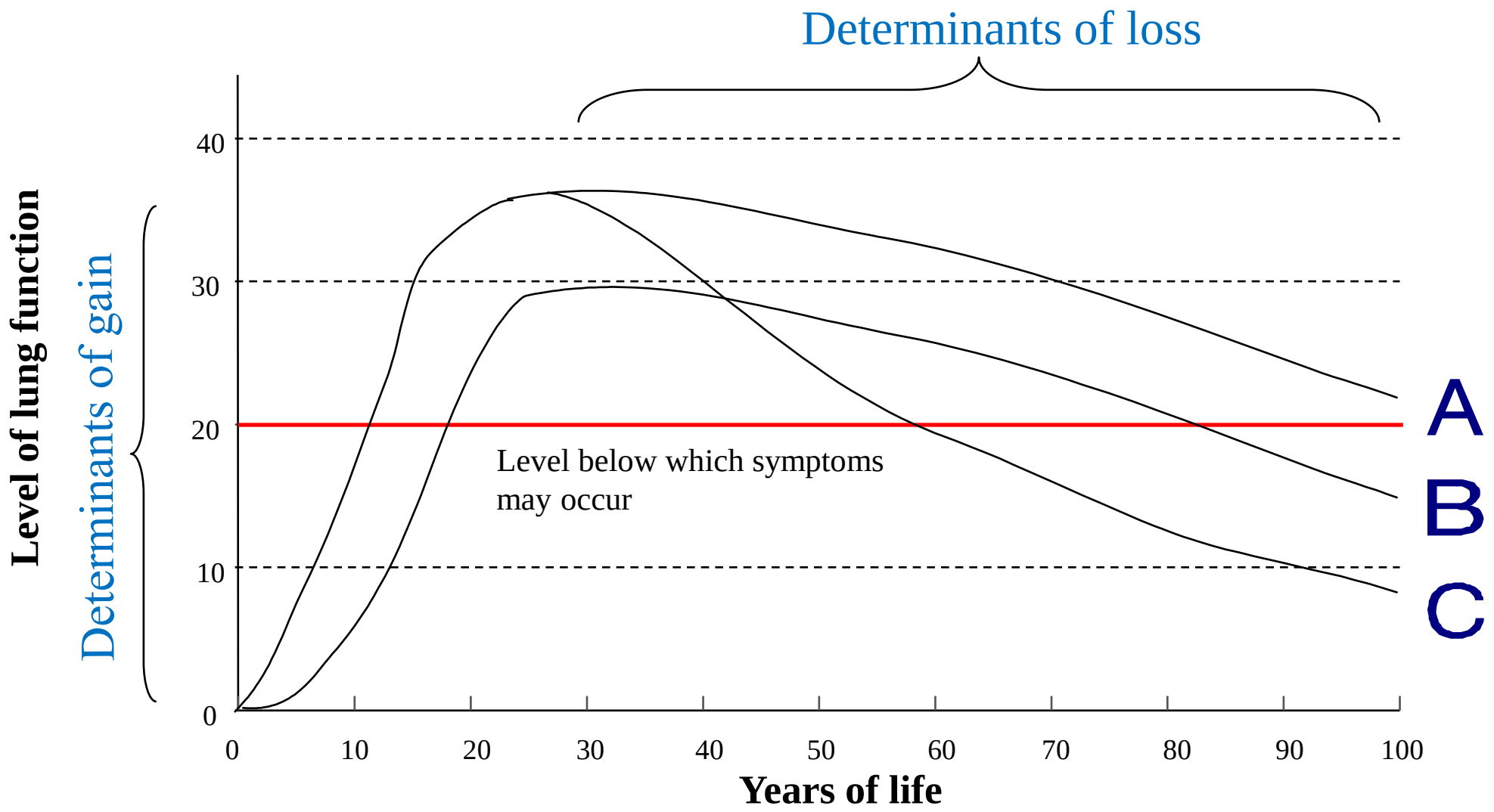
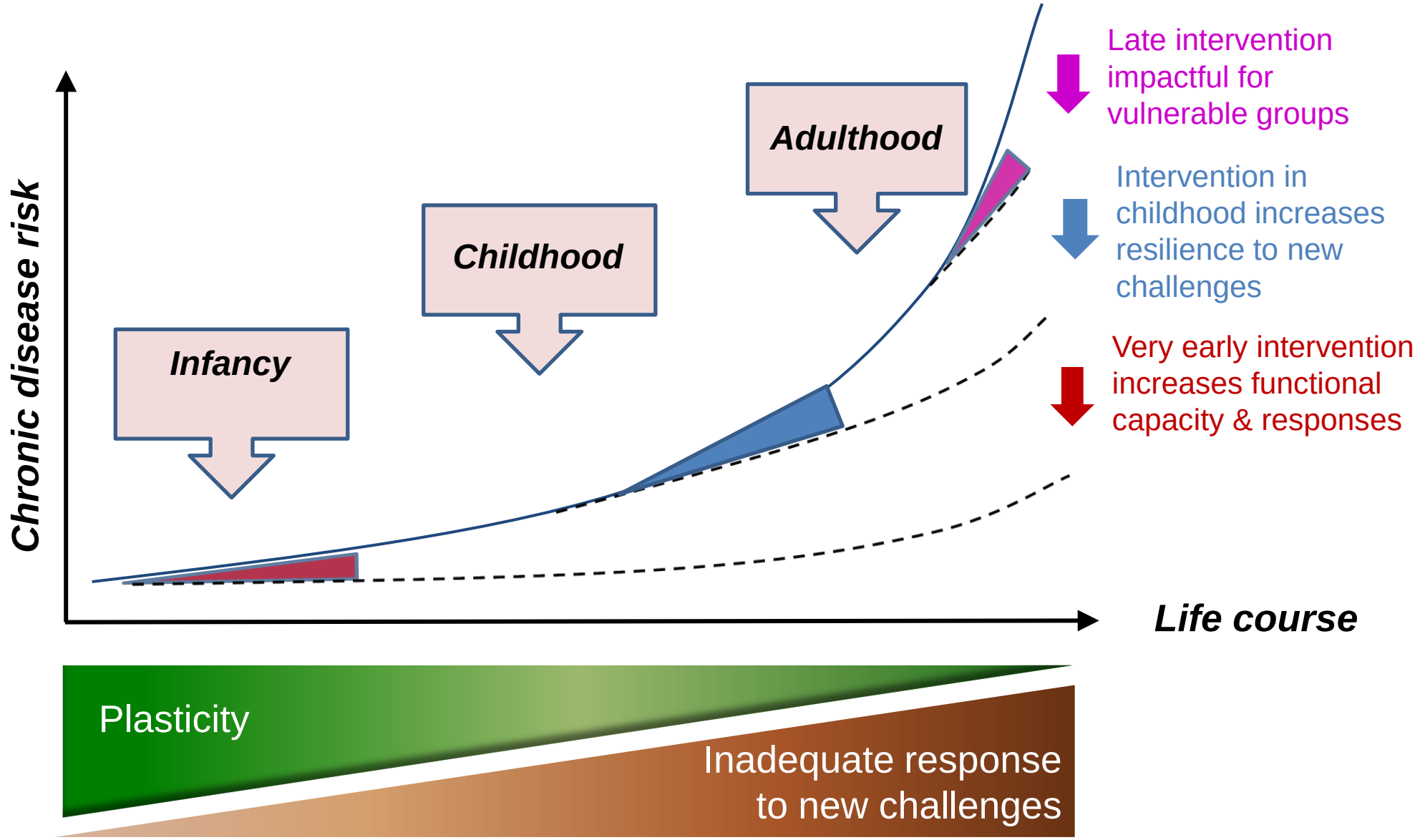
An introduction to the lifecourse

Health or Functioning Trajectories – Development & Decline



taken from Strachan (1997)

Lifecourse strategy for disease prevention



Adapted from Godfrey et al DOI: http://dx.doi.org/10.1016/j.tem.2009.12.008

“The life course may be regarded as combining biological and social elements which interact with each other. Individuals' biological development takes place within a social context which structures their life chances, so that advantages and disadvantages tend to cluster cross-sectionally and accumulate longitudinally.”

-- Bartley, Blane & Montgomery *BMJ* 1997

Life course epidemiology is defined as the study of long term effects on later health or disease risk of physical or social exposures during gestation, childhood, adolescence, young adulthood and later adult life.

Ben-Shlomo Y, Kuh D. Int J Epidemiol 2002;31:285–93

Why is time important?

- Temporality - establishing the timing of events – before & after – in ‘causal’ associations.
- Dose/duration of ‘exposure’ may be important
- Biological development & decline – different responses depending on when events occur
- Historical - changes in social norms over time influence behaviours, social relations and psychological reactions.

