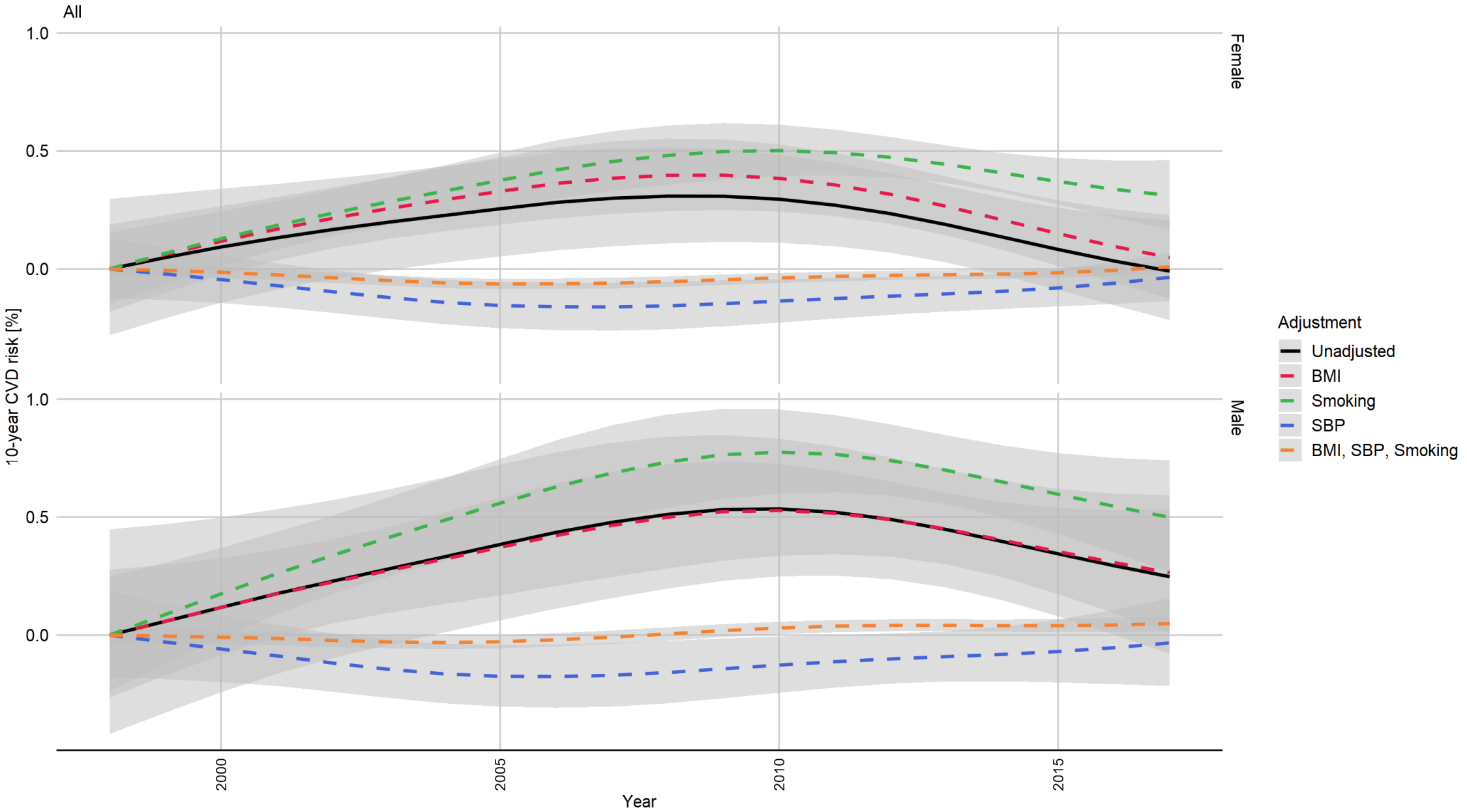


Proportion of year-by-year variance of CVD risk score explained by variations in in selected biological and behavioural factors. South African population 40-74 years. By age group and sex.



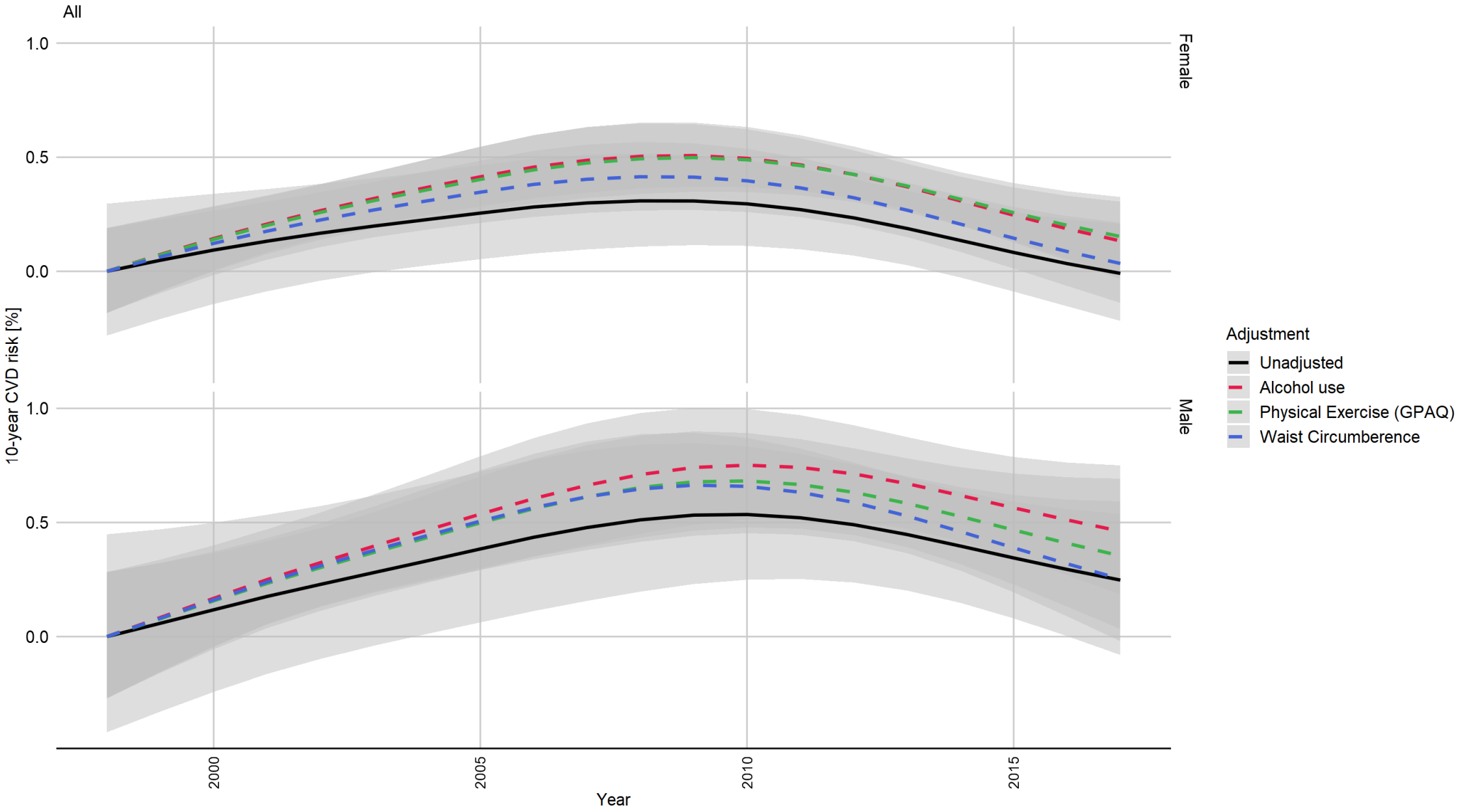
Trends in major CVD risk factors. South African population 40-74 years. By sex.

Estimates with 95% confidence intervals and smoothed trends..



Estimated trends in CVD Risk. South African population 40-74 years 2012-2017. Adjusted for selected risk factors. By sex.

