ExPoSE

Explaining Population trends in cardiovascular risk: A comparative analysis of health transitions in South Africa and England

UCL Health Survey for England (HSE) Seminar

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24 May 2022

UKRI Economic and Social Research Council

Outline & Agenda

- Project overview
- Updates & preliminary results
- Next steps

Project overview

Funders

The project is funded by the UK's **Economic and Social Research Council (ESRC)**under the *Secondary Data Analysis Initiative*:

Consultants

- Health and Social Surveys Research Group (HSE team), UCL
  - Consulting on use of the Health Survey for England (HSE)

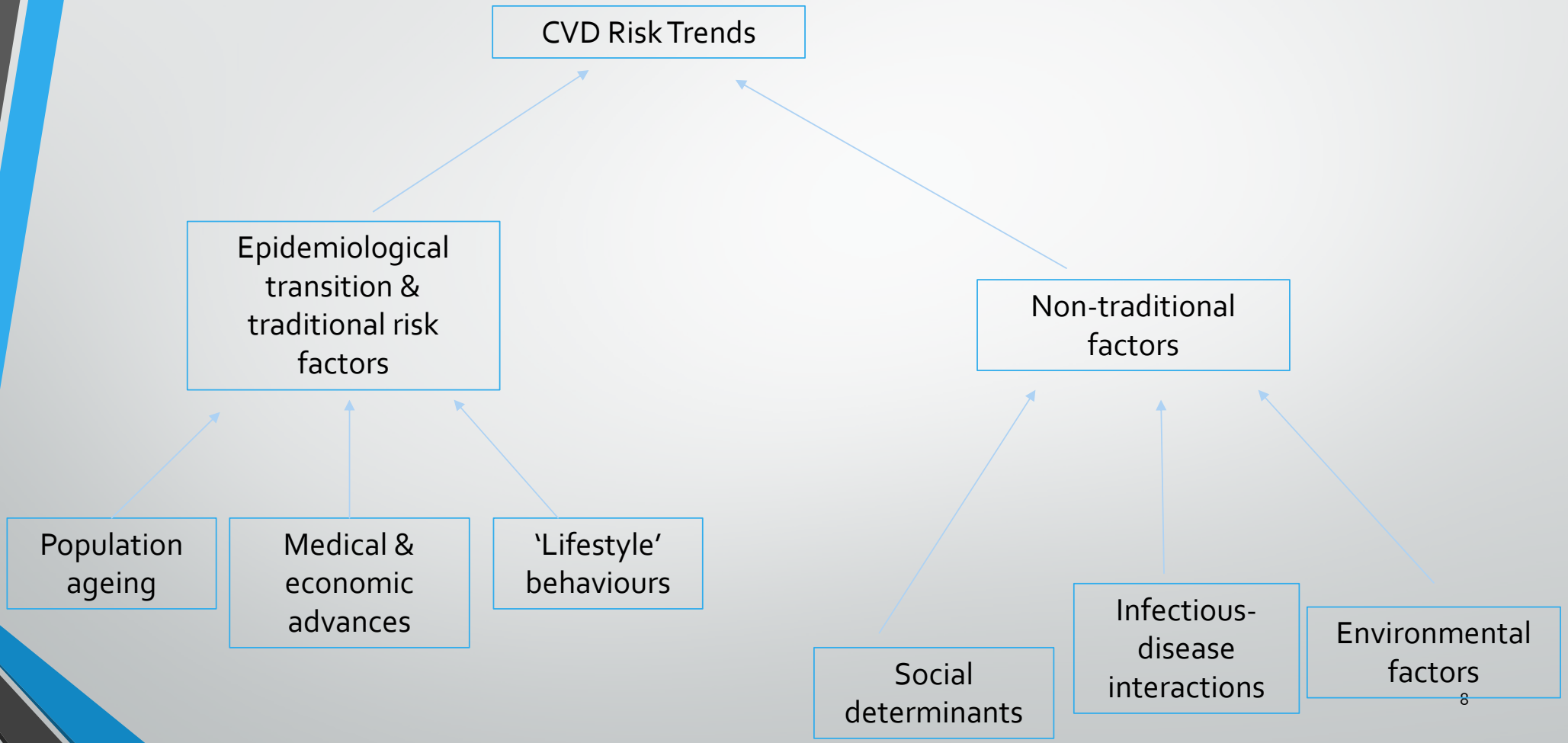
Stakeholder & Users Advisory Group

- **Departments of Health**: SA National Department of Health
- **Academic**: Stellenbosch, Greenwich, UCL, Wits University, KCL
- **Research**: South African Medical Research Council, Human Sciences Research Council, Africa Health Research Institute, NatCen Social Research
- **Civil society**: Health Systems Trust, Heart & Stroke Foundation of South Africa
- **Healthcare**: Charlotte Maxeke Hospital, Khayelitsha District Hospital, Council for Medical Schemes
- **Data hosting**: DataFirst, UK Data Service

Research questions

1. What are the population trends in CVD risk in South Africa since its first national health survey in 1998?
2. To what extent are these trends explained by demographic, behavioural, social, environmental, health-related and/or other factors?
3. How do these results compare to those in a high-income country with a different infectious disease profile such as England over the same time period?

Conceptual framework



Data sources

South Africa:

- 11 Nationally-representative cross-sectional surveys from South Africa 1998 through 2017
  - DHS 1998, DHS 2003, SAGE 2007-8, NIDS 2008, NIDS 2010-11, SANHANES 2012, NIDS 2012, NIDS 2014-15, SAGE 2014-15, DHS 2016, NIDS 2017

England:

- 20 nationally-representative cross-sectional surveys from the Health Surveys for England (HSE), 1998-2017

Main outcome variable

Non-laboratory-based CVD risk score (sex-specific):

Function of:

- Age
- Systolic blood pressure
- Current smoking
- Diabetes diagnosis
- Hypertension treatment
- BMI