Socially critical periods in human development

- Transitions into and through education
- School examinations
- Entry to labour market
- Leaving parental home
- Establishing own residence
- Transition to parenthood
- Job insecurity, change, or loss
- Onset of chronic illness
- Exit from labour market

Bartley *et al*

Lifecourse epidemiological models

- Critical or sensitive periods
- Accumulation of risk
- Pathways or chains of risk

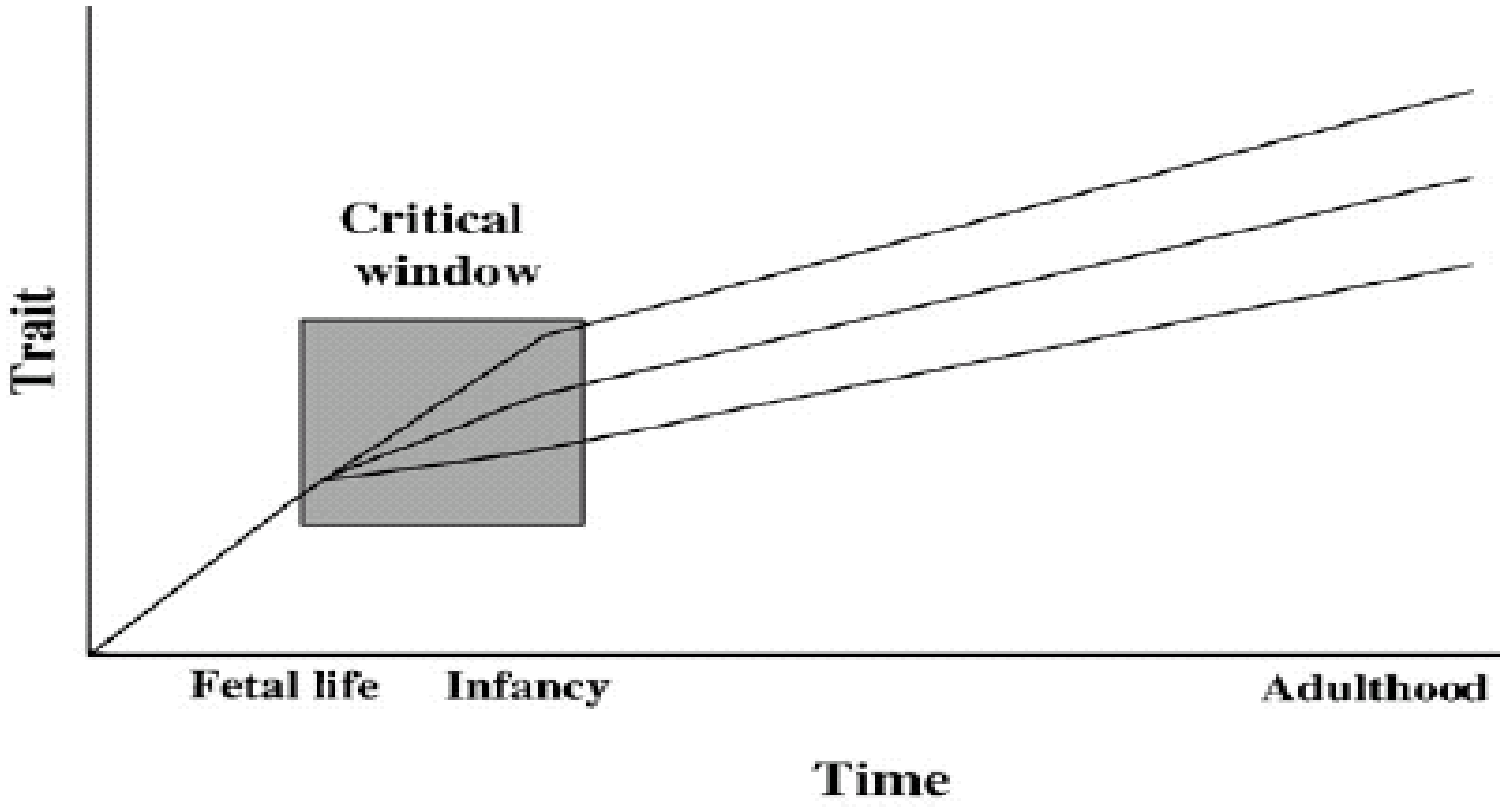


FIG. 1. Diagrammatic representation of programming. Phenotypic variation manifesting during an early window of plasticity is preserved into later life.

Wells (2003) *J. Theor. Biol.* **221**:143-61

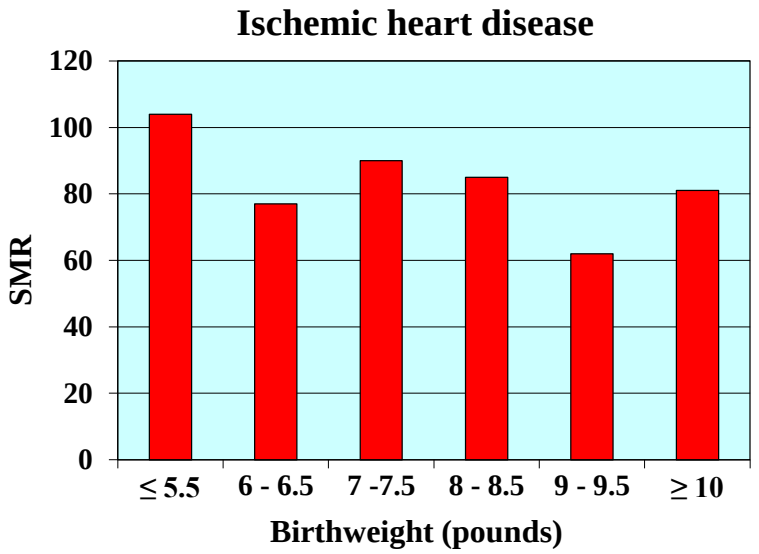
Lifecourse epidemiology: Barker's Fetal origins/biological programming hypothesis

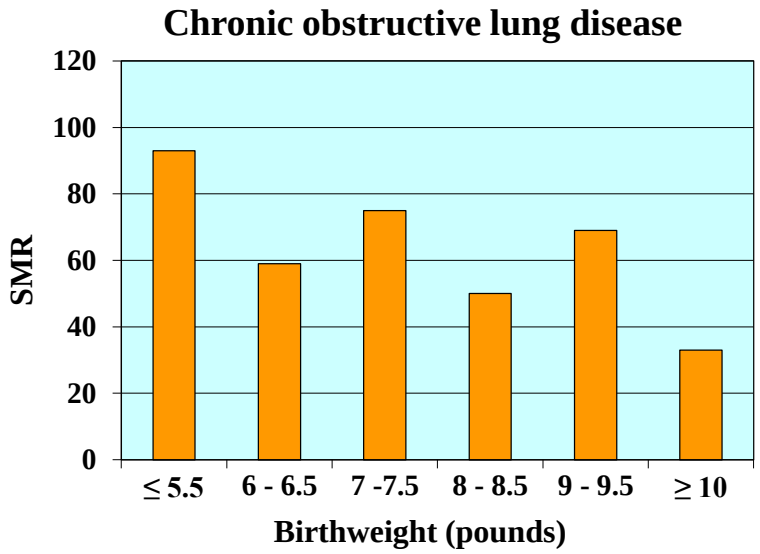
"the process whereby a stimulus or insult during critical periods of development has lasting or lifelong effects on the structure or function of organs, tissues and body systems"

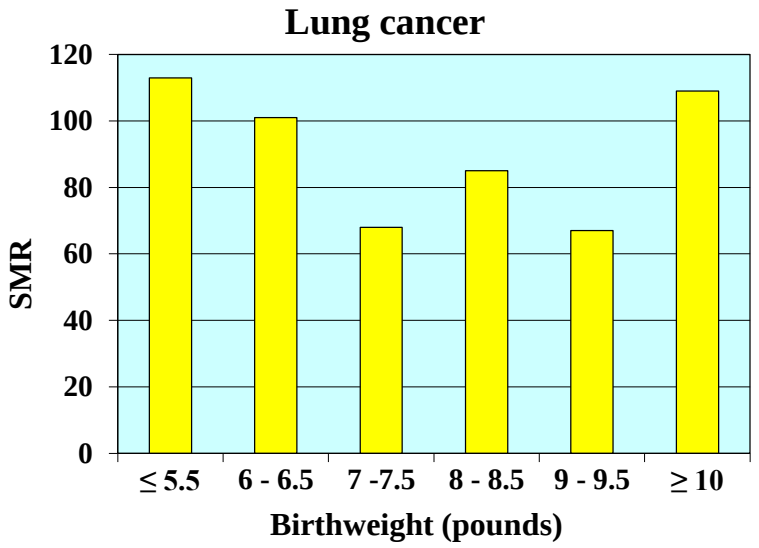
Critical period – a limited time period during which an exposure has an effect. For example:

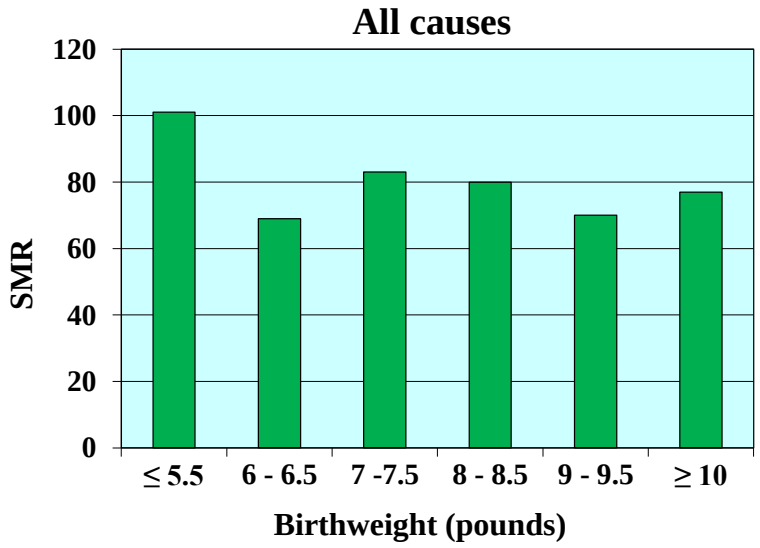
- Thalidomide and limb abnormalities
- Birth weight & adult chronic disease?

