Embodied lives:
the production of health inequalities through social-biological processes

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Die Deutsche Gesellschaft für Medizinische Soziologie
Online March 2026

Health inequalities

"systematic, avoidable and unfair differences in health that can be observed between populations, between social groups within the same population or as a gradient in a population classified by social position"

[McCartney, Popham, et al. 2019]

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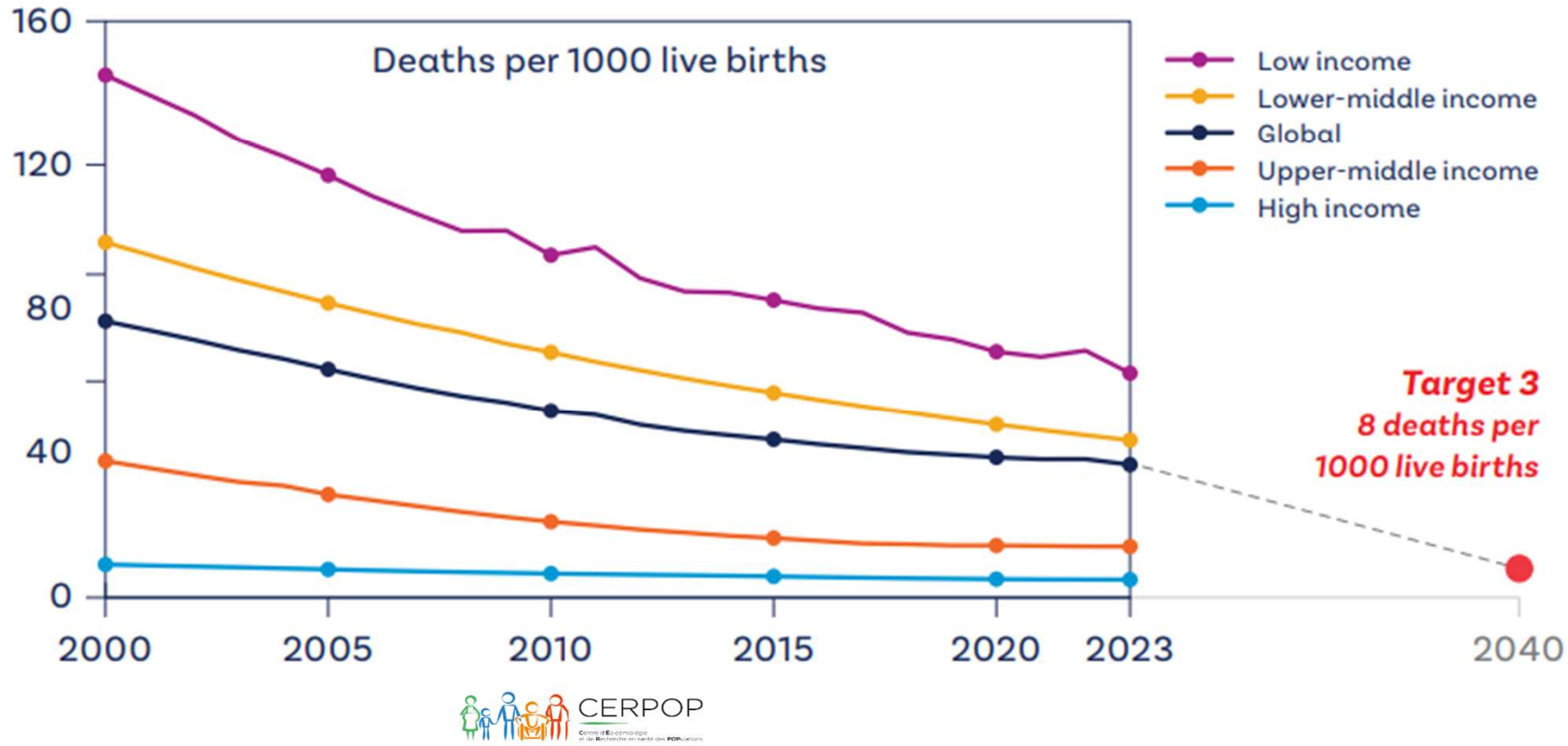
Between-country health inequalities

Under-five mortality rate (deaths per 1000 live births) globally and by World Bank income grouping (UN IGME estimates, 2000–2023)



World report on social determinants of health equity [WHO 2025]

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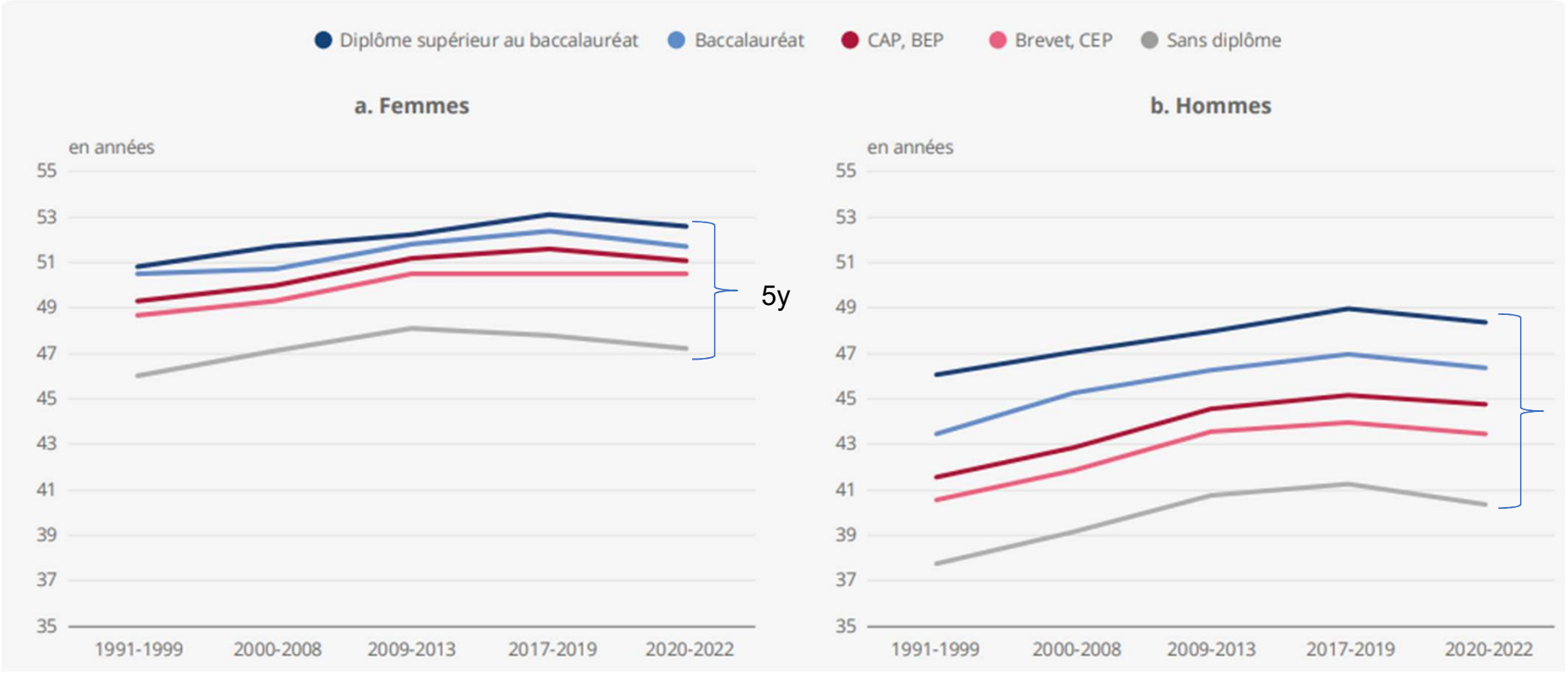
Within-country inequalities: Average life expectancy at 35 in France by education & sex

[Blanpain Insee 2024]



Life expectancy trends are starting to drop. Average life expectancy beyond 35y is lowest for people with low education

Gaps are wider among men, the most highly educated men have the same LE as women with the lowest education

Health inequalities: cardiovascular diseases

Inequalities by Income in the Prevalence of Cardiovascular Disease and Its Risk Factors in the Adult Population of Catalonia

[Mullachery et al J Am Heart Assoc. 2022]

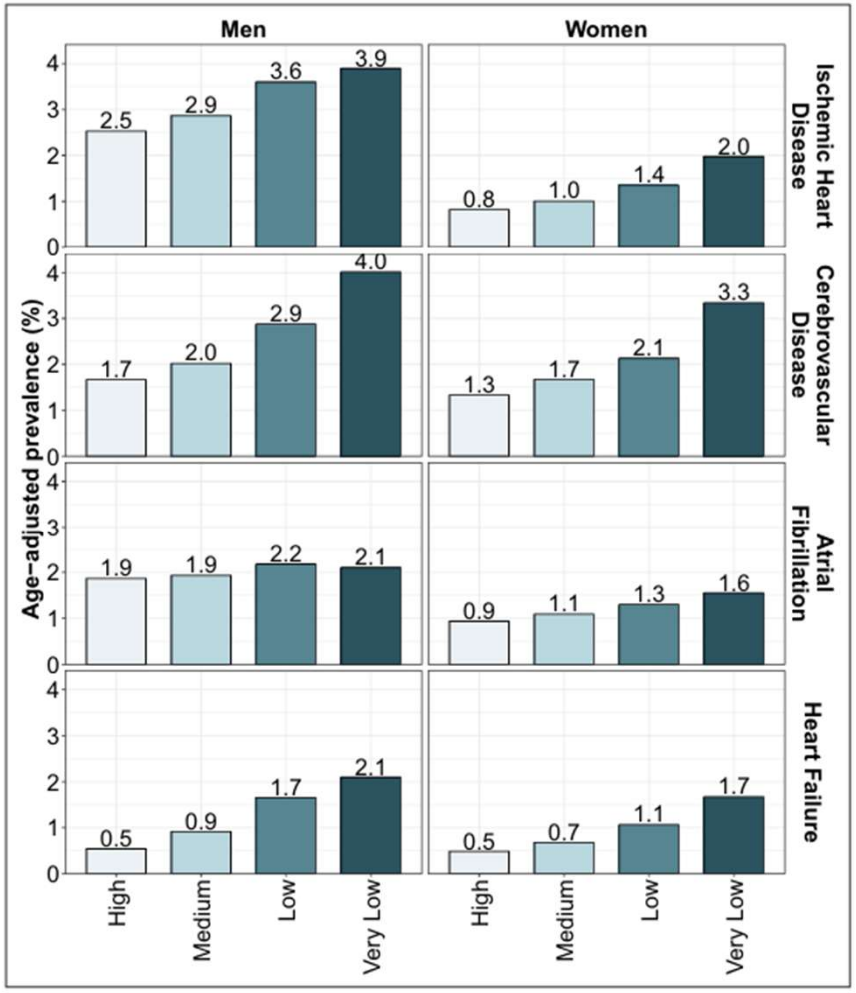
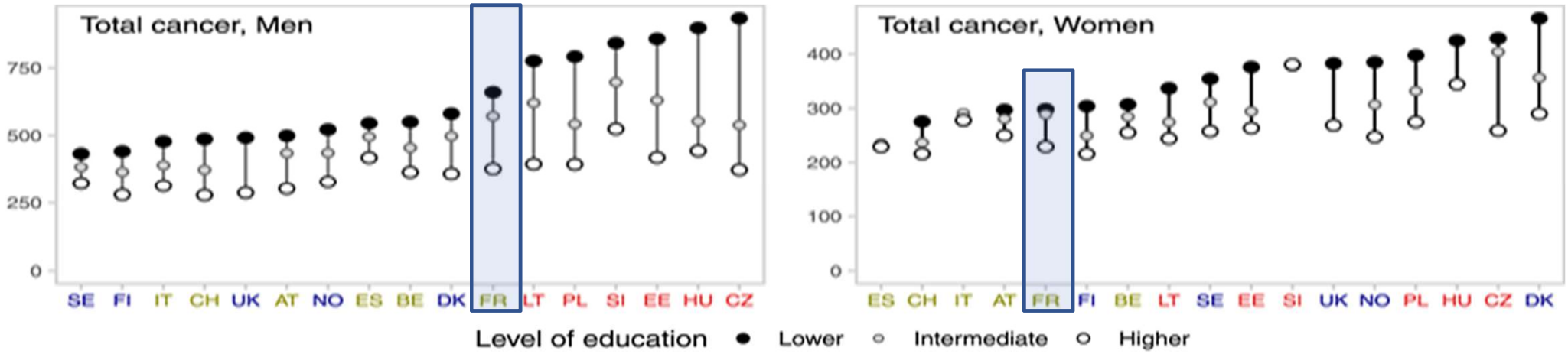


