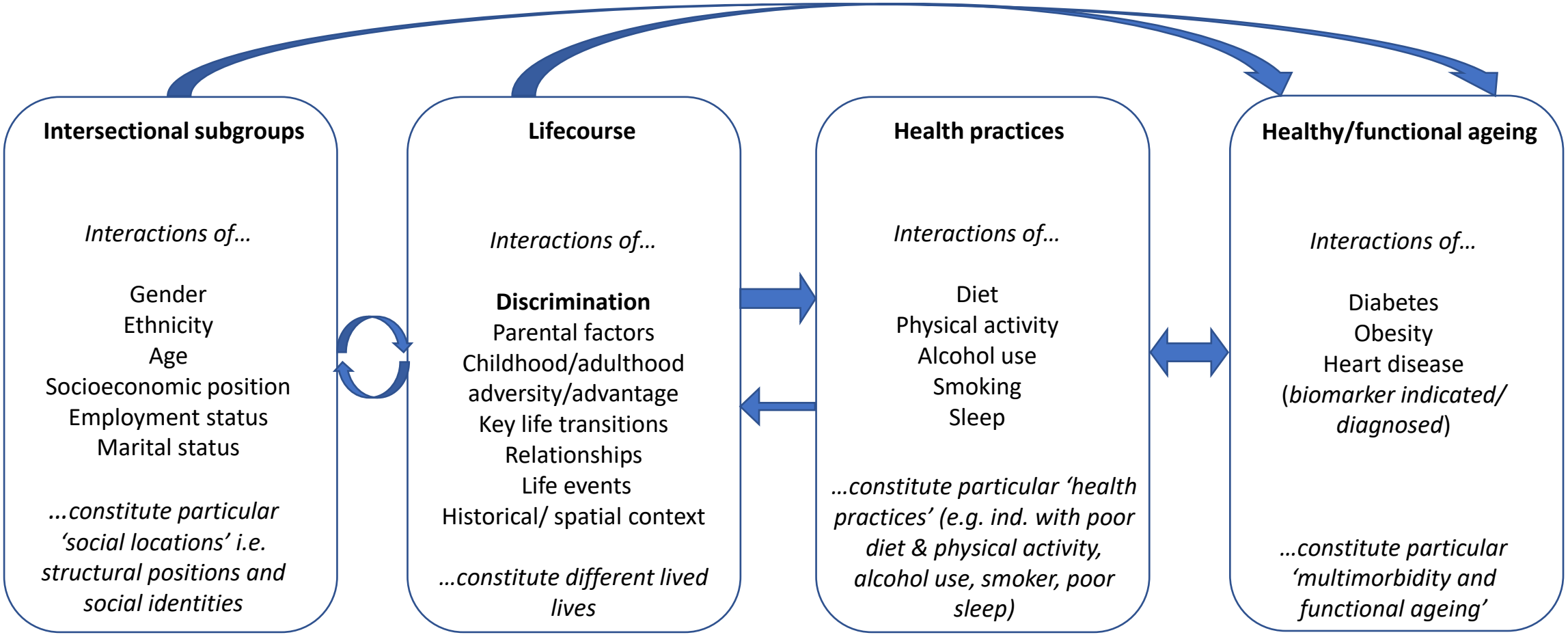
Mapping intersectional inequalities in biomarkers of healthy ageing and chronic disease in older English adults

Chronic disease and healthy ageing at the intersections: social locations, biomarkers, and health practices

- Two year ESRC funded project at University of Sheffield.
- Dr Dan Holman (PI), Prof. Sarah Salway and Dr. Andrew Bell (Co-Is).
- Specifically interested in chronic disease/healthy ageing inequalities due to huge and growing societal, healthcare, personal costs. A key research/policy challenge.
- Academic work includes methodological development, theoretical work (incorporating life course), expanding intersectionality geographically, and examining mechanisms of intersectional differences.
- Non-academic work involves working with stakeholders e.g. workshop, consultation survey, animation, policy/practice paper (under review).
- For further details (plus new explainer video!) please see project website: http://intersectionalhealth.org (+ newsletter)

Conceptual model



Conceptual model

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Mapping intersectional inequalities in biomarkers of healthy ageing and chronic disease in older English adults