Standardised mortality ratios according to birthweight





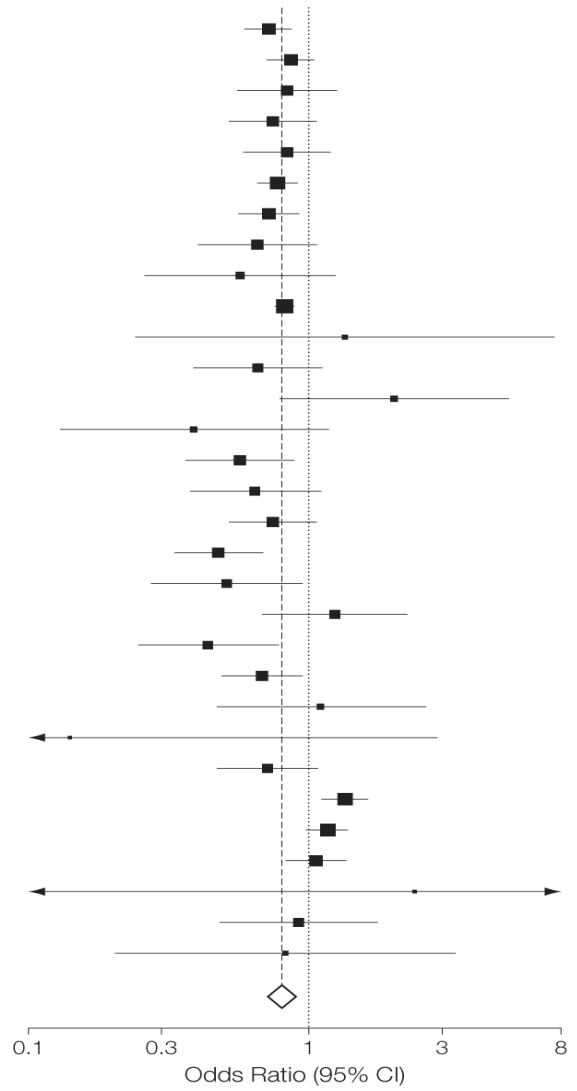




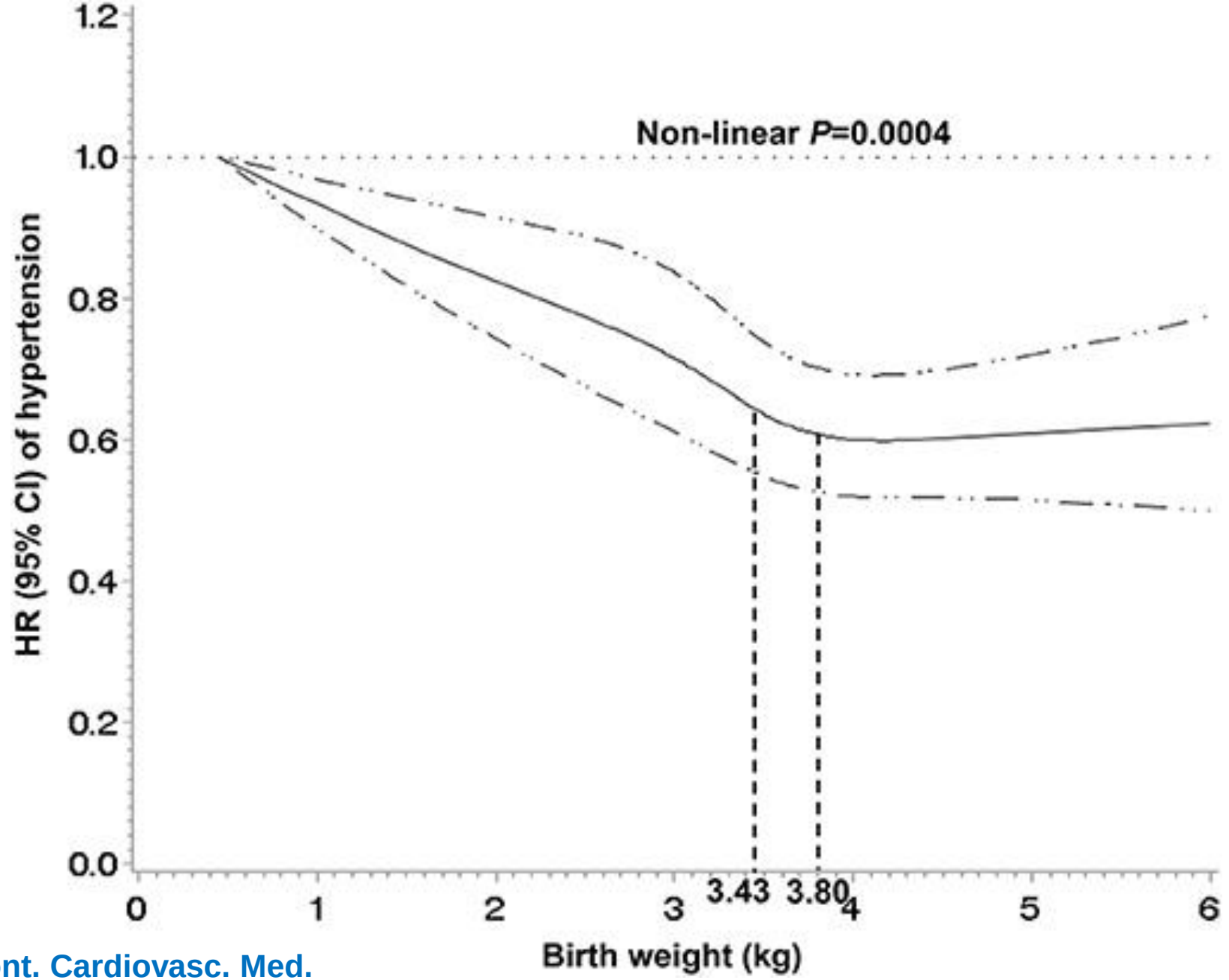
Barker *et al*, Lancet, 1989;2:577-80

Meta-analysis: birth weight significantly inversely associated with development of type 2 diabetes, not explained by social class.

Source	Age at Outcome, y	Odds Ratio (95% CI)	Weight, %
Forsén et al,[19] 2000	70	0.72 (0.60-0.87)	5.93
Lawlor et al,[25] 2003	68	0.87 (0.72-1.04)	5.90
Yarbrough et al,[37] 1998	67	0.84 (0.56-1.25)	3.53
Hales et al,[6] 1991, and Barker et al,[7] 1993	64	0.75 (0.53-1.06)	4.01
Jeffreys et al,[23] 2006	63	0.84 (0.59-1.20)	3.95
Curhan et al,[13] 1996	62	0.78 (0.67-0.91)	6.24
Eriksson et al,[16] 2003	60	0.72 (0.57-0.92)	5.19
Lithell et al,[26] 1996	60	0.66 (0.41-1.06)	2.86
De Rooij et al,[14] 2006	58	0.57 (0.26-1.23)	1.46
Rich-Edwards et al,[31] 1999	58	0.82 (0.77-0.89)	7.00
Huxley and Neil,[21] 2004	55	1.36 (0.24-7.55)	0.35
Wadsworth et al,[36] 2005	53	0.66 (0.39-1.12)	2.57
Martyn et al,[27] 1998	52	2.03 (0.79-5.19)	1.05
Phipps et al,[30] 1993	52	0.39 (0.13-1.17)	0.81
Eriksson et al,[17] 2004	50	0.57 (0.37-0.88)	3.16
Anazawa et al,[8] 2003	50	0.65 (0.38-1.09)	2.52
Birgisdottir et al,[10] 2002	49	0.75 (0.53-1.05)	4.02
Lawlor et al,[24] 2006	49	0.48 (0.34-0.68)	3.95
Vanhala et al,[35] 1999	47	0.51 (0.28-0.94)	2.06
Fall et al,[18] 1998	47	1.24 (0.69-2.25)	2.17
Tian et al,[34] 2006	46	0.44 (0.25-0.77)	2.31
Carlsson et al,[12] 1999	46	0.68 (0.50-0.94)	4.32
Mi et al,[29] 2000	45	1.11 (0.48-2.59)	1.24
Shiell et al,[32] 2000	43	0.14 (0.01-2.87)	0.12
Hyppönen et al,[22] 2003	41	0.71 (0.47-1.08)	3.41
Dyck et al,[15] 2001[a]	32	1.35 (1.13-1.62)	5.94
Dyck et al,[15] 2001[b]	32	1.17 (1.00-1.38)	6.18
McCance et al,[28] 1994	30	1.06 (0.84-1.35)	5.25
Hulman et al,[20] 1998	29	2.41 (0.06-89.31)	0.08
Bhargava et al,[9] 2004	29	0.92 (0.49-1.76)	1.93
Suzuki et al,[33] 2000	22	0.83 (0.21-3.34)	0.52
Overall (random-effects model) $I^2 = 66\%$; $P<.001$		**0.80 (0.72-0.89)**	**100.00**