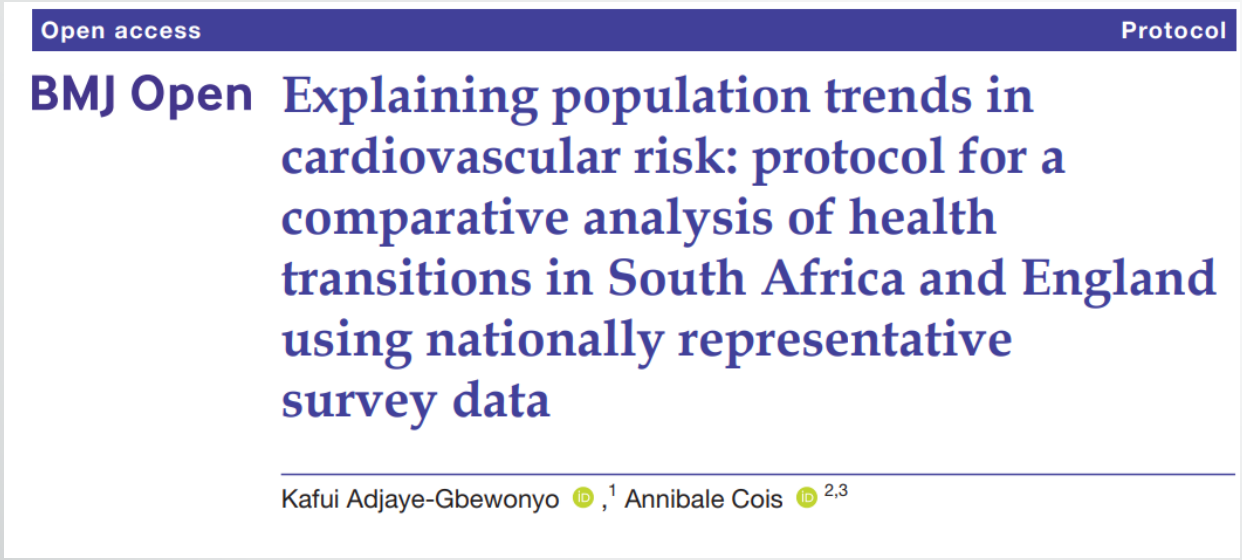
Analysis

Examine population trends in CVD risk

Identify potential explanatory variables

Explain trends over time

Protocol



Open access Protocol

BMJ Open

Explaining population trends in cardiovascular risk: protocol for a comparative analysis of health transitions in South Africa and England using nationally representative survey data

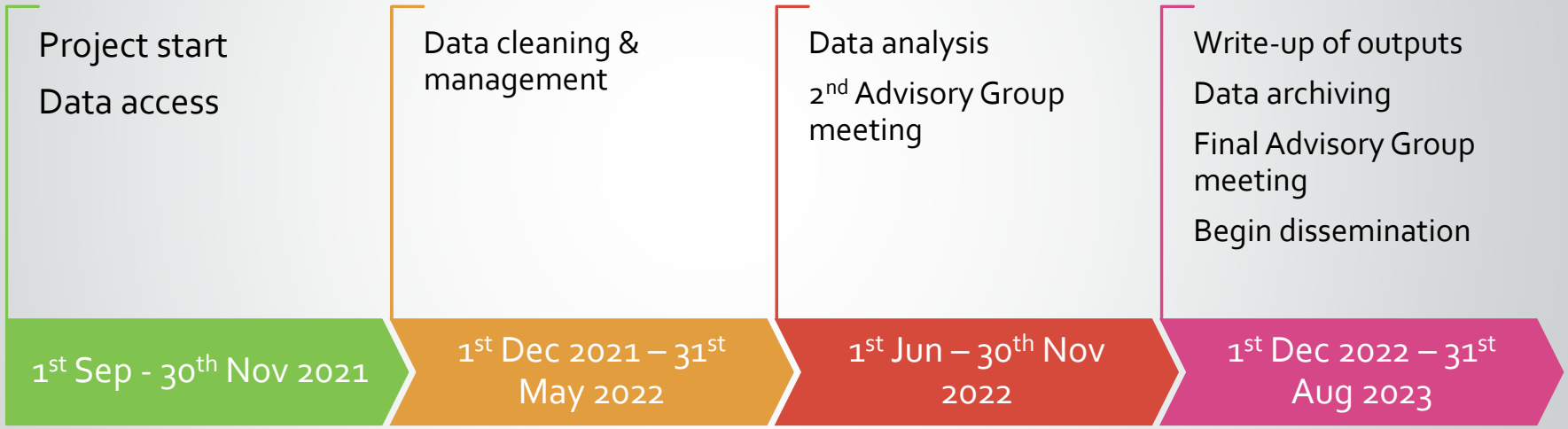
Kafui Adjaye-Gbewonyo ,[1] Annibale Cois [2,3]

https://bmjopen.bmj.com/content/bmjopen/12/3/e061034.full.pdf

Outputs & Impact

- Research publications & presentations
- Harmonised dataset & code made publicly available
- Policy brief/report
- Public engagement activities and media
- Trainings on use of dataset

Timeline


Project start
Data access
1st Sep - 30th Nov 2021
Data cleaning & management
1st Dec 2021 – 31st May 2022
Data analysis
2nd Advisory Group meeting
1st Jun – 30th Nov 2022
Write-up of outputs
Data archiving
Final Advisory Group meeting
Begin dissemination
1st Dec 2022 – 31st Aug 2023

Survey trends in CVD Risk Score and its components

and some notes on measuring socioeconomic status

Preliminary results: South Africa

Harvard NHANES risk score

$$\hat{p} = 1 - S_0(t)^{\exp(\Sigma_{i=1}^{p} \beta_i X_i - \Sigma_{i=1}^{p} \beta_i \bar{X}_i)}$$