Daniel Holman[1]✉, Sarah Salway[1] & Andrew Bell[2]

Chronic diseases and their inequalities amongst older adults are a significant public health challenge. Prevention and treatment of chronic diseases will benefit from insight into which population groups show greatest risk. Biomarkers are indicators of the biological mechanisms underlying health and disease. We analysed disparities in a common set of biomarkers at the population level using English national data (n = 16,437). Blood-based biomarkers were HbA1c, total cholesterol and C-reactive protein. Non-blood biomarkers were systolic blood pressure, resting heart rate and body mass index. We employed an intersectionality perspective which is concerned with how socioeconomic, gender and ethnic disparities combine to lead to varied health outcomes. We find granular intersectional disparities, which vary by biomarker, with total cholesterol and HbA1c showing the greatest intersectional variation. These disparities were additive rather than multiplicative. Each intersectional subgroup has its own profile of biomarkers. Whilst the majority of variation in biomarkers is at the

Research questions

- 1. What are the extent/nature of intersectional differences in later life (50+) biomarker measures of healthy ageing?
- 2. Are these intersectional differences multiplicative or additive?

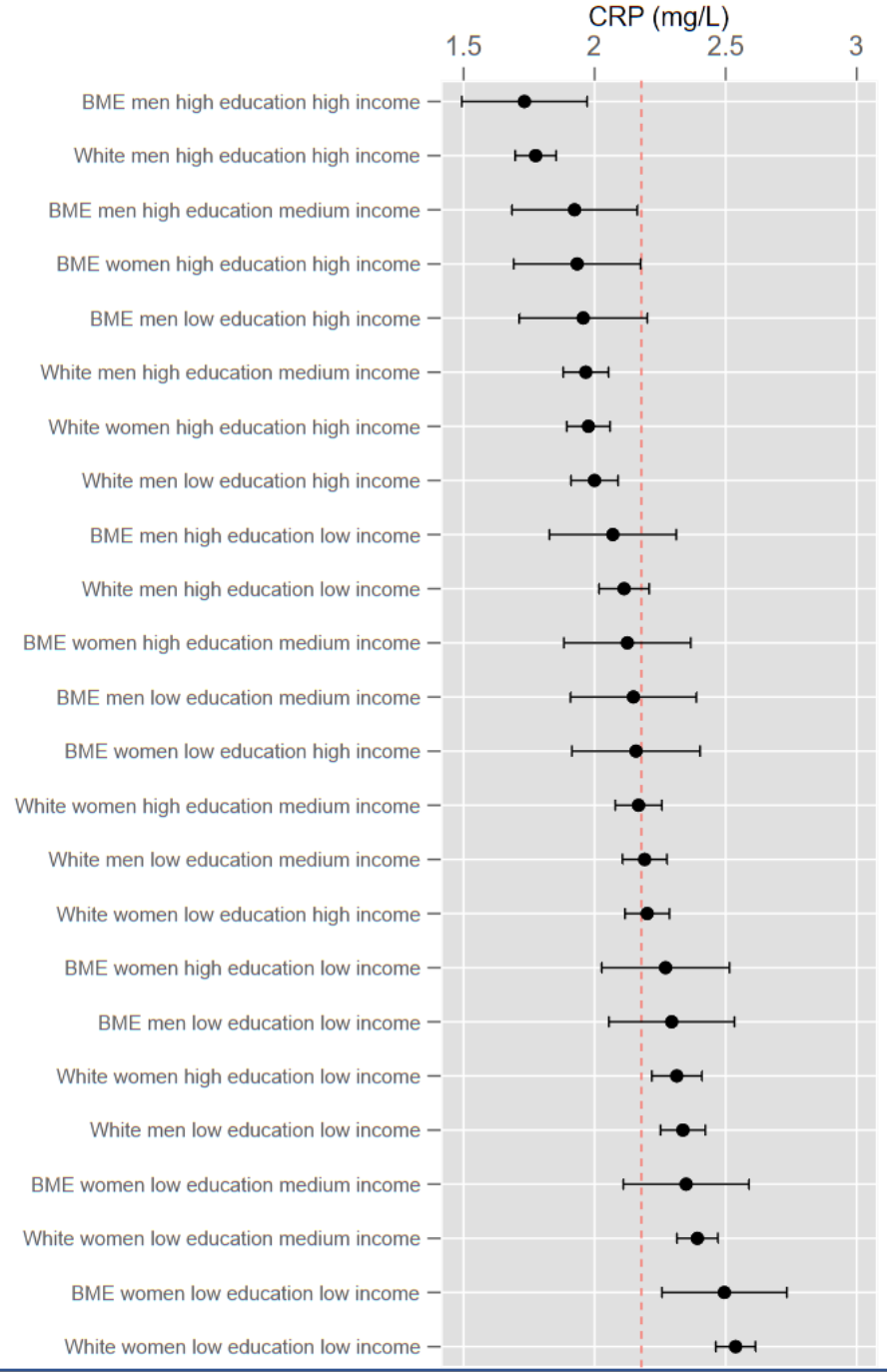
Methods I

- Pooled data on adults living in England aged 50+ from English Longitudinal Study of Ageing (2012-3, n=7,753) and UK Household Longitudinal Study (2010-12, n=8,864) = 16,437.
- Nationally representative samples and contain socio-demographic variables ethnicity, gender, age, education, income.
- And biomarkers:

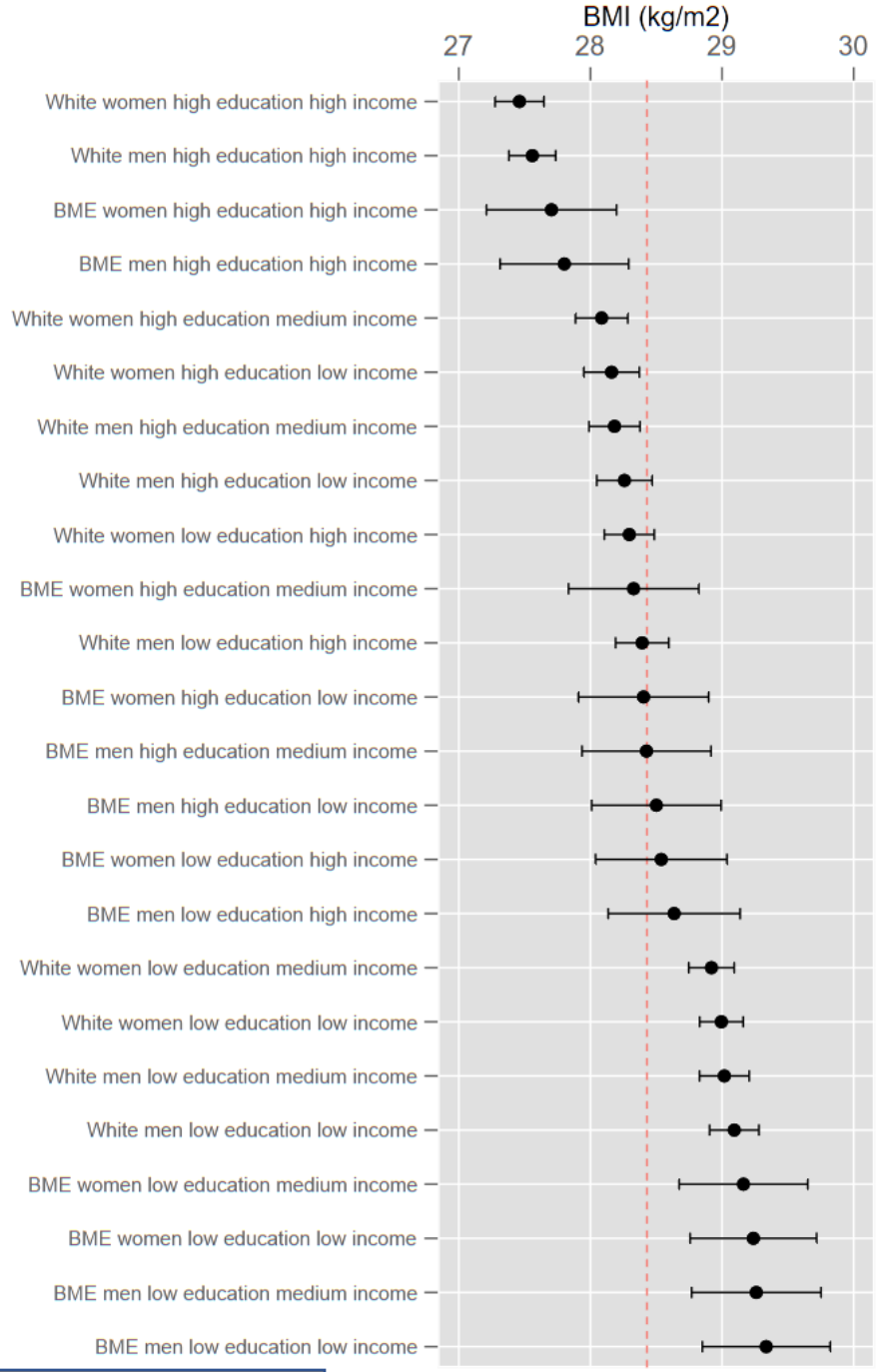
Biomarker	Significance for healthy ageing/chronic disease
HbA1c	Blood glucose concentration past 2/3 months. Used to diagnose diabetes.
Total cholesterol	Risk factor for cardiovascular events and stroke.
C-reactive protein	A marker of inflammation, predictor of cardiovascular disease and diabetes.
Systolic blood pressure	Predictor of cardiovascular disease.
Resting heart rate	Independent risk factor for cardiovascular disease and mortality.
BMI	Risk factor for a range of diseases.

