Part 2: How to use biological data in social science research?

Outline

- Introduction to data
- Issues to consider with examples
- More information on data, advice etc

Data sources: biomarkers

Shared via UKDS

- *Understanding Society*
- English Longitudinal Study of Ageing
- Health Survey for England
- Scottish Health surveys
- NCDS (1958 birth cohort)
- BCS70 (1970 birth cohort) (forthcoming)

Shared by study teams

- ALSPAC
- NSHD (1946 cohort)
- Southampton women's study

Ruiz et al (2017) A guide to the biomarker data in the CLOSER studies, CLOSER.

Nurse interviews, Understanding Society

Measure	Applications
Height and weight Waist circumference Percent body-fat (bioelectrical impedance)	BMI and assessment of excess body fat: obesity and risk factor for range of major chronic conditions and social outcomes
Respiratory function (Spirometry) (FVC,FEV_1, PF, FEV_1/FVC)	To detect both obstructive and restrictive respiratory diseases including COPD.
Diastolic and systolic blood pressure, resting pulse rate	Risk factor for stroke and heart conditions Risk cardio-vascular disease
Grip strength	Indicator muscle strength. Functional limitations and disability in older ages.
Blood samples (non-fasting), 19.8ml)	For the extraction of analytes and DNA
Short questionnaire on health on day of measurement, medications etc	Factors that may need to be considered in analysing physical measures and bloods

Blood analytes, Understanding Society

Measure	Applications
Cholesterol & triglycerides	‘Fat in the blood’ associated heart disease (CVD)
Glucose intolerance - HbA1c	Undiagnosed or poorly managed diabetes
Inflammatory markers - c-reactive protein, fibrinogen	Measures of inflammation – due injury or infection – acute or chronic – response to stress
CMV seropositivity	Immunoscenence - wear & tear immune system, chronic stress, associated diabetes
Anaemia – haemoglobin, ferritin	Marker for poor nutrition; increases with age, sig. health consequences
Liver function - ALP, ALT, AST, GGT, albumin	Associated alcohol, drugs, obesity, consequence of other diseases
kidney function – creatinine	Kidney diseases increase age, associated other diseases
Hormones – testosterone, IGF1, DHEAS	associated with stress processes, building muscles, ageing Testosterone - marker aggression IGF1 –associated diet, diabetes and cancer DHEAS -associated CVD, muscle strength, cognition

Using biomarker data

- Usual statistical concerns re outliers, distribution etc
- Clinically feasible ranges
- Recent events – accidents, operations, smoking, food & alcohol, etc
- Context of blood sampling – time of day, room temperature etc
- Co-morbidities
- Medications
- Internationally agreed approaches to standardisation
- Clinical cut-offs

Benzeval et al (2014) Understanding Society: The UK Household Longitudinal Study Biomarker User Guide and Glossary, ISER.

C-Reactive Protein (CRP)

- Marker of inflammation

  An ‘acute phase protein’