+ sex

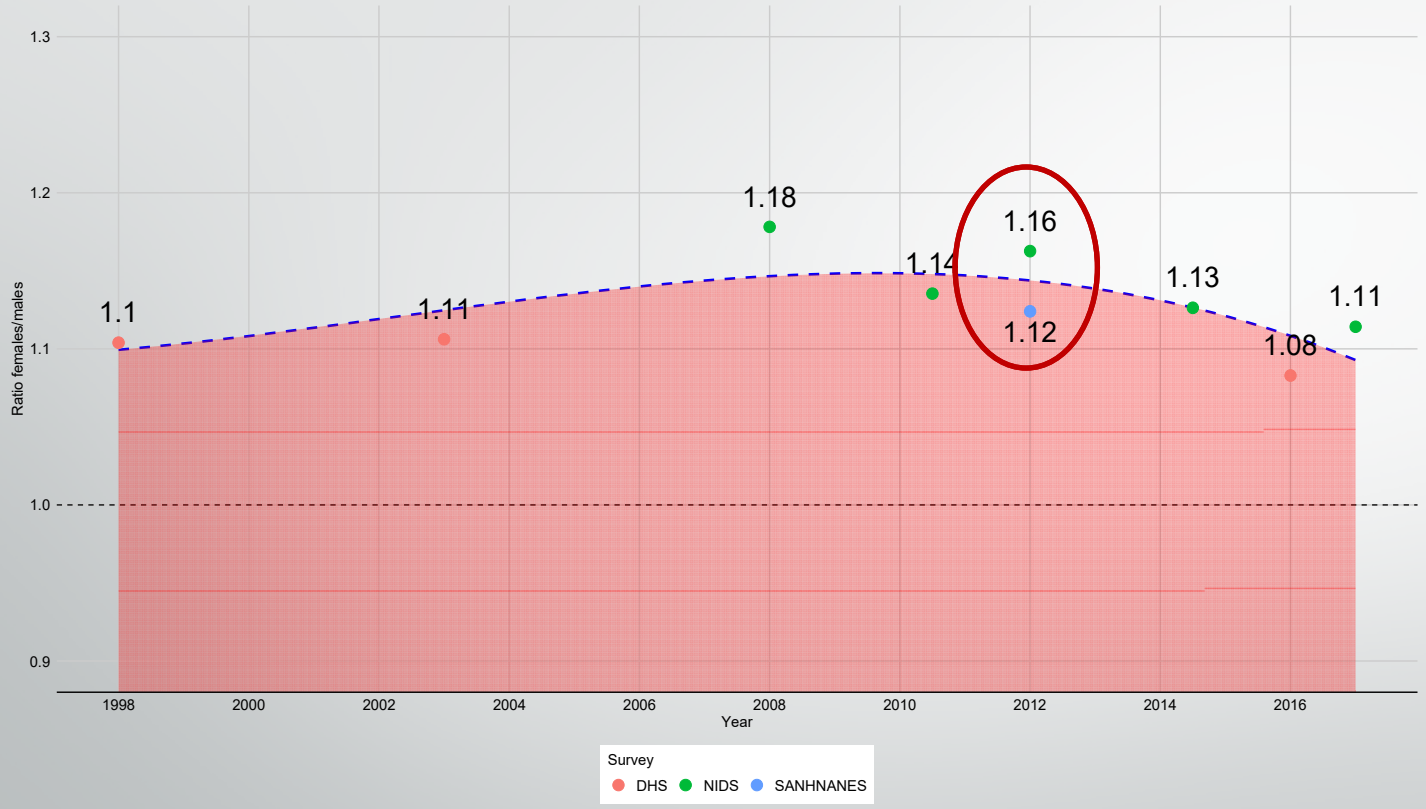
Components

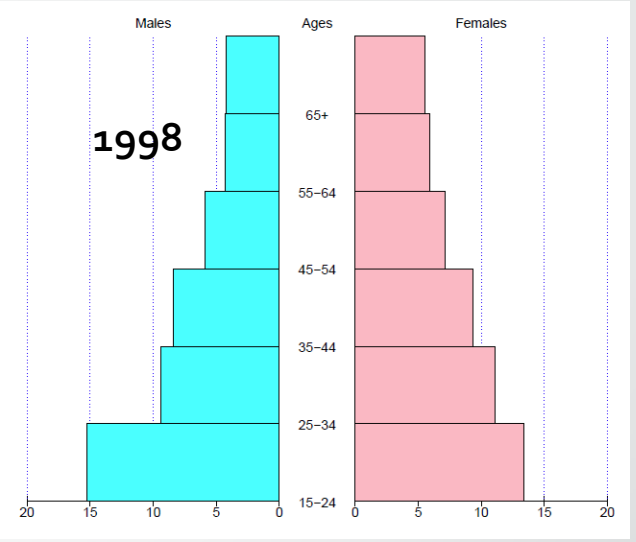
	Women (n=3349)				Men (n=2837)			
	β	SE	HR	p value	β	SE	HR	p value
Age†	3·904	0·218	49·608	<0·0001	3·560	0·182	35·196	<0·0001
Systolic blood pressure†	1·545	0·267	4·689	<0·0001	1·627	0·251	5·091	<0·0001
Current smoker	0·571	0·083	1·770	<0·0001	0·568	0·073	1·766	<0·0001
History of diabetes	0·649	0·130	1·914	<0·0001	0·641	0·145	1·898	<0·0001
History of blood pressure treatment	0·367	0·092	1·443	<0·0001	0·220	0·105	1·246	0·037
Body-mass index†	0·847	0·198	2·332	<0·0001	0·727	0·242	2·069	0·0026

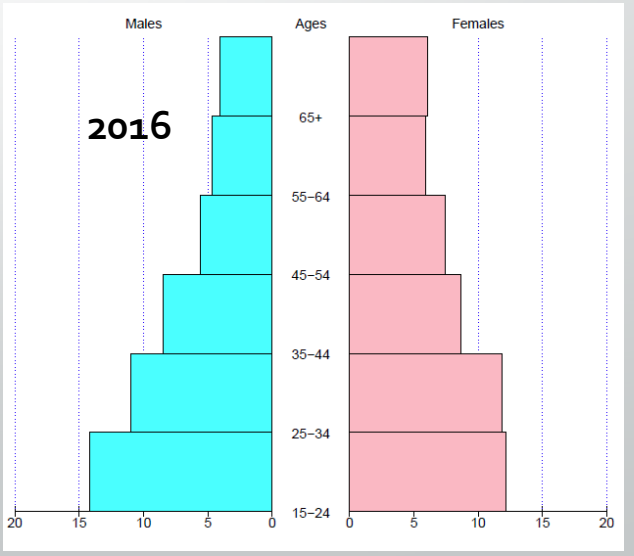
HR=hazard ratio. β=beta coefficient. *C statistic (95% CI): 0·829 (0·813–0·845) for women; 0·784 (0·766–0·801) for men. †Natural logarithm of the continuous variable. ‡C statistic (95% CI): 0·831 (0·816–0·847) for women; 0·783 (0·765–0·800) for men.