Whincup et al. JAMA 2008

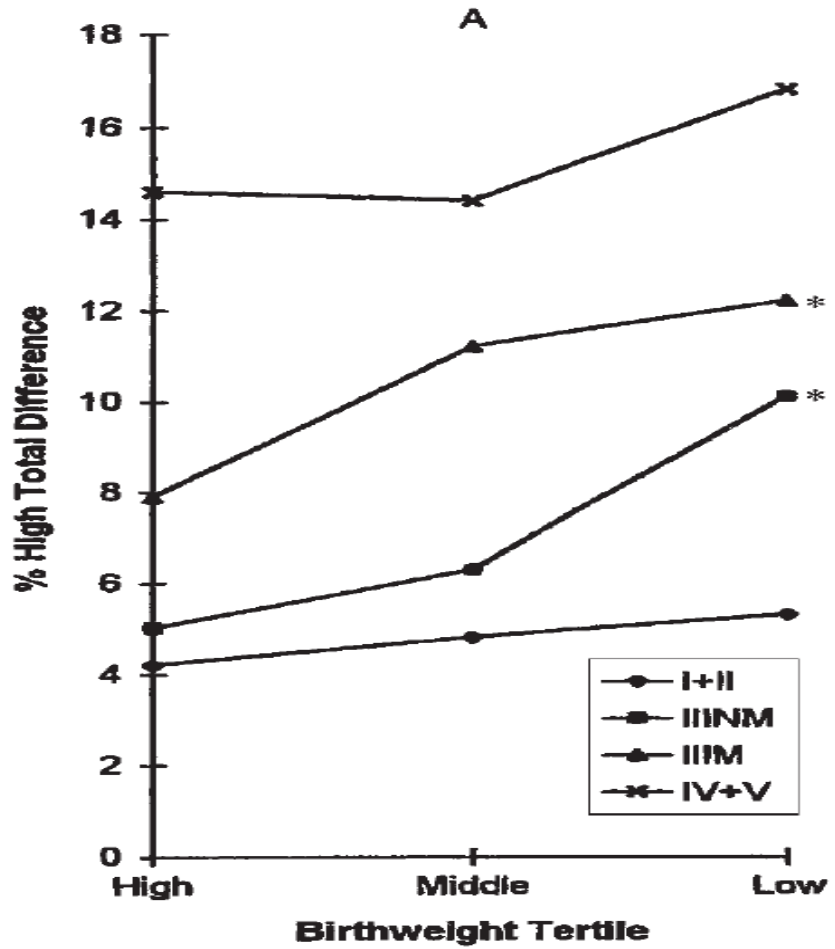


Zhang et al 2021 Front. Cardiovasc. Med.

Effect modification

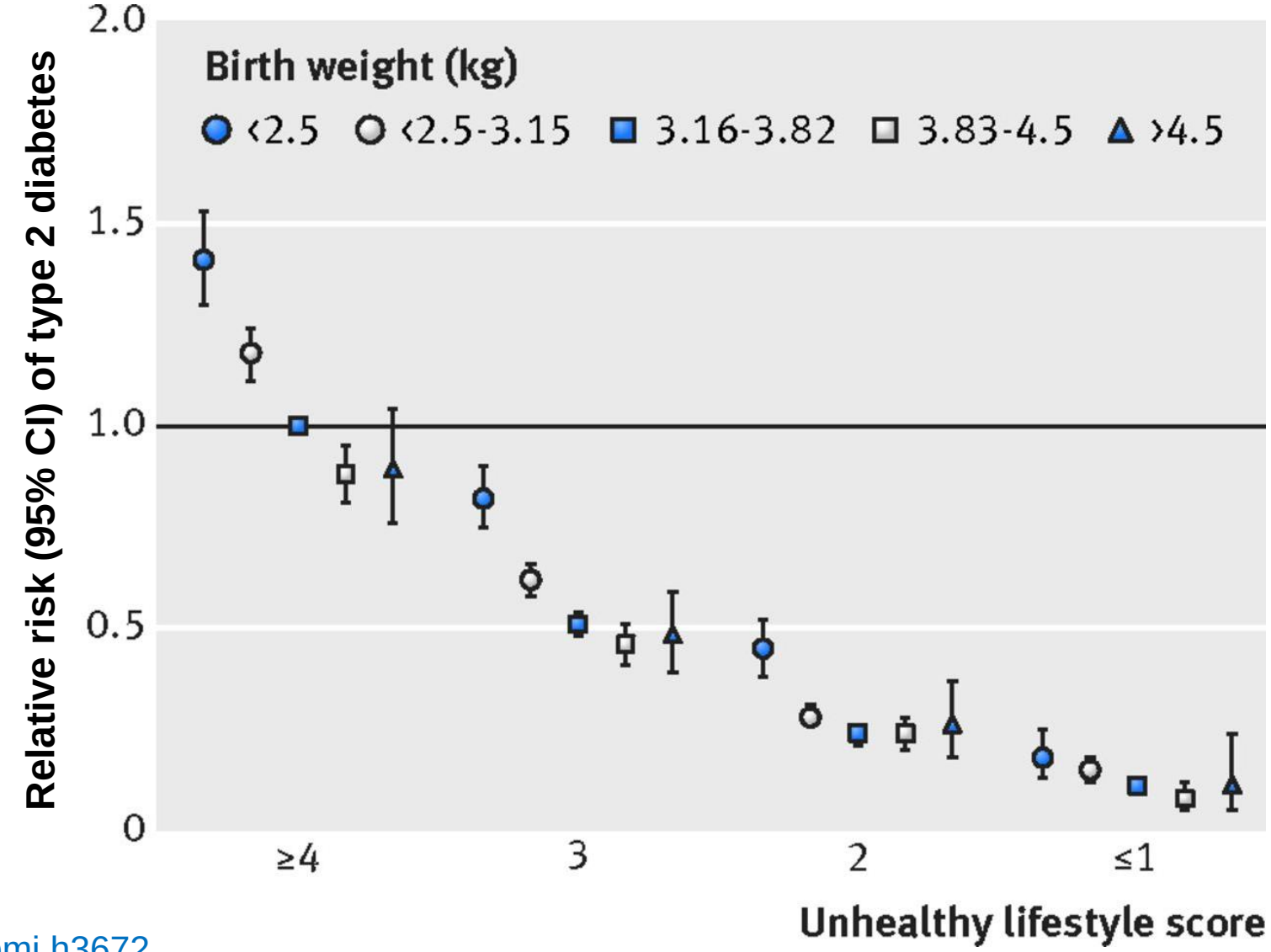
The ‘effect’ of a (early life) risk factor depends on the level of a (later life) factor e.g. social context

Prevalence of high total difficulties, hyperactivity and peer relationship problems by social class and birthweight tertile



Kelly *et al*. *Int J Epidemiology* 2001;30:88-94

Multivariate relative risks of type 2 diabetes according to joint categories of birth weight and unhealthy lifestyle based on the pooled data from three cohorts (Health Professional Follow-up Study 1986-2010, Nurses' Health Study 1980-2010, Nurses' Health Study II 1991-2011).