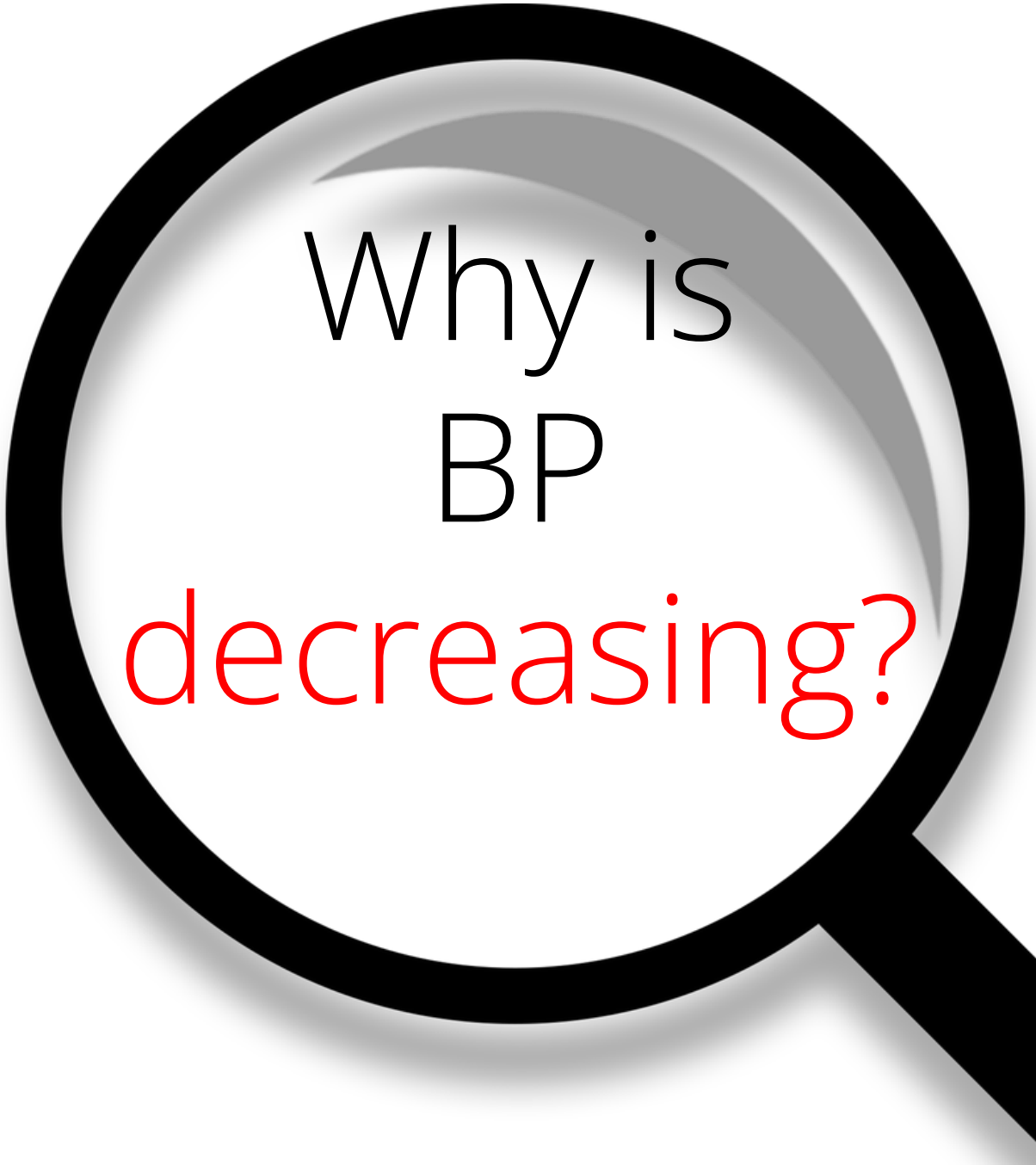
WHO non-laboratory risk score. Centred at year = 1998.

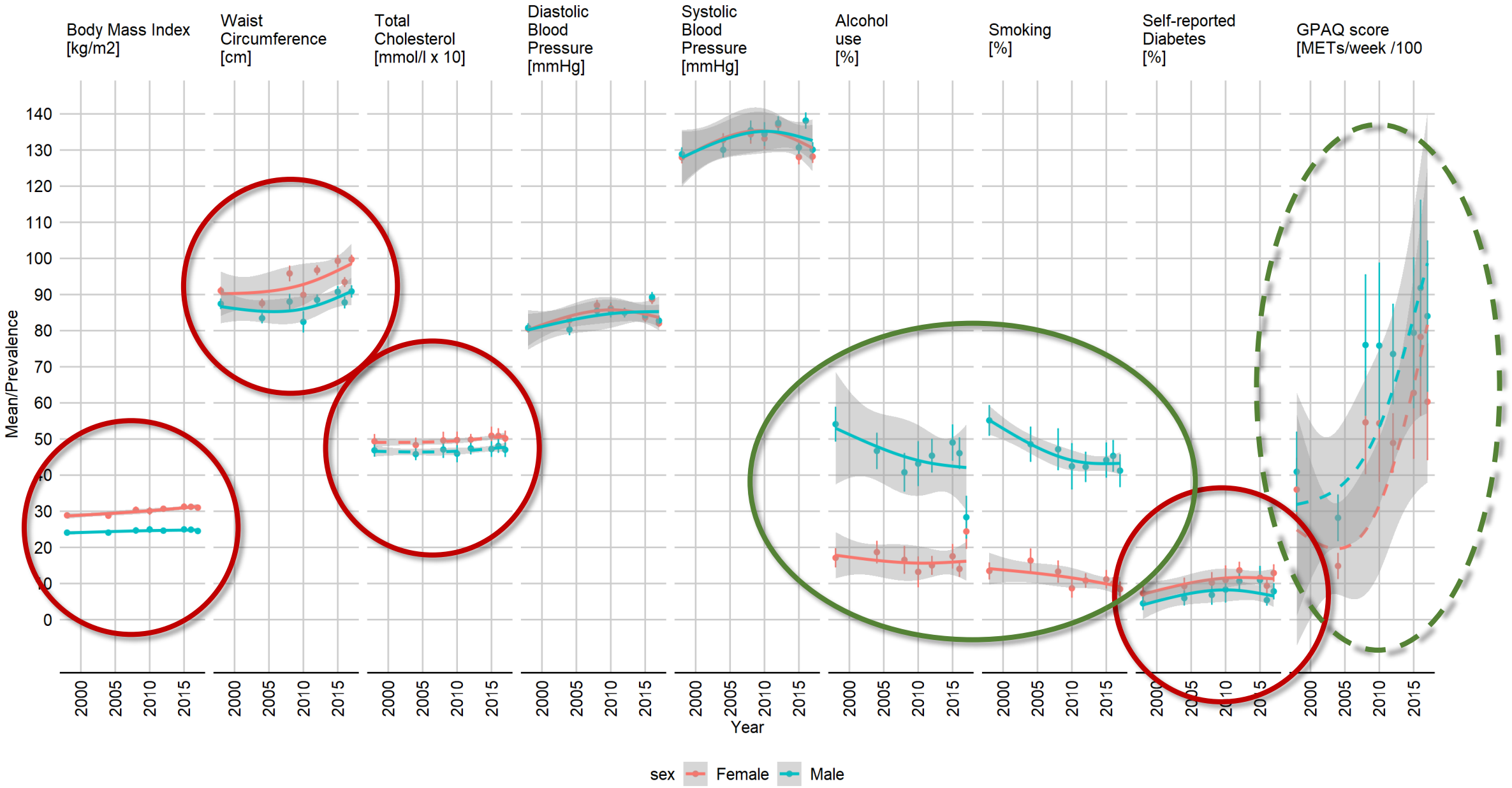


Estimated trends in CVD Risk. South African population 40-74 years 2012-2017. Adjusted for selected risk factors. By sex.

WHO non-laboratory risk score. Centred at year = 1998.

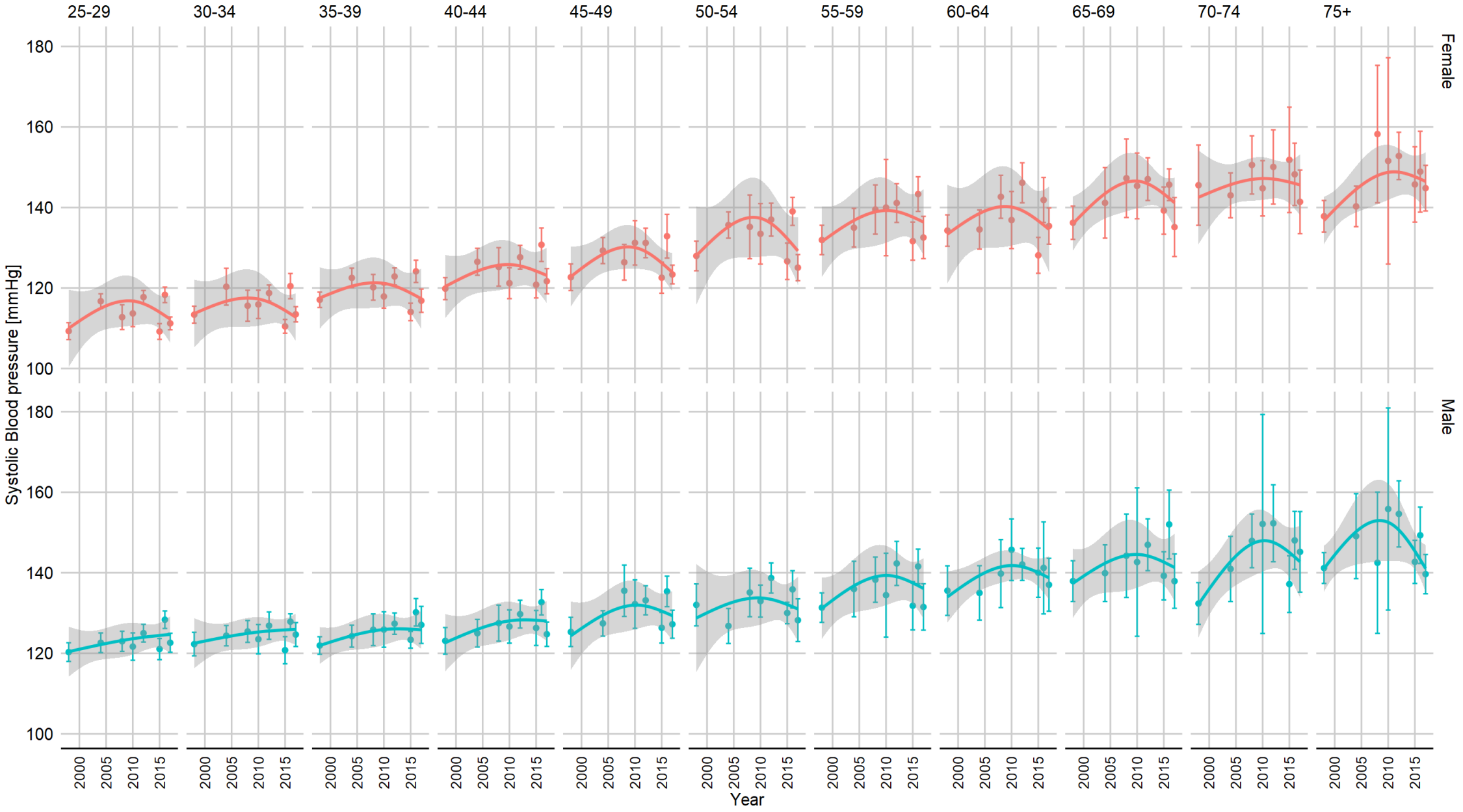

Blood
Pressure


Why is
BP
decreasing?