Adapted form: Gaziano et al, 2008

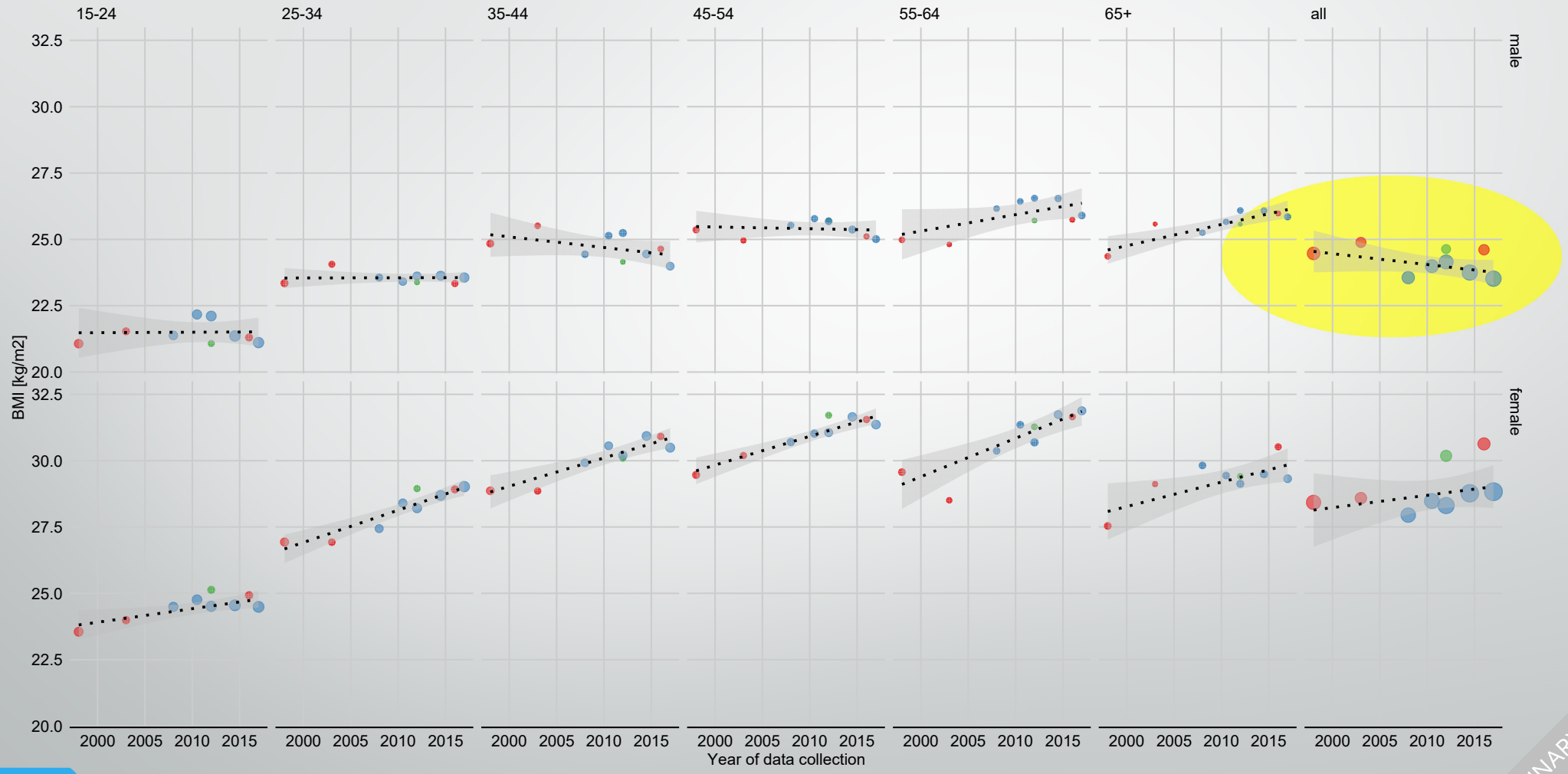
Sex ratio and age distribution, SA population 15+