Figure 2. Age-adjusted prevalence of 4 cardiovascular diseases by sex and income.
Prevalence was standardized using the direct method of standardization and the 2000 to 2025 World Health Organization's World Standard Population

Inequalities: Education level and cancers in Europe

Age-standardised mortality rate Per 100 000



While inqualities are observed in most places, the extent and nature of them varies considerably
The pattern of cancer inequalities among women and men respectively is varied

[Vaccarella et al Lancet RH 2023]

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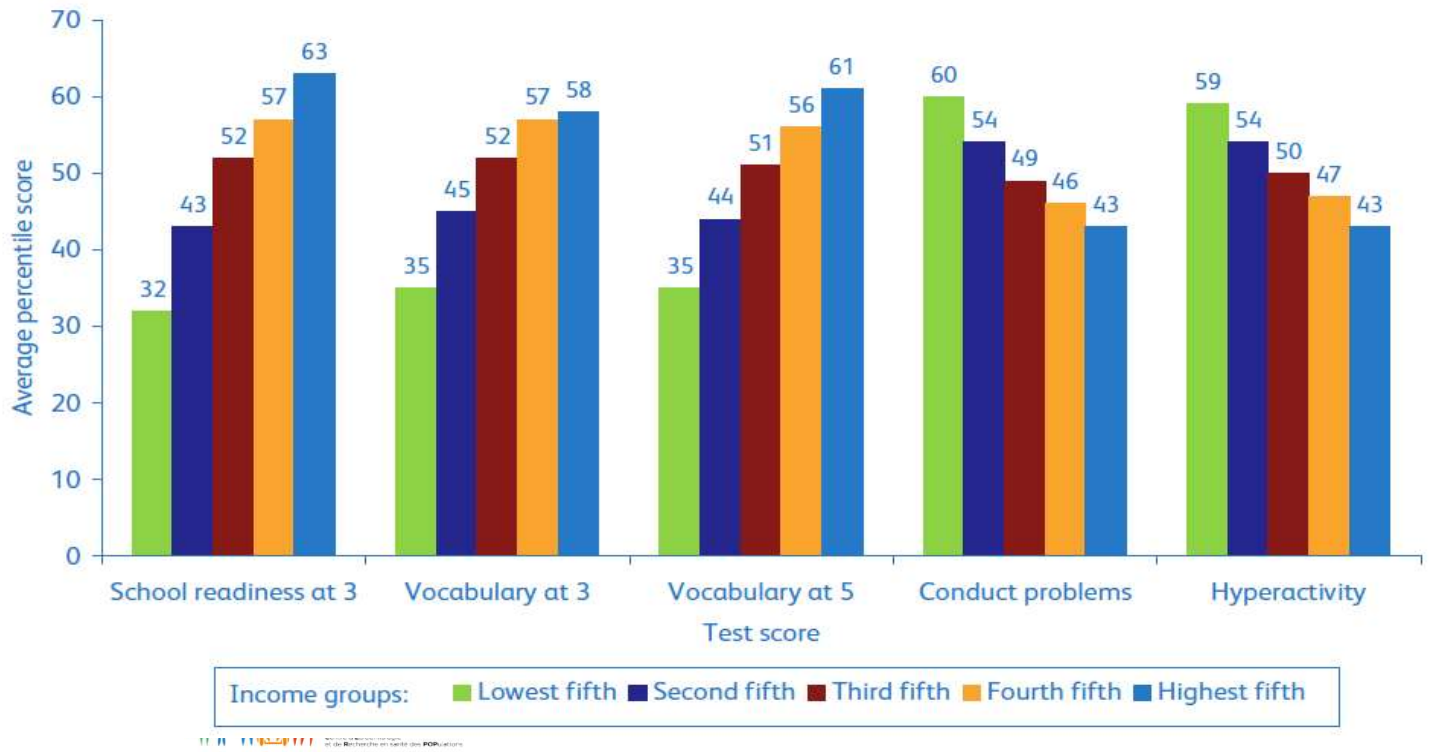
The early origins of inequalities in child development

Figure S12: Indicators of school readiness by parental income group, UK: Average assessment for group as percentile of overall range of assessments

There are already substantial gaps in school readiness at ages 3 and 5 between children from poorer and richer families



[Waldfogel & Washbrook, 2011, Child Devt Research]

The social gradient in health

Is pervasive across populations and over time, we observe it using many different types of social variables, and many health outcomes

Why?

(Typical answers)

C'est la vie!

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Poor people behave poorly!

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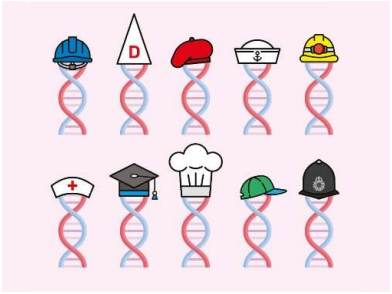

Its genetic!

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The social gradient in health

Is pervasive across populations and over time, we observe it using many different types of social variables, and many health outcomes

Why?

I will argue this is due to two phenomena

- Ubiquitous intersectional systems
- Embodiment

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Ubiquitous intersectional systems

Intersectionality:

How social positions such as gender, social class, race/ethnicity, sexual orientation (etc)

"*intersect at the micro level of individual experience to reflect interlocking systems of privilege and oppression (i.e., racism, sexism, heterosexism, classism) at the macro social structural level*" [Bowleg 2012]

[Carbado, Crenshaw et al 2013]

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Ubiquitous intersectional systems

Like a landscape immersed in thick fog, the social environment is omnipresent, it touches everything:

- the way you're raised as a child
- where you live and go to school or work
- the type of food you eat
- the people you form relationships with
- the type of job you have
- your activities and hobbies
- your retirement
- when & how you die

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Ubiquitous intersectional systems

Intersectional ubiquitous systems affect health indirectly and directly through a tissue of causal structures, having small but potentially widespread effects on population-level health, disease and mortality

"Small changes in ubiquitous causes may result in a more substantial change in the health of populations than larger changes in rarer causes"

[Keyes & Galea 2016, pg72]

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Embodiment

“at the most general level, embodiment …/… refers to how we, like any living organism, literally incorporate, biologically, the world in which we live, including our societal and ecological circumstances”

[Krieger 2005 JECH]

Embodiment

One of the most fundamental processes that underlies the production of health inequalities over the life course

- Is overlooked among scientists and health professionals
- Is often misunderstood
- Helps explain persistent systemic health inequities
- Is an adaptive process driven by socio-structural determinants from early life

[Bartley & Kelly-Irving 2024]

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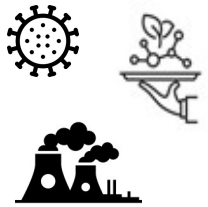
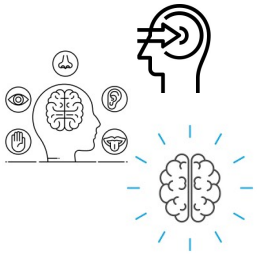
Embodied lives: Responding biologically to a socially structured environment

Those of exogenous origin



Those of endogenous origin



[Kelly-Irving & Delpierre JECH 2021]

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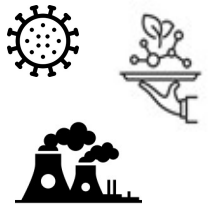
Embodied lives: Responding biologically to a socially structured environment

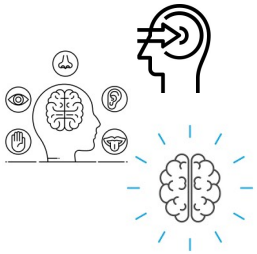
Those of exogenous origin



entities or conditions external to the body that, when entering the body or interacting with it, elicit physiological responses leading to physical harm or exertion

For example: foodstuffs, asbestos, viruses, bacteria, pollutants, etc.

Those of endogenous origin



[Kelly-Irving & Delpierre JECH 2021]

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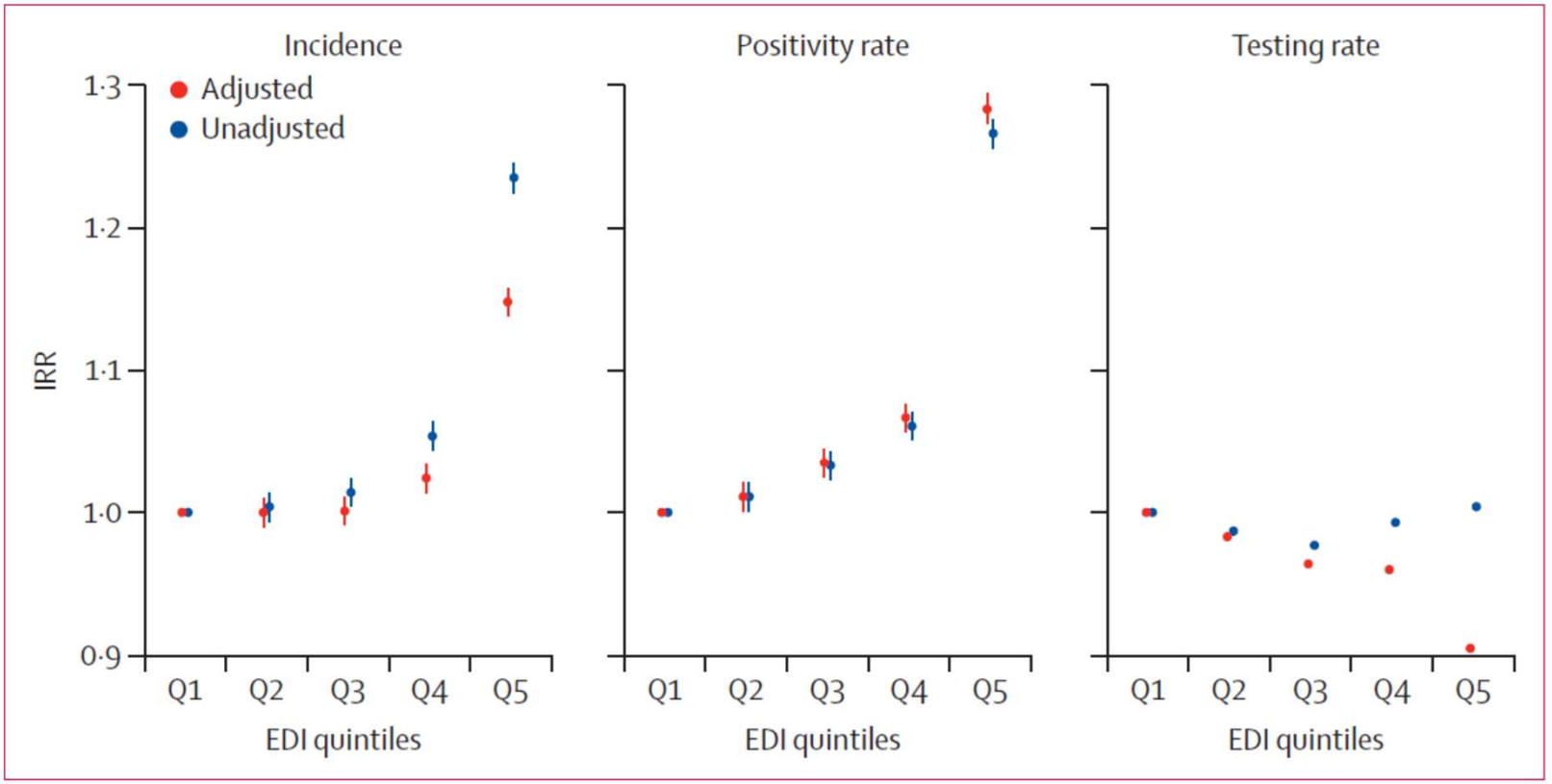
France: social deprivation & SARS-CoV-2

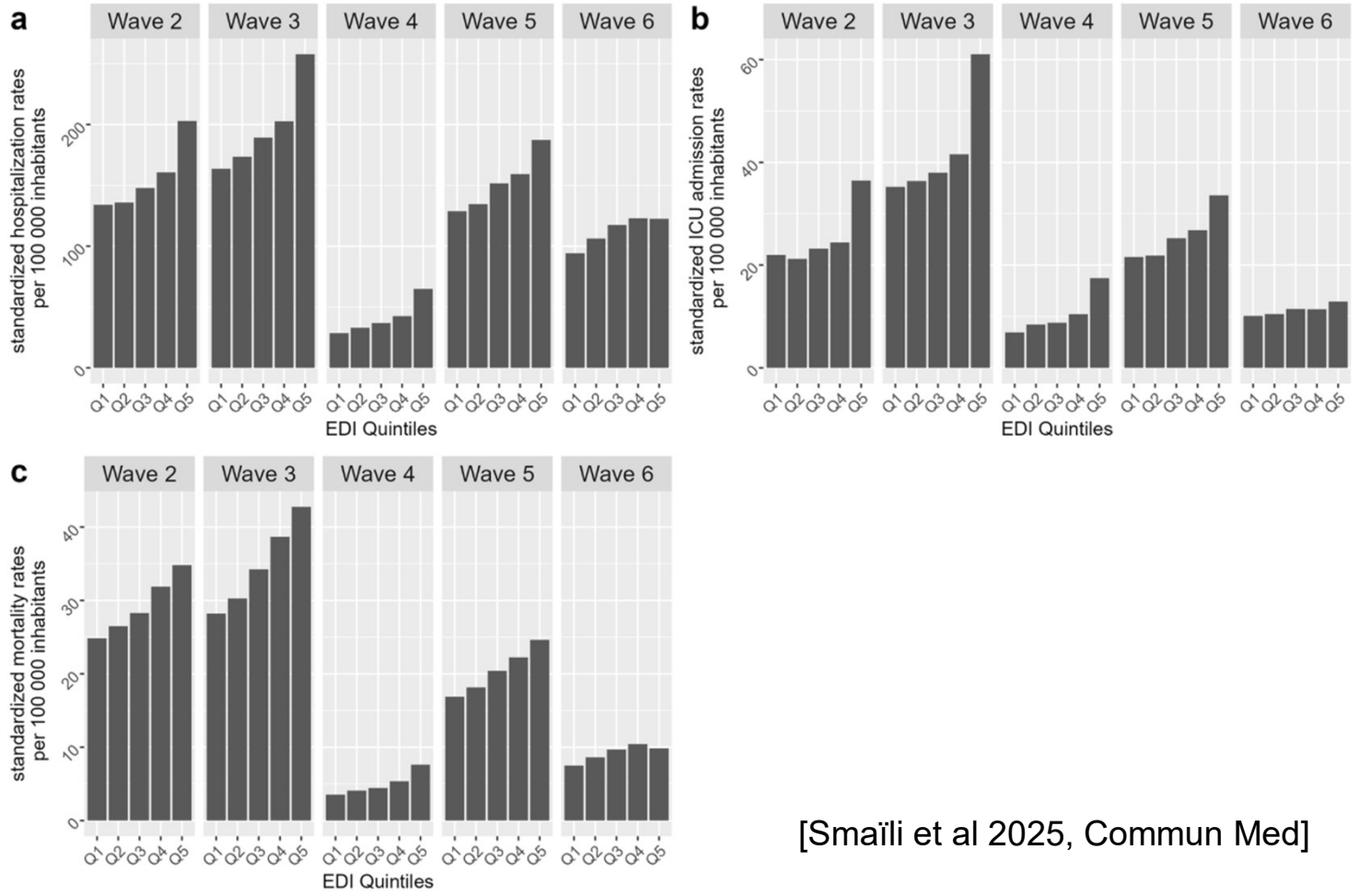


IRR = incidence rate ratios
Adjusted models: for week, population density, & region as random-intercept

Figure 2: **IRRs of the association between EDI quintile and SARS-CoV-2 incidence, positivity rates, and testing rates**

[Vandentorren et al 2022, Lancet PH]

France: social deprivation & Covid19 outcomes



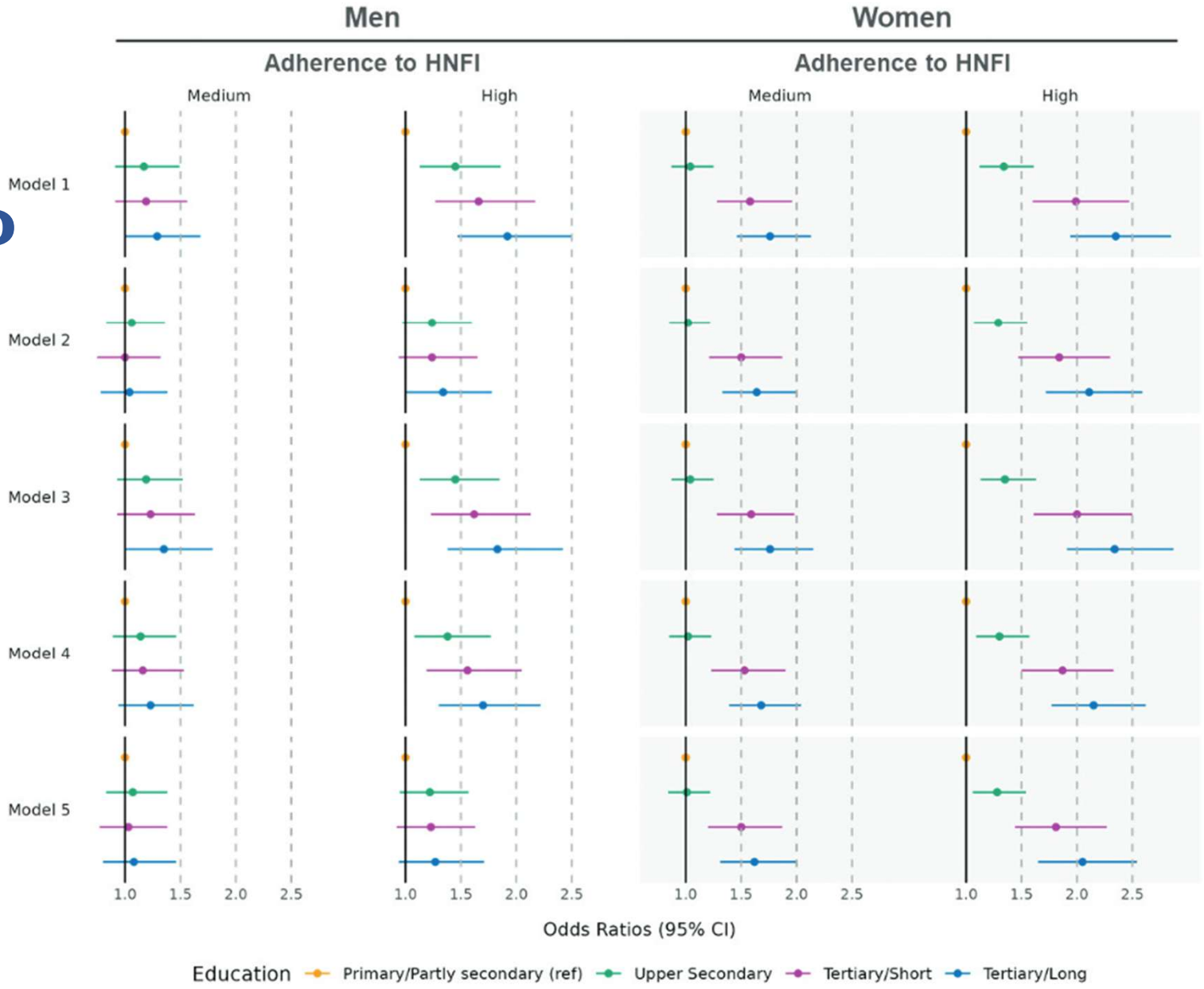
[Smaïli et al 2025, Commun Med]

Norway: Education & adherence to the the Healthy Nordic Food Index

Multinomial logistic regression models using the Tromsø Study 2015–2016

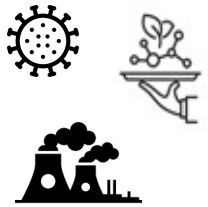
Model 1 adjusted for age; **Model 2** + age, hh income; **Model 3** age, subjective occupational social status; **Model 4** age, self-rated health; **Model 5** age, household income, subjective occupational status and self-rated health

[El Rashidi et al 2026, Food & Nut R]

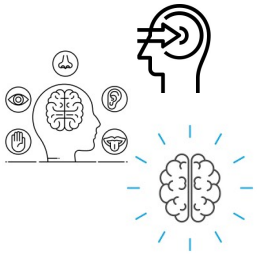


Embodied lives: Responding biologically to a socially structured environment

Those of exogenous origin



Those of endogenous origin



perception of situations, experience of relationships and other daily psychosocial experiences. These occur when **sensory interpretations of socially patterned interactions with the environment elicit responses from the central nervous system, as well as cognitive and psychological functions**

For example: the stress response system

[Kelly-Irving & Delpierre JECH 2021]

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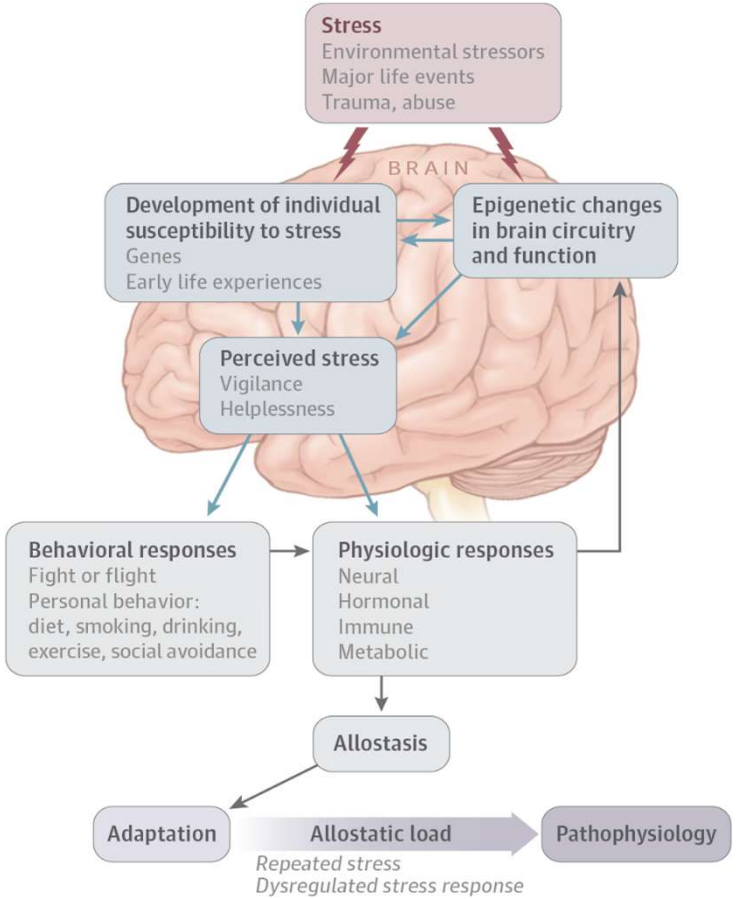
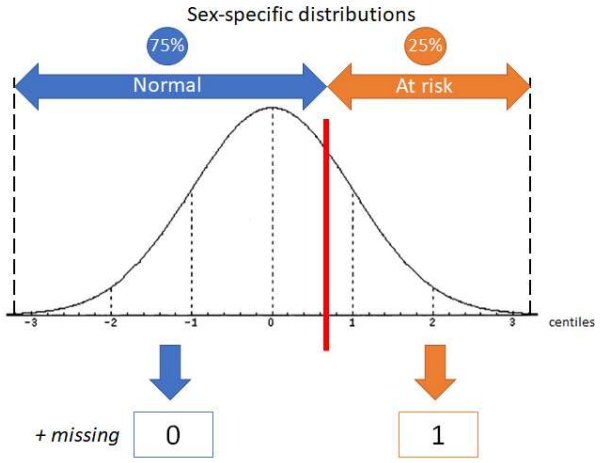
Physiological wear & tear : Allostatic Load



[Source: Mc Ewen, JAMA Psychatry, 2017]

Multi-system measure of **chronic physiological stress involved in the response to stress** (endocrine, immune/inflammatory, cardiovacular & metabolic)

ex: Cortisol, HDL, LDL, Triglycerides, IGF-1, CRP, Fibrinogen, IgE, SBP, DBP, Pulse, FEV



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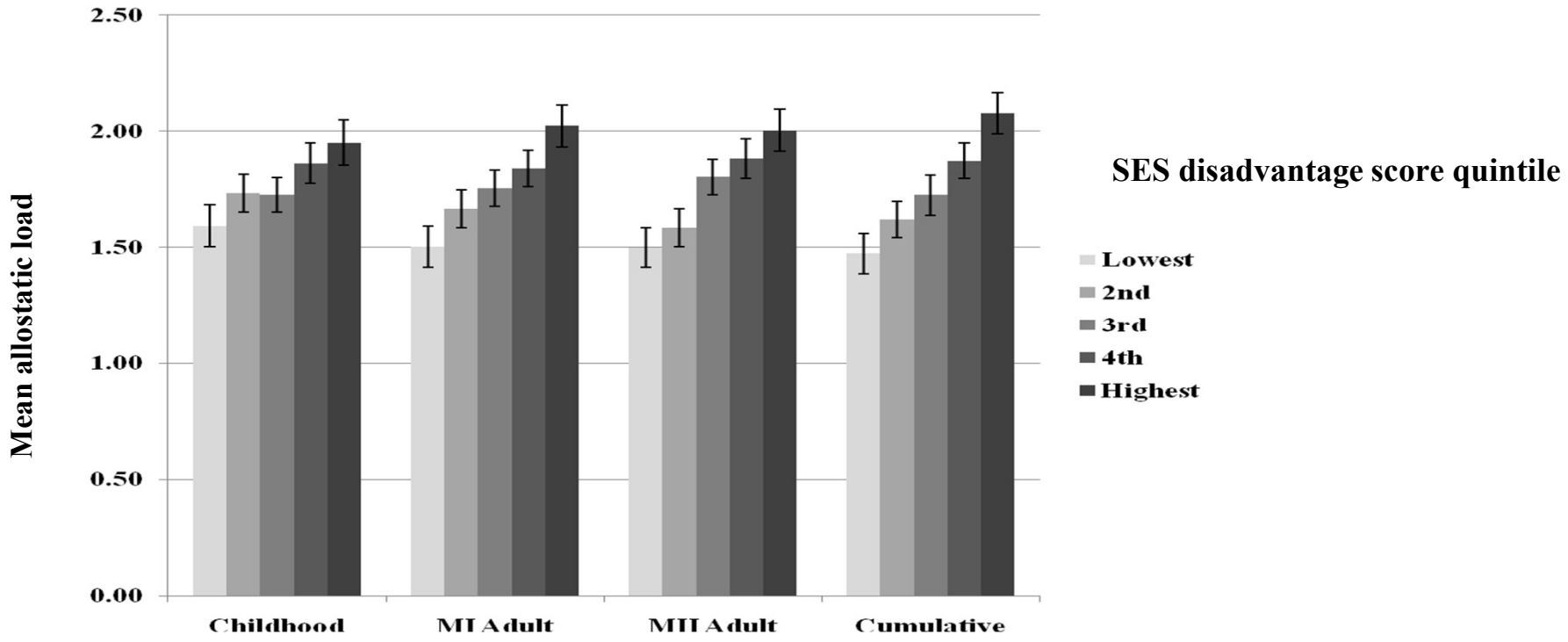
Disadvantage across the lifecourse & allostatic load: social-patterning



Gruenewald et al, Soc. Sci & Med, 2012

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Social position at birth & allostatic load

Using the UK 1958 birth cohort

Solís et al PNAS 2016

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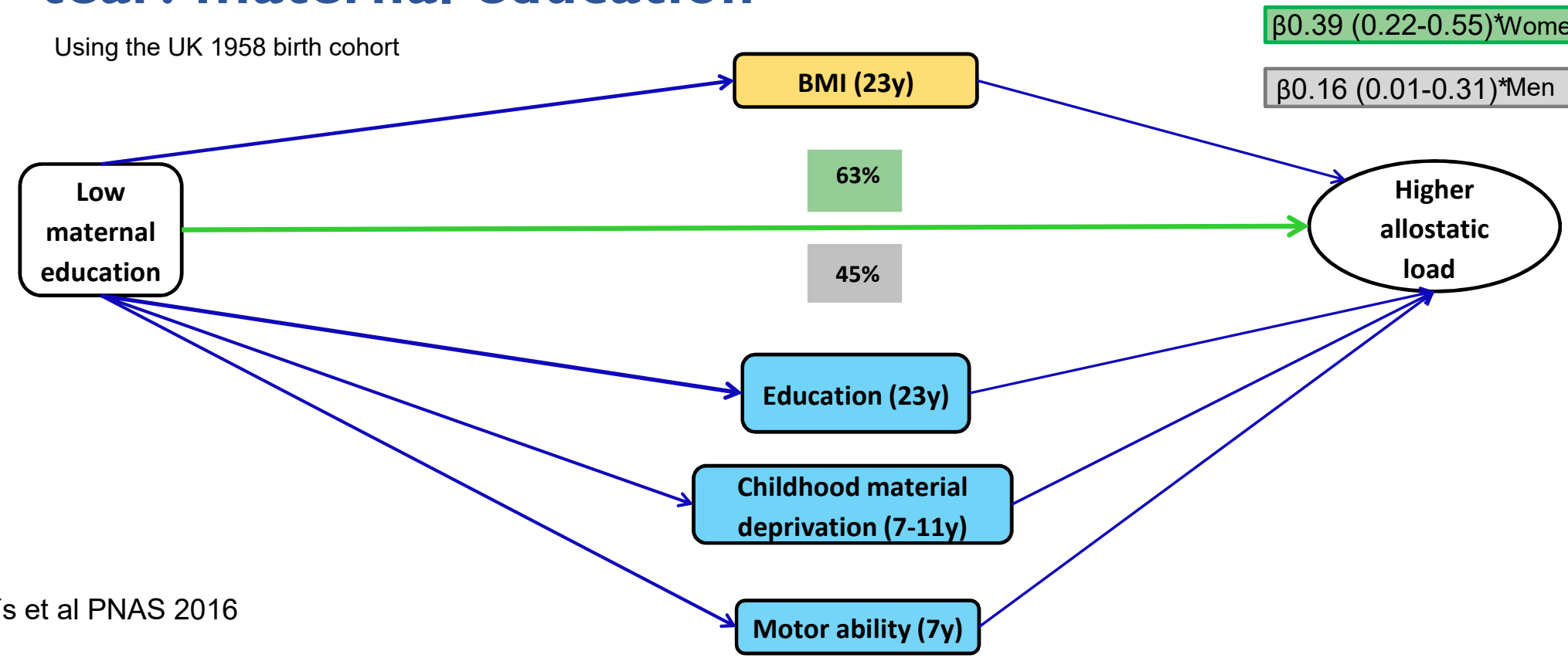
Socioeconomic pathways to physiological wear and tear: maternal education

Using the UK 1958 birth cohort



Solís et al PNAS 2016

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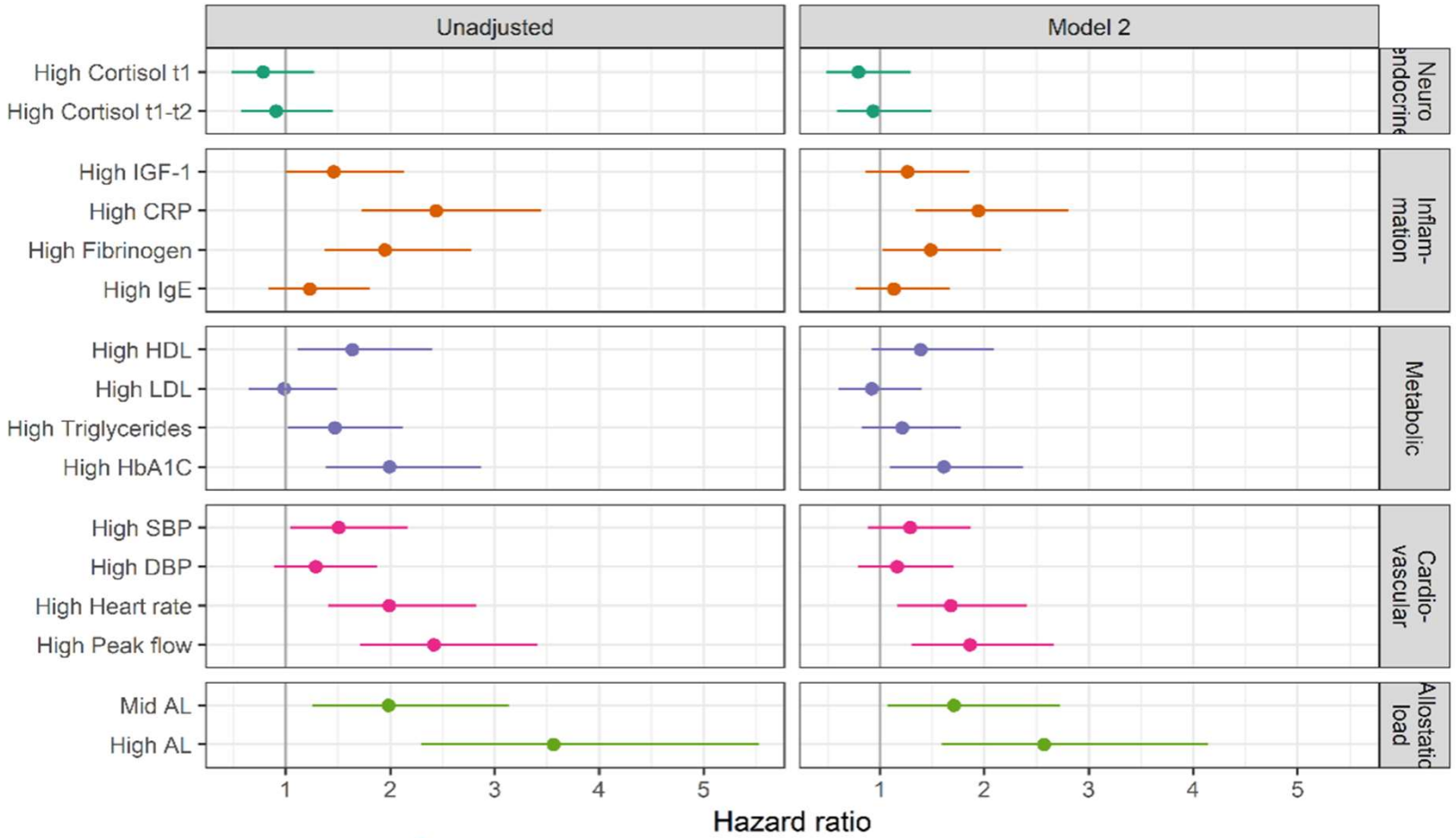
Contribution of each biomarker to the association between Allostatic Load & premature mortality

⇒ AL is the strongest determinant of mortality

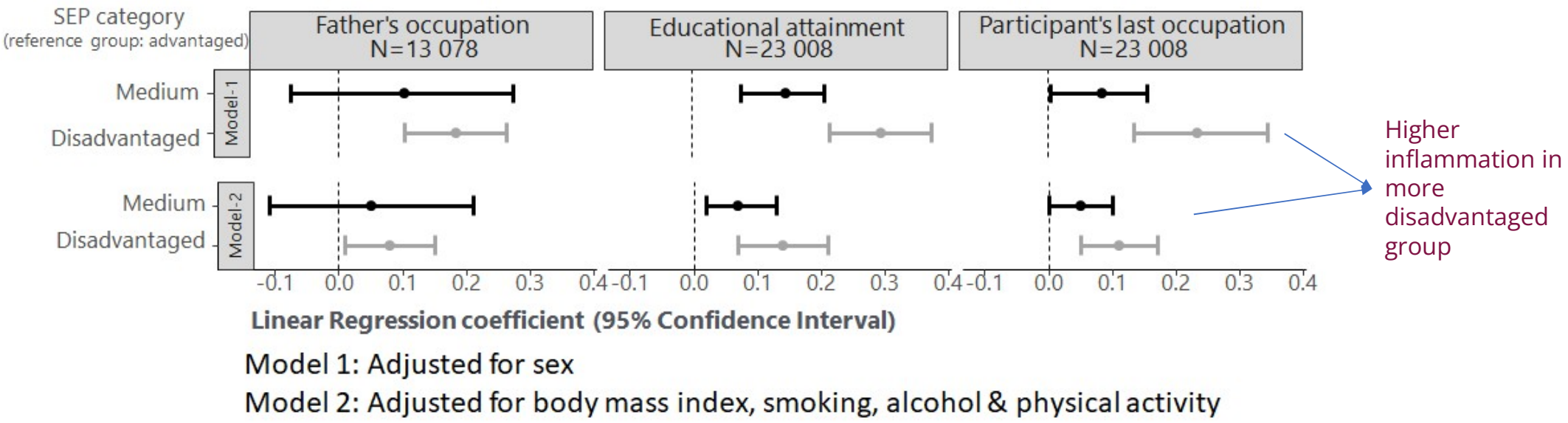
⇒ Large contribution from the inflammatory/ immune & cardiovascular systems



Castagné et al 2018 EJE

Under the skin: Social position at three life stages & inflammation (CRP)

Using 6 European cohorts



[Berger *et al* 2019 Nat Comms]

Chronic inflammation is higher adults from more disadvantaged social backgrounds, and this is not explained by 'classic risk factors'

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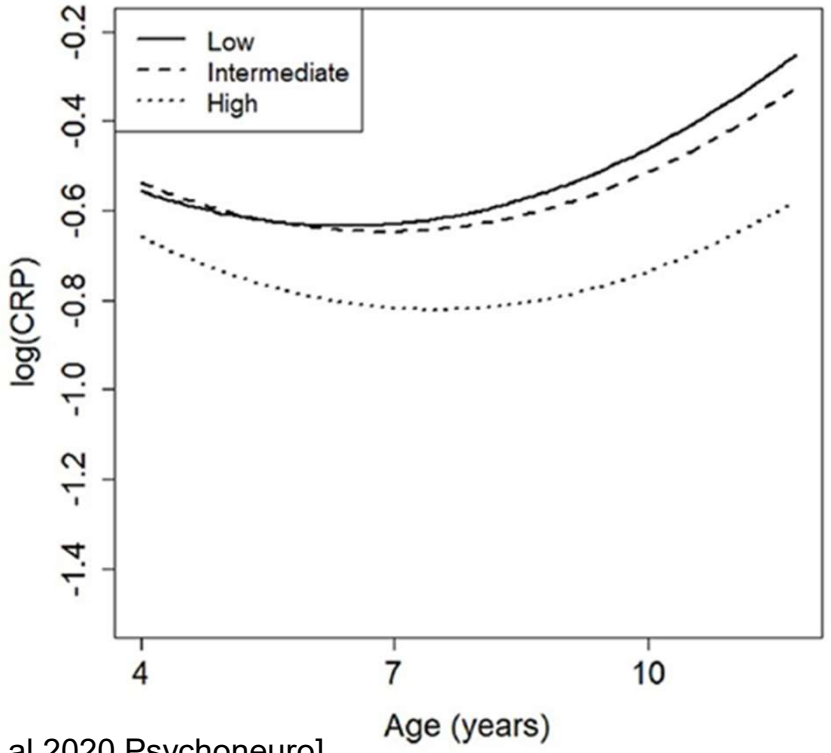
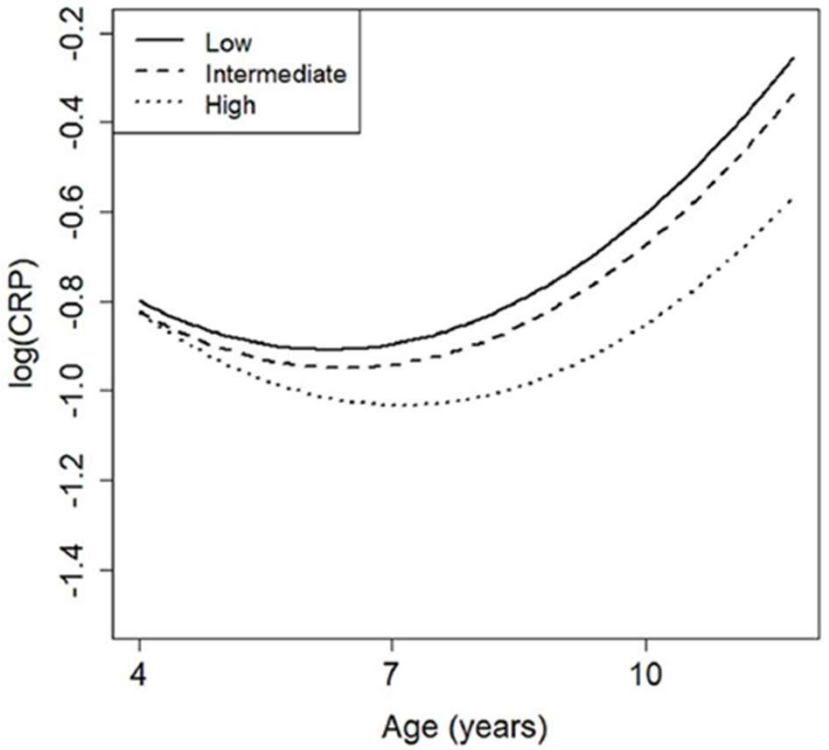
When? Life course & timing for social pattern of inflammation (CRP)

Using the Gen XXI Cohort Porto

Girls **Household Income**



Boys **Household Income**



[Soares et al 2020 Psychoneuro]

Higher levels of inflammation among the more disadvantaged children emerges earliest in the life course for boys, with steeper increases across childhood. Girls have higher levels of inflammation earlier on.

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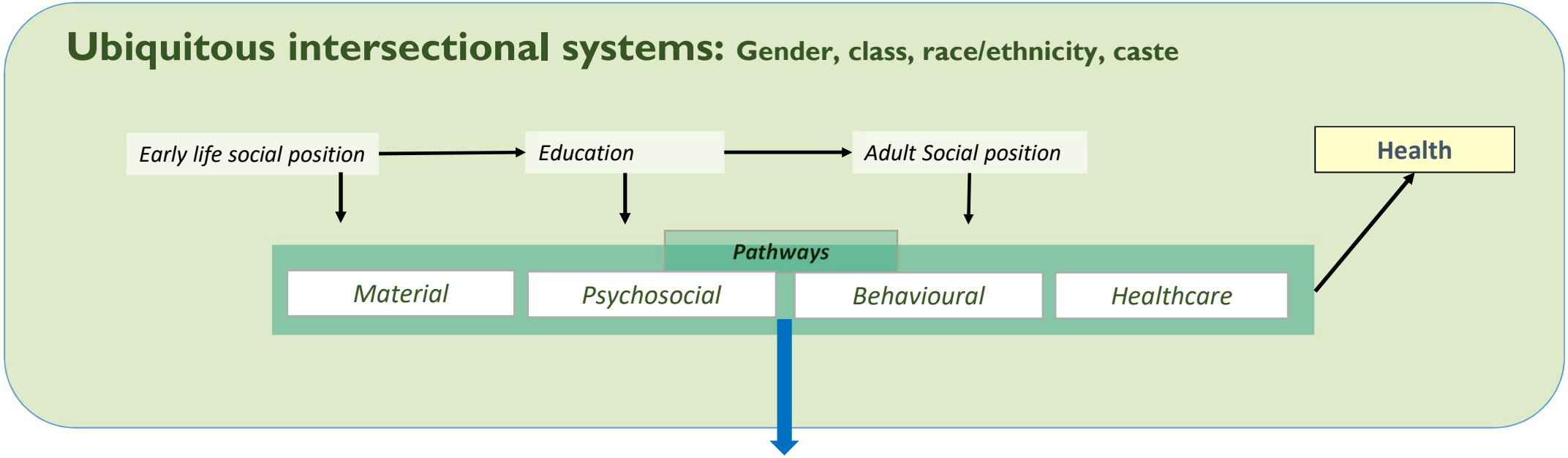
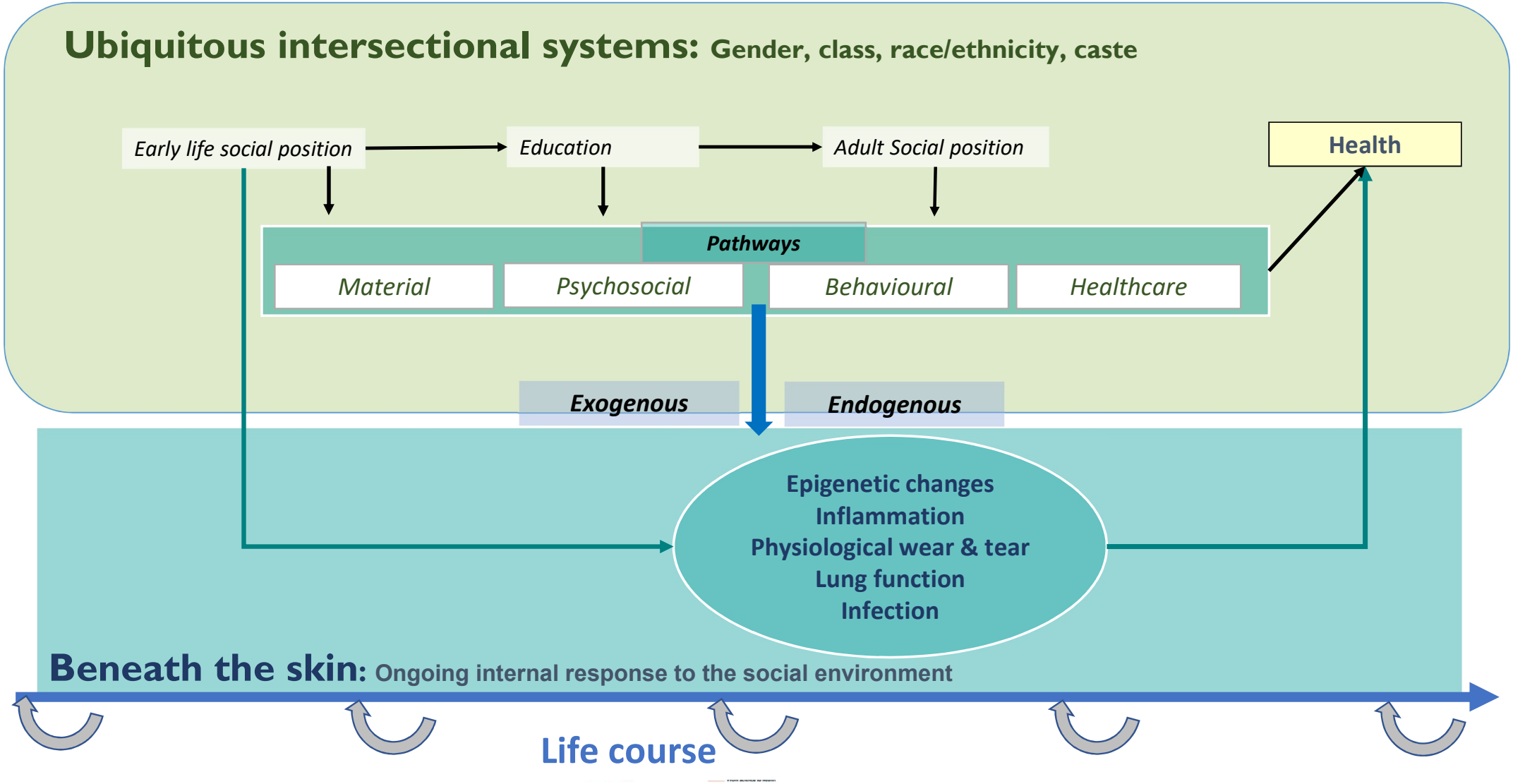
Embodiment



Life course

Embodiment


Ubiquitous intersectional systems: Gender, class, race/ethnicity, caste
Early life social position
Education
Adult Social position
Health
Pathways
Material
Psychosocial
Behavioural
Healthcare
Exogenous
Endogenous
Epigenetic changes
Inflammation
Physiological wear & tear
Lung function
Infection
Beneath the skin: Ongoing internal response to the social environment
Life course

Gendhi project research questions

How are health inequalities produced at the intersection of ubiquitous social systems (gender, social class and race/ethnicity) over the life course?

- How are bodies constructed over the life course?
- Are there social biases in health care?

Embodied child development: Elfe cohort 3.5y

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Centre d'Epidémiologie et de Recherche en santé des POPulations

Embodied child development: Elfe cohort 3.5y

To describe child development indicators at the intersection of gender and social class

- Child Development Inventory (CDI), questionnaire that measures child development via an overall scale and subscales covering eight skill areas
- Data collected when children were aged 3.5 years

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Embodied child development: Elfe cohort 3.5y

To describe child development indicators at the intersection of gender and social class

- Child Development Inventory (CDI), questionnaire that measures child development via an overall scale and subscales covering eight skill areas
- Data collected when children were aged 3.5 years

Expressed language: Clear & understandable

-sentences of 4+ words, 10+ words, has a vocab of 20+ words
-asks questions, gives reasons after using 'because'
-structured sentences, detailed accounts

« Self-help »: bodily autonomy

-washes/ dries hands
-uses toilet alone and controls sphincter
-uses fork to eat
-dresses alone & can do-up at least 1 button

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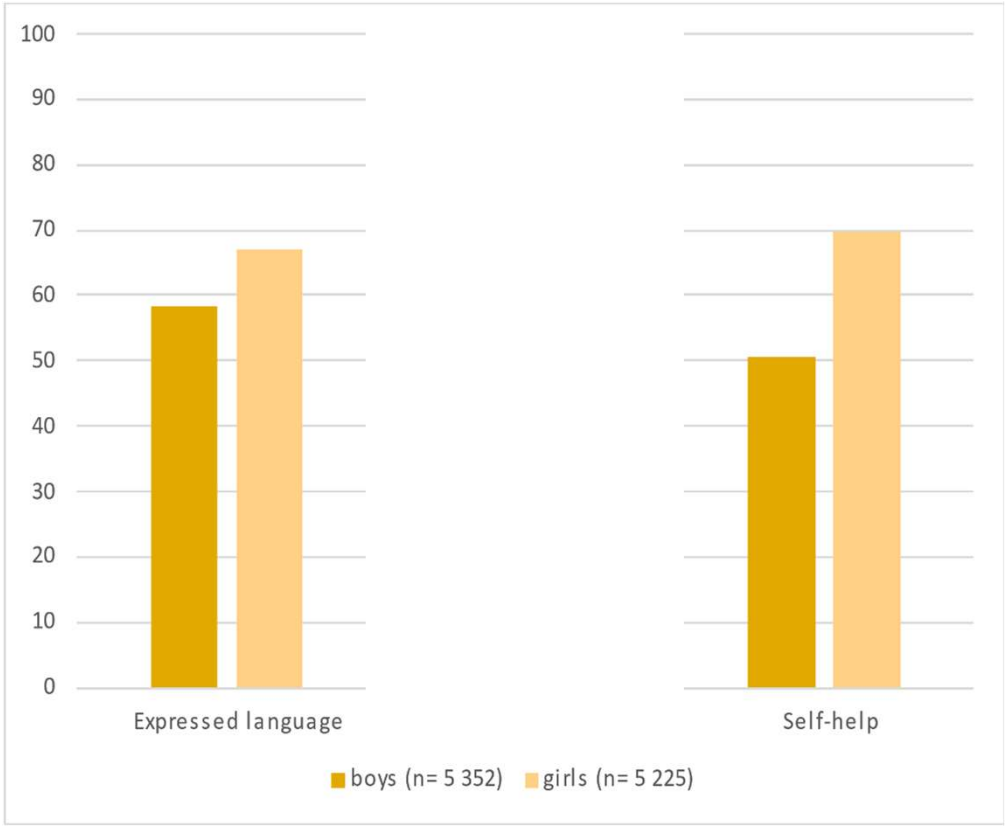
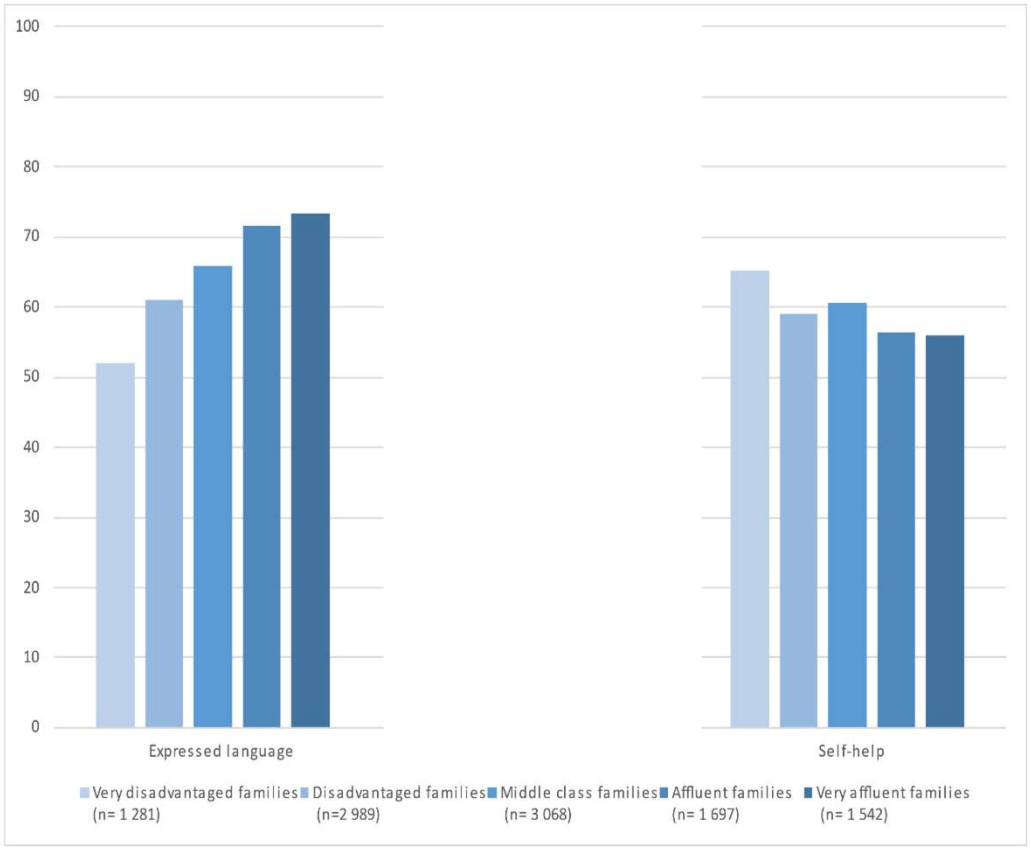
Embodied child development: Elfe cohort age 3.5y

Percentage of higher than average scores by sex



Girls are more likely to have higher scores in indicators of child development at 3.5y

Percentage of higher than average scores by social class



Social class pattern in indicators of child development at 3.5y

[Courtesy I Malroux]

Expressed language in girls & boys by social class: Elfe cohort 3.5y

Figure 2. Predicted probabilities of interaction between class and gender on the probability of obtaining an above-average score for expressive language (%)

- A social gradient in expressed language at 3.5y
- The most disadvantaged children are least likely to have above average rates of expressed language
- The gap between girls and boys is relatively consistent across social class groups

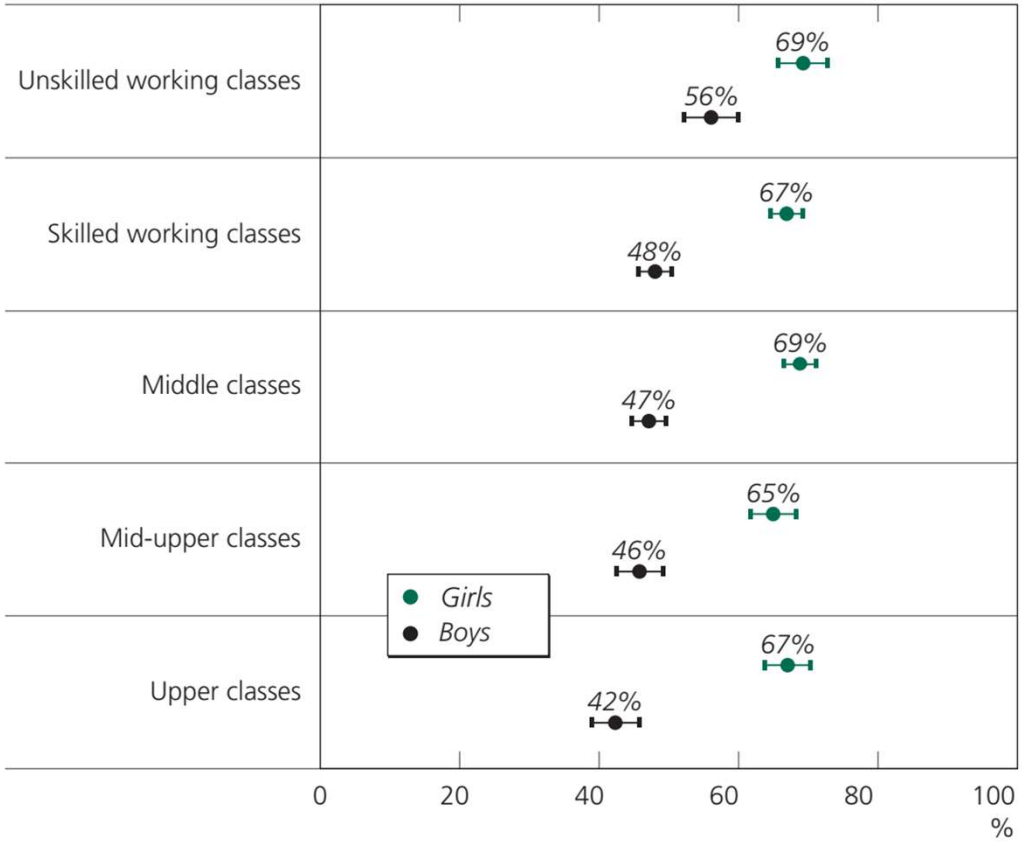
Model adjusted for parental migration status, maternal age, birth weight, childcare arrangements, birth rank

[Malroux et al, Population, 2025]

‘Self-help’ Bodily autonomy in girls & boys by social class : Elfe cohort 3.5y

- Girls are more likely to score above average in ‘self help’ at age 3.5y than boys
- No social class difference in girls
- Boys in most advantaged families are least likely to perform well
- Most disadvantaged boys ressemble girls the most

Figure 4. Predicted probabilities of interaction between class and gender on the probability of obtaining an above-average score for self-help skills (%)



Model adjusted for parental migration status, maternal age, birth weight, childcare arrangements, birth rank

[Malroux et al, Population, 2025]

Embodied child development: Elfe cohort age 3.5y

- Embodiment considered using normative markers of development, language expression & bodily autonomy
- Do the findings for bodily autonomy challenge accepted stereotypes that girls are essentially biologically more developed than boys?

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Applying a quantitative intersectional approach to blood pressure: Constances cohort

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Applying a quantitative intersectional approach to blood pressure: Constances cohort

To map predicted Systolic Blood Pressure (SBP) means across intersectional groups in order to identify those at higher risk

- Intersectionality theory to study blood pressure
- CONSTANCES cohort (2012-2021) in the French general population
- N=150 739 individuals aged 25 to 69
- Nested within intersectional strata defined by combining sex, age, race/ethnicity, and education

[Silberzan et al, SSM, 2026]

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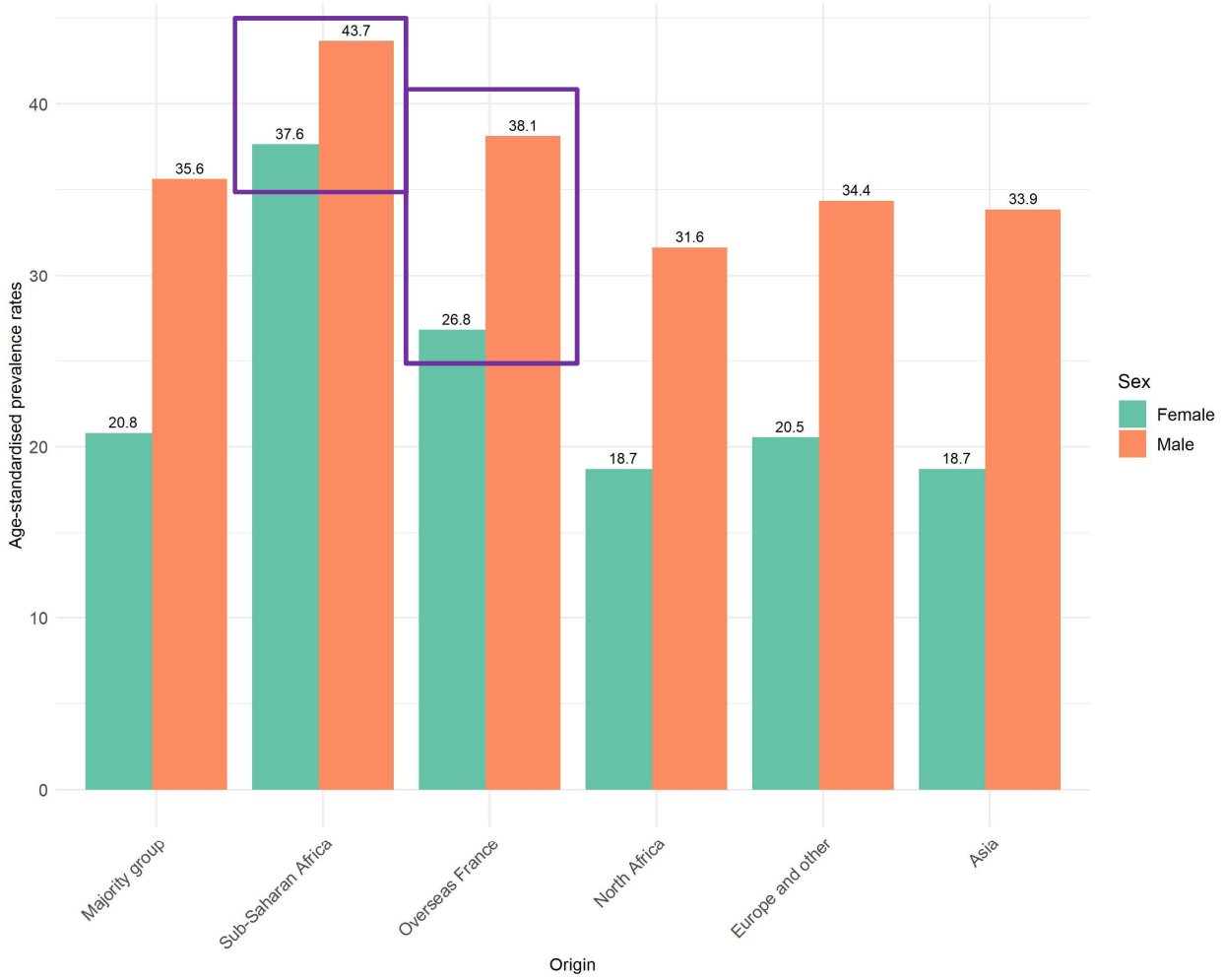
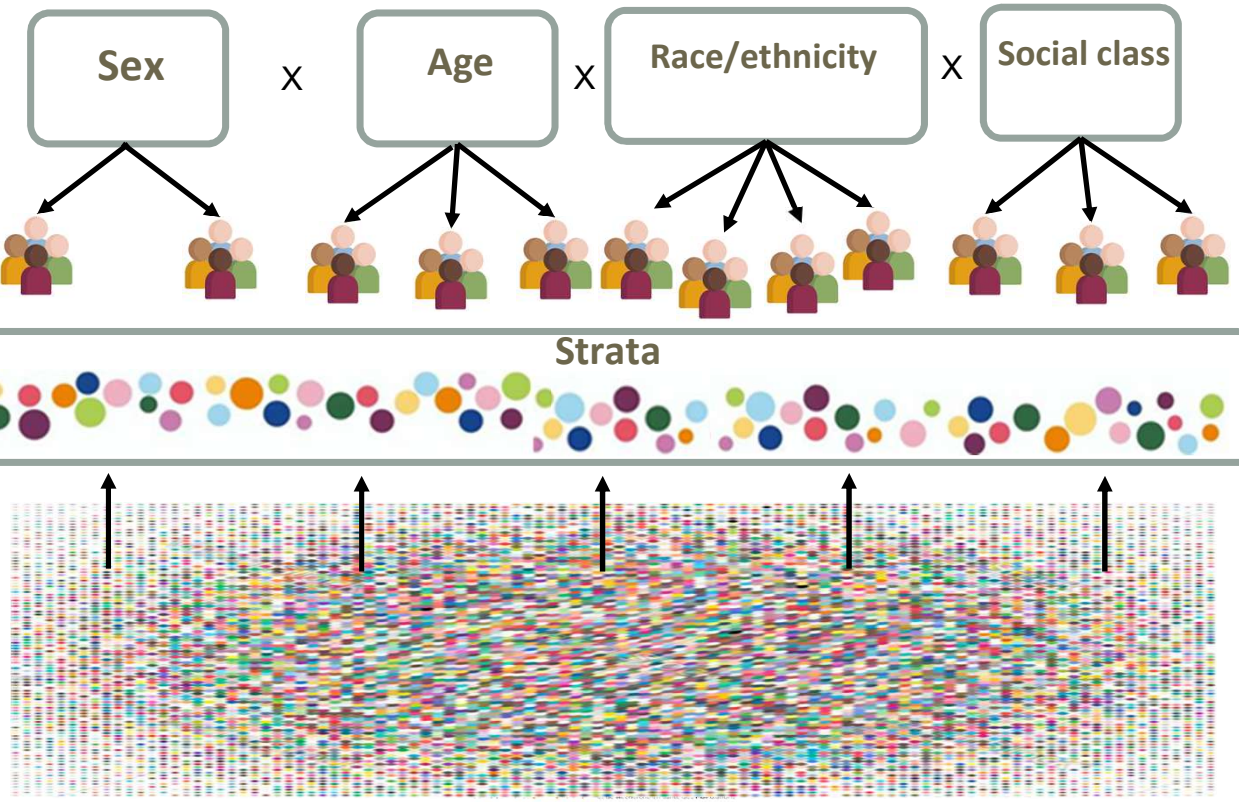
Age-adjusted hypertension prevalence by sex & race/ethnicity : Constances cohort

- Men have a higher rate of hypertension in all groups
- Hypertension rate is higher among SSA and Overseas territories for men and women
- The gap in hypertension rates between men and women is smaller for SS-African and Overseas France categories



[Silberzan et al, SSM, 2025]

Multilevel analyses (MAIHDA) capture intersectional systems



Number of categories = 12

Level 2
Example of a single stratum: women, aged 60-69, from South Asia, working class

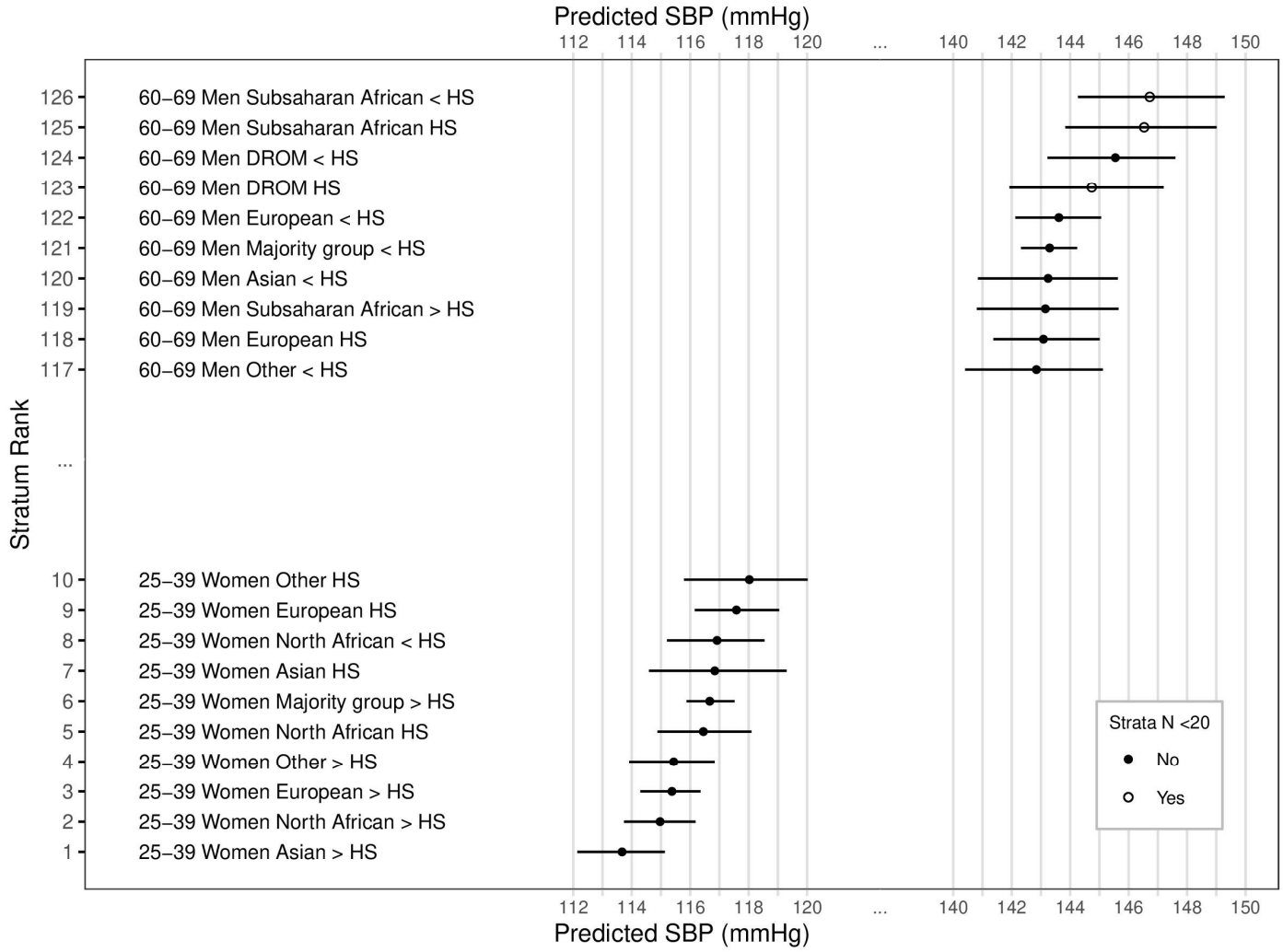
N strata = 72 (2x3x4x3)

Level 1

Individuals in your data set

Systolic blood pressure (SBP) predicted probabilities by sex, age, education & race/ethnicity: Constances cohort

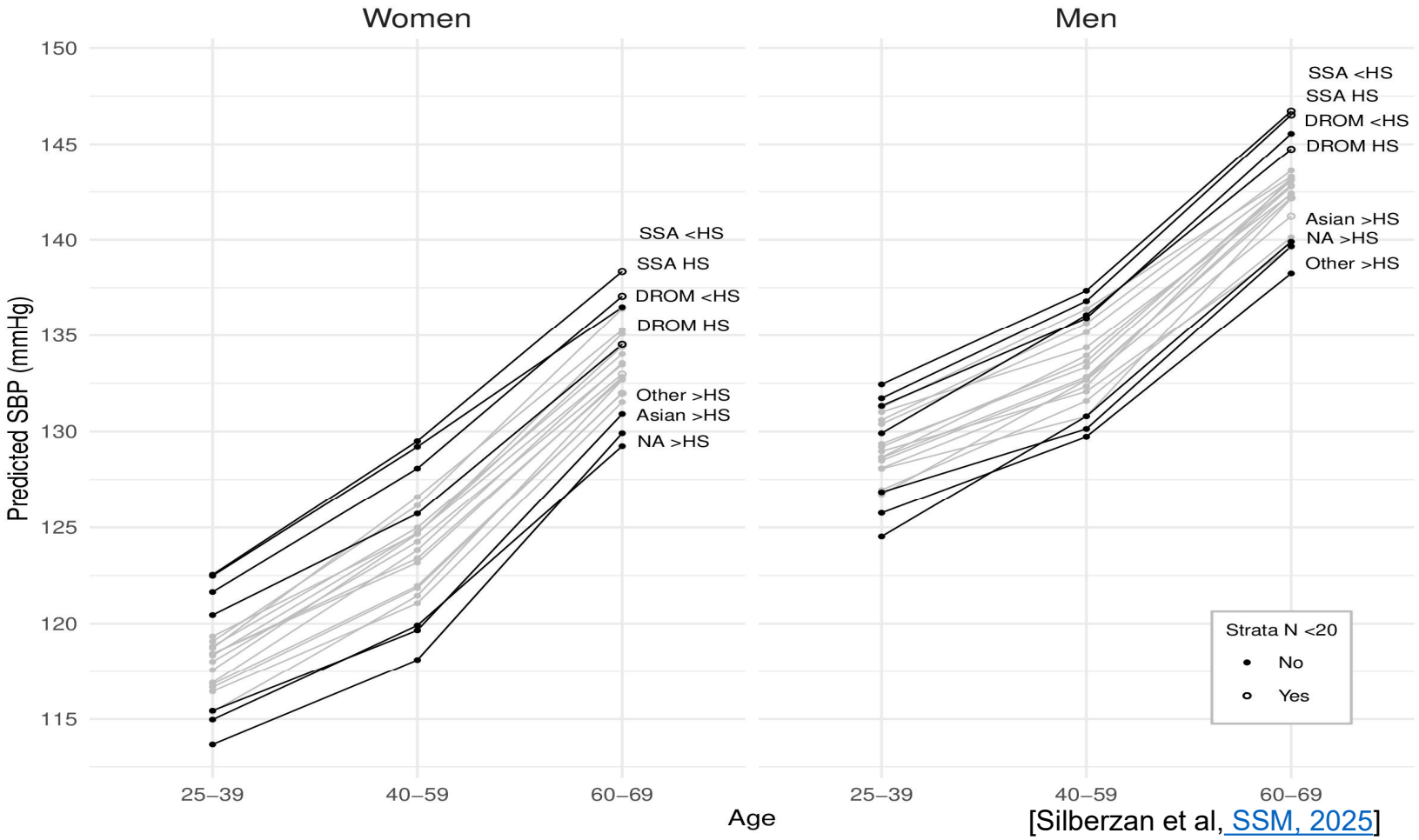
- Describing intersectional strata at the higher & lower ends of the distribution
- High SBP characterised as older men belonging to SSA & overseas France group
- Role of educational attainment?



Ten lowest and ten highest predicted SBP
DROM : French overseas territories, < HS : less than high school diploma, HS: high school diploma, >HS: high school diploma

Systolic blood pressure (SBP) predicted probabilities by sex, age, education & race/ethnicity: Constances cohort

- In both men & women, SSA & overseas group have higher SBP even in the youngest age group
- Steeper increase in men between 40-59 to 60-69y groups & for women in lowest SBP groups
- This work underlines racialised inequalities in blood pressure in France



[Silberzan et al, SSM, 2025]

Concluding remarks

Embodiment is one of the most fundamental processes that underlies the production of health inequalities over the life course

Intersectional ubiquitous systems affect *who* in society is exposed to health-harmful conditions, experiences adversity, discrimination, and their life long embodied consequences

Considering these two phenomena together over the lifecourse may help us understand the production of health inequalities and develop interventional research to reduce them

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EQUITY

gendhi
gender & health inequalities

Thank you!

www.gendhi.eu

This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement N° 856478)