Trends in major CVD risk factors. South African population 40-74 years. By sex.

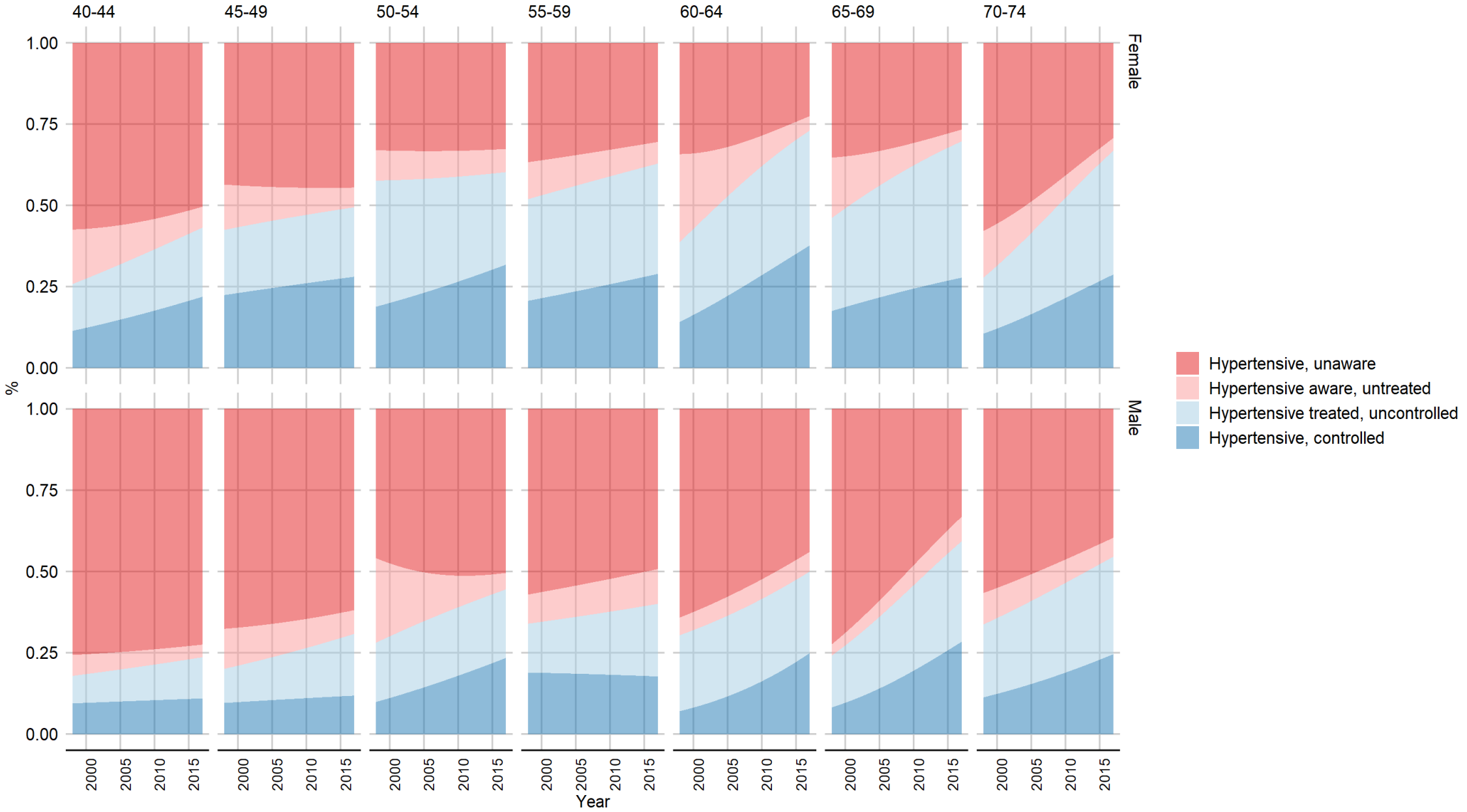
Estimates with 95% confidence intervals and smoothed trends..



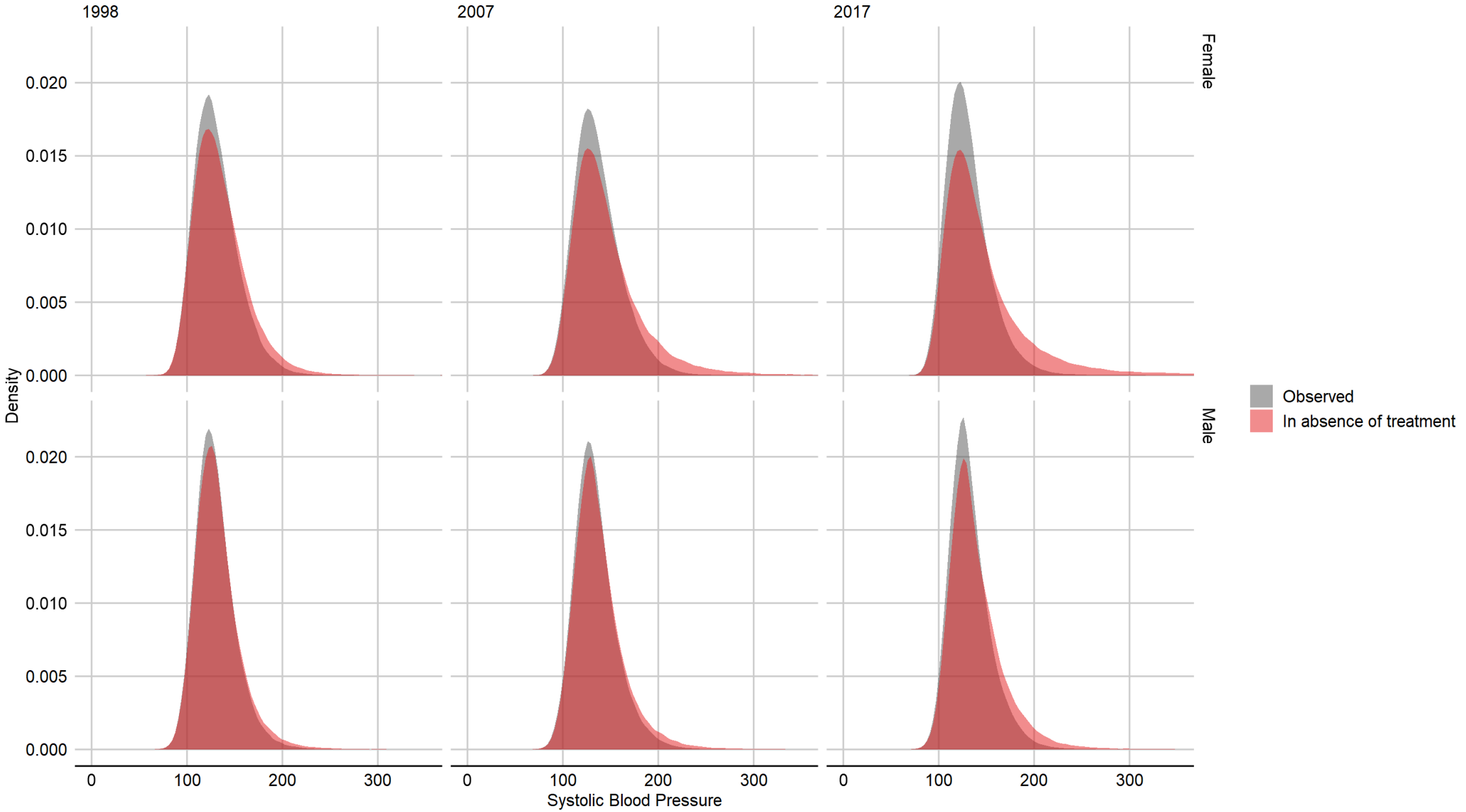
Trends in systolic blood pressure. South African population 40-74 years. By age and sex..

Estimates with 95% confidence intervals and smoothed trends..

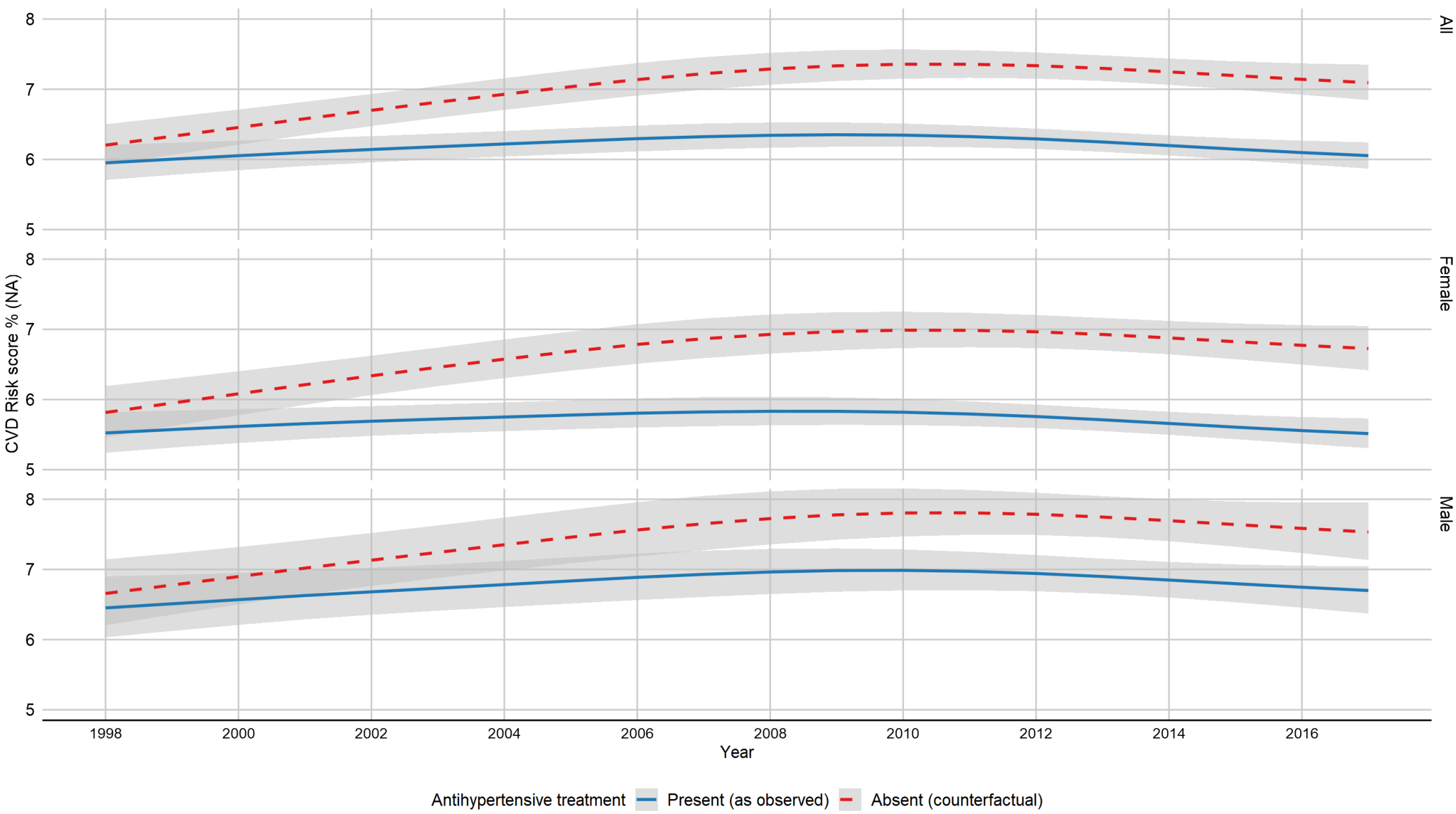
Treatment?