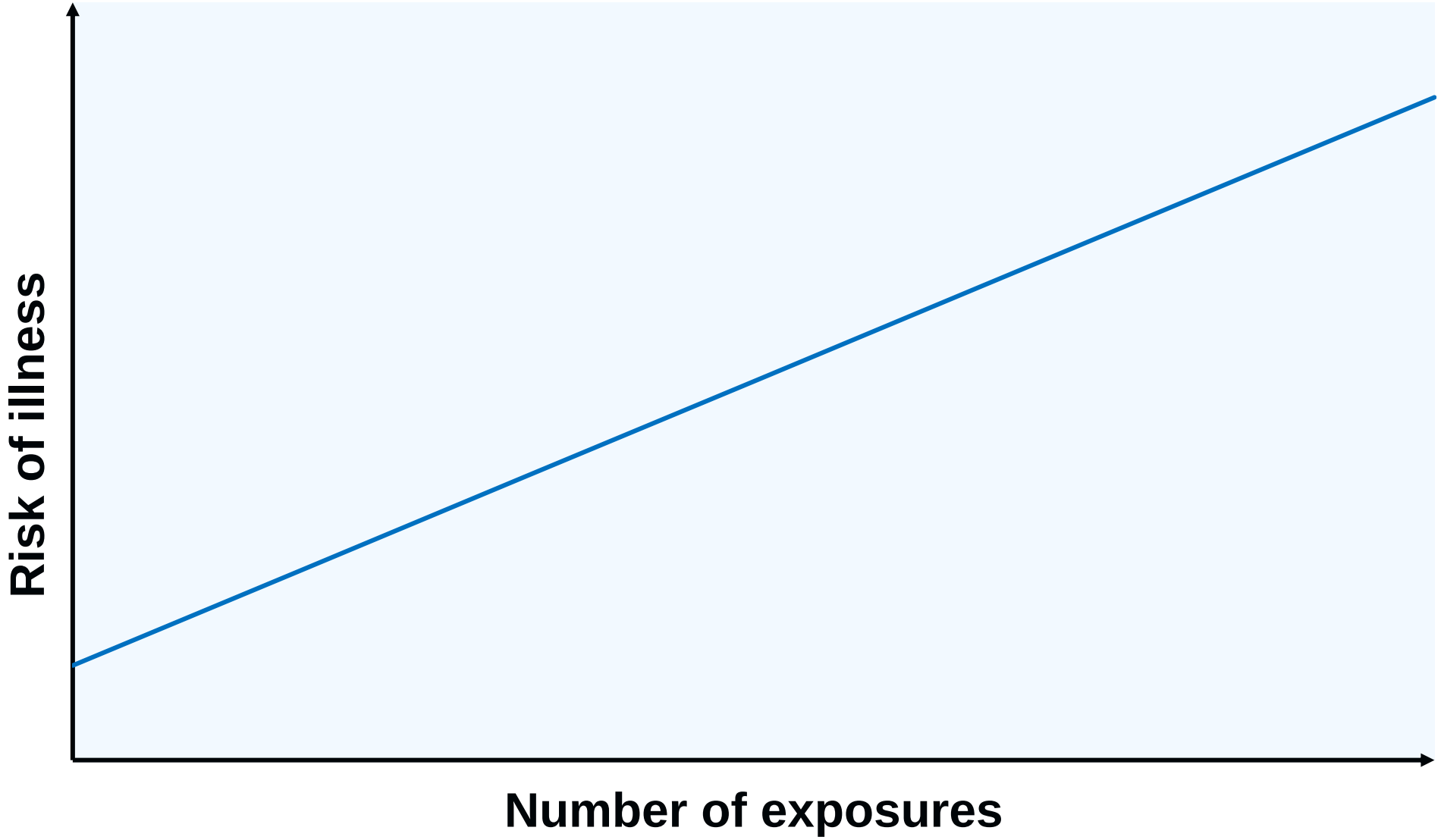
Li et al. BMJ 2015;351:bmj.h3672

Accumulation of risk

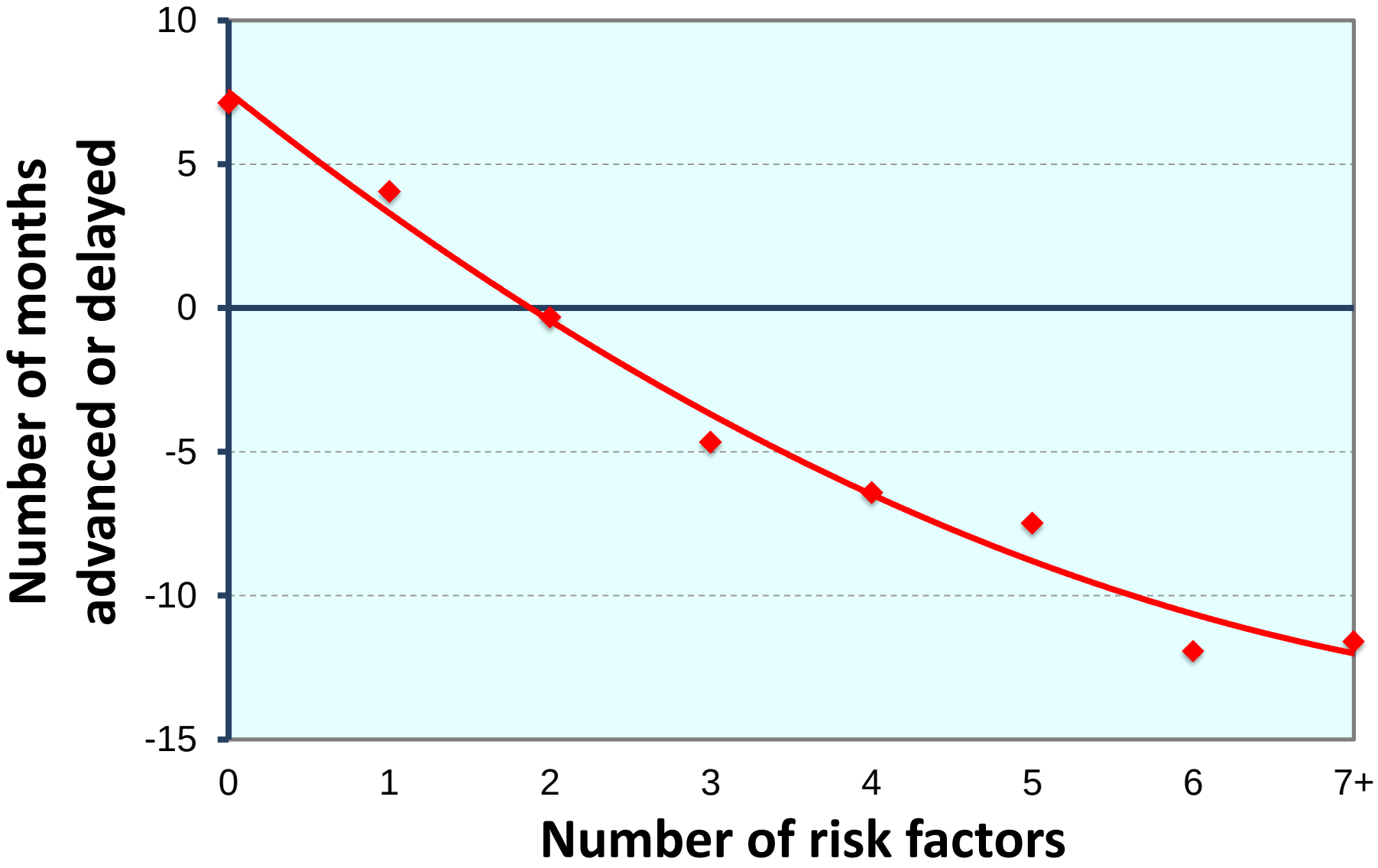
Life course exposures or insults gradually accumulate through episodes of illness and injury, adverse environmental conditions and health damaging behaviour

Kuh et al *JECH* (2003)