- Associated with social position and ageing

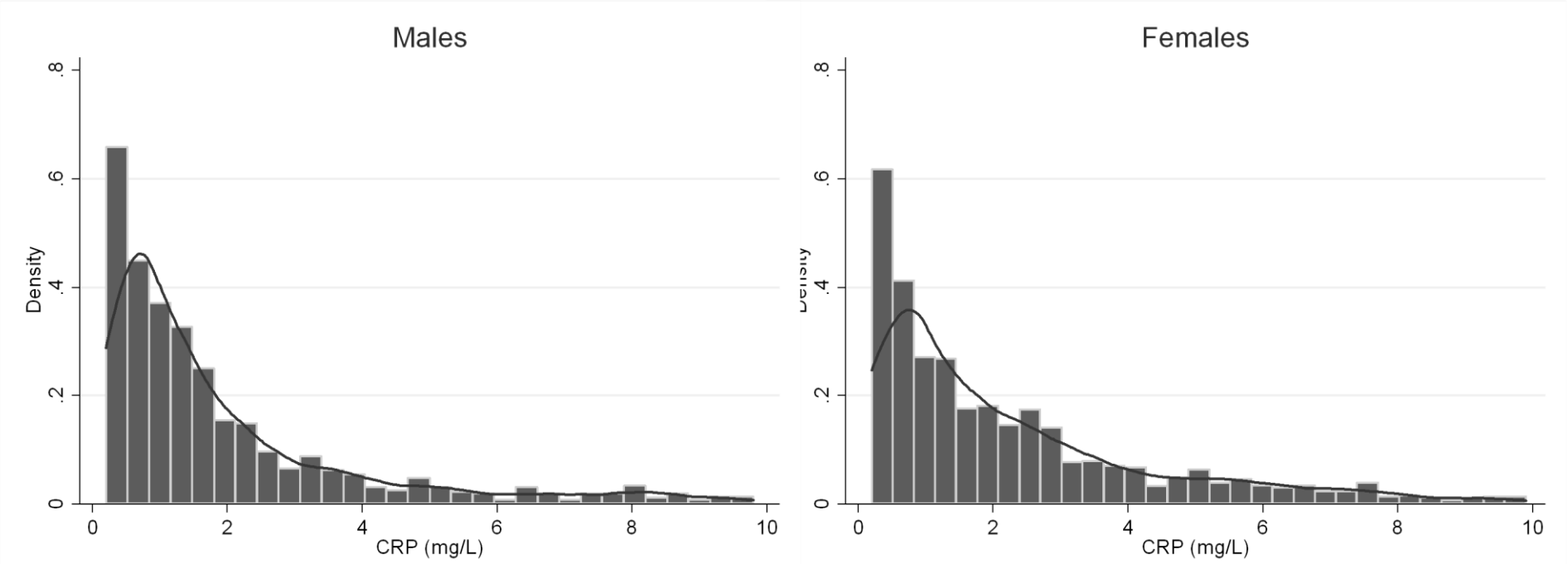
- Risk factor or marker for a wide variety of diseases; cardiovascular disease, cancer, arthritis

C-Reactive Protein (CRP)

- Current/recent infections: >10mg/L (often excluded)
- Systemic inflammation: 3-10mg/L
- In general, CRP levels of over 3mg/L are considered as levels that are high risk for Cardiovascular disease.

C-Reactive Protein (CRP)