Methods II

- Why analyse biomarkers? Objective so we can be sure that intersectional differences are not due to differential reporting/social subjective processes (i.e. reflect true underlying biological differences).
- Analysis: used the multilevel method to ‘map out’ intersectional subgroup differences and test/account for additive/multiplicative effects.
- An improvement on using interaction terms; helps to solve problem of multiple testing, small intersections, and interpretation.
- Tested for the extent to which health is clustered at the intersectional level i.e. do intersections do a good job of accounting for differences in population health?



X axis = effect size. Ref level = sample mean.



Disparities in biomarkers across intersections. Shading illustrates effect size; range determined by data.

	n (%)	HbA1c (mmol/mol)	Cholesterol (mmol/L)	CRP (mg/L)	SBP (mm Hg)	RHR (bpm)	BMI (kg/m^2)
BME men low education low income	62 (0.38%)	45.73	4.71	2.29	134.96	68.36	29.34
BME men low education med income	38 (0.23%)	45.41	4.73	2.15	134.33	67.88	29.26
BME men low education high income	21 (0.13%)	44.36	4.84	1.96	134.92	67.04	28.64
BME men high education low income	39 (0.24%)	44.91	4.81	2.07	133.96	67.69	28.50
BME men high education med income	41 (0.25%)	44.60	4.83	1.92	133.33	67.21	28.43
BME men high education high income	56 (0.34%)	43.55	4.94	1.73	133.92	66.37	27.80
White men low education low income	1414 (8.60%)	41.41	5.14	2.34	133.65	67.01	29.09
White men low education med income	1321 (8.04%)	41.10	5.15	2.19	133.01	66.53	29.02
White men low education high income	895 (5.45%)	40.05	5.27	2.00	133.61	65.69	28.39
White men high education low income	730 (4.44%)	40.60	5.24	2.11	132.65	66.34	28.26
White men high education med income	1096 (6.67%)	40.28	5.25	1.97	132.01	65.86	28.18
White men high education high income	1733 (10.54%)	39.23	5.37	1.78	132.61	65.03	27.56
BME women low education low income	66 (0.40%)	45.24	5.29	2.50	132.70	70.81	29.24
BME women low education med income	47 (0.29%)	44.92	5.30	2.35	132.07	70.33	29.16
BME women low education high income	34 (0.21%)	43.87	5.42	2.16	132.66	69.50	28.54
BME women high education low income	40 (0.24%)	44.42	5.39	2.27	131.71	70.14	28.40
BME women high education med income	36 (0.22%)	44.11	5.40	2.12	131.07	69.67	28.33
BME women high education high income	38 (0.23%)	43.06	5.52	1.93	131.66	68.83	27.70
White women low education low income	2506 (15.25%)	40.92	5.71	2.54	131.39	69.46	28.99
White women low education med income	1916 (11.66%)	40.61	5.73	2.39	130.75	68.99	28.92
White women low education high income	1220 (7.42%)	39.56	5.85	2.20	131.35	68.15	28.30
White women high education low income	626 (3.81%)	40.11	5.81	2.31	130.39	68.79	28.16
White women high education med income	979 (5.89%)	39.79	5.83	2.17	129.75	68.32	28.09
White women high education high income	1483 (9.02%)	38.74	5.95	1.98	130.35	67.48	27.46