Hypertension cascade. South African population 40-74 years. By age and sex..

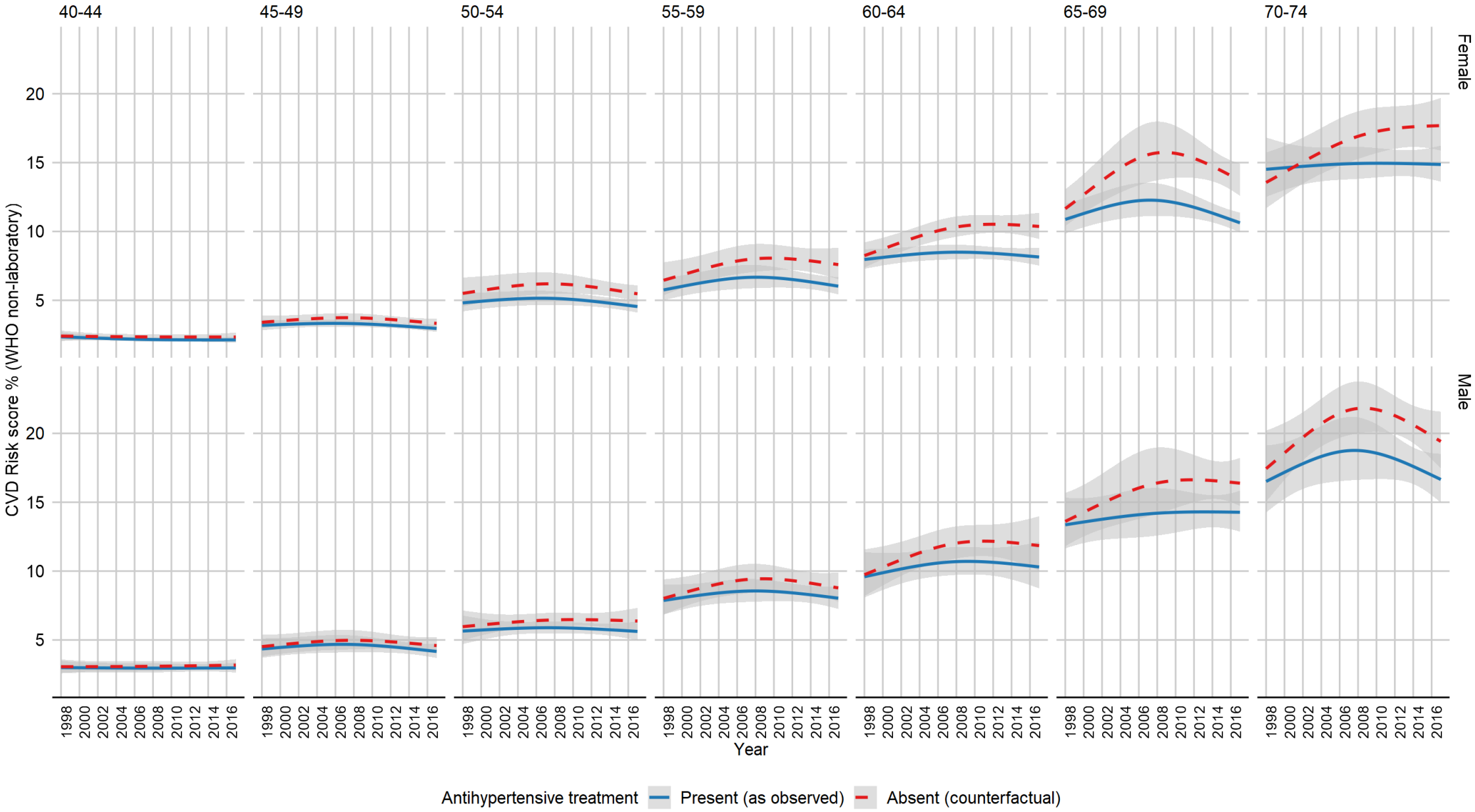


Observed vs counterfactual distribution of systolic blood pressure. South African population 40-74 years. by year and sex



Estimated trend in CVD Risk. South African population 40-74 years. Observed and in absence of treatment. By sex.

WHO non-laboratory risk score. Estimates and 95% confidence intervals/bands.

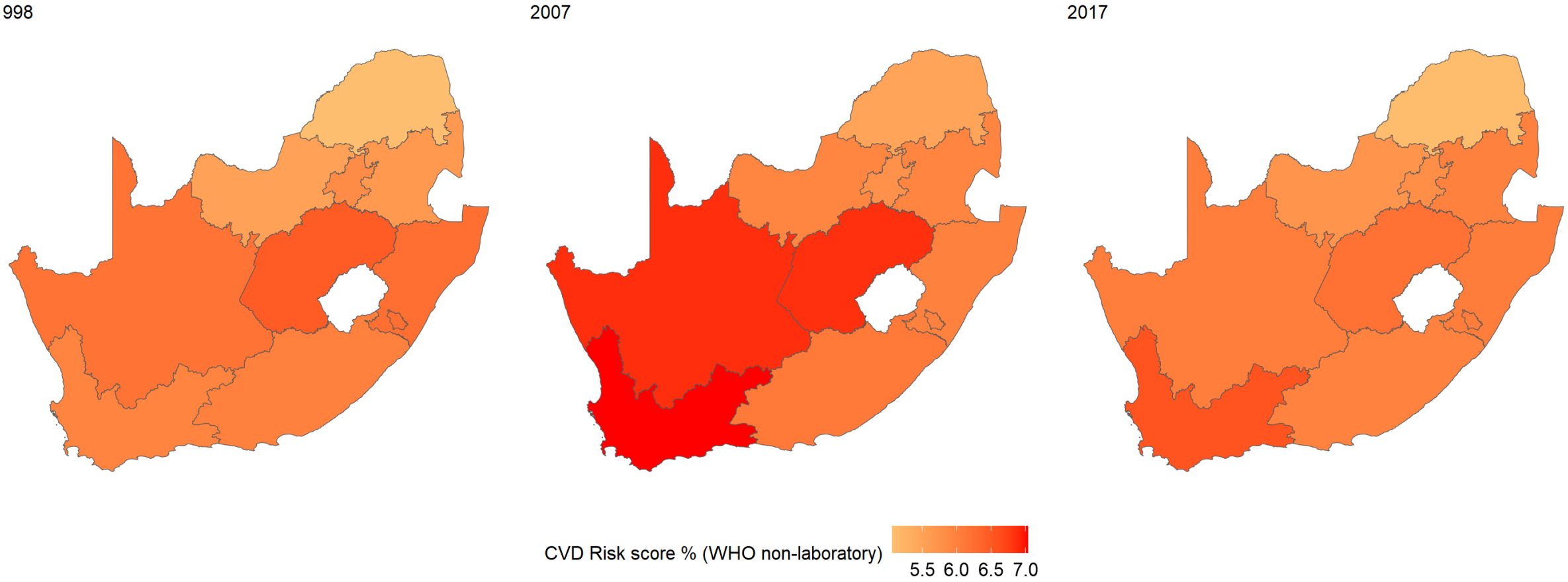


Estimated trend in CVD Risk. South African population 40-74 years. Observed and in absence of treatment. By sex and age.

WHO non-laboratory risk score. Estimates and 95% confidence intervals/bands.

