Using social theory to examine social-to-biological research questions: an interdisciplinary challenge from theory to praxis

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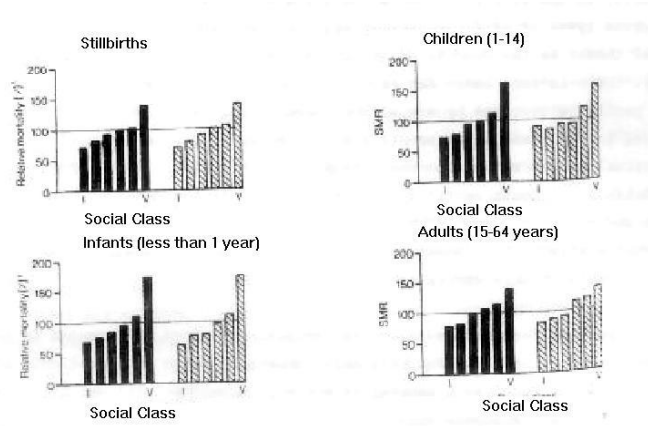
The socioeconomic gradient in health

The gradient is a 'social fact' characterised by (Hertzman 2012)

- an omnipresence across countries
- its resurgence on emerging health conditions
- not fully explained by classic risk factors (typically about 20-35%)
- a large array of potential pathological processes
- observed gender/ sex differences
- begins as a developmental gradient in early life



Black Report 1980

How and why do socioeconomic gradients in health occur?

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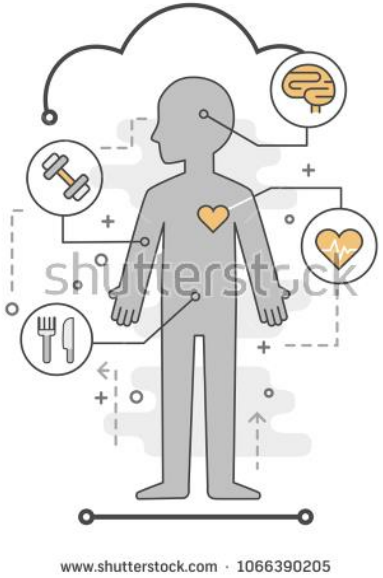

We need an interdisciplinary approach combining social sciences, mathematics and biomedical science to establish social-to-biological plausibility

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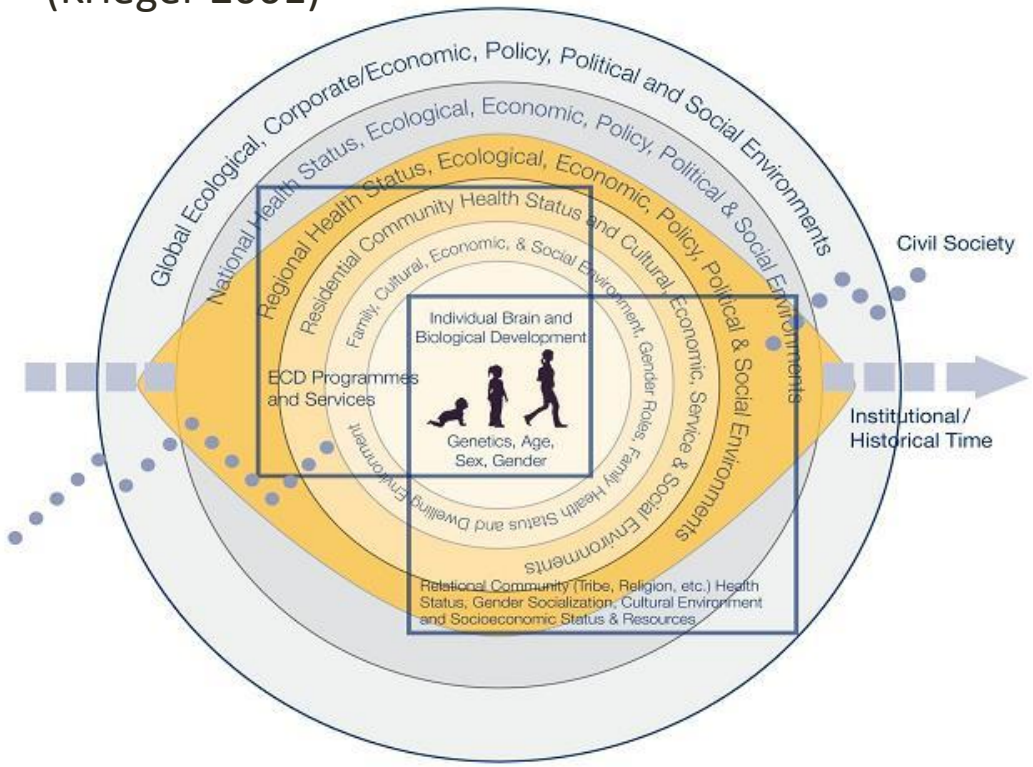
Embodiment: A complex social environment over the lifecourse & specific biological mechanisms

"A concept referring to how we literally incorporate, biologically, the material and social world in which we live" (Krieger 2001)



The embodiment dynamic always involved biological mechanisms that need to be hypothesised & understood

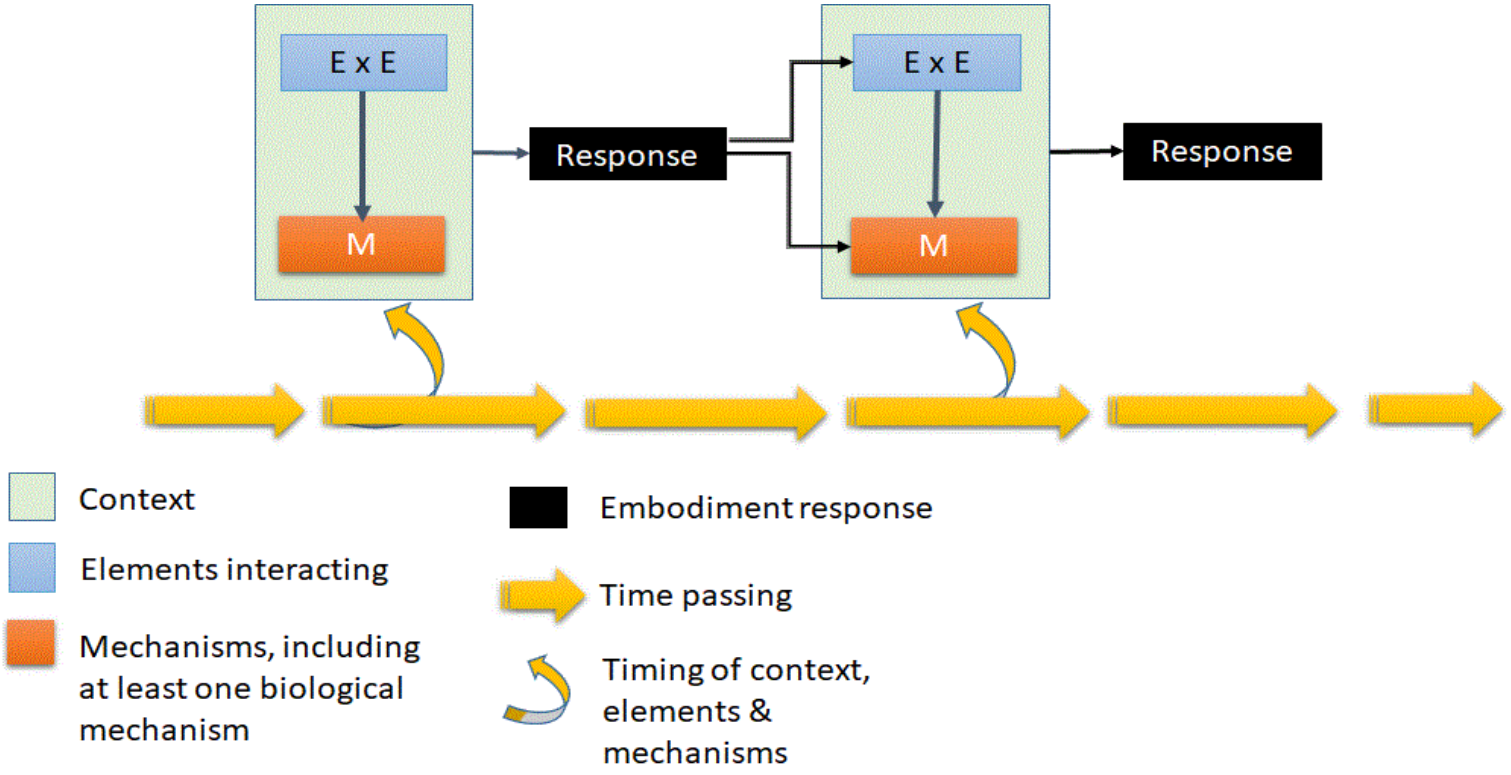
Types of biological mechanisms:

- **Of exogenous origin**
- **Of endogenous origin**

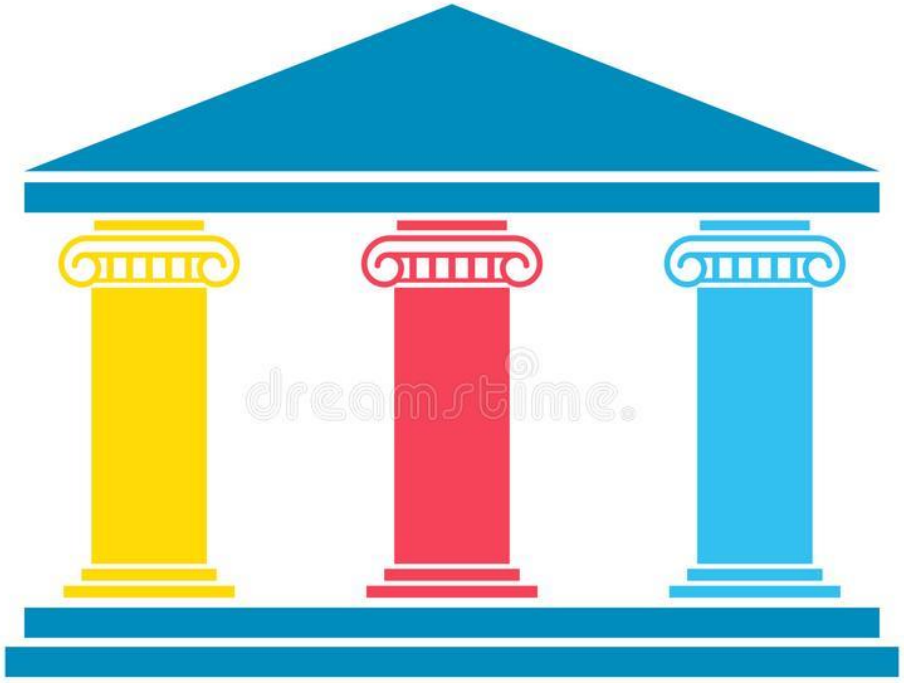
These interact and involve molecular-level mechanisms (ex: epigenetic) (Kelly-Irving & Delpierre 2018)

Embodiment as a dynamic

"Humans come to physically represent their past environments in their present state through a constant process of change"



Social-to-biological research rests upon three pillars



Social theory | Biological mechanisms | Appropriate methods

A dedication to:

- Grasping the social theory behind the social variables driving your question: reading social science texts
- Understanding the biological systems, mechanisms & functions related to your health question: reading biomedical literature
- Understanding and applying appropriate methodological approaches to serve the question: reading up on methods & trying them out

Today: An overwhelming abundance of data

- Where do you start?
- How to know which variables to select?