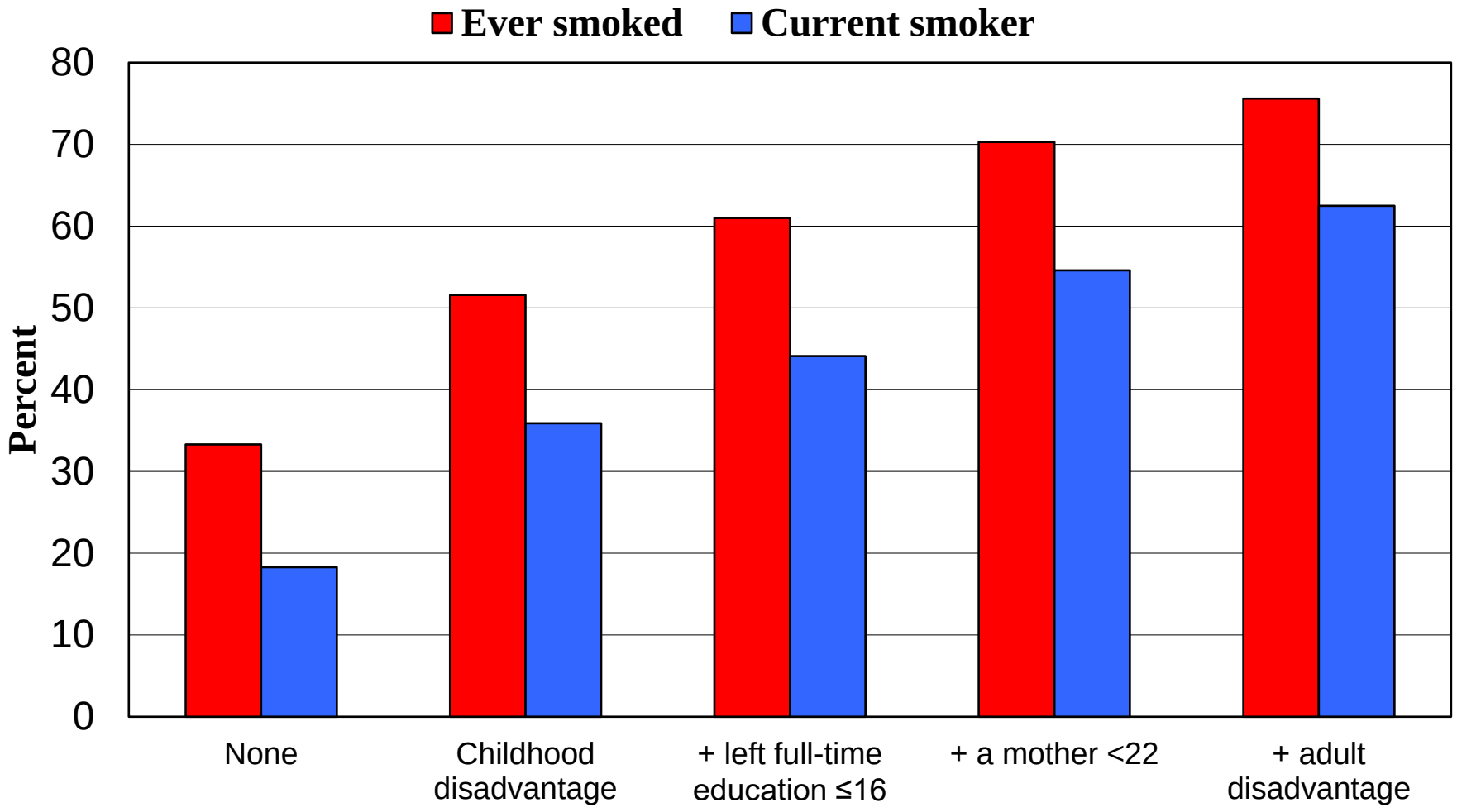
Accumulation



Verbal months ahead or behind at age 3 by number of risk factors

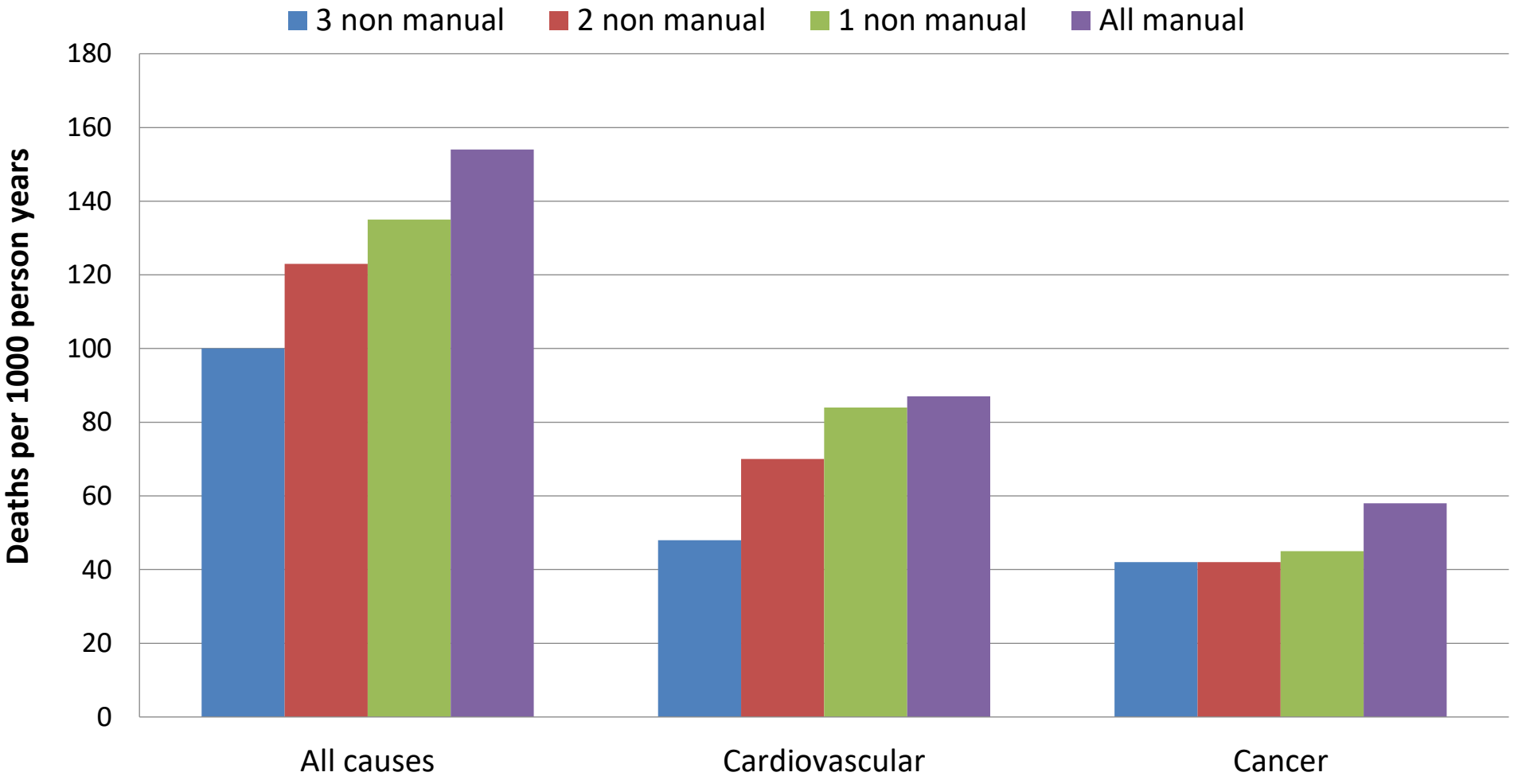


Disadvantaged trajectories and smoking status of women aged 22-34, England, 1998-2002



Graham *et al*. JECH 2006;60:7-12

Mortality by occupation of father and own occupation at 2 time points in adulthood



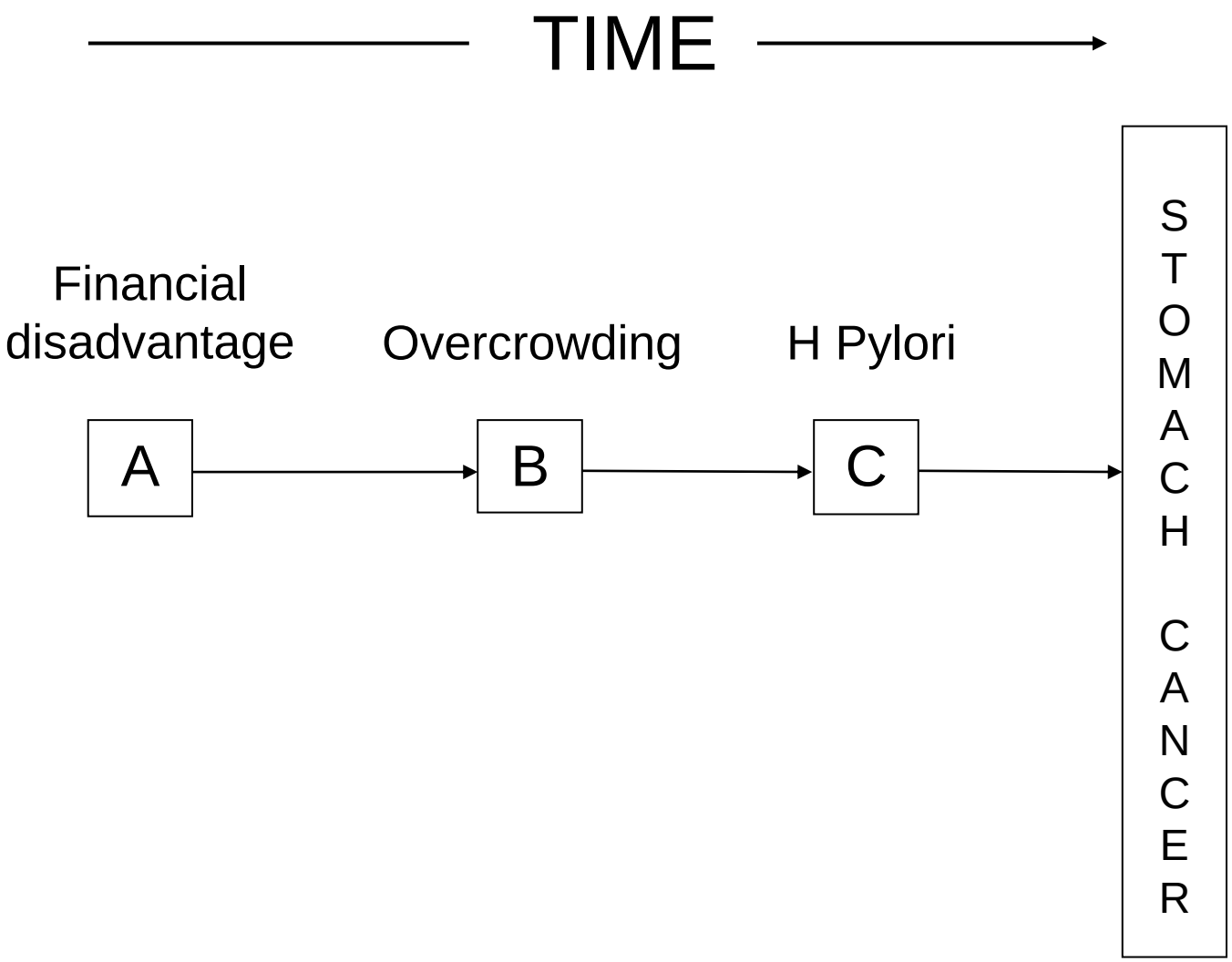
Davey Smith *et al. BMJ* 1997; 314:547-52

Pathways/chains of risk

"The impact of some factor in childhood may lie less in the immediate behavioural change it brings about than in the fact it sets into motion a chain reaction in which one 'bad' thing leads to another, or, conversely, that a good experience makes it more likely that another one will be encountered."