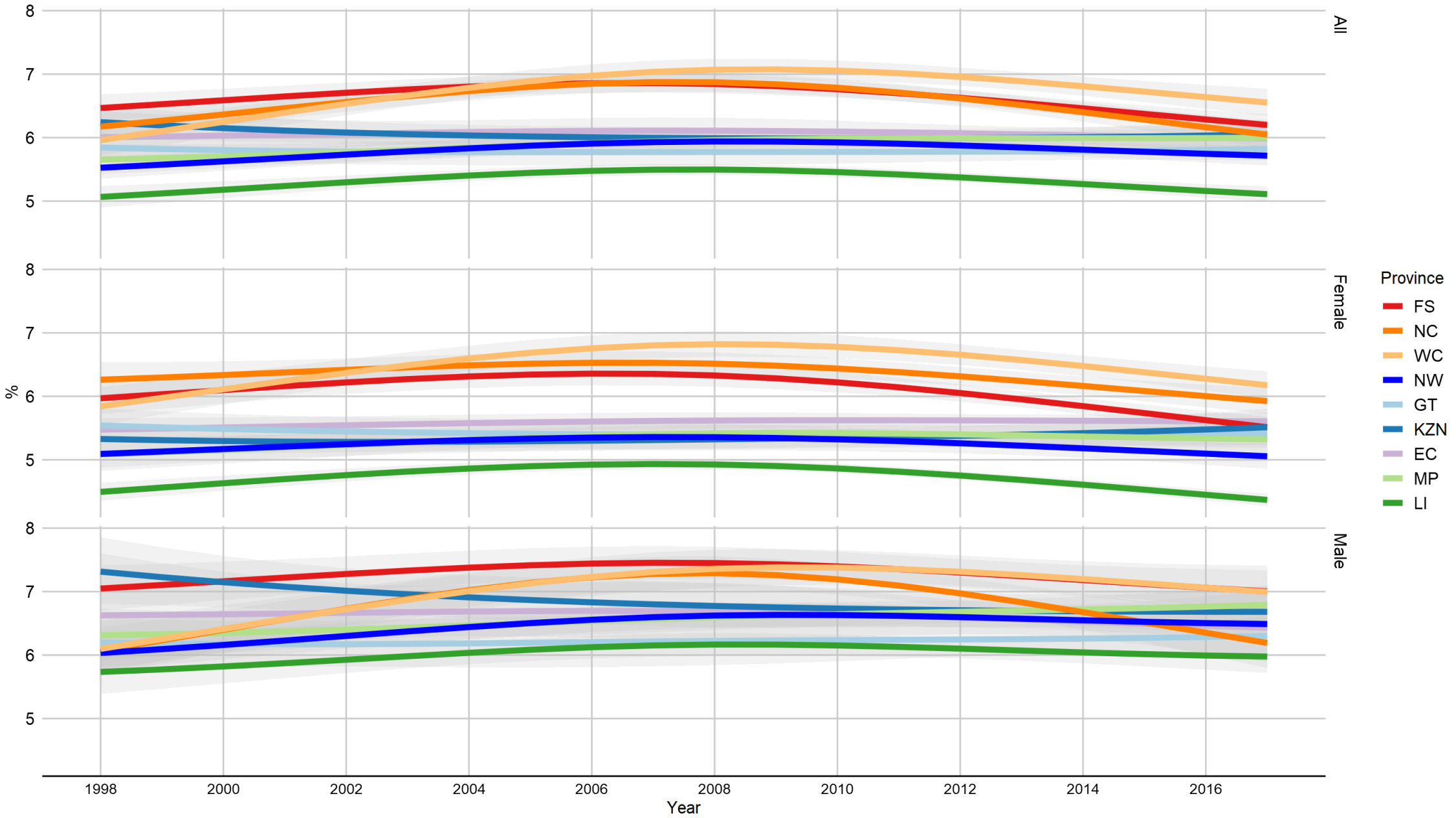
Estimated average effect on antihypertensive treatment on the treated. South African population 25+. By sex and age.

Socioeconomic factors & inequality



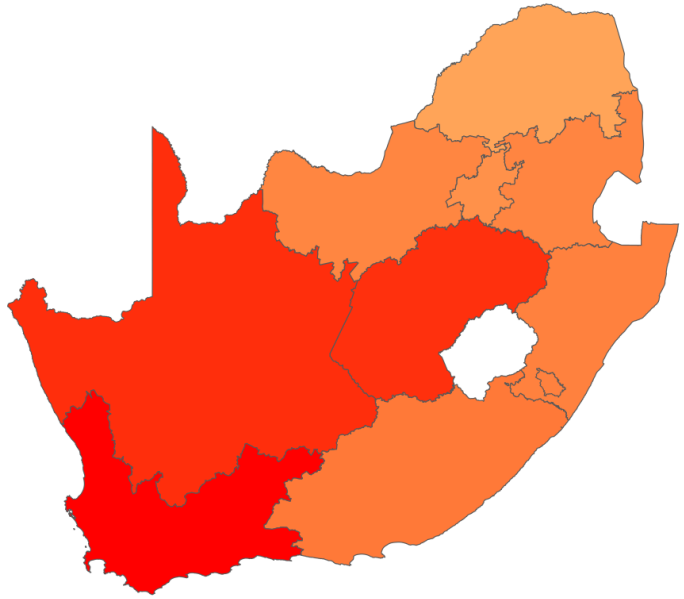
Estimated average cardiovascular risk South Africa, 40-74 years. Age standardised., by province.

WHO non-laboratory risk score.



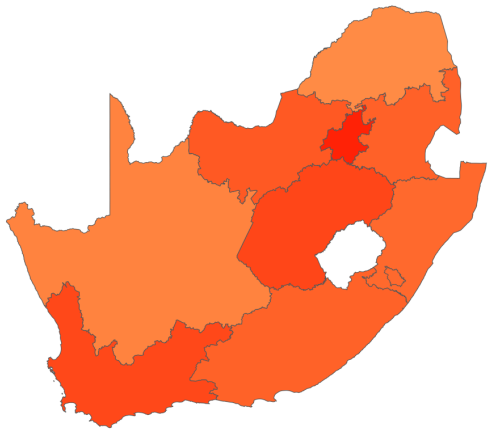
Estimated trend in CVD Risk. South African population 40-74. **Age standardised, by province.**

WHO non-laboratory risk score.



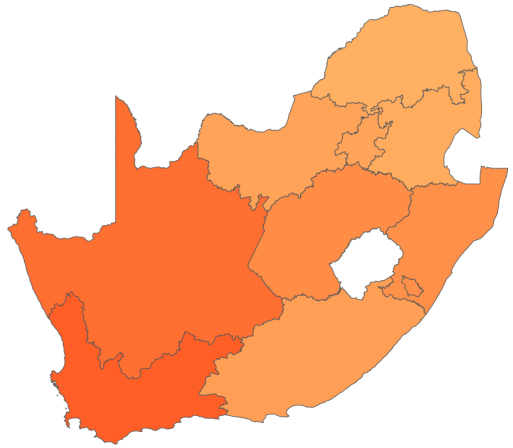
CVD Risk score % (WHO non-laboratory)