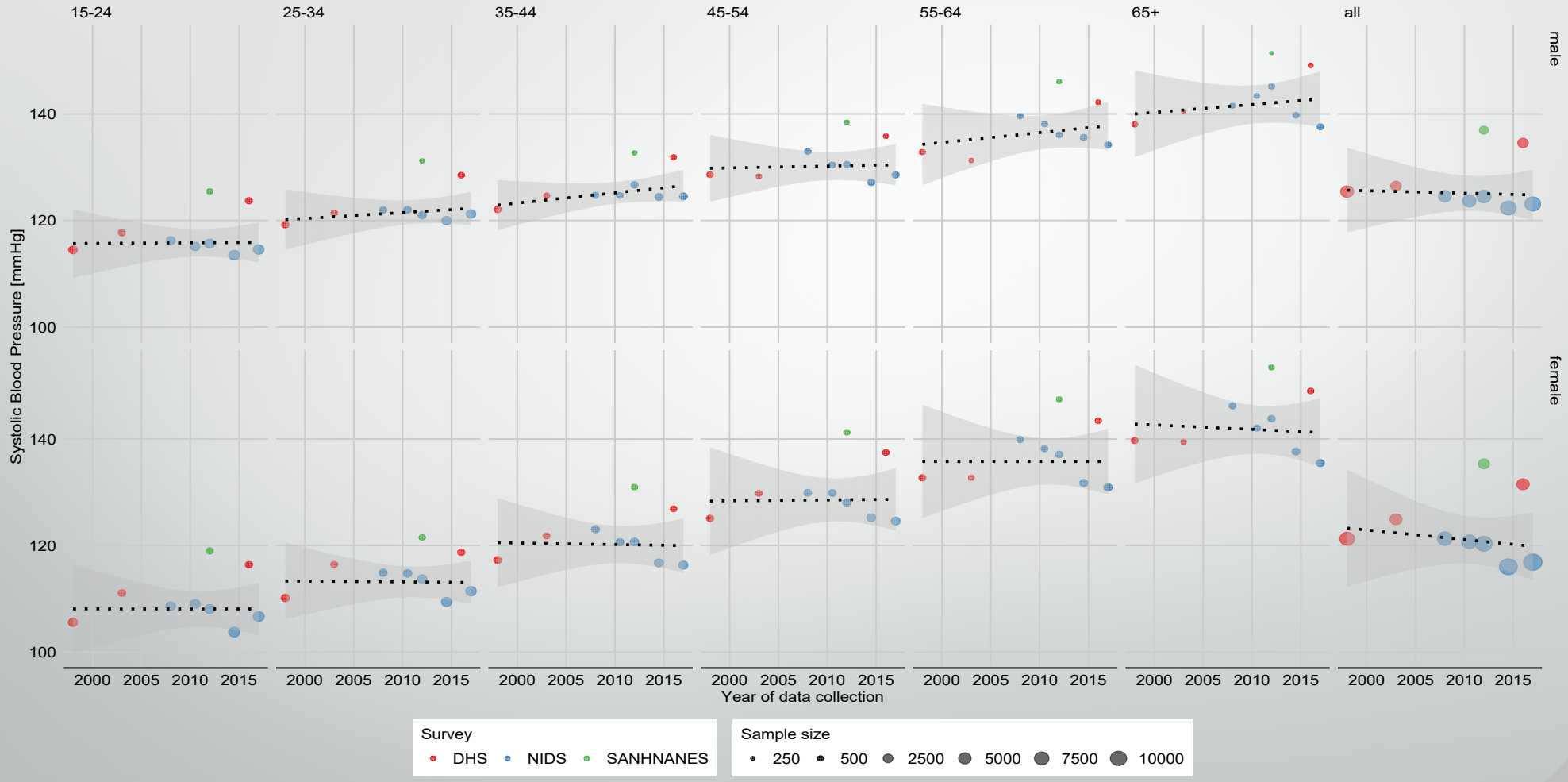




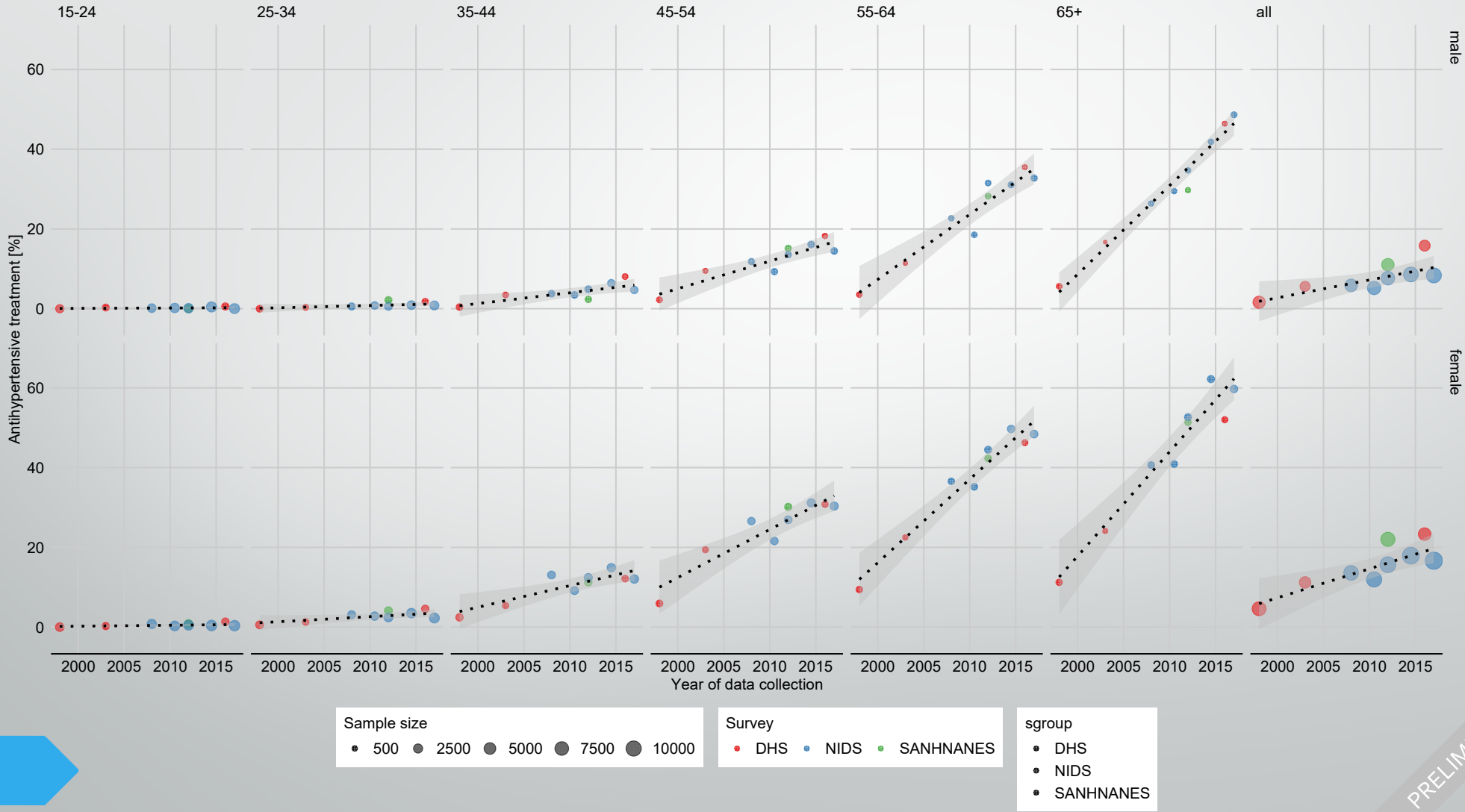
Mean BMI, SA population 15+, by sex & age



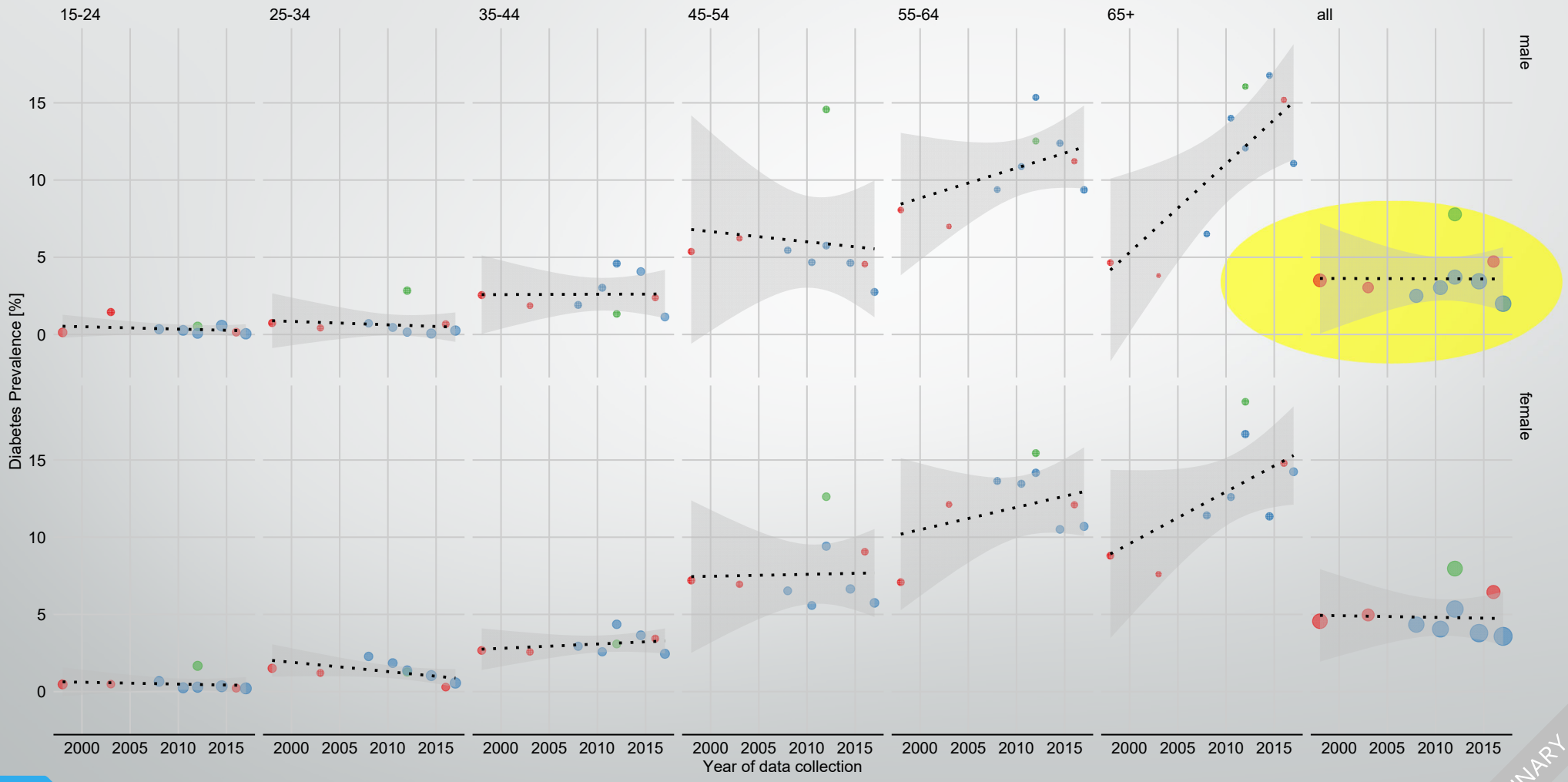
Mean SBP, SA population 15+, by sex & age