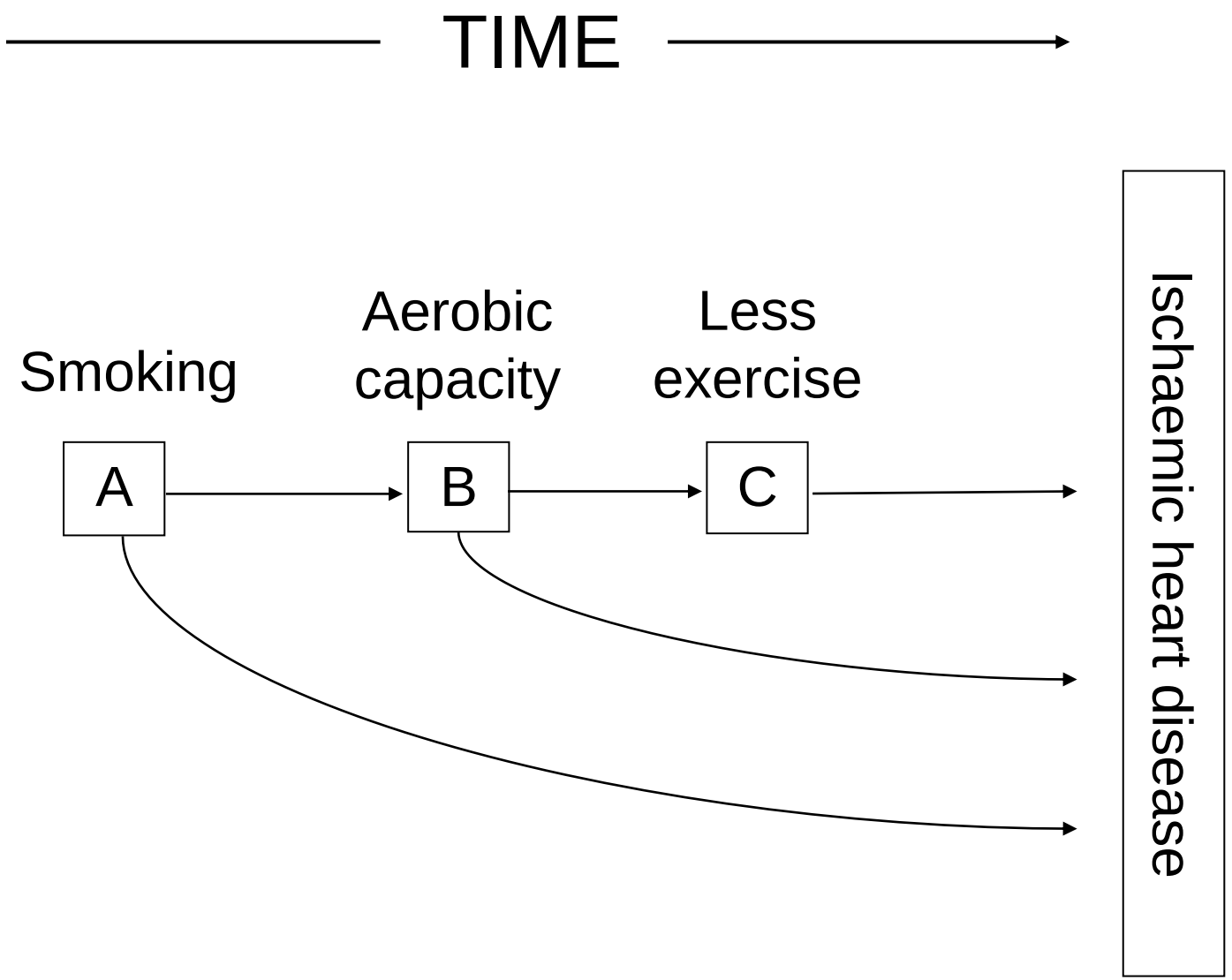
Rutter 1988

Chains of risk model



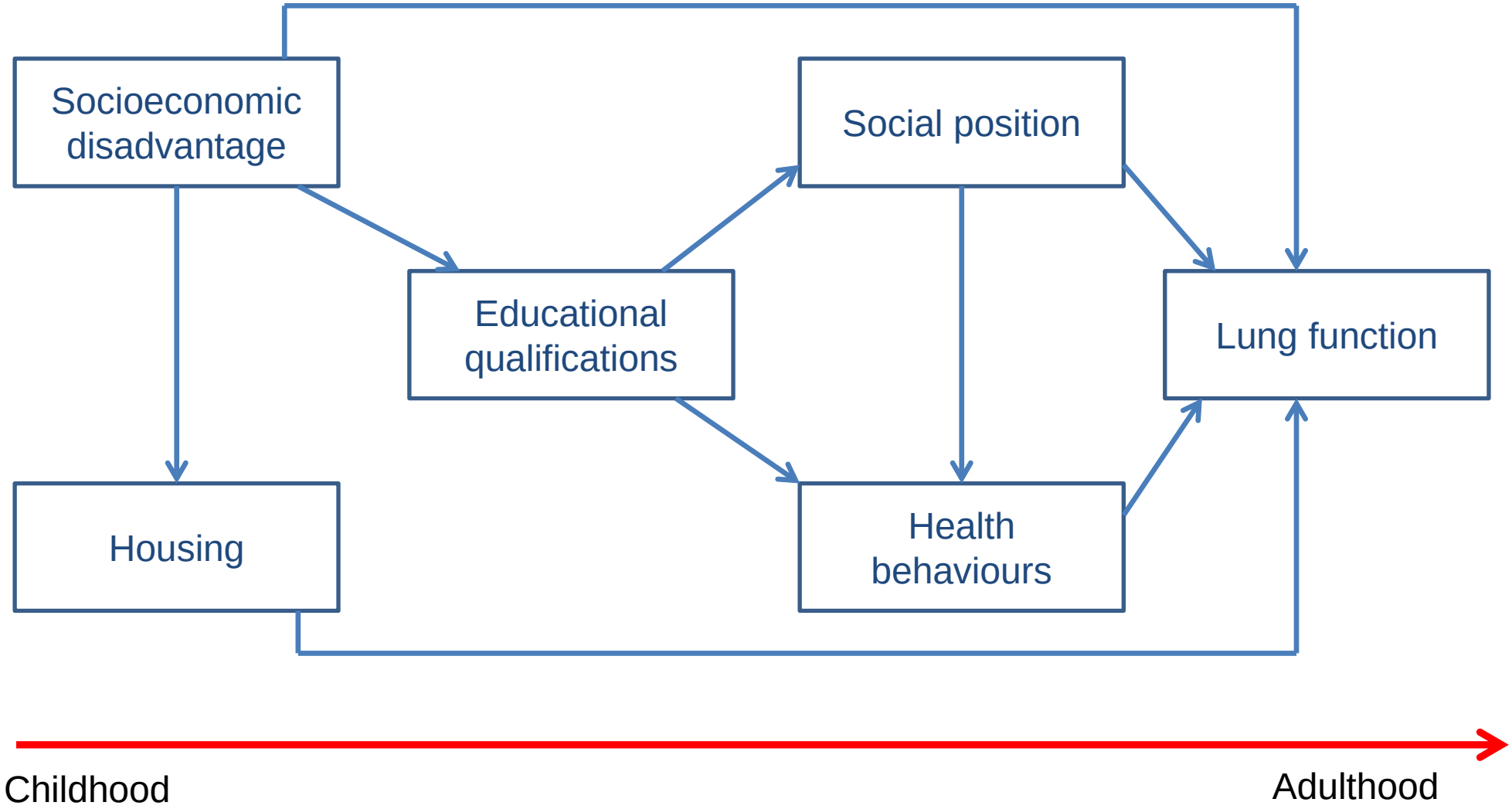
Kuh et al (JECH 2003)