Findings

- We observe large intersectional differences in biomarkers of healthy ageing/chronic disease by considering multiple axes of inequality together.
- These differences are associated with important clinical outcomes in morbidity and mortality. E.g. men with high education, high income CRP= 1.75 mg/L; women low education low income CRP = 2.5 mg/L – associated with 50% increase risk of heart disease and 20% risk of vascular death.
- (However we do not know intersectional variation in the link between biomarker > clinical outcome).
- These are just average differences – a lot of variation (most variation!) is within intersectional groupings (the 'tyranny of the average' problem – risk factors drive overall differences but do not determine individuals).
- Differences are likely driven by a range of factors, some even biological, some to do with social determinants over life course, and some of this variation undoubtedly driven by discrimination, but we have not tested for this in the current analysis.
- Intersectional differences were additive not multiplicative. As noted by Bauer, intersectionality is ***not*** the hypothesis of multiplicative differences, but rather, about intersectional heterogeneity and systems of social power that drives that heterogeneity.
- But this might suggest that (multiple but separate) single component health equity interventions/policies are more efficient/effective than multicomponent (multiple combined) interventions. Still lots of work to be done on policy implications of additive vs. multiplicative effects.

Limitations

- Our study is exploratory. We did not take into account medication use; confounding with diagnosis and severity and our purpose wasn’t causal inference, but should be explored in further work.
- Intersectional bias possible e.g. intersectional variation in non-response, the meaning of categories.
- Ethnicity – we were restricted to a white/ethnic minority distinction due to sample size limitations.

Future work. Intersectionality as a rich framework for future studies.

- **We consider this first step (i.e. mapping out what the main disparities actually are) in an ongoing project which includes policy/stakeholder work, and further empirical work investigating lifecourse influences, early childhood experiences, and health practices.**
- **Explore intersectionality using larger samples**, especially necessary for examining particular ethnic categories e.g. administrative data, biobank data (though these introduce their own limitations).
- **Role of discrimination** i.e. unfair treatment. Difficult causally!
- **Geographical context** – the role of location in generating intersectional differences.
- **Explore intersectional patterning in non-response and other forms of bias**, including in some categories e.g. having a university degree might influence life chances for those of a certain age more than others.
- **Explore intersectional patterning in link between biomarkers and clinical outcomes.**
- **Life course analysis**, to explore trajectories, sensitive periods, social roles, turning points, identity/position over individual/historical time.
- **Social determinants** to understand what social conditions/processes explain intersectional patterning.
- **Policy/intervention analysis** - 1. Can this approach help with targeted/tailored policies/interventions? 2. Can this approach help to evaluate the intersectional effects of wide-scale policies/interventions?

Further reading on project

- **Project website:** http://intersectionalhealth.org
- **3 minute explainer video:** https://www.youtube.com/watch?v=rwqnC1fy_zc
- **The published paper:** Holman, D., Salway, S. and Bell, A. (2020) *Mapping intersectional inequalities in biomarkers of healthy ageing and chronic disease in older English adults*. Scientific Reports.
- **Synthesising intersectionality and life course analyses:** Holman, D. and Walker, A. (2020) *Understanding unequal ageing: towards a synthesis of intersectionality and life course analyses*. European Journal of Ageing.
- **Stakeholder views on applying intersectionality to public health:** Holman, D., Salway, S., Bell, A., Beach, B., Adebajo, A., Ali, N., Butt, J. (2020) *Can intersectionality help with understanding and tackling health inequalities? Perspectives of professional stakeholders* (preprint): https://medrxiv.org/cgi/content/short/2020.10.26.20217463v1