Current antihypertensive treatment, SA population 15+, by sex & age

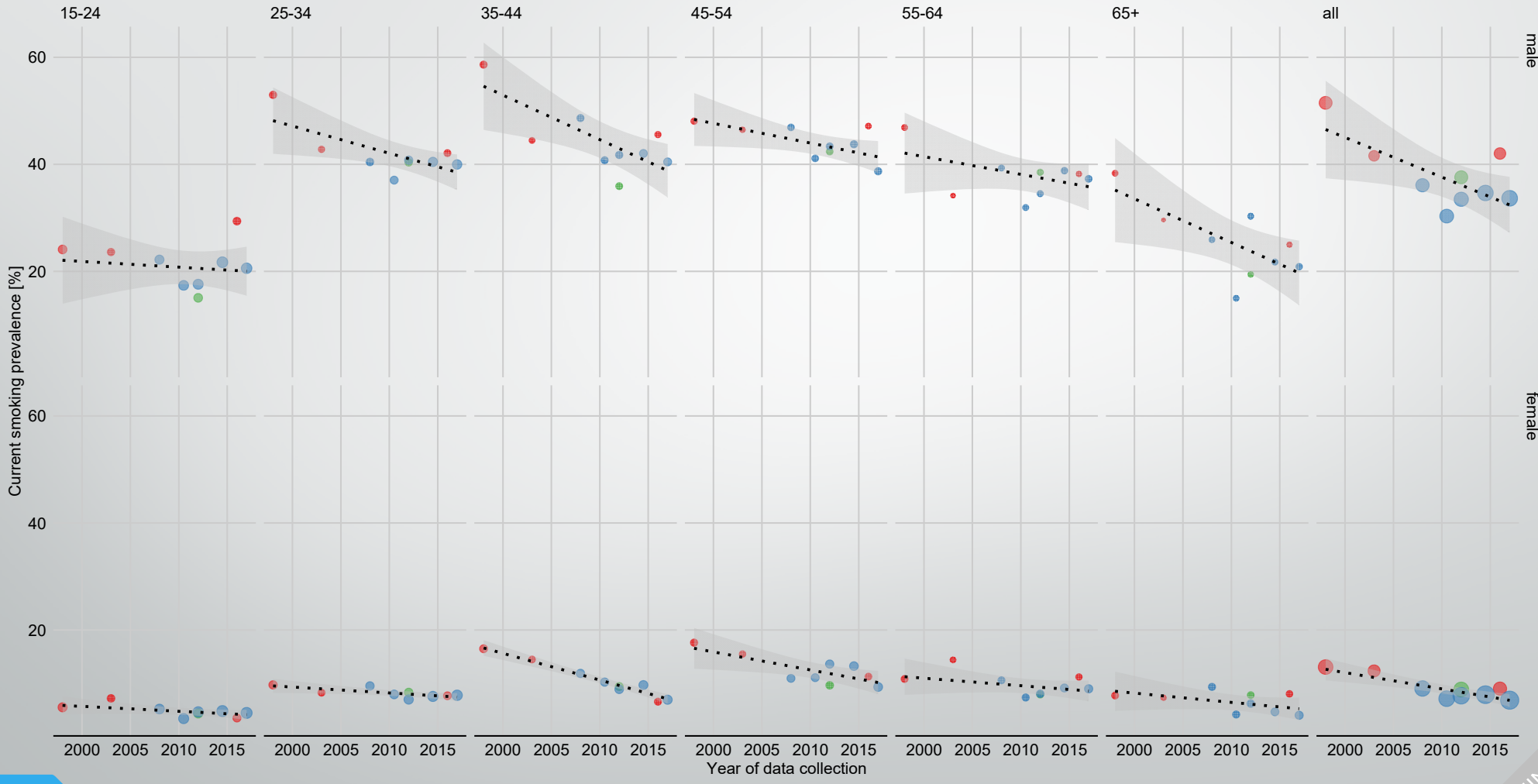


Self-reported Diabetes prevalence, SA population 15+, by sex & age

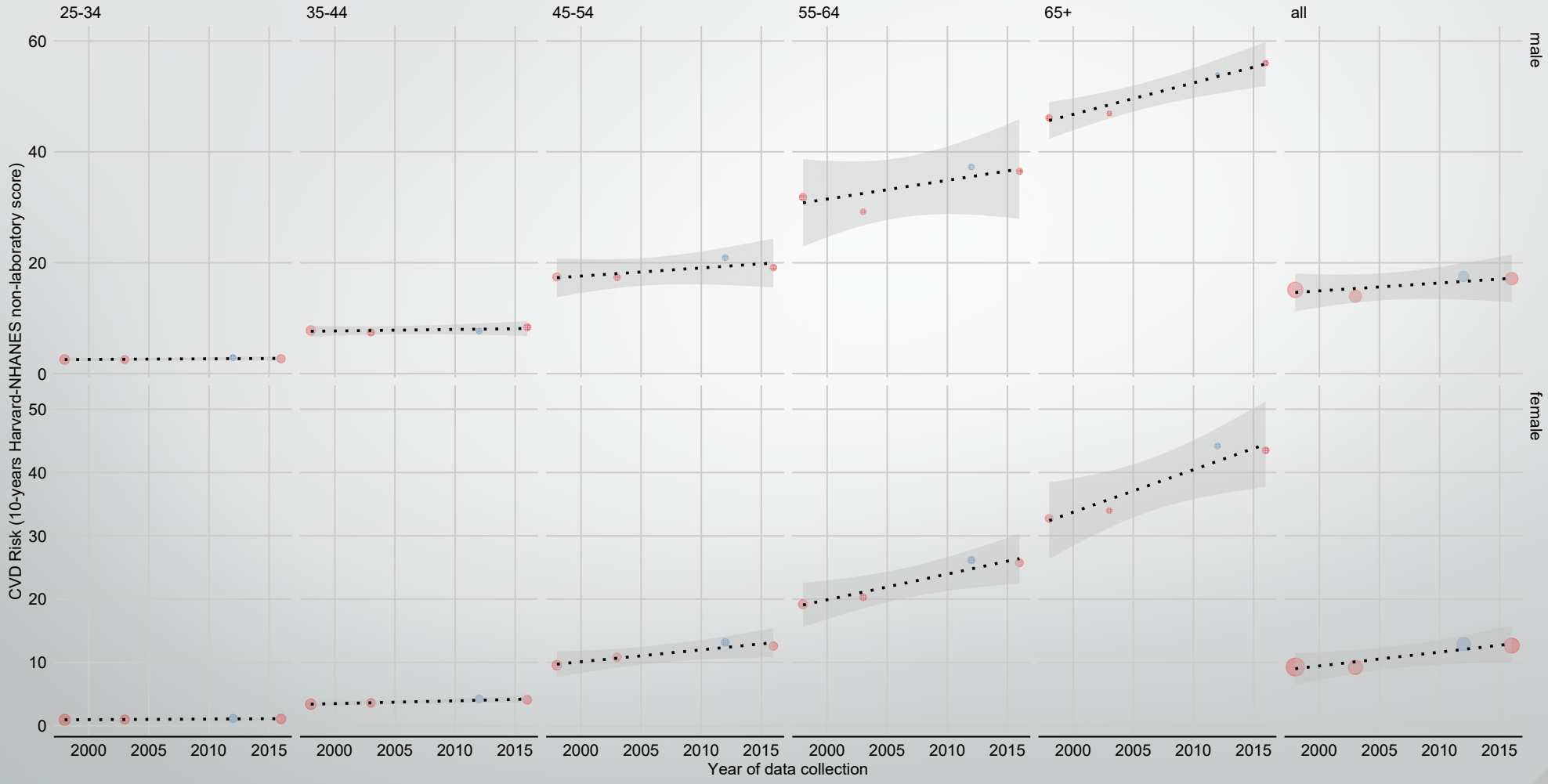


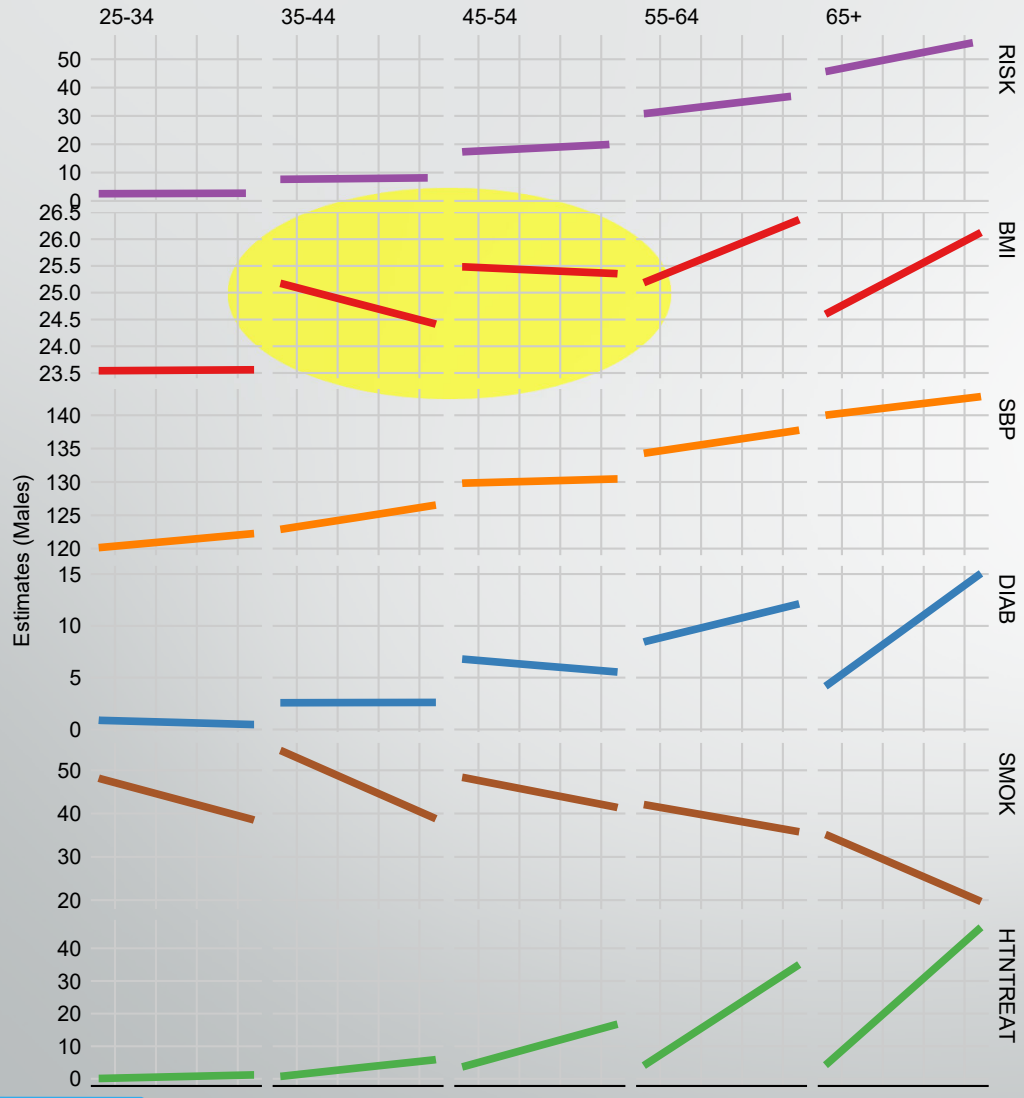
PRELIMINARY

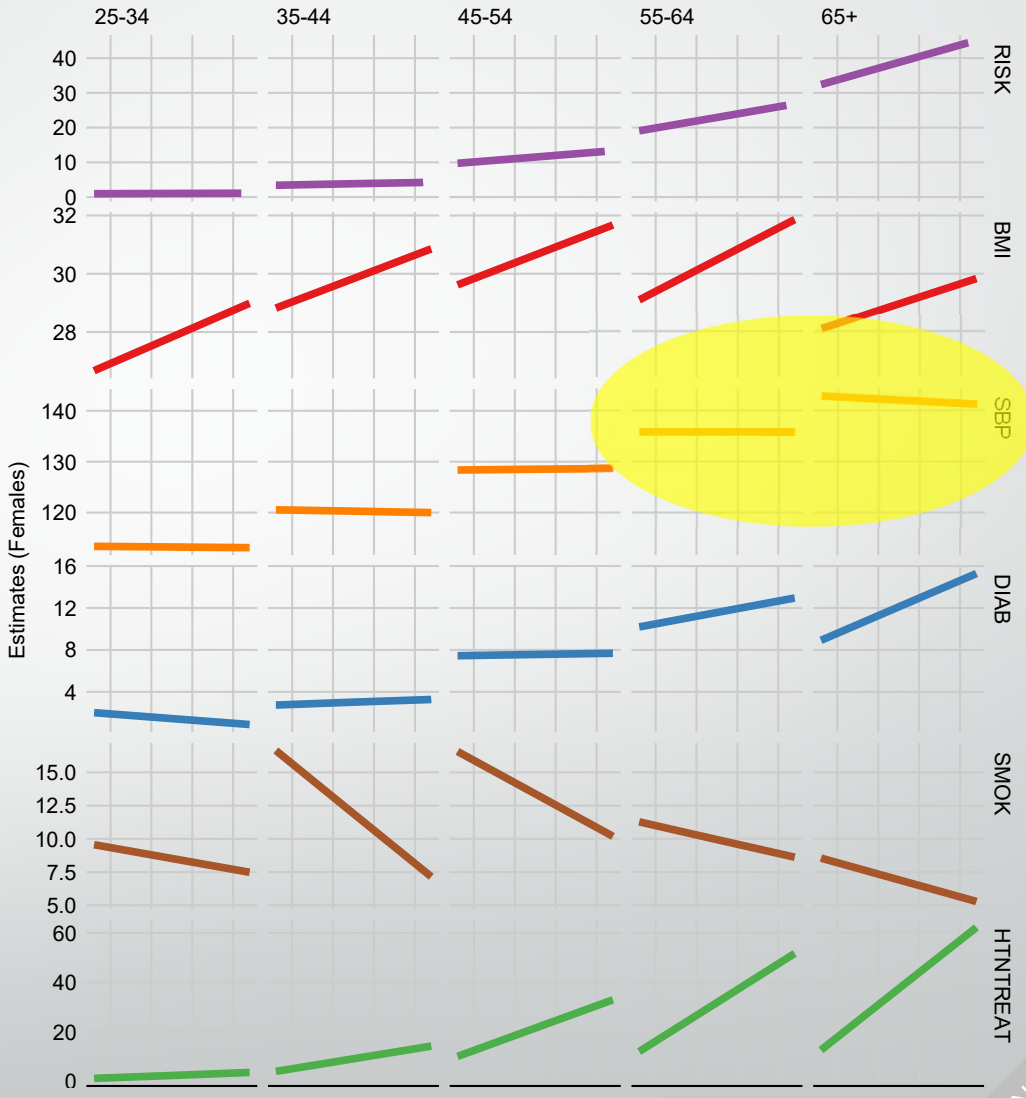
Current smoking prevalence, SA population 15+, by sex & age



Harvard NHANES Risk score, SA population 25+, by sex & age







Males

Females

PRELIMINARY!

- Additional data
- Harmonization
- Reweigthing
- Risk scores

Calibration

GBD data

Local mortality estimates

Alternatives

Framingham
D'Agostino et al, 2008

Pooled cohort equations
Munter et al, 2014

WHO-ISH charts
Mendis et al, 2007

Globorisk
Hajifathalian et al, 2015
Ueda et al, 2017

Non-laboratory INTERHEART risk score (NL-IHRS)
Joseph et al, 2017

WEALTH INDEX

FA-based on each survey

PCA

MCA/LTA/…

'Universal' Indices

IWI, AWE, CWI

Jeroen Smits · Roel Steendijk
Soc Indic Res (2015) 122:65–85
DOI 10.1007/s11205-014-0683-x

> consistency across populations and time (LMIC)

'robust' to difference in indicators and missing data

evidence of good properties in explaining variance on key health indicators

Next steps

- Preparation of Health Survey for England data with Health and Social Surveys Research Group (UCL)
- Completion of data harmonisation
- Further analysis of trends
- Stakeholder and User Advisory Group Meeting 2
- Explanation of trends

Questions & comments?

Extra slides