Distribution of CRP by gender, *Understanding Society* waves 2 & 3



Notes: Excluded cases with CRP>10mg/L

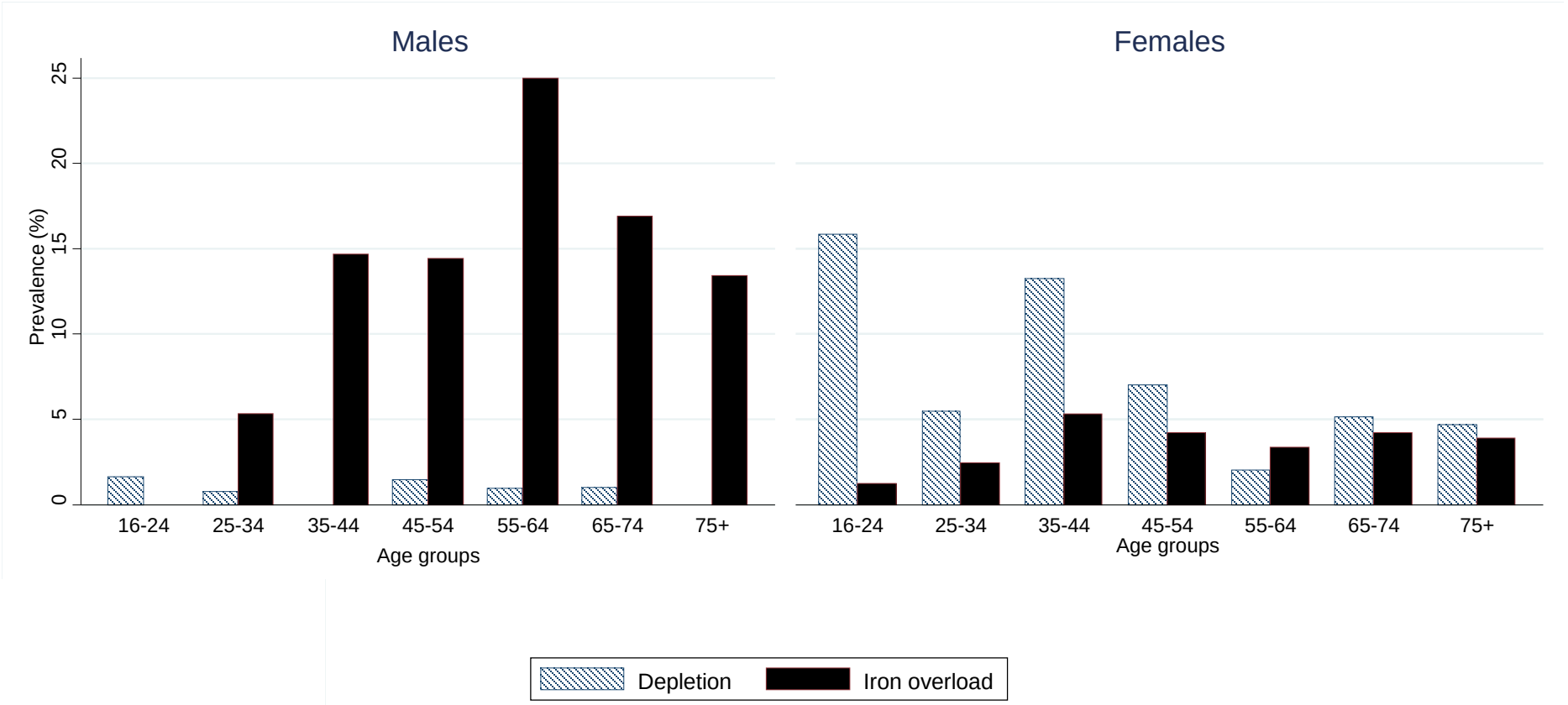
Ferritin

- Indicator of iron storage

- Both high and low measures pathological
  - low measures indicators of anaemia,
    - prevalent in women
    - associated with fatigue
  - high measures (haemochromatosis)
    - higher prevalence in men
    - associated with heart disease/diabetes

Ferritin

Prevalence of “depletion” and “iron overload” by age and gender,
Understanding Society waves 2 & 3



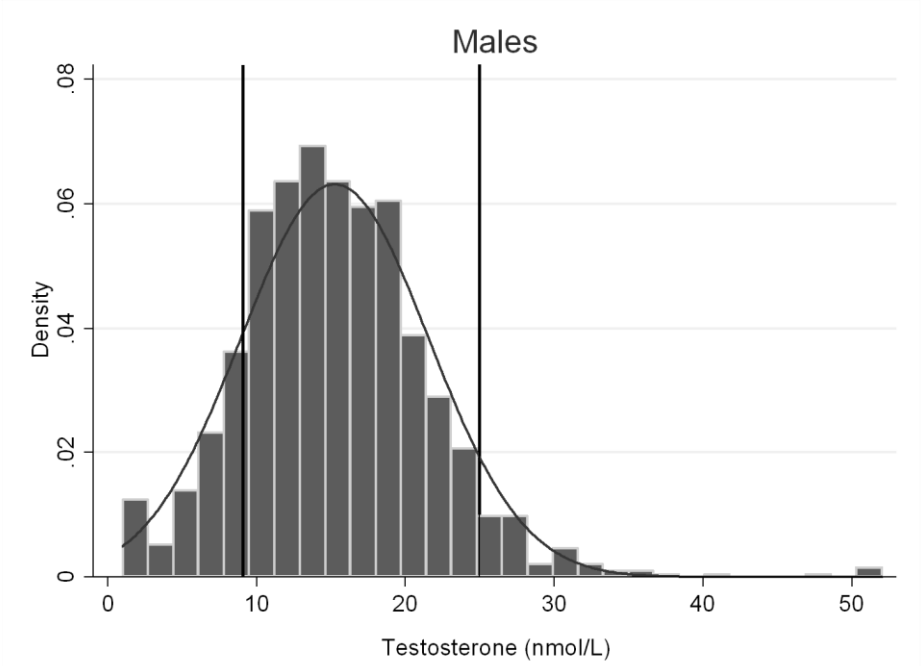
Testerosterone:

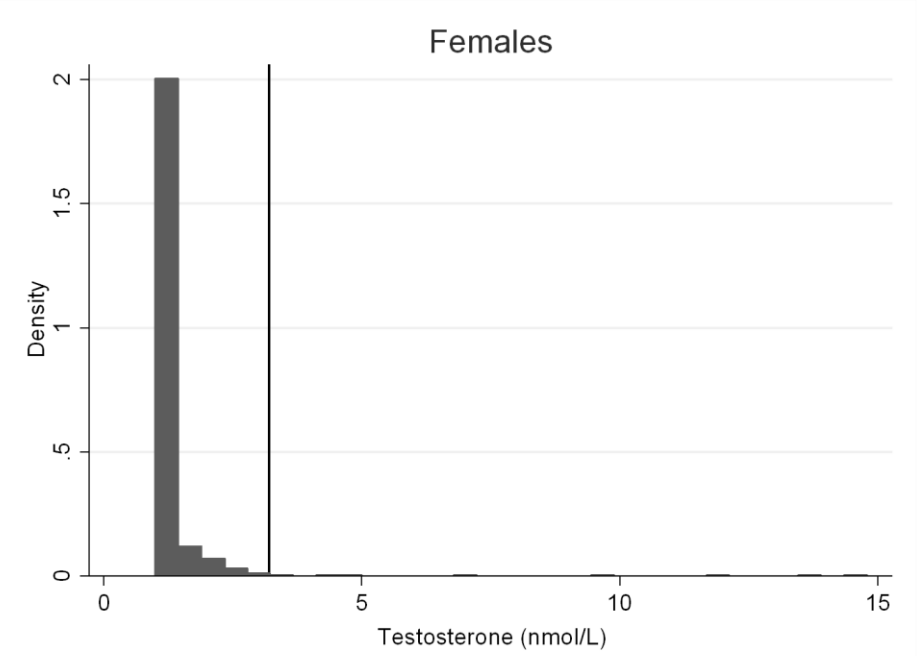
- Anabolic hormone involved in growth and development

  - Developmentally important – male social behaviour (Alexander, 2014)?
  - Mid-life – experimental studies suggest changes in testosterone are associated with competitive/aggressive behaviour (Carre et al., 2011)
  - Tendency to self employment (Nicolaou et al 2017)
  - Late-life – low testosterone associated with loss of muscle mass/development of frailty (O'Connell et al., 2011)

Testosterone

Distribution of Testosterone levels by gender , *Understanding Society* waves 2 & 3