If you're interested in how structural, social, psychosocial, biological (etc) factors interact over time to influence health then you are confronted with a stifling complexity in your data
-multi-level relationships
-dynamics over time

Have no fear, theory is here!

- Your practice should be anchored in theory: theory & praxis go hand in hand
- Theory facilitates hypothesis generation
- Your methods to select data & analyse them should be used to service your theory

Don't get too bogged down in the definition of theory:

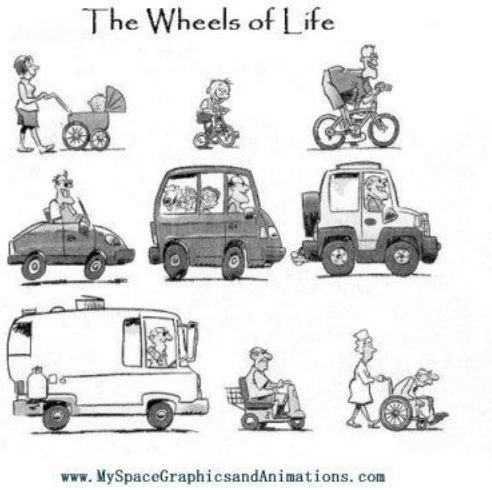
"An organised set of principles, rules and scientific laws aiming to describe and explain observations"

Theories & principles help to identify the hypotheses and relationships you want to examine in your research

A 5 step approach to linking theory & practice

-A brief overview of a 5 step approach to moving from theory, to method to practice based on :
Why use a life course framework in health research?
https://researchfrontier.wordpress.com/2019/06/22/why-use-a-life-course-framework-in-health-research/

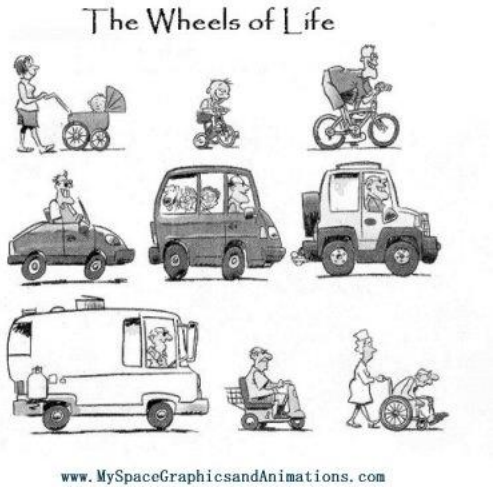
-Some examples



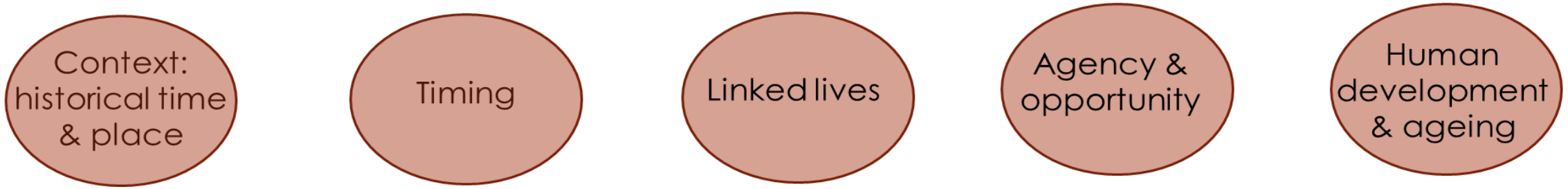
A 5 step approach to linking theory & practice: Lifecourse framework

The lifecourse approach is a conceptual framework upon which a variety of disciplinary traditions have converged, including demography, psychology, la sociology, biomedical sciences & epidemiology (Kelly-Irving, Tophoven & Blane 2015)

- Interdisciplinary & flexible
- Embraces complexity
- Trajectories from early life & between generations
- Principles & mechanisms



1. Identify your theoretical framework: Elder's principles



- Help to specify your research question
- These principles help to map out the conceptual model you will test empirically

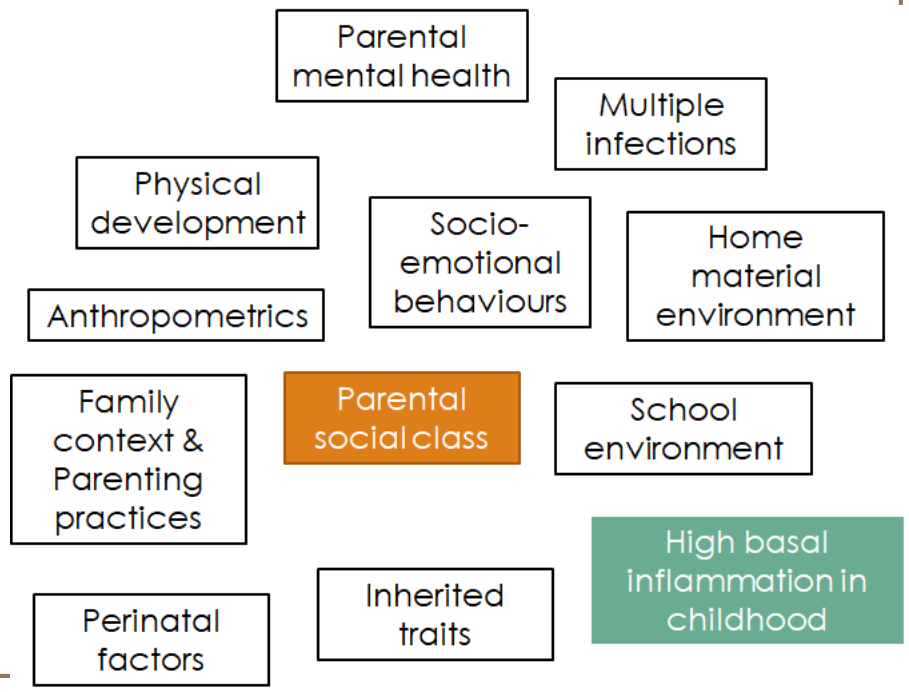
2. Draw-up your conceptuel model

- Using the theory you chose, think through your research question:

Are early life socioeconomic conditions related to childhood inflammation?

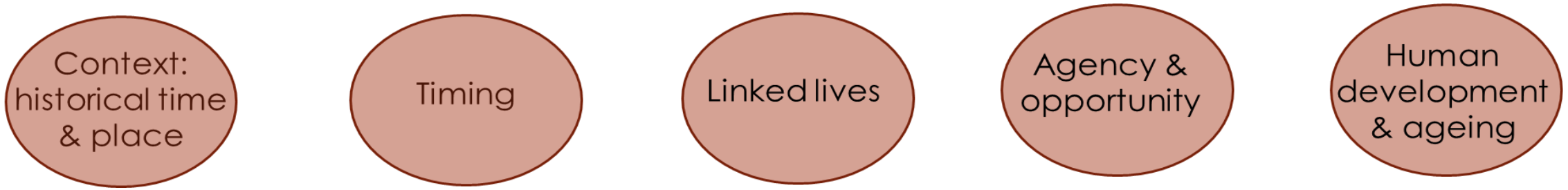
- The different possible conceptual variables will start to become apparent

Primordial soup of ideas & variables :



2. Draw your conceptual model

- Use the theoretical principles to organise the ideas in your soup of conceptual variables…



