A socio-ecological model of the double burden of malnutrition

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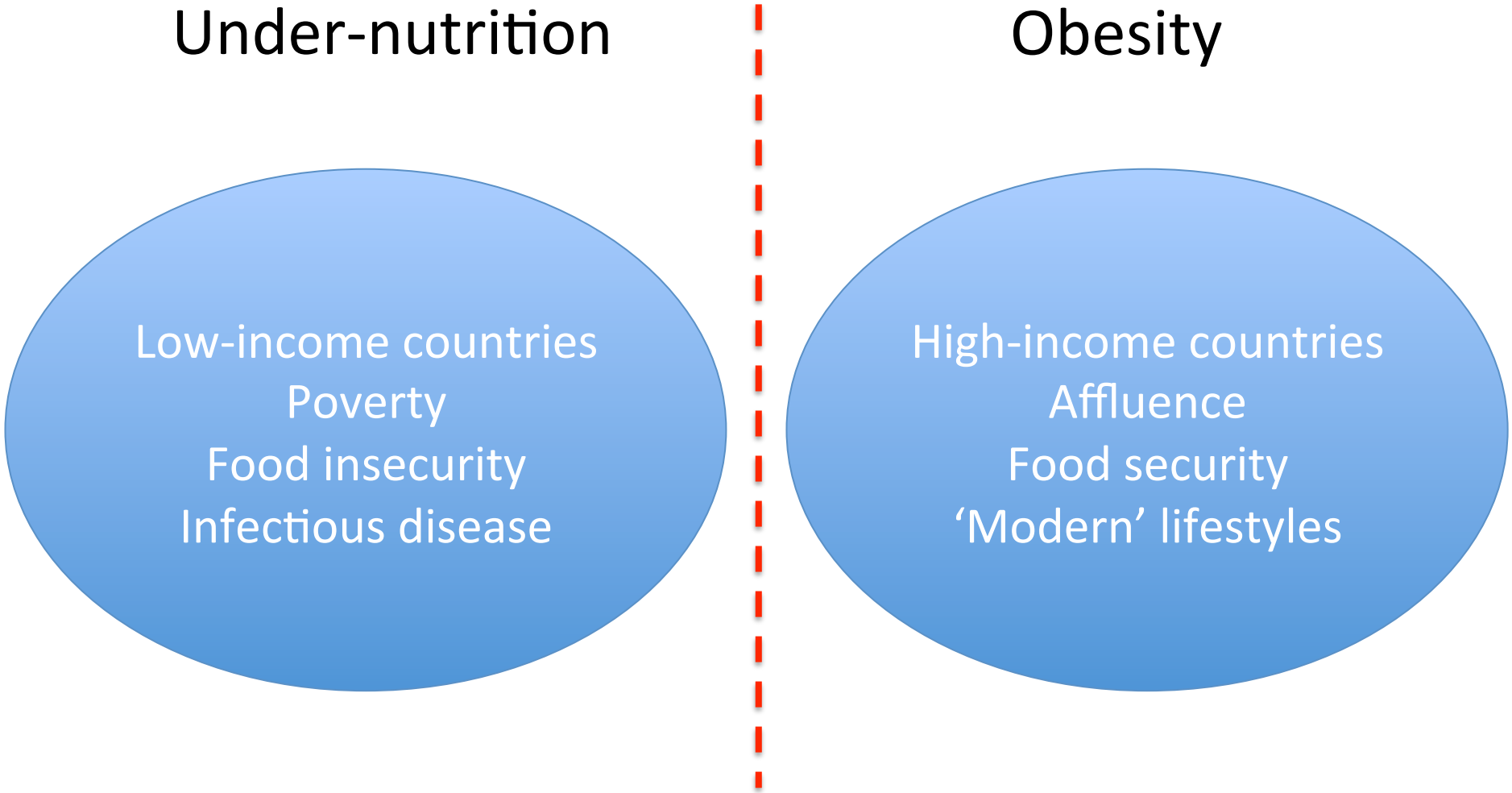
Looking backwards …