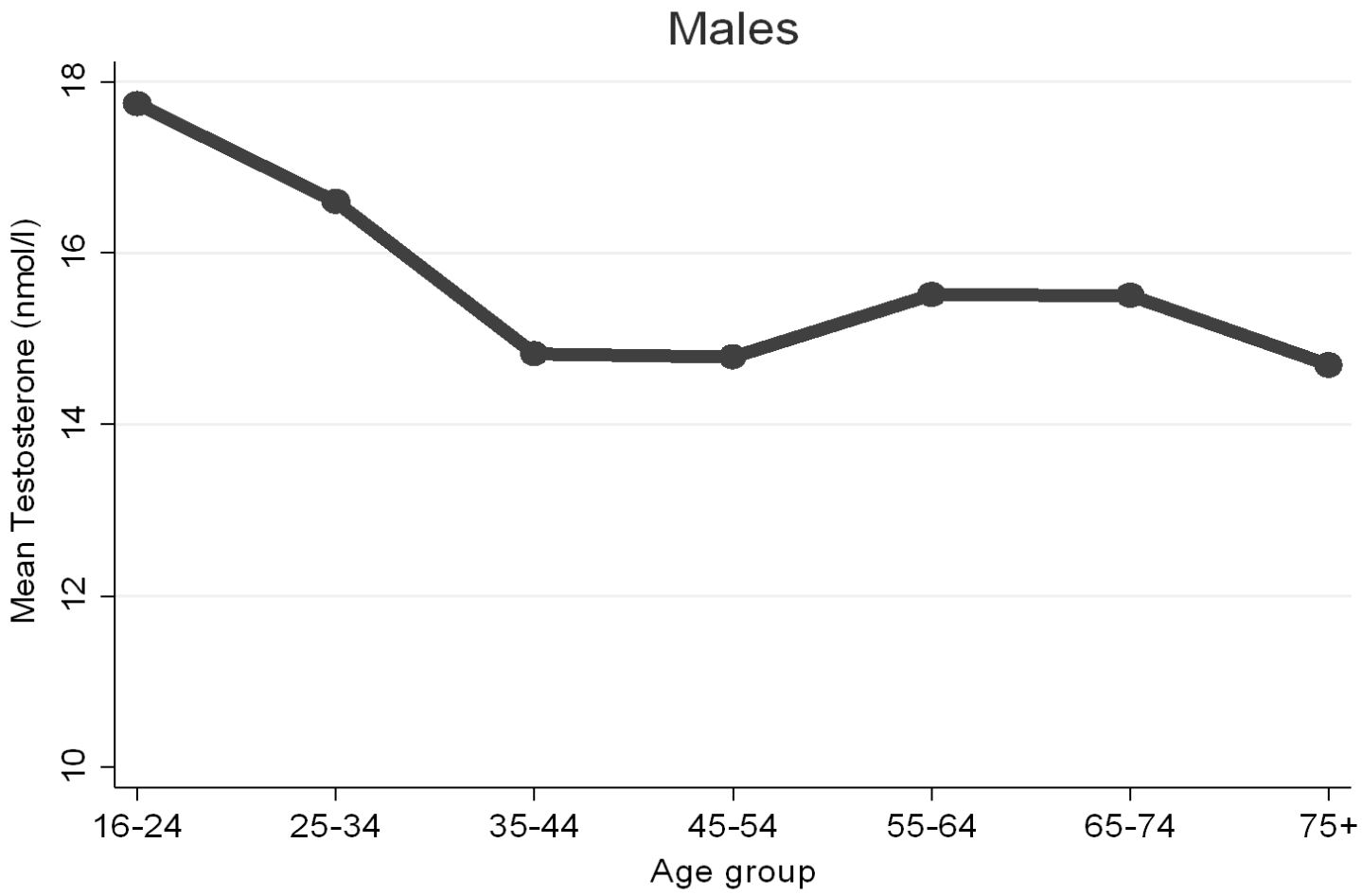




Most data below detection: focus on data from men only

Testosterone

Mean testosterone levels by age: Males, *Understanding Society* waves 2 & 3



Kidney function

- Chronic kidney disease important public health imperative.
- Increased prevalence in an ageing population
- Social distribution of kidney disease (Al-Quoud et al, 2011)