Chains of risk model

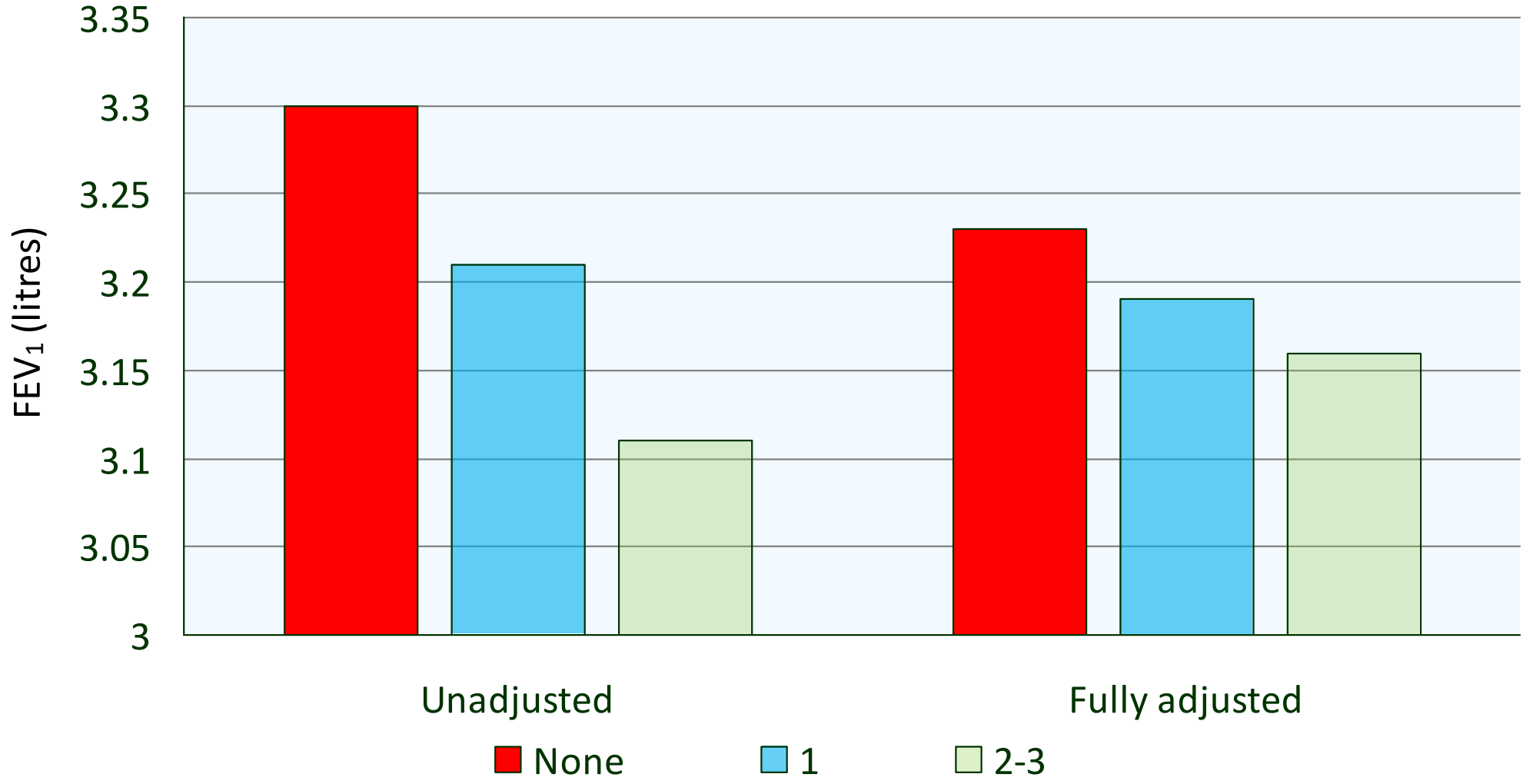


Kuh et al (JECH 2003)

Pathways model, using the example of the influence of childhood disadvantage on adult lung function



Mean FEV_1 in men and women in the 1958 cohort study by childhood financial adversity score



Bartley, Kelly, Sacker *Am J Epidemiol* 2012

The UK is world-leading in its wealth of data sources that follow people over their lives.

Birth Cohort Studies:

National Survey of Health & Development (NHSD) (born in 1946)

National Child Development Study (NCDS) (born in 1958)

British Cohort Study (BCS) born in 1970

Avon Longitudinal Study of Parents and Children (ALSPAC) 1990-1992

Millennium Cohort Study (MCS) born in 2000-2001

Born in Bradford (BiB) born 2007-2011

Early Child Cohort

Children of the 2020s

Panel Studies:

Understanding Society (UKHLS)

British Household Panel Study (BHPS)

English Longitudinal Study of Ageing (ELSA)

Health, Alcohol and Psychosocial factors in Eastern Europe (HAPIEE) Study

Occupational cohorts: Whitehall II (Stress and Health Study)

Twin studies: Gemini: Health and Development in Twins

Regional: Southall and Brent Revisited (SABRE)

ONS Longitudinal Study (LS)

UK Biobank

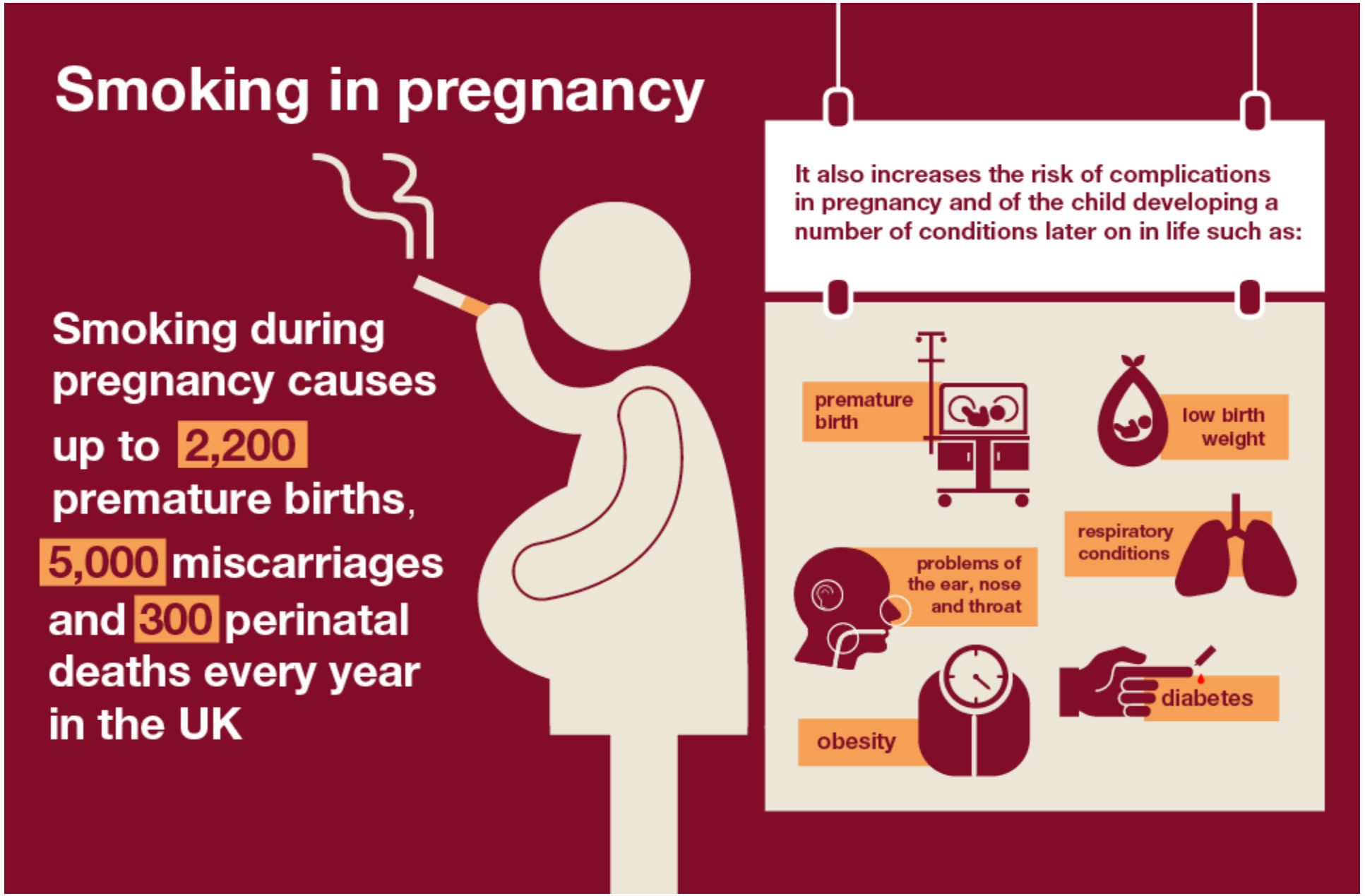
Cigarette smoking in pregnancy: its influence on birth weight and perinatal mortality

No. of cigarettes smoked per day	Death rate / 1000	Birth weight (kg)
0	32.0	3.386
1 – 4	38.5	3.295
5 – 9	42.2	3.204
10 – 19	41.6	3.208
20 – 30	41.2	3.175

Conclusion: ‘This evidence should have important implications for health education aimed at getting pregnant mothers to give up smoking’

Butler, Goldstein & Ross. BMJ 1972

Smoking in pregnancy



Public Health England (2016), Health matters: giving every child the best start in life.

Challenges in lifecourse research

- Requires information on same individuals (and their families) from across the whole lifecourse – expensive: time and money.
- Missing data – attrition can cause study to be biased or under-powered
- Measurement: changes over time; error/imprecision; unmeasured factors
- Conceptualising temporal relationships explicitly
- Modelling the reality of lifecourse complexity – how best to deal with repeat observations of dependent/outcome and independent/explanatory exposure measures & potential multiple interactive effects over time.
- Mixed methods can help to understand detail and motivation of processes.

Summary

- Time is key to understanding association between social & biological constructs & direction of association
- Age effects: development and decline
- Historical period effects → cohort differences.
- Lifecourse models
  - sensitive or critical periods;
  - accumulation: dose and duration;
  - pathways and chains of risk
- Plausibility - understanding how the social becomes biological.
- Complexity