5.5 6.0 6.5 7.0



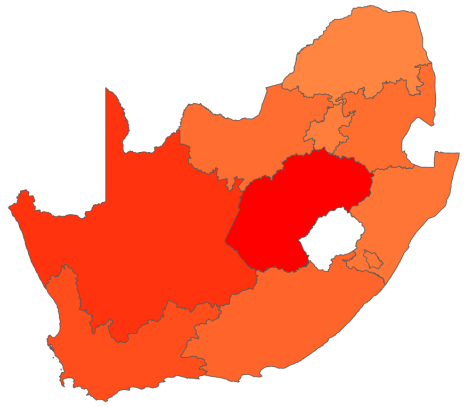
Average BMI

26 27 28 29



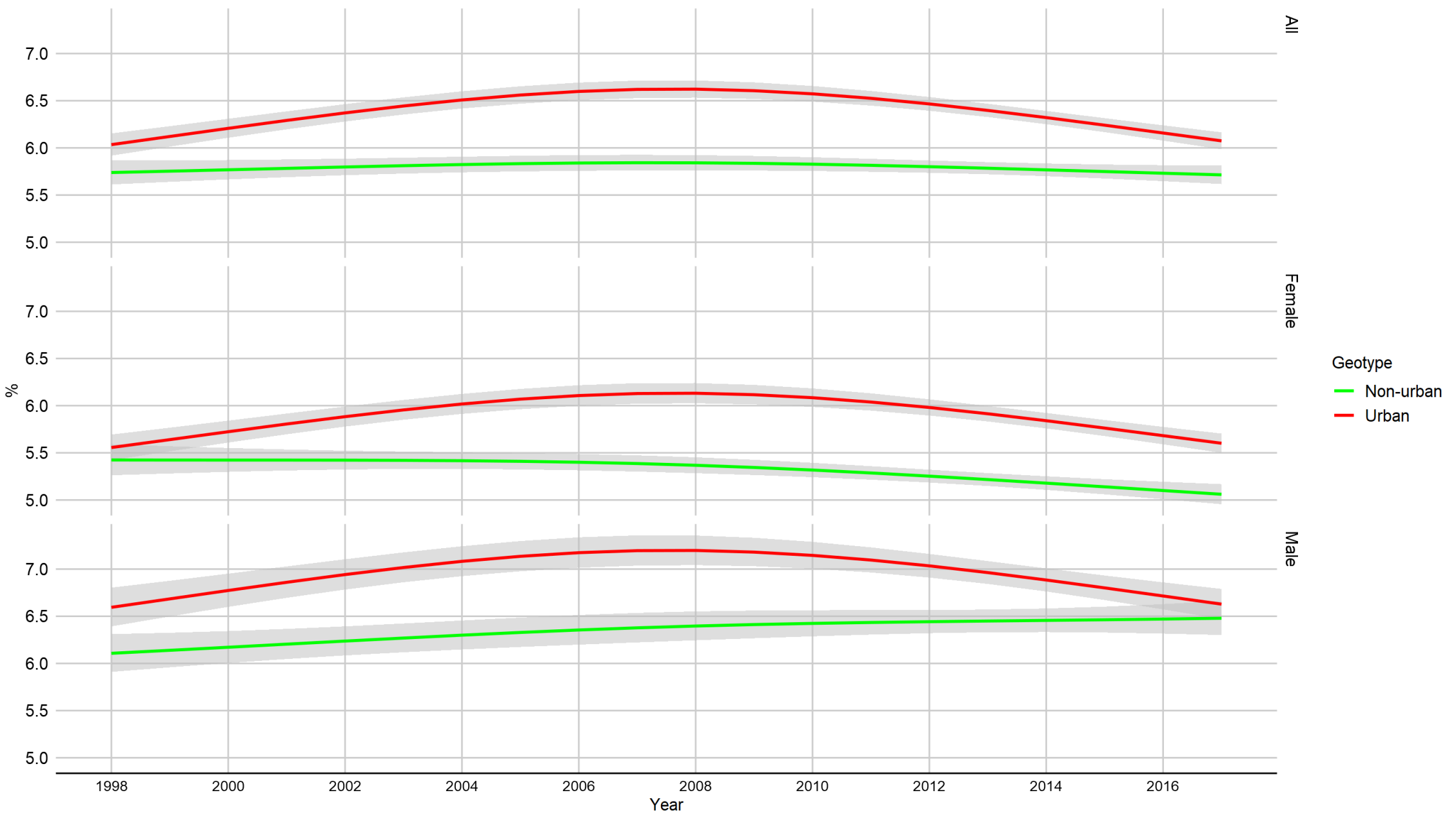
Smoking prevalence

0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45



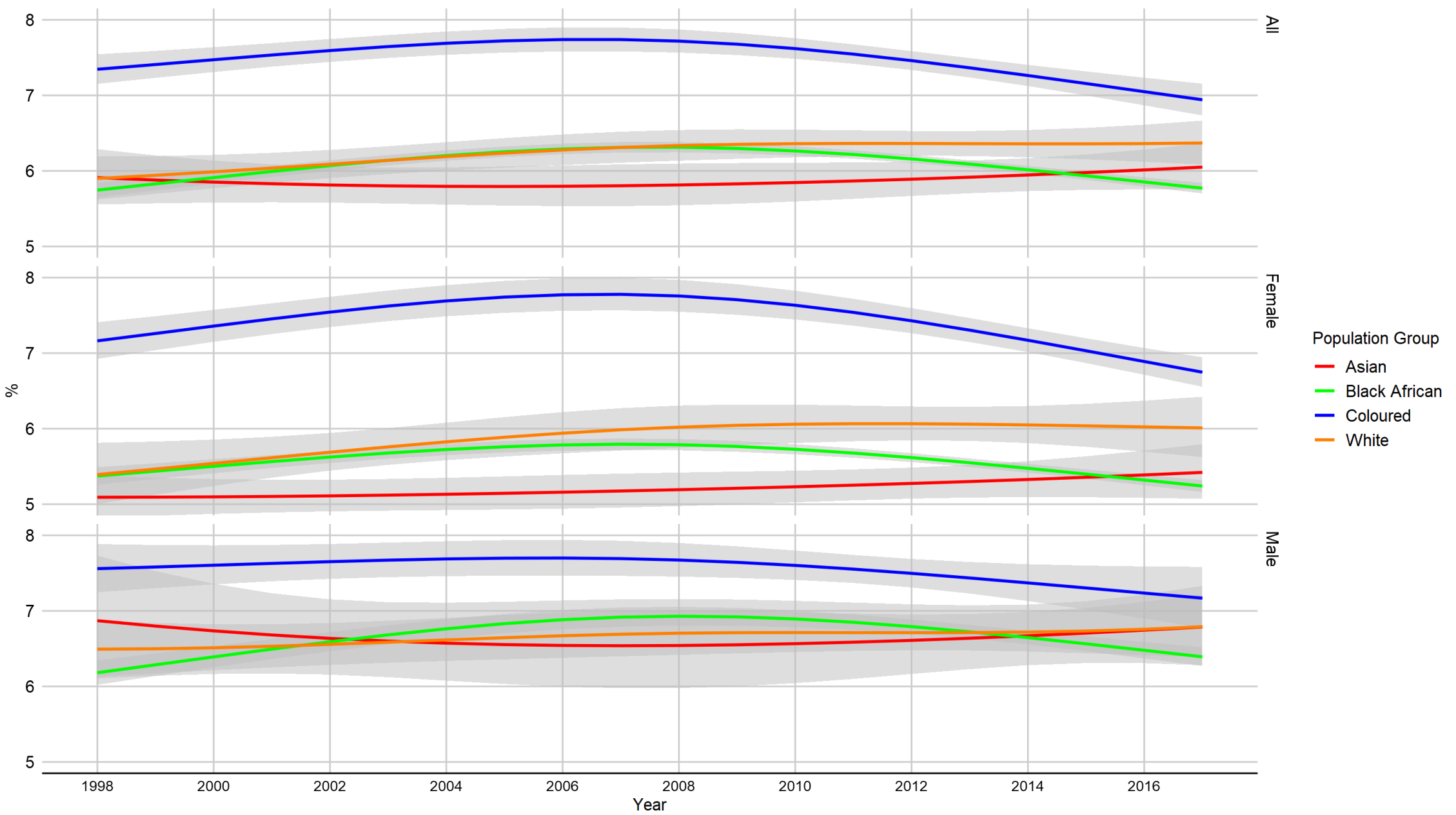
Average Systolic Blood Pressure

130 135 140



Estimated trend in CVD Risk. South African population 40-74 **Age standardised. By geographic type.**

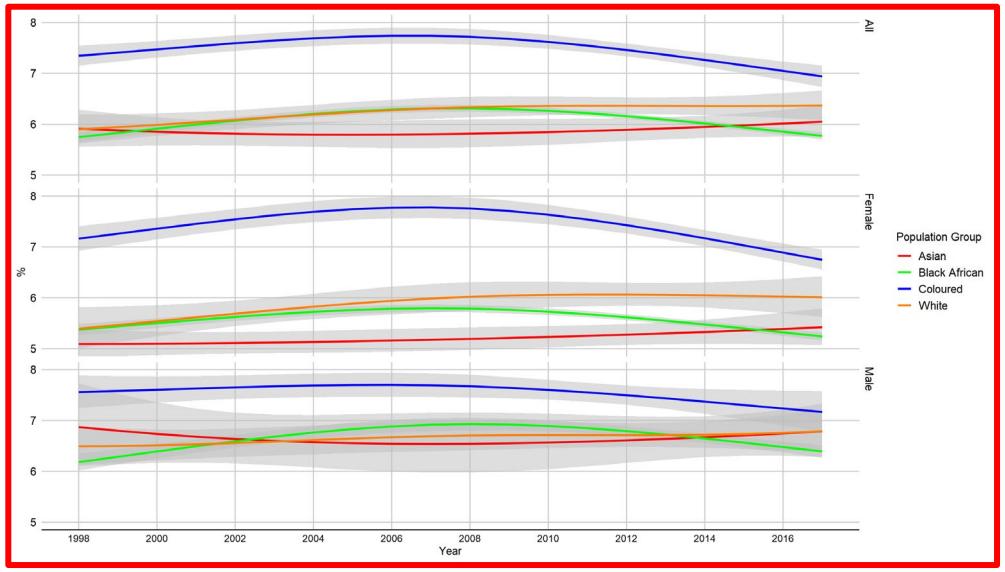
WHO non-laboratory risk score.



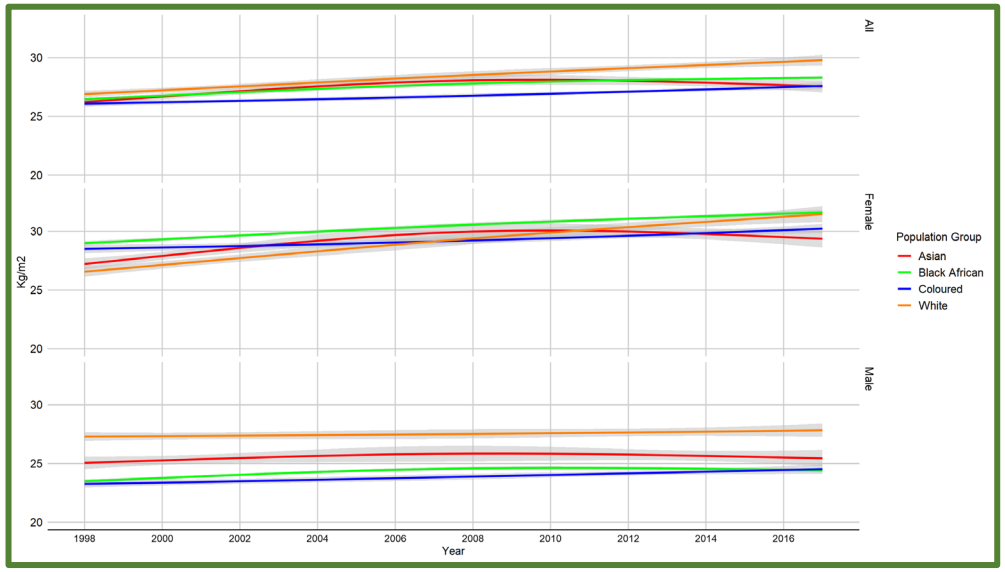
Estimated trend in CVD Risk. South African population 40-74. Age standardised. By population group and sex.

WHO non-laboratory risk score. Estimates and 95% confidence intervals/bands.