Datasets: South African Surveys			
Survey	Year	Adult Ages	Sample Size
DHS	1998	15+	13,827
DHS	2003	15+	8,115
SAGE	2007-8	18+	4,223
NIDS	2008	15+	16,872
NIDS	2010-11	15+	21,874
NIDS	2012	15+	22,457
SANHANES	2012	15+	7,436 [a]
NIDS	2014-15	15+	22,741
SAGE	2014-15	18+	26,804
DHS	2016	15+	5,685
NIDS	2017	15+	30,109

Datasets: England Surveys			
Survey	Year	Adult Ages	Sample Size
HSE	1998	16+	15,908
HSE	1999	16+	14,642
HSE	2000	16+	10,481
HSE	2001	16+	15,647
HSE	2002	16+	10,330
HSE	2003	16+	14,836
HSE	2004	16+	13,520
HSE	2005	16+	10,303
HSE	2006	16+	14,142
HSE	2007	16+	6,882
HSE	2008	16+	15,098
HSE	2009	16+	4,645
HSE	2010	16+	8,420
HSE	2011	16+	8,610
HSE	2012	16+	8,290
HSE	2013	16+	8,795
HSE	2014	16+	8,077
HSE	2015	16+	8,034
HSE	2016	16+	8,011
HSE	2017	16+	7,997

Examine population trends in CVD risk

- Uniform coding of variables
- Analysis of sampling strategies
- Survey 'quality'
- Flexible trend modelling
- Trends in individual components

Non-laboratory-based CVD risk score

$$CVDrisk = \beta_1 \cdot \ln(age) + \beta_2 \cdot \ln(systolic\ blood\ pressure) + \beta_3 \cdot Current\ smoker + \beta_4 \cdot Diabetes\ diagnosis + \beta_5 \cdot Hypertension\ treatment + \beta_6 \cdot \ln(BMI)$$

Identify potential explanatory variables

- Evidence on potential explanatory variables: demographic, socioeconomic, behavioural, health, healthcare, geographic, environmental and psychosocial variables at multiple levels
- Availability across surveys
- Missing data, bias, quality…
- Uniform coding