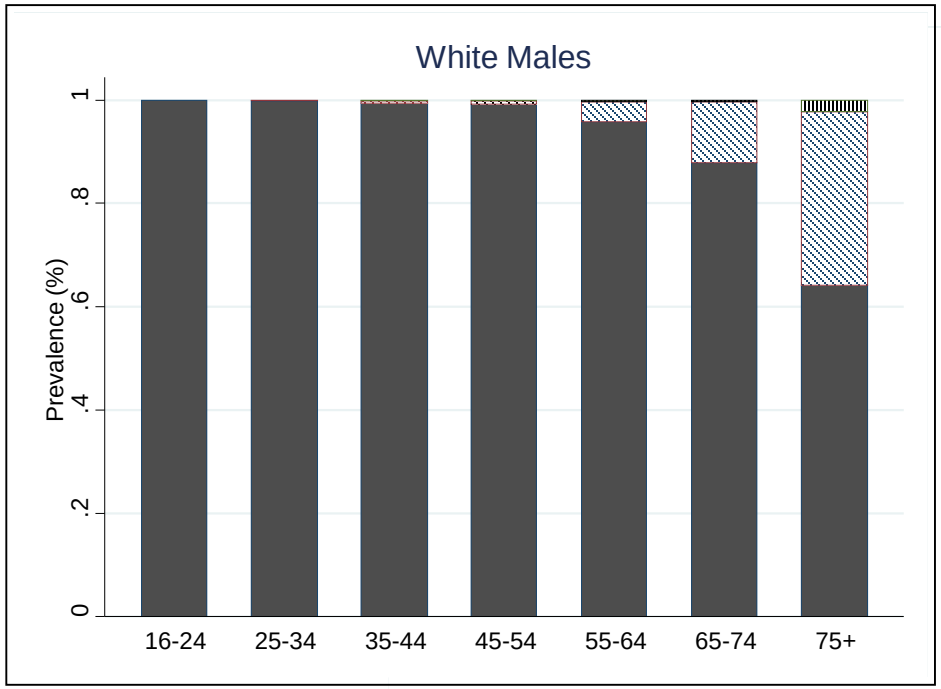
Kidney function

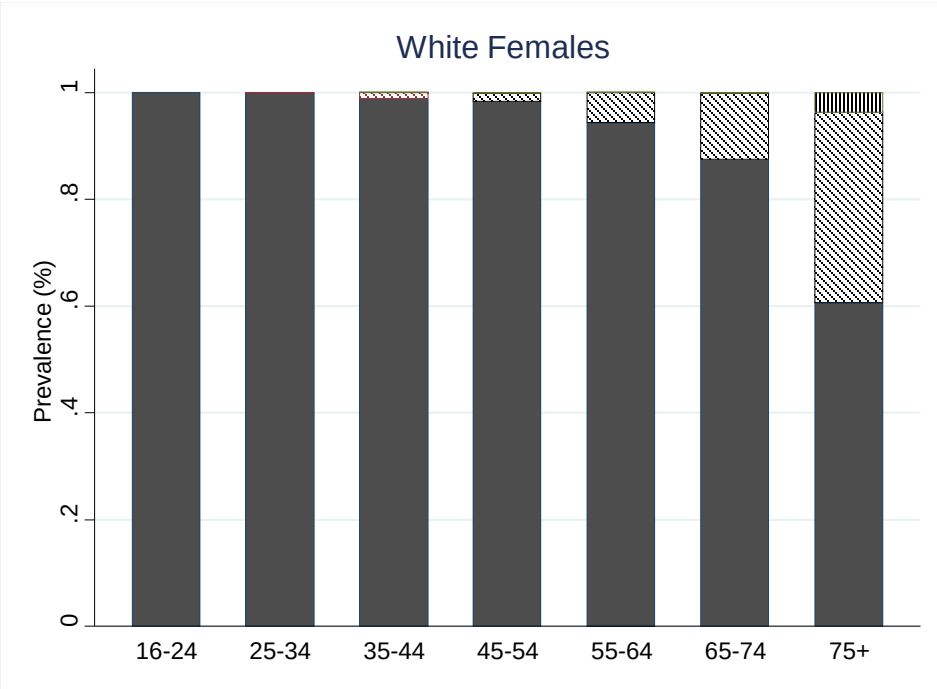
- Many approaches to measure kidney function
- Measured with creatinine (UKHLS) or cystatin (Health and Retirement study, US), previously with assessed with Urea

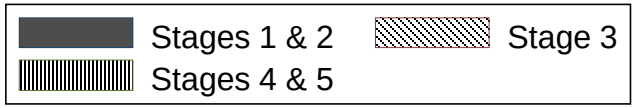
- New equations based on these measures, dependent on age, gender and levels (CDK-EPI):
- white men with a creatinine level <0.9 mg/dL, 141 x (serum creatinine/0.9)$^{-0.411}$ x(0.993)^{age};
- for serum creatinine level > 0.9 mg/dL, 141 x (serum creatinine/0.9)$^{-1.209}$ x (0.993)^{age}.
- white women with a serum creatinine level <0.7 mg/dL, 144 x (serum creatinine/0.7) $^{-0.329}$ x (0.993)^{age};
- for serum creatinine level >0.7 mg/dL, 144 x (serum creatinine/0.7)$^{-1.209}$ x (0.993)^{age}

eGFR (Glomerular Filtration Rate)

Stages of kidney disease by age and gender, *Understanding Society* waves 2 & 3







Allostatic load – ‘wear and tear’ - cumulative physiological burden (Bruce McEwen)

- **Primary response to stress**
  - Sympathetic nervous system – reacts to stress – fight or flight: increases heart rate, blood pressure etc
  - Hypothalamic-pituitary adrenocortical (HPA) axis – response to stress, release of hormones (cortisol, DHEA)
- **Secondary outcomes**
  - Immune: Interleukin-6, c-reactive protein (CRP), insulin-like growth factor-1 (IGF-1)
  - Metabolic: cholesterol, HbA1c, albumin, creatinine, homocysteine
  - Cardiovascular and respiratory systems: blood pressure, peak expiratory flow, heart rate/pulse
  - Anthropometric -- Waist-to-hip ratio, body mass index (BMI)
- **Tertiary outcomes**
  - Manifestation in disease (eg heart disease, hypertension)
- **Combined as score in range ways**
  - Simple addition v weighted; clinical cut offs V distributional

Read and Grundy (2012) Allostatic load - a challenge to measure multisystem physiological dysregulation , NCRM.

NCRM National Centre for Research Methods

For more information visit
www.ncrm.ac.uk