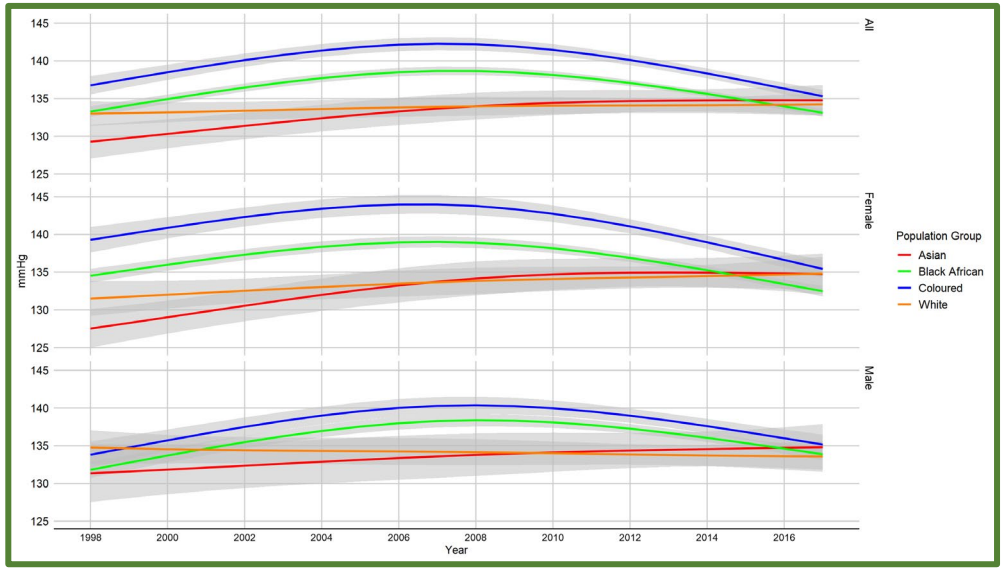
Risk



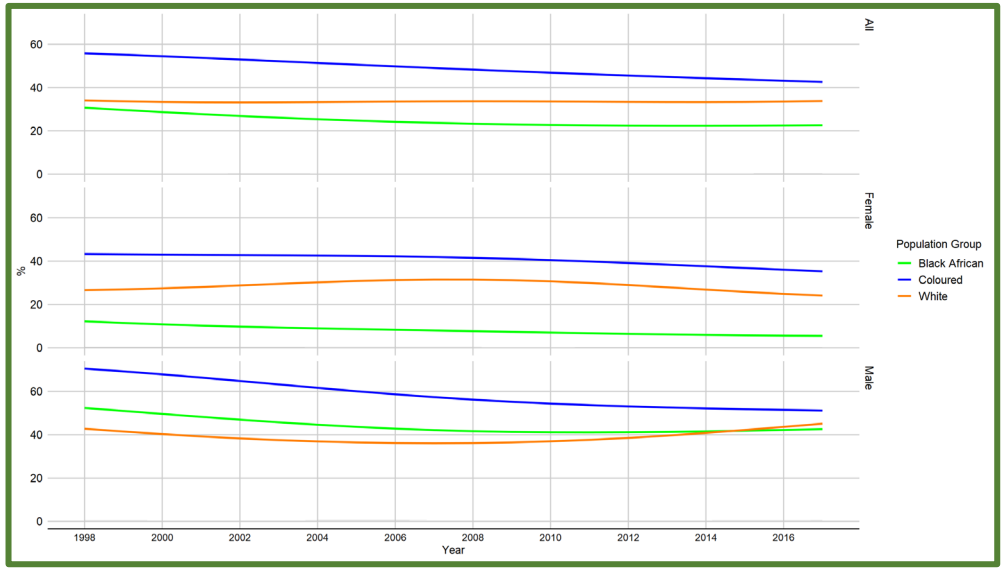
Average BMI



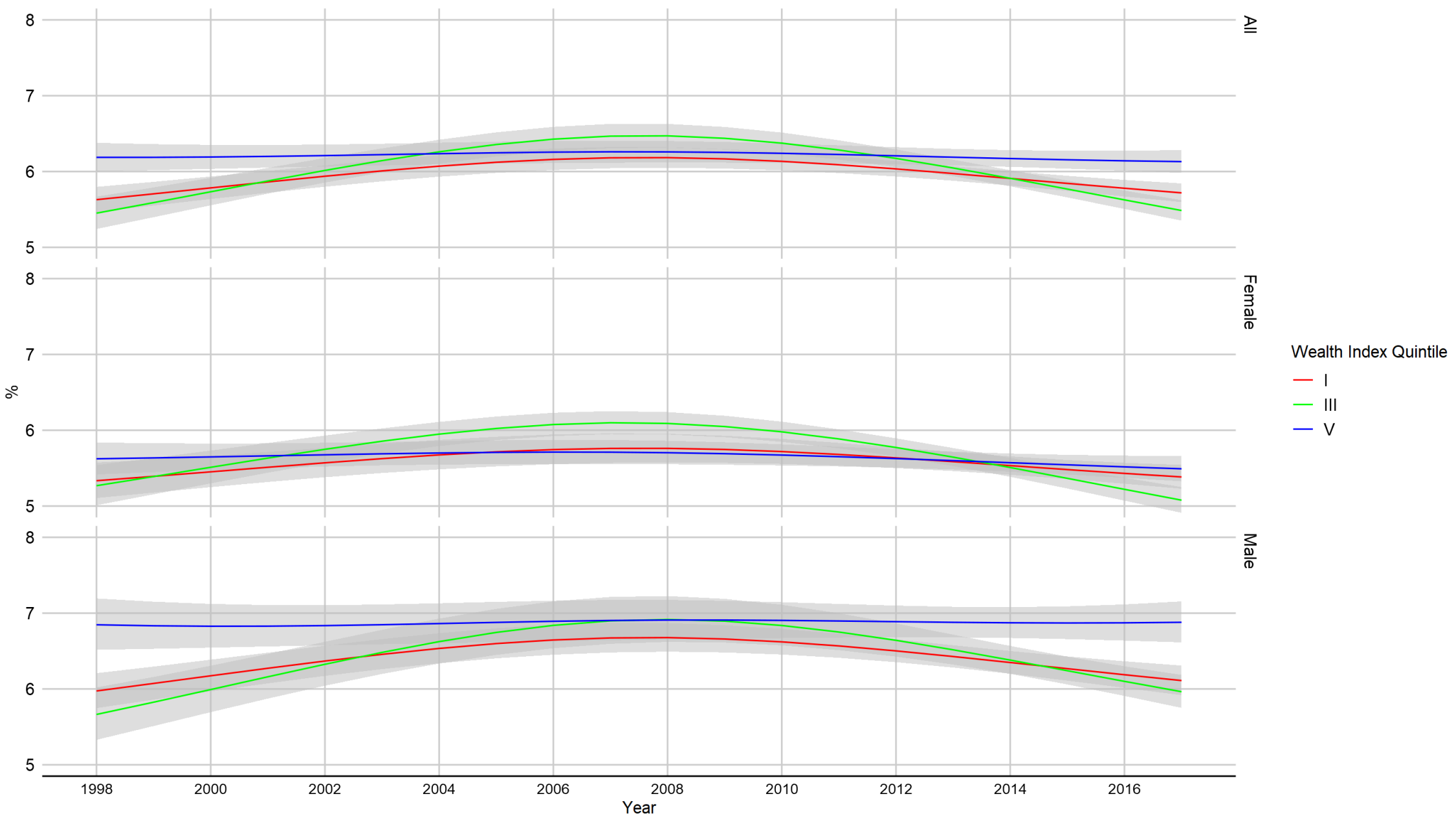
Average SBP



Smoking prevalence

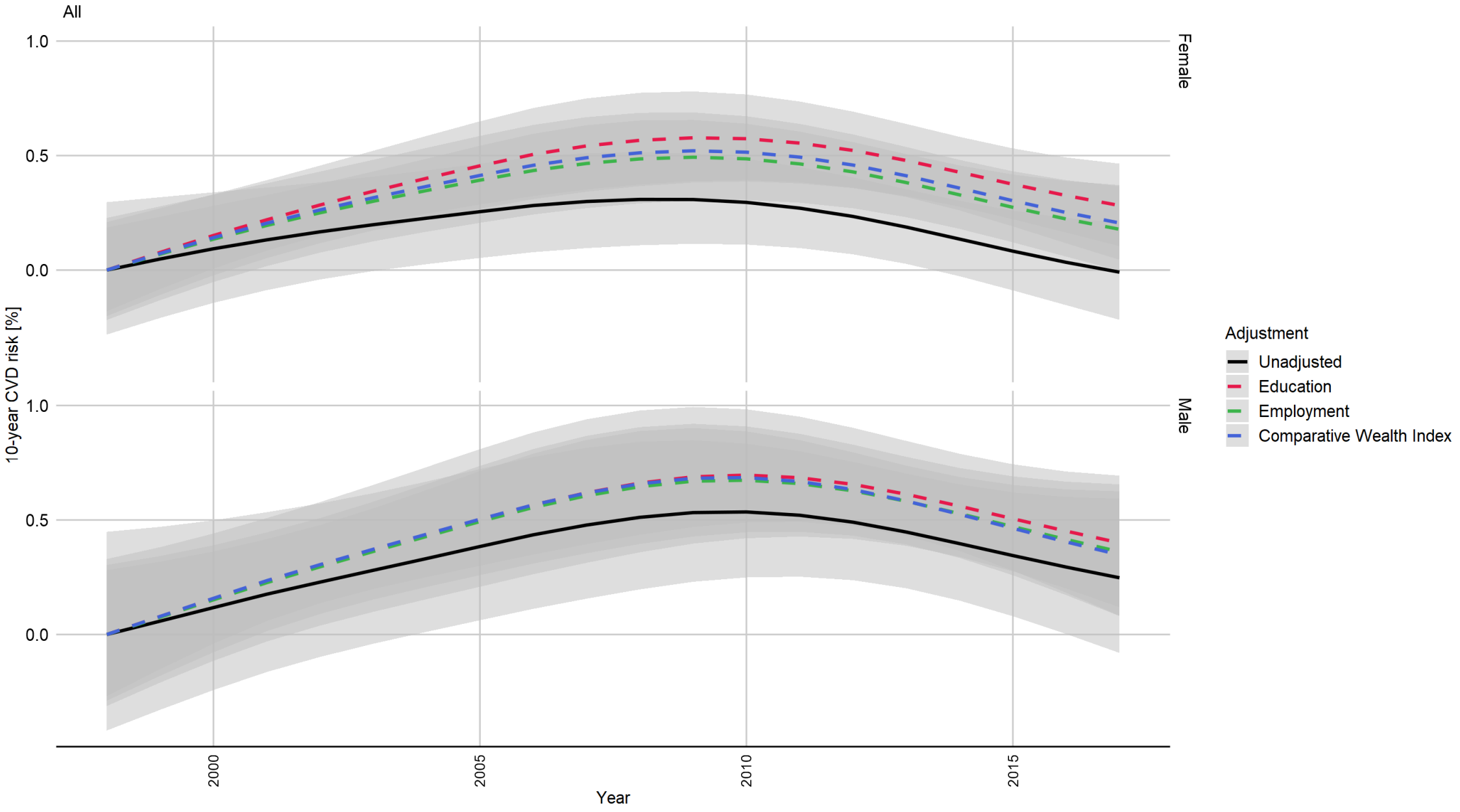


Estimated average cardiovascular risk and distribution of selected risk factor South Africa, 40-74 years. Age standardised., by population group.