- Preliminary analysis of association with CVD risk and consistency across datasets

Explain trends over time

- Multilevel structural models with CVD risk/subcomponents as outcome
- CVD risk score as composite of latent variables
- Explore alternative estimation methods and modelling approaches (random-effects and fixed-effects models)
- Local datasets to 'anchor' the main model
- Missing data, inter-survey incongruencies
- Dealing with heterogeneous sampling schemes

Traditional Risk Factors	
Population Ageing	Age
Behavioural	Alcohol use
	Physical activity
	Diet (fruit, vegetable, processed food consumption)
Metabolic	Waist/hip circumference
	Diastolic blood pressure
	Resting heart rate
	Cholesterol
	Lipids
	HBA1C
Health	Haemoglobin
	Parity & current pregnancy
	Hormone use
	Diagnosed cardiovascular/circulatory conditions
	Diagnosed metabolic conditions
	Diagnosed respiratory conditions

Traditional risk factors, continued	
Medical	Medication for high blood pressure
	Medication for diabetes
	Medication for high cholesterol
	Health insurance coverage
	Healthcare utilisation
Socio-demographic	Ethnicity
	Urban/rural
Socio-economic	Educational attainment
	Wealth index/income

Non-traditional factors	
Health	Diagnosis with HIV/AIDS
	Diagnosis with TB
	Health insurance coverage
Socio-economic	Employment status
	Receipt of government support
	Food security
Socio-demographic	Marital status
Psychosocial	Recent death in household
	Victim of crime
Environmental	Season/Air temperature
	Geographic location