2. Draw your conceptual model

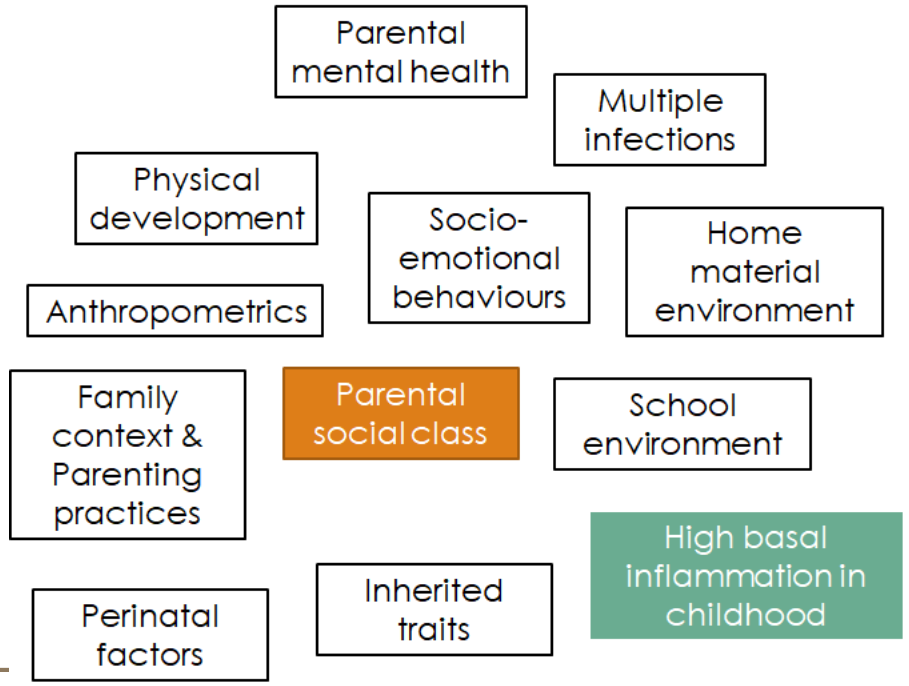
Context: historical time & place

Timing

Linked lives

Agency & opportunity

Human development & ageing



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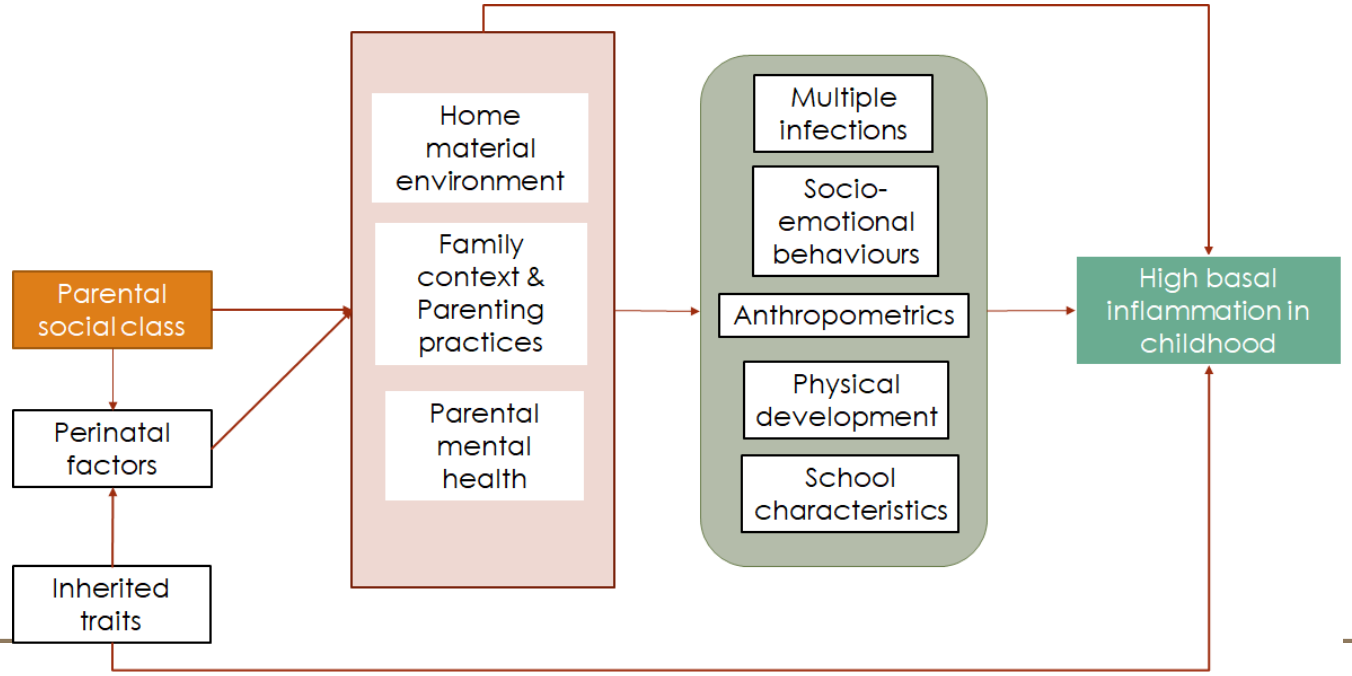
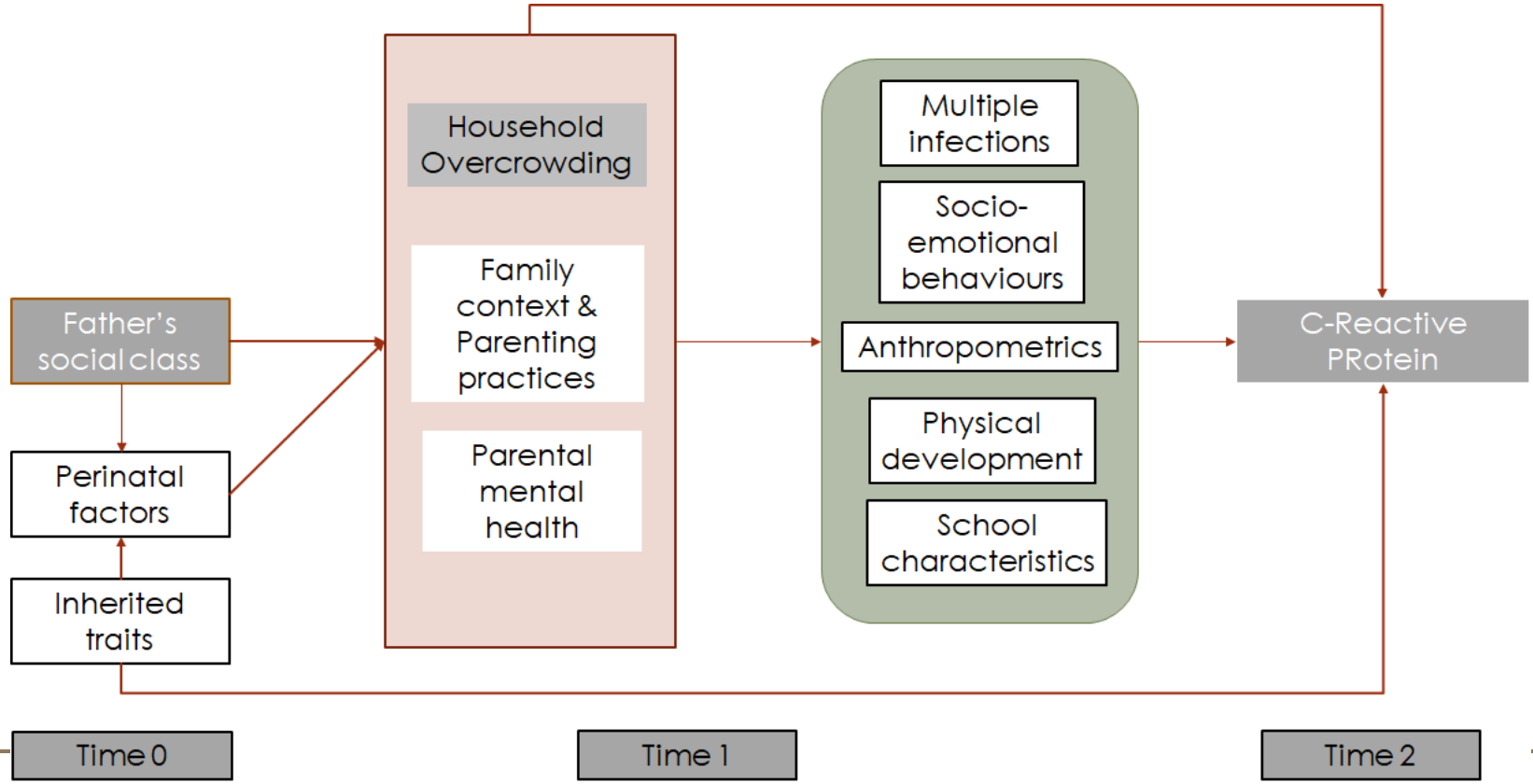


3. Go to your dataset & plug in the empirical variables

- The conceptual variables help you define & select the variables in your data – and realise their limitations



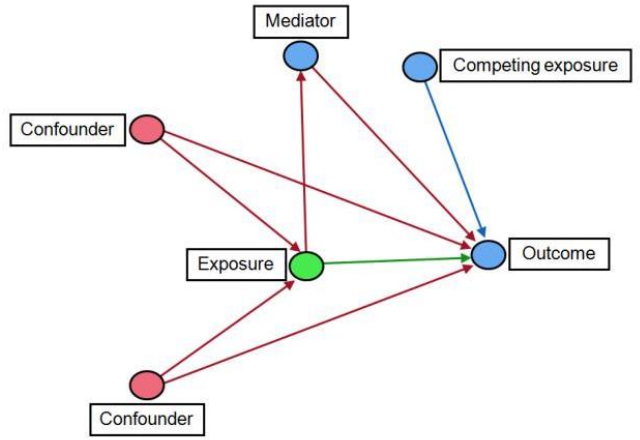
4. Define your empirical model & select the right analytical approache

- It will now be easier to take decisions about your analytical approach and which statistical models to select which best service your theory
- Time-varying variables, confounders & mediators should become easier to define
- Your empirical model may be appropriate

to test with causal inference models

What is a DAG (Directed Acyclic Graph)?

- A type of 'causal path diagram' with: unidirectional ('causal') arrows linking variables; and no circular paths



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5. Interpretation

- The lifecourse approach: a common investigative framework

- The approach guides theory selection, methodological considerations and a framework for interpretation of your findings without getting too lost in the forest of data

- It is a sufficiently flexible framework to allow different disciplinary traditions to work together and even meld their theories or methods while offering a road map for analysis and interpretation of results

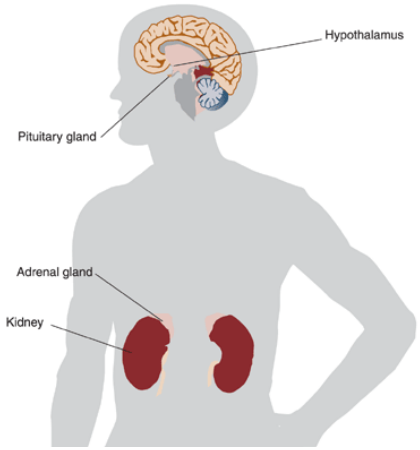
From our own work: pathways between social position & biological health

Inductive deductive cycle

A deductive approach is aimed and testing theory, an inductive approach is concerned with the generation of new theory emerging from the data

As researchers we generally do both…

Hypothesised mechanisms of endogenous origin: Stress & HPA axis



Stress is a process that entails a stimuli, appraisal of it, and a response (Miller et al 2011)

"a non-specific response of the body to any demand for change" (Seyle 1936)

Hypothalamo-Pituitary-Adrenal (HPA) influences and feedback interactions between:

-hypothalamus, pituitary gland & adrenal gland

Release of cortisol & adrenaline

Peripheral responses

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Pathways between parental Social position & Allostatic Load

Exposure variables: socially structuring

Paternal occupation

Registrar General's Social Classes

I - Professional occupations & II - Intermediate occupations,

III - Skilled occupations (non-manual),

III - Partly skilled occupations (manual),

IV - Partly skilled occupations & V-unskilled occupations

Maternal education

highest education level (mother left school after legal minimal age)

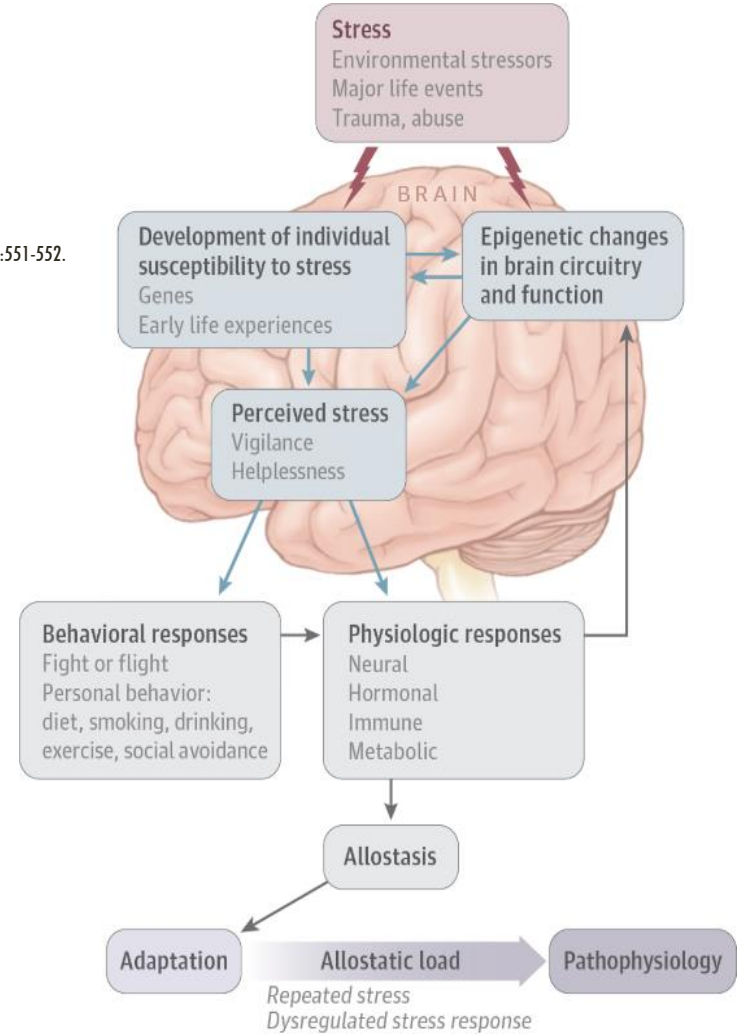
lowest education level (mother left school before legal minimal age)

Allostatic load (AL)

Homeostasis: Physiological mechanism of internal regulation through constancy

Allostasis: Physiological mechanism of internal control through change

JAMA Psychiatry. 2017 Jun 1;74(6):551-552.



Allostatic load (AL):

-"The strain on the body produced by **repeated ups and downs of physiologic response** .../... and the impact of wear and tear on a number of organs and tissues, can predispose an organism to disease. We define this state of the organism as allostatic load" (*McEwen and Stellar 1993*)

-Allostatic Load is the **price paid by the organism** over time to adapt itself to environmental challenges.
(*McEwen et al. 1993; Seeman et al., 1997*)

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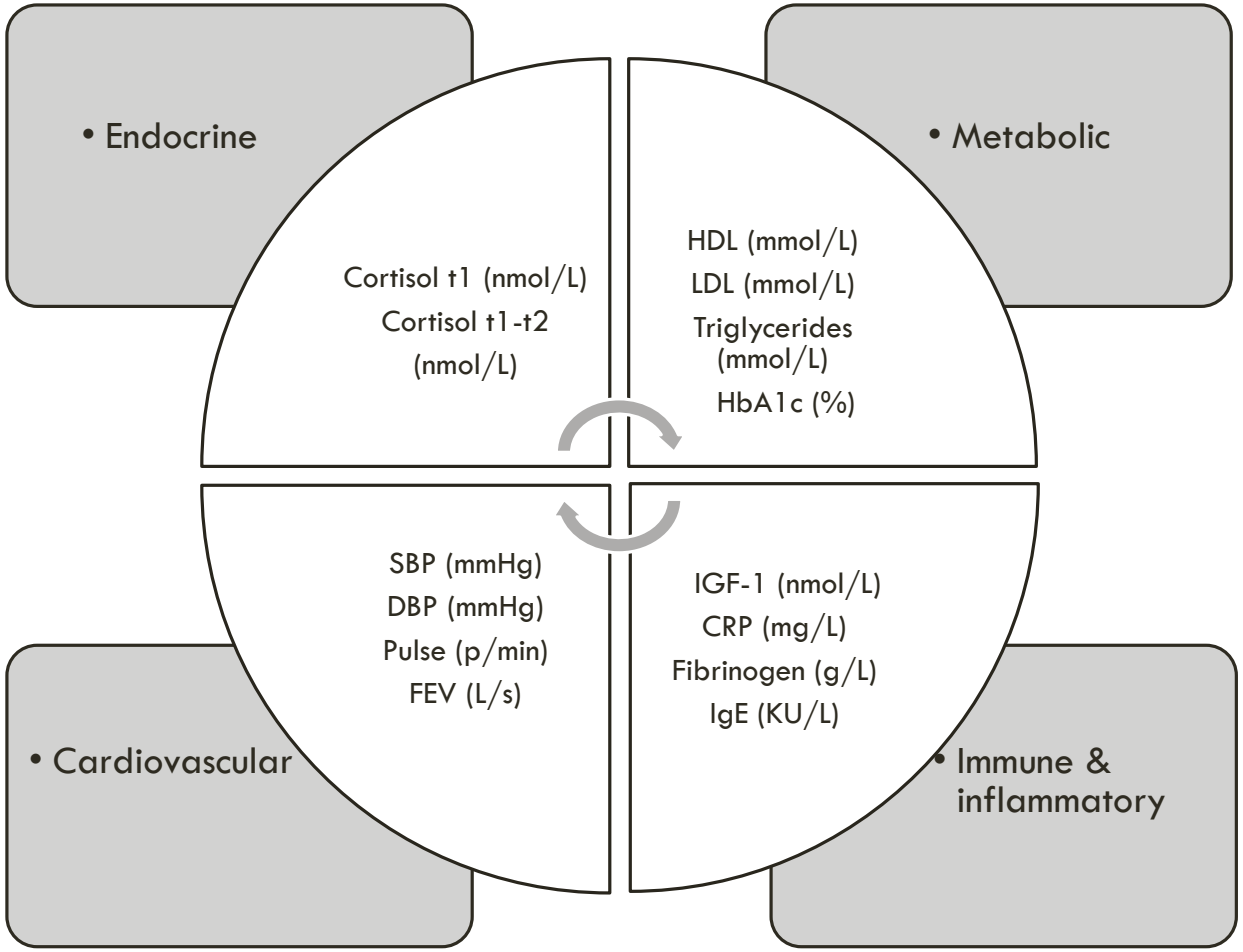
Allostatic load score

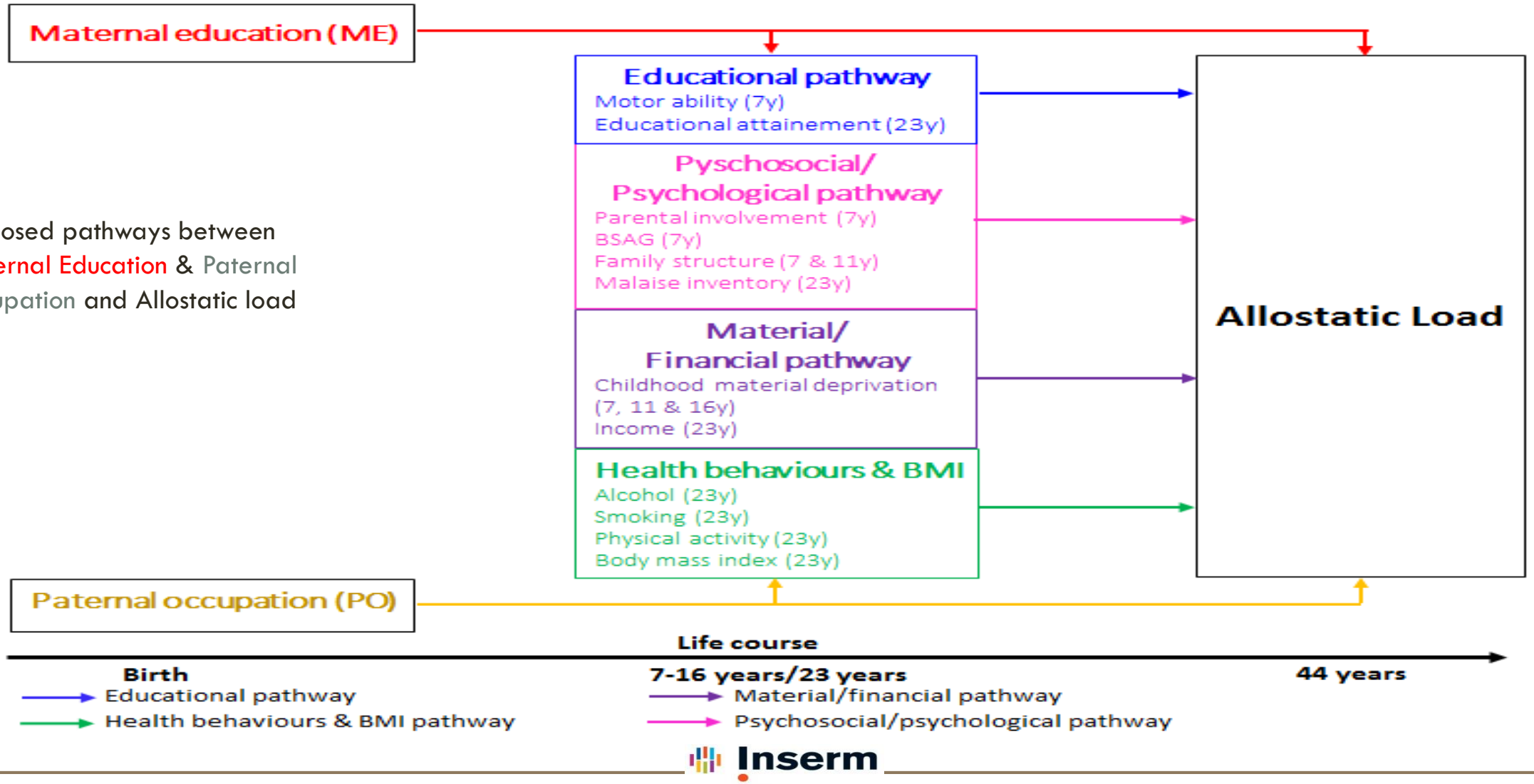


-Each biomarker that exceeds the 75th/ 25th percentile cut-off is attributed a score of 1. Allostatic load is measured by the cumulative score.
(Seeman et al, 1997, 2001)

-Sex specific

Path analysis of parental SEP & AL

Proposed pathways between Maternal Education & Paternal Occupation and Allostatic load



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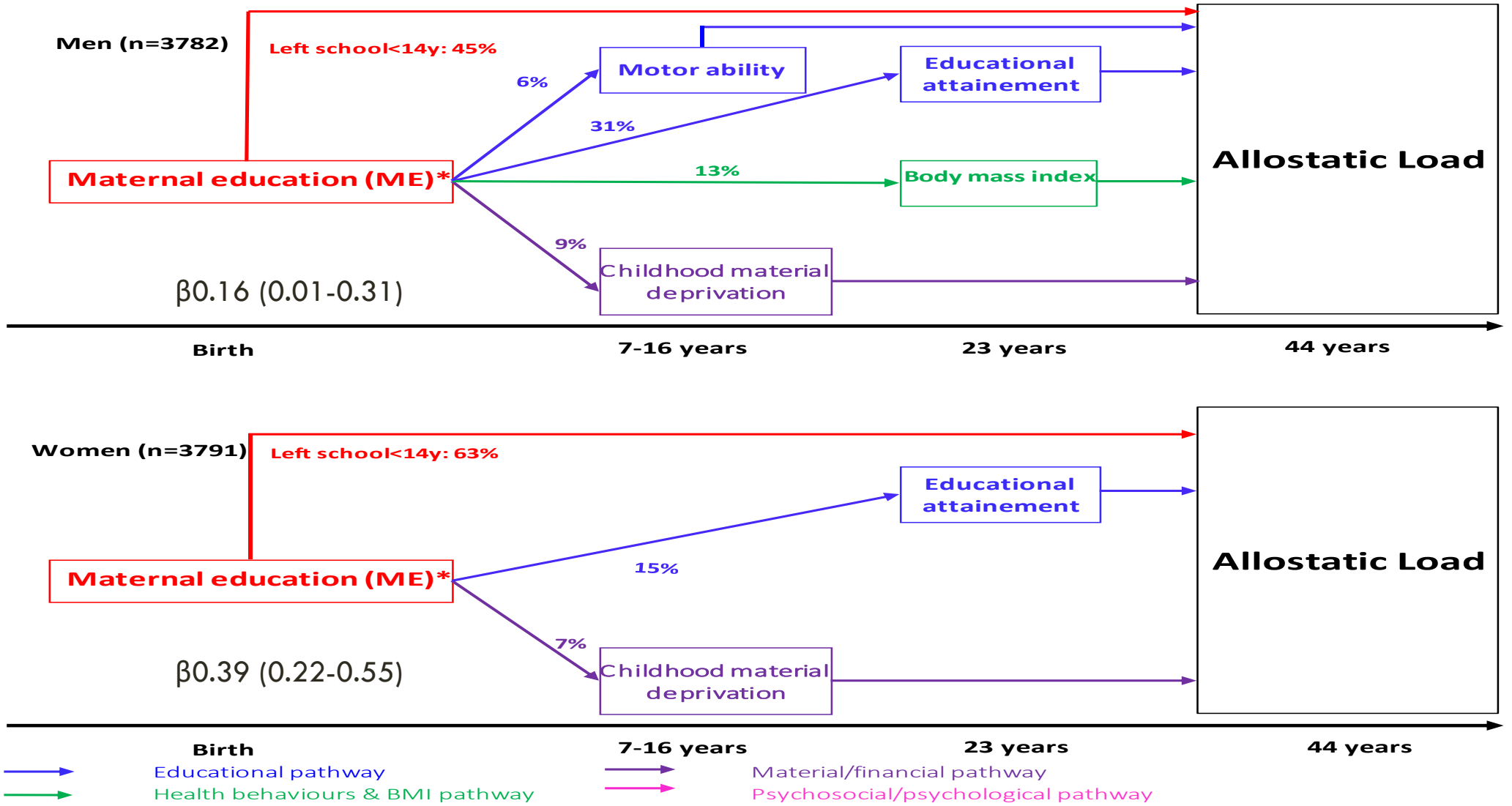
Results: Pathways between parental SEP & AL



Barboza Solis et al 2016

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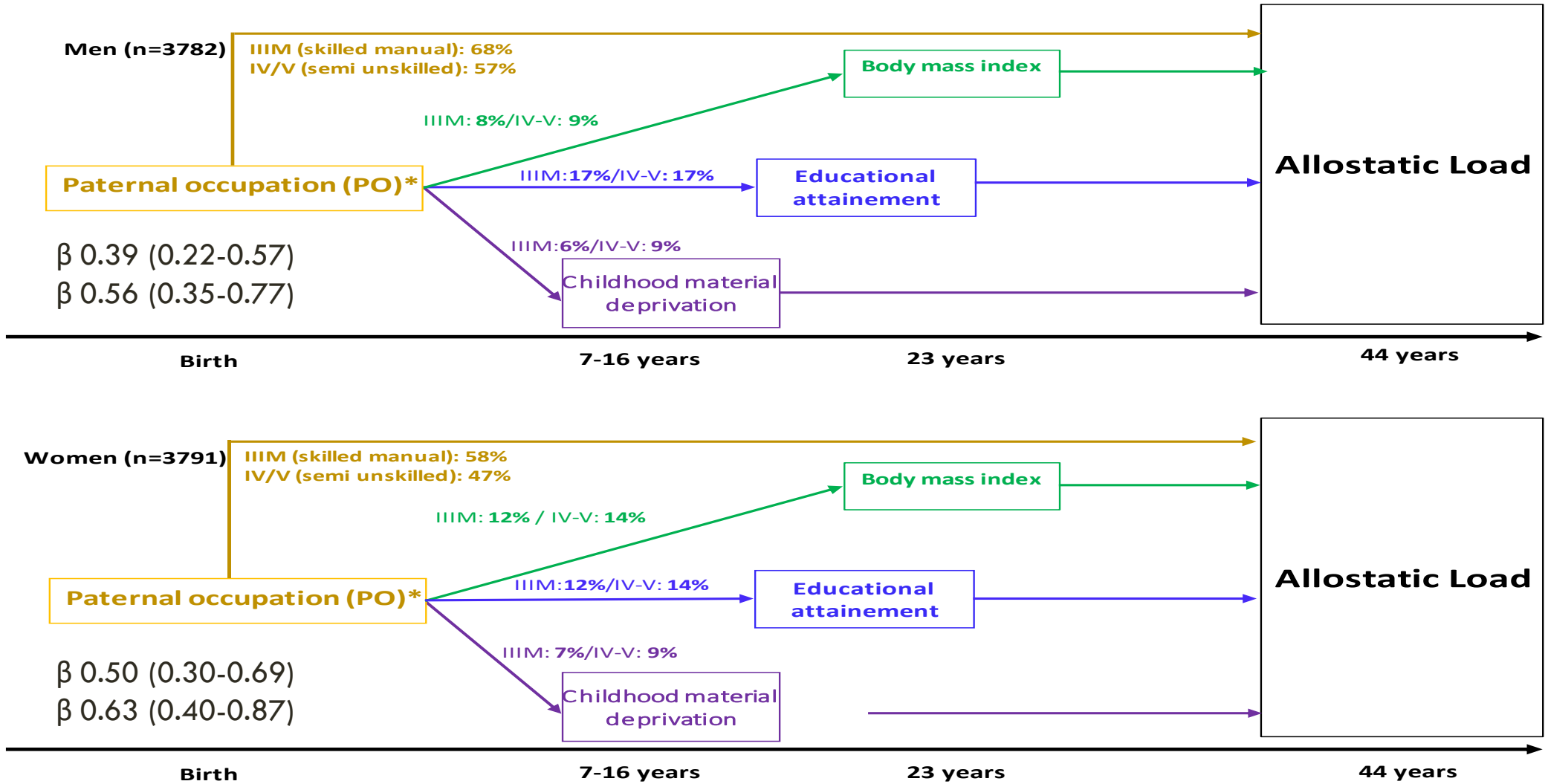
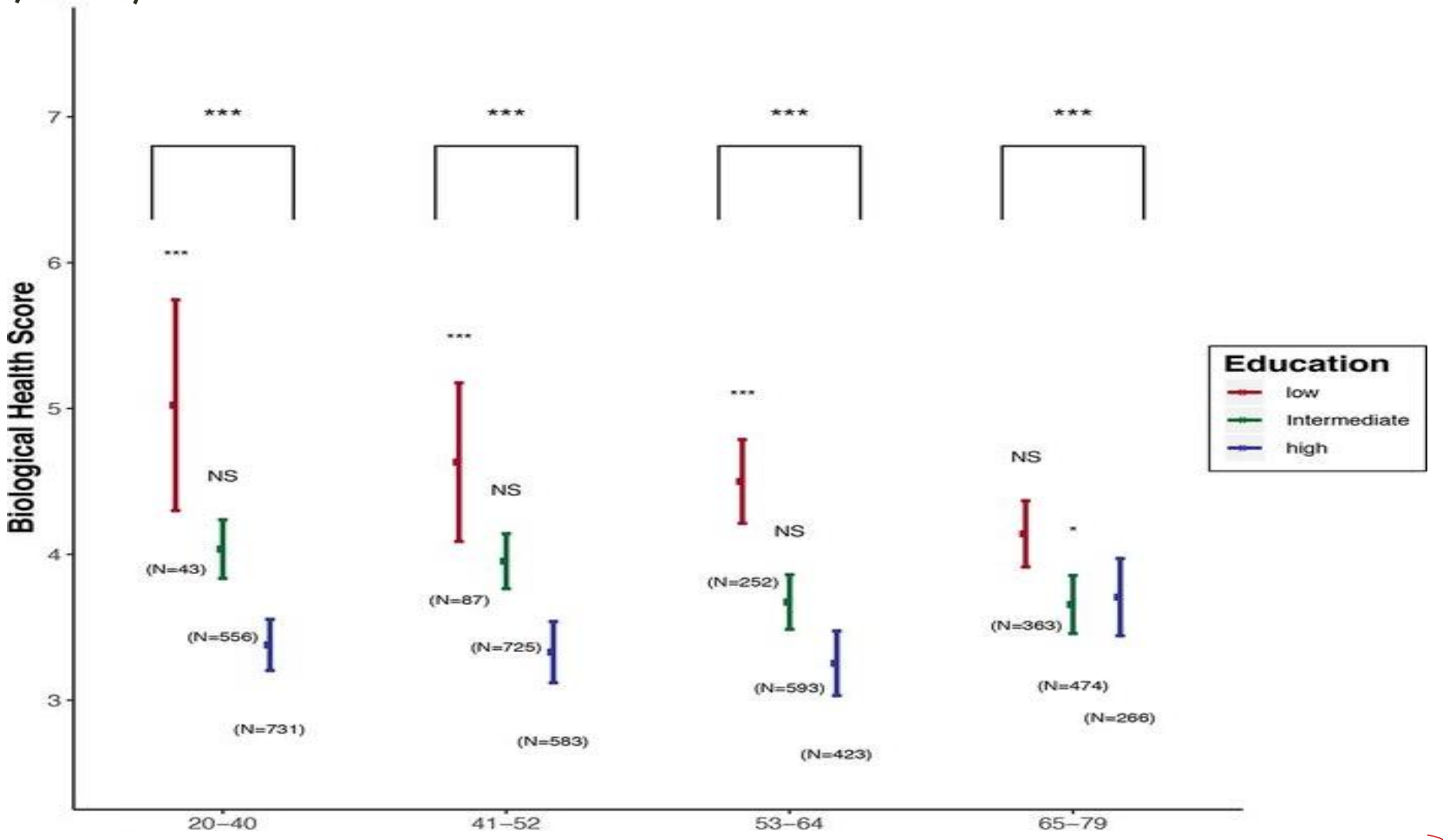


Barboza Solis et al 2016

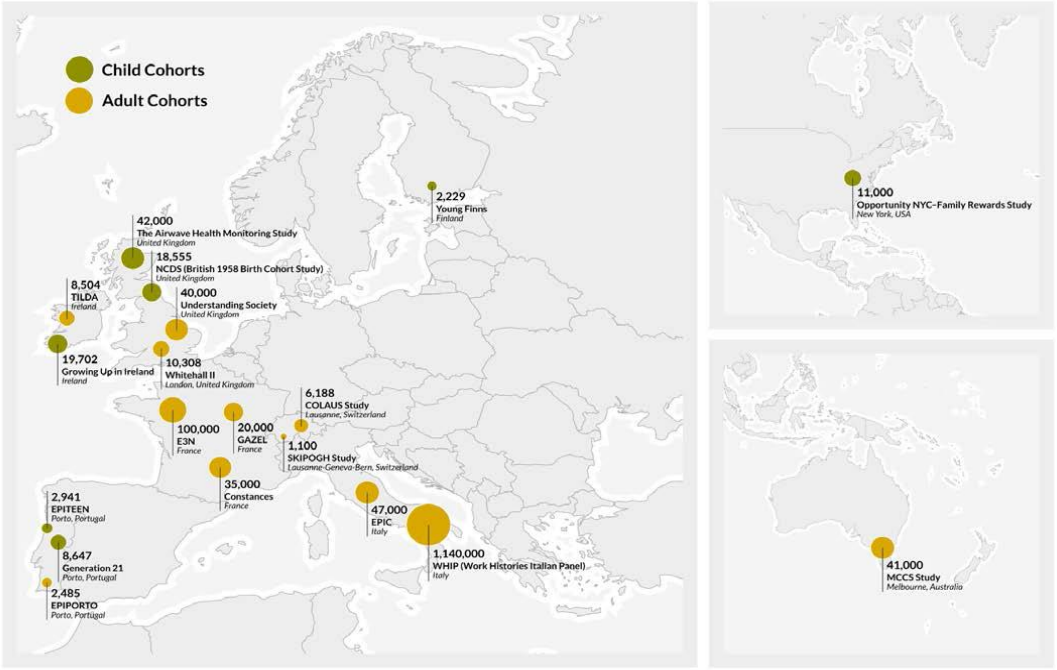
Educational patterns in biological response

- Cross-sectional analyses: Educational attainment & biological health score by age in *Understanding Society* (Karimi et al 2019, JECH)



Women

The Lifepath project: breadth cross-contexts

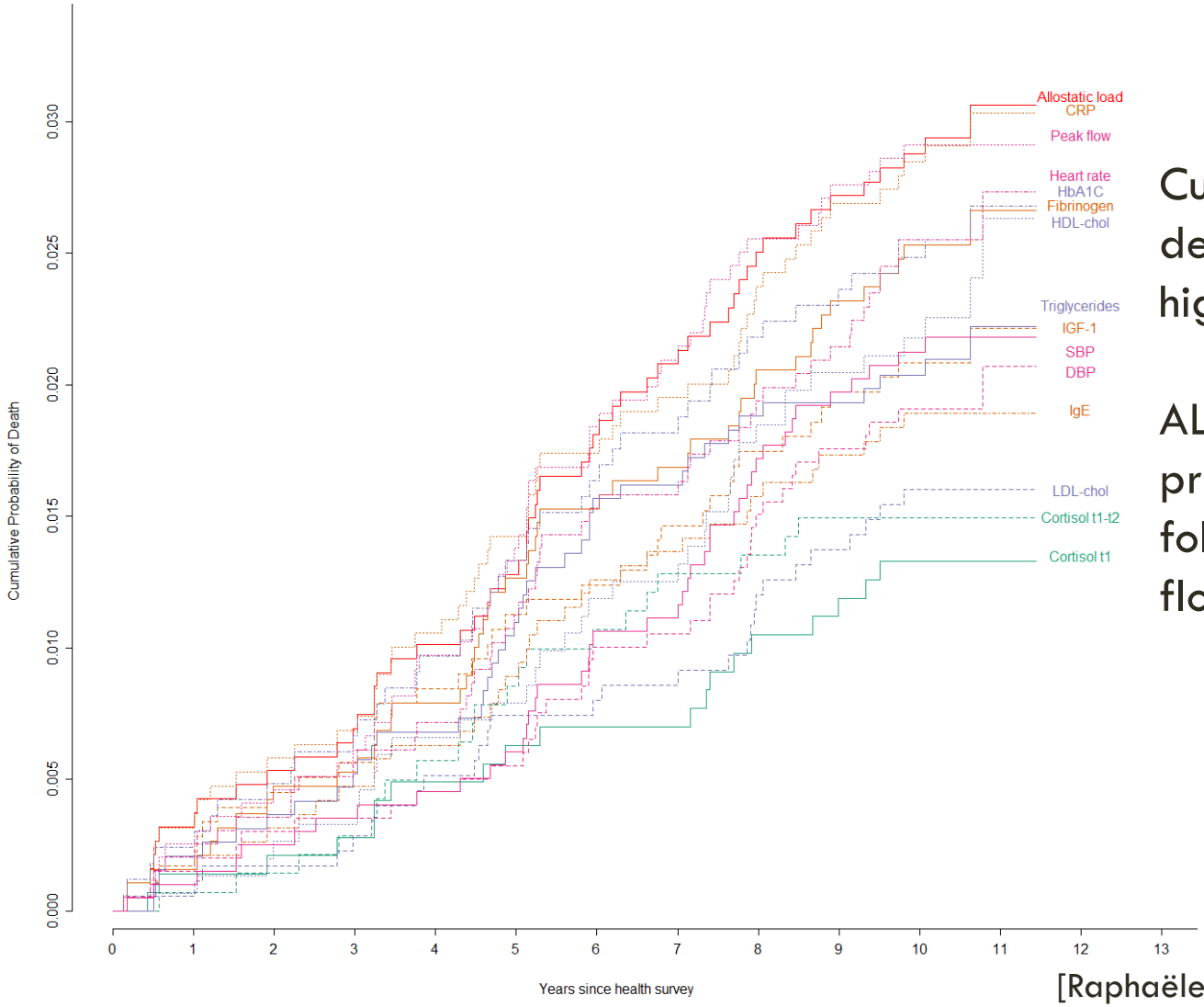


- Includes information and biological samples from 17 cohorts
- Many countries covered by the cohorts
- Combination of measures of socioeconomic position, risk factors for chronic diseases and biomarkers

⇒6 cohort studies were included with life course SEP, CRP measurements & behaviours/lifestyle variables

[Paolo Vineis, Lifepath, H2020]

Allostatic load, individual biomarkers & mortality risk

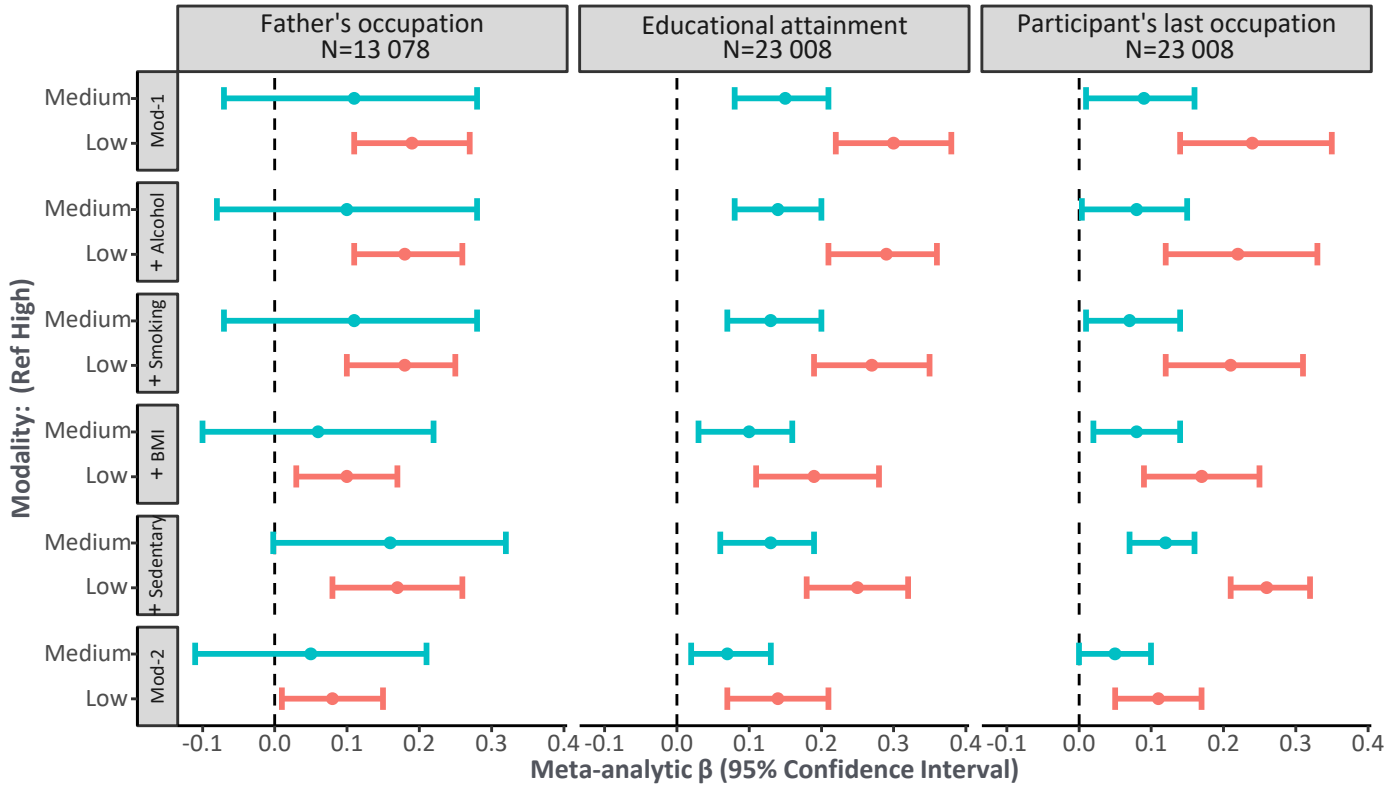


Cumulative probability of deaths over time for each high risk group

AL is the strongest predictor of mortality followed by CRP and peak flow

[Raphaële Castagné et al 2018 *EJE*]

Association between each life course social position & c-reactive protein



- Strong, graded association between the 3 life course SEP individually and CRP in meta-analyses
- Association was attenuated upon adjustment for BMI

[Eloise Berger, Raphaële Castagné et al, *Nat Comms* (2019)]

Social position and embodiment

- Working on an individual cohort gives us insight into contextualised mechanisms while pooling cohorts gives us a sense of consistency and validity
- **Inflammatory system** emerges as an important driver of overall physiological health
- The most likely set of mechanisms involved in heightened inflammation is the stress response system & adipose tissue deposit
- **Educational attainment** consistently stands out may act as a physiological stress-regulating buffer

→Why? Cultural capital & its early life transmission to children?

Circling back to social theory: Bourdieu's capitals

- Social world understood through the concept of capital(s) which are forms of power accumulated by social groups
- Bourdieu re-worked Marxist sociology's concept of economic capital to add other spheres of capital: cultural, social & symbolic
- He delineated a 'social space' wherein these capitals play out & lead to some social groups dominating others through the accumulation of capitals

Reading: P Bourdieu, The forms of capital, 1986, [in Richardson, J., Handbook of Theory and Research for the Sociology of Education]

Social theory: Bourdieu's capitals

Cultural capital: can exist in three forms in the **embodied state**, i.e. in the form of long-lasting dispositions of the mind and body; in the **objectified state**, in the form of cultural goods (pictures, books, dictionaries, instruments, machines, etc.); and in the **institutionalized state**, a form of objectification which must be set apart because, as will be seen in the case of educational qualifications

Social capital: Social capital is the aggregate of the resources which are linked to possession of a durable network relationships of mutual acquaintance and recognition which provides each of its members with a collectively owned capital

Economic capital: material wealth & resources which can be used to derive the other forms of capital

Social theory of embodiment: Bourdieu's cultural capital

The objectified state of cultural capital: acquired books, music, educational diplomas

"The cultural capital objectified in material objects and media, such as writings, paintings, monuments, instruments, etc., is transmissible in its materiality"

The institutionalised state of cultural capital: Institutional recognition of objectified forms of cultural capital such as certain types of qualifications or institutional positions

The embodied state of cultural capital:

"Most of the properties of cultural capital can be deduced from the fact that, in its fundamental state, it is linked to the body and presupposes embodiment… Like the acquisition of a muscular physique or a suntan, it cannot be done at second hand"

Social theory of embodiment: Bourdieu's cultural capital

The embodied state of cultural capital:

Let's unpick the example of « suntan » in terms of a social-to-biologcal phenomenon & go beyond Bourdieu's reference to the body using Krieger's notion of embodiment « under the skin »…

Cultural capital: example

Bourdieu's example of suntan: a social-to-biological rationale

- Social structure & labour market: some people exposed to working (formally or informally) outdoors
- Social structure leads to behaviours: socially desirable outdoor activities (golf, tennis…) or indoor activities (music concert, studying…)
- Being outdoors exposes human skin to ultra violet (UV) light from the sun
- Human epidermal cells responds to UV light biologically by producing melonin
- Depending on genetic characteristics people may: a) have an allergic reaction to UV exposure; b) sunburn as a result of damaged skin cells c) melanin produces a darkening of the skin d)…
- Context dependent social « status » of skin colour: based on socio-historical context having « a tan » may be perceived as low social status, or high social status… (France vs Japan)

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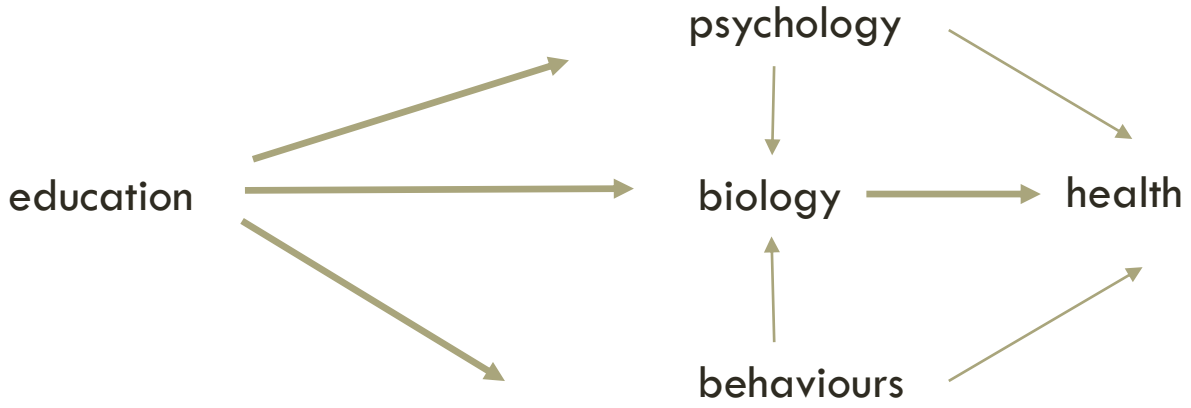
Social theory

Biologically plausible phenotype

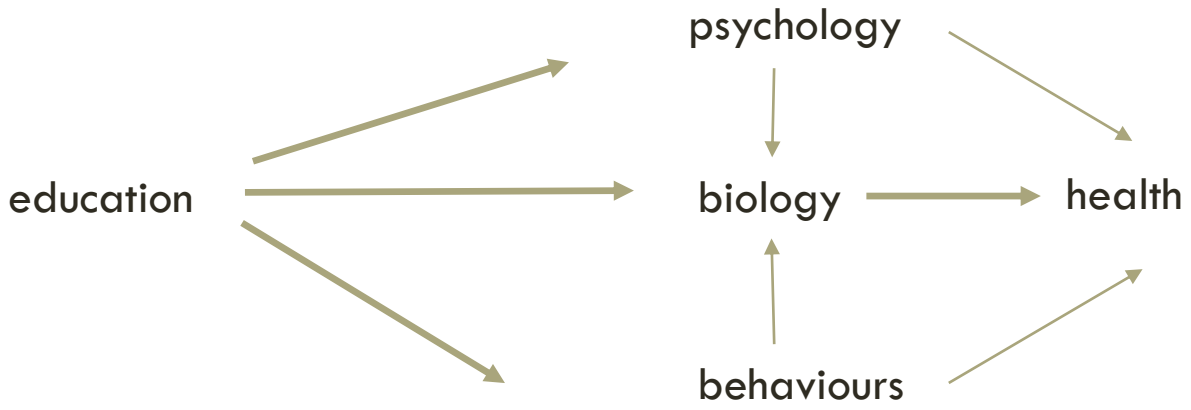
Contextually-dependent interpretation

The theoretical backdrop of a social-to-biological question



The theoretical backdrop of a social-to-biological question

Elder, Lifecourse principles



The theoretical backdrop of a social-to-biological question

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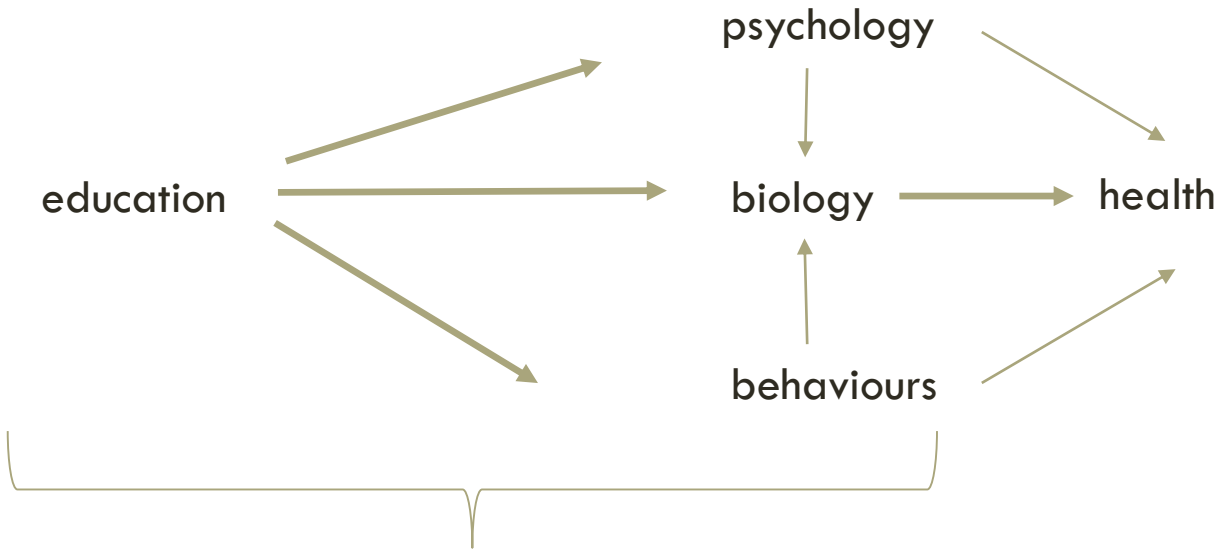
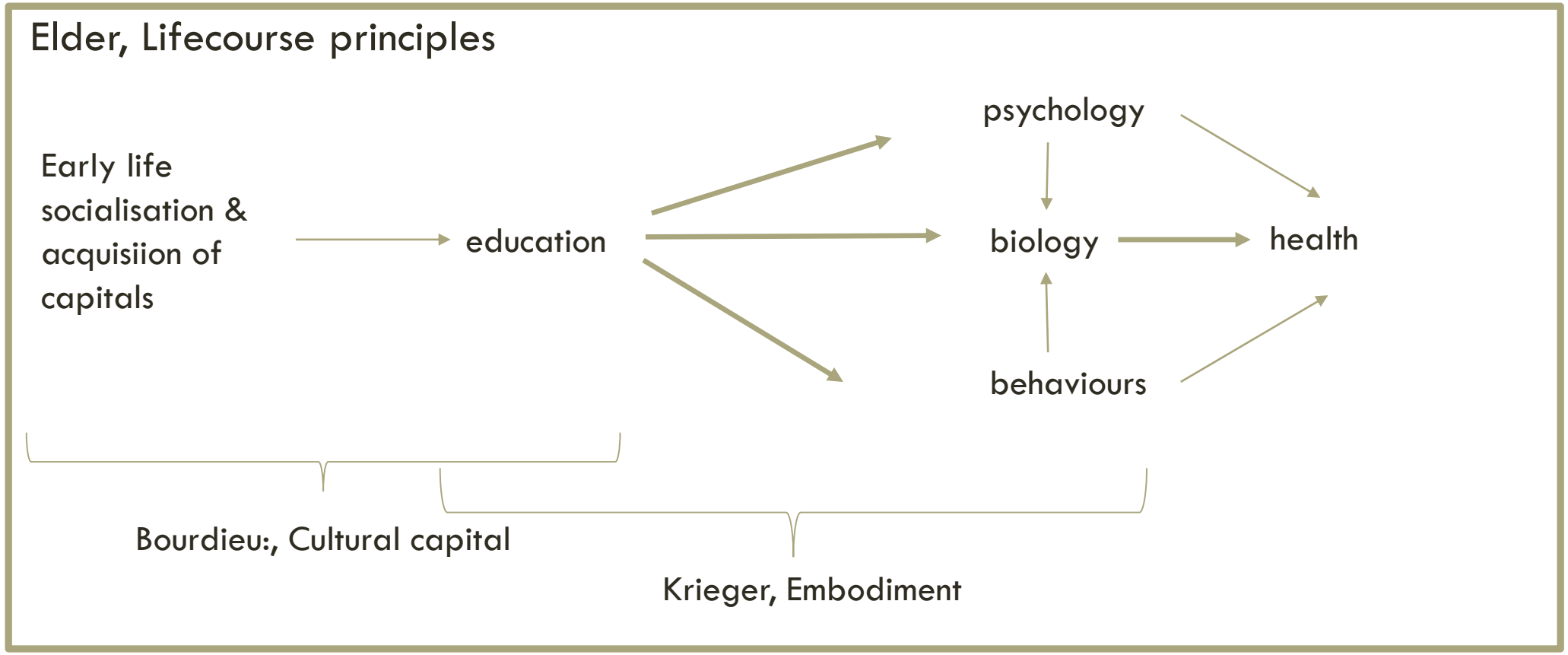


Krieger, Embodiment

The theoretical backdrop of a social-to-biological question



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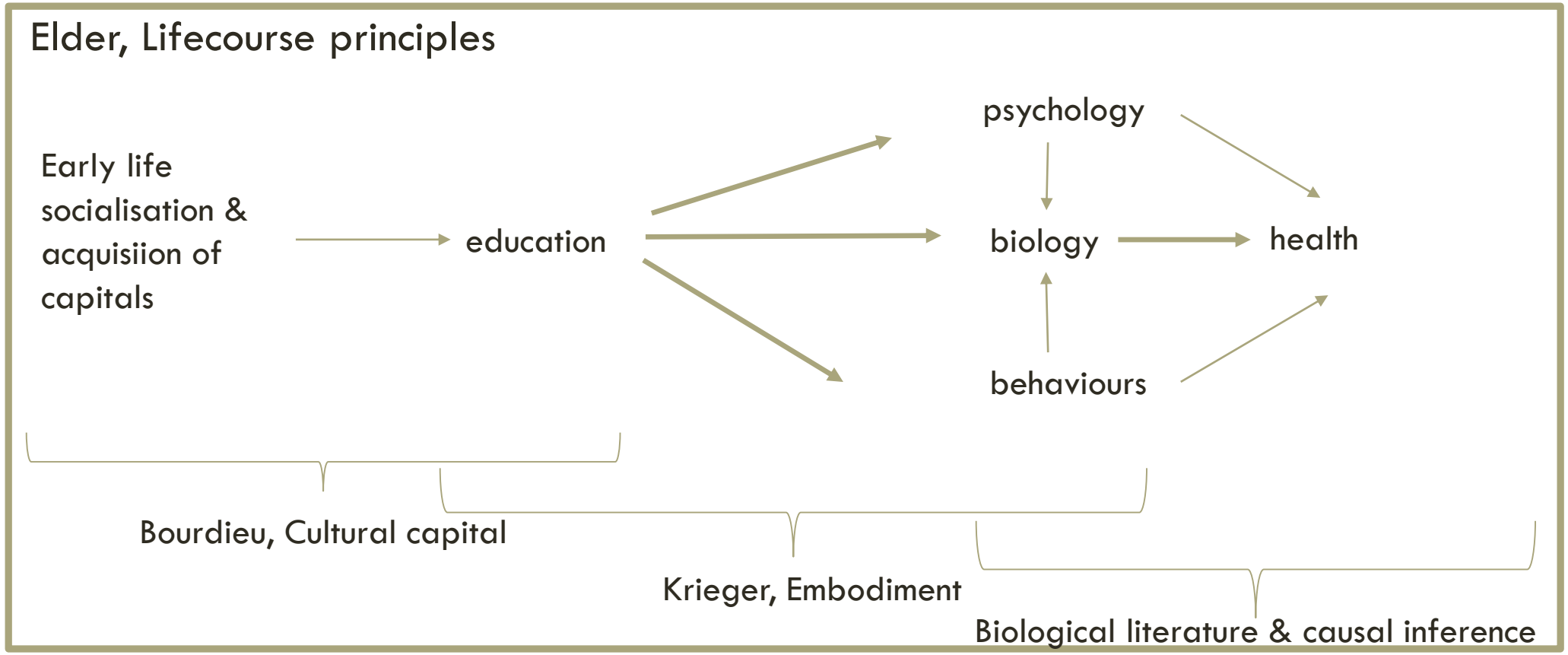


Using theory: New research question

- Does cultural capital acquired in childhood affect educational trajectories and biological health?

- Concept of educational acculturation (Lahire 2019): where cultural capital from the family sphere comes into contact with the expectations within the educational sphere

- Consonance or dissonance between the family & school spheres may affect educational trajectories & physiological wear-and-tear

Anxieties of a researcher…

All research is riddled with limitations, and mistakes…

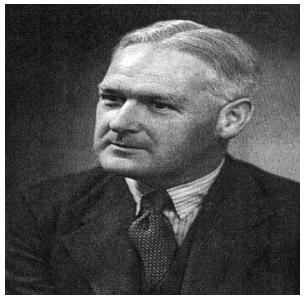
- Biases: survivor, recall, selection
- What **are** we measuring?
- How much biological detail to go into?
- Lack of biological data across childhood
- Harmonisation of data versus detailed specific variables?

Conceptual frameworks, theory & methods

- Offer a structuring & reassuring backdrop
- Finding the framework that suits you will facilitate your selection of methods & data
- When you do go down a rabbit hole (literature, methods etc), the framework will be there to guide you back

Thank you!

Causality: Bradford-Hill's principles



- Temporal sequence
- Strength of association
- Dose response relationship
- Replication
- Biological plausibility
- Alternative explanations
- Cessation of exposure
- Coherence with other knowledge
- Specificity

Piecing together sources of evidence: depth & breadth

Depth: taking a deep dive

Detailed descriptive data, collected repeatedly, appreciation of context, thoughts about mechanisms, meaning & interpretation:

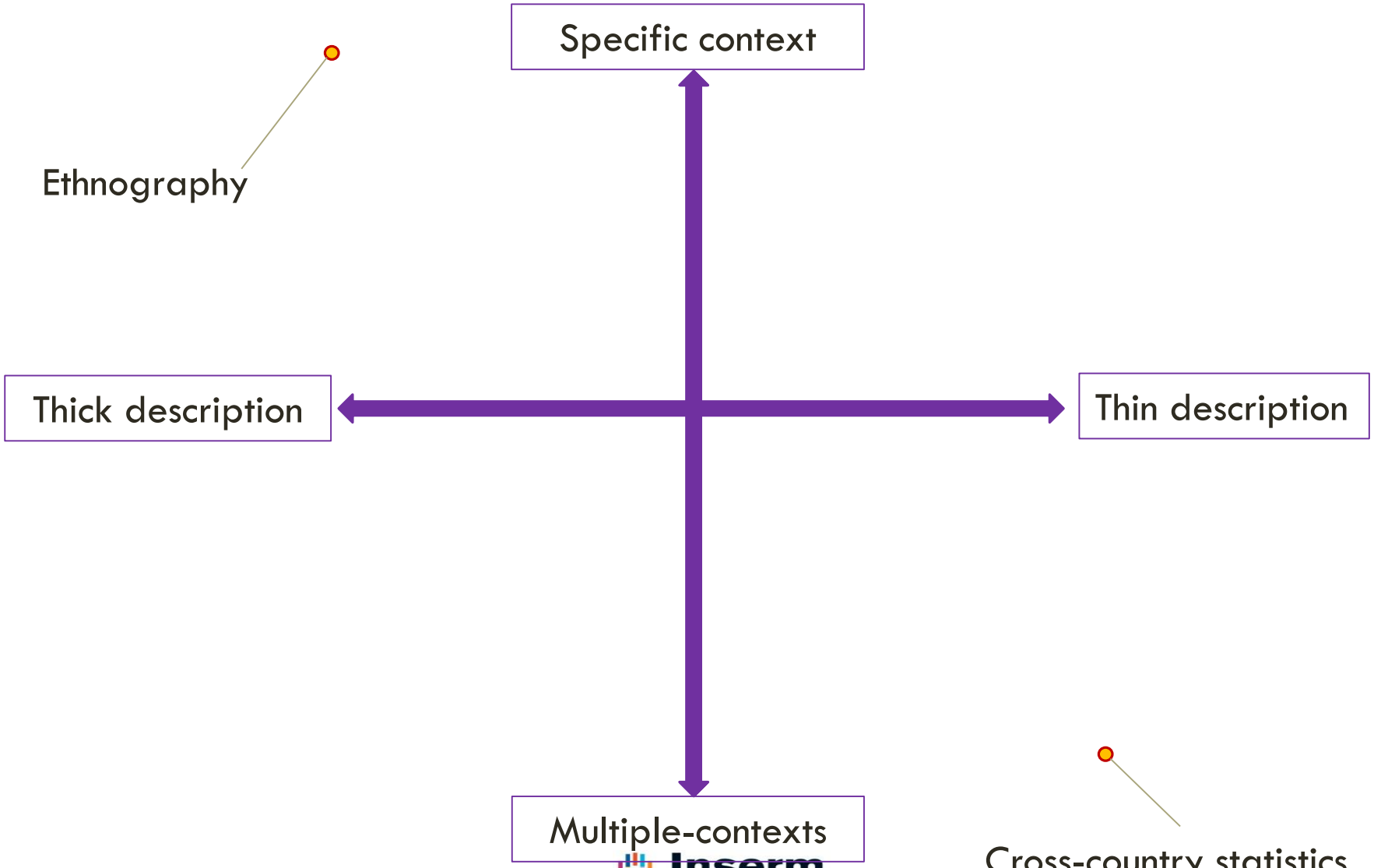
Thick description (Geertz 1973) – context-specific

Breadth: scanning across contexts

Harmonised data across contexts, countries, time & place, trends or changes across context:

Thin description – across multiple contexts

Depth & breadth: triangulation



Depth & breadth: triangulation