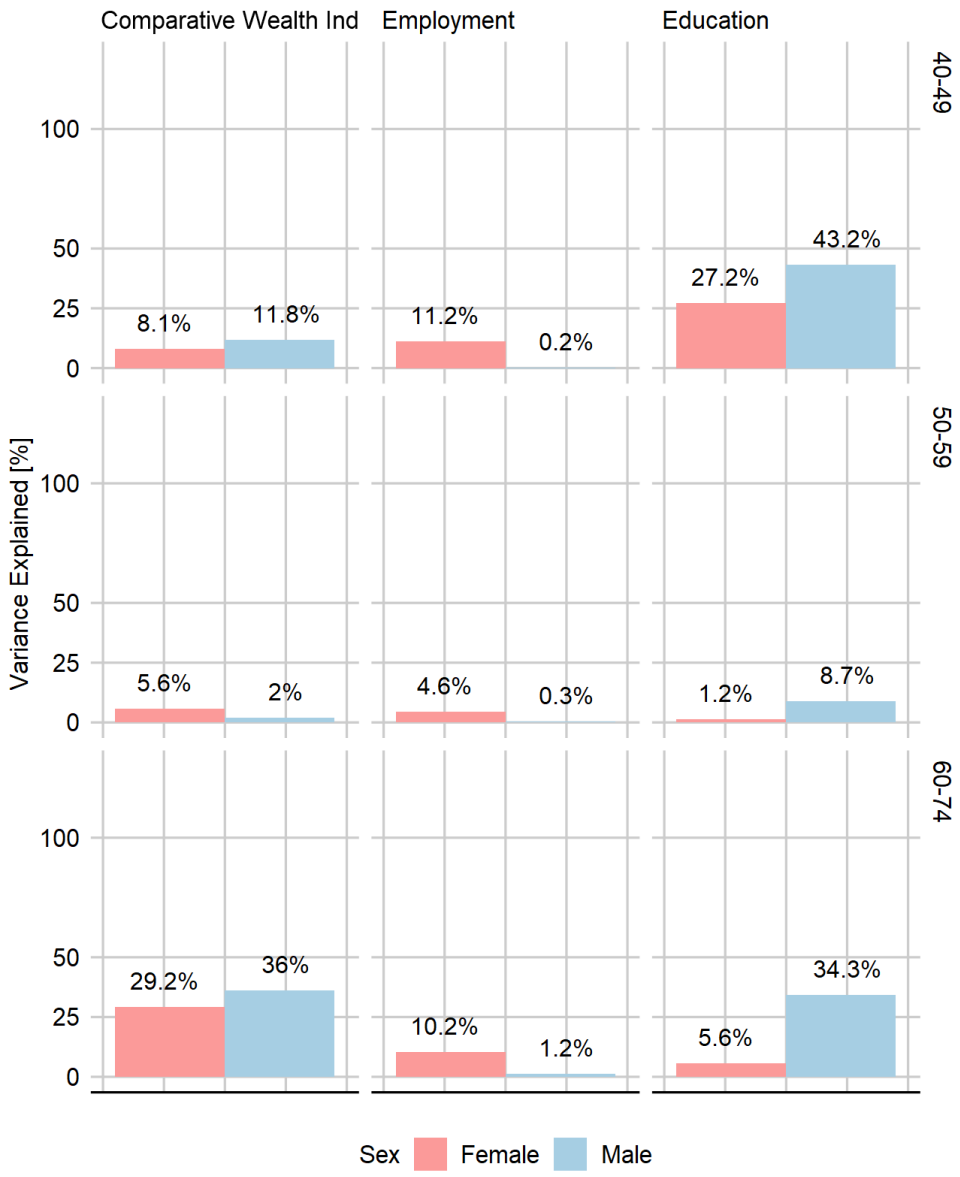
Estimated trend in CVD Risk. South African population 40-74 Age standardised. By household wealth index and sex.

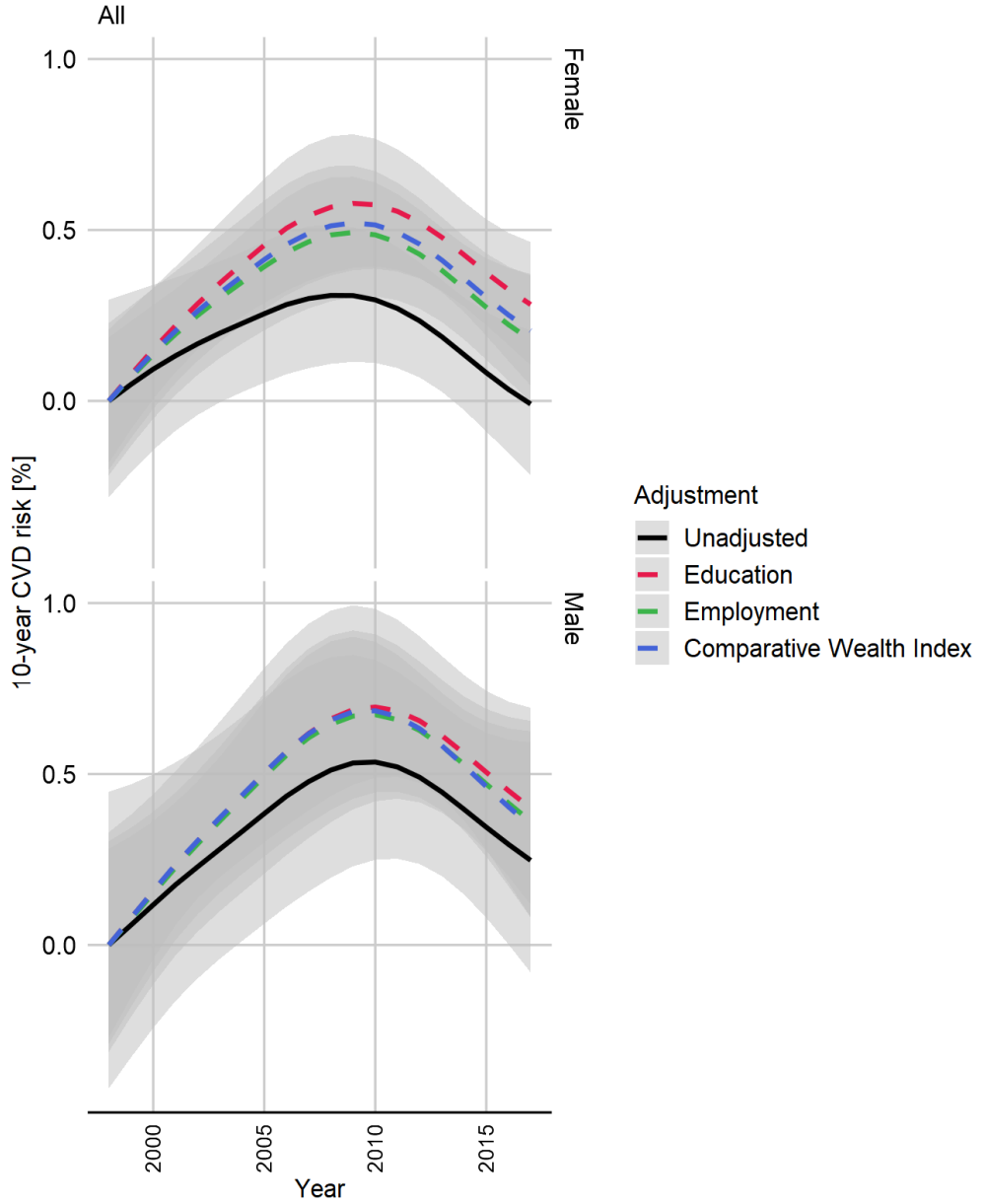
WHO non-laboratory risk score. Estimates and 95% confidence intervals/bands.



Estimated trends in CVD Risk. South African population 40-74 years 2012-2017. Adjusted for selected socioeconomic indicatros. By sex.

WHO non-laboratory risk score. Centred at year = 1998.





Proportion of variance explained and adjusted trends for selected socioeconomic factors. South African population 40-74 years. By sex.

Who non-laboratory risk score.

Conclusions & Discussion Points

- Trends in CVD risk scores in South Africa showed an increasing and then decreasing pattern from 1998-2017. This contrasts to England where declines were observed from the beginning of the period.
- Decreases are present, with different magnitude and timing, across age groups and sexes. Absolute risk is consistently higher among males.
- Trends in CVD risk scores seemed to be influenced most strongly by variations in SBP. Demographic changes and variation in smoking, alcohol use, physical exercise and BMI/waist circumference also contribute, to a lesser extent.
- Trends in average blood pressure are significantly affected by increasing diffusion (and, possibly, improved effectiveness) of antihypertensive treatment. Increasing treatment penetration/quality may contribute the risk reduction. Enhancing awareness and treatment among males may help to reduce sex inequalities in CVD risk.
- CVD risk scores (and major risk factors) show remarkable gender, geographic and socioeconomic patterns, with some signs of convergence.
- Improving socioeconomic circumstances including education and employment may also lead to population improvements in CVD risk.

Thank you!

Stellenbosch UNIVERSITY IYUNIVESITHI UNIVERSITEIT

UNIVERSITY OF GREENWICH

UCL

UKRI Economic and Social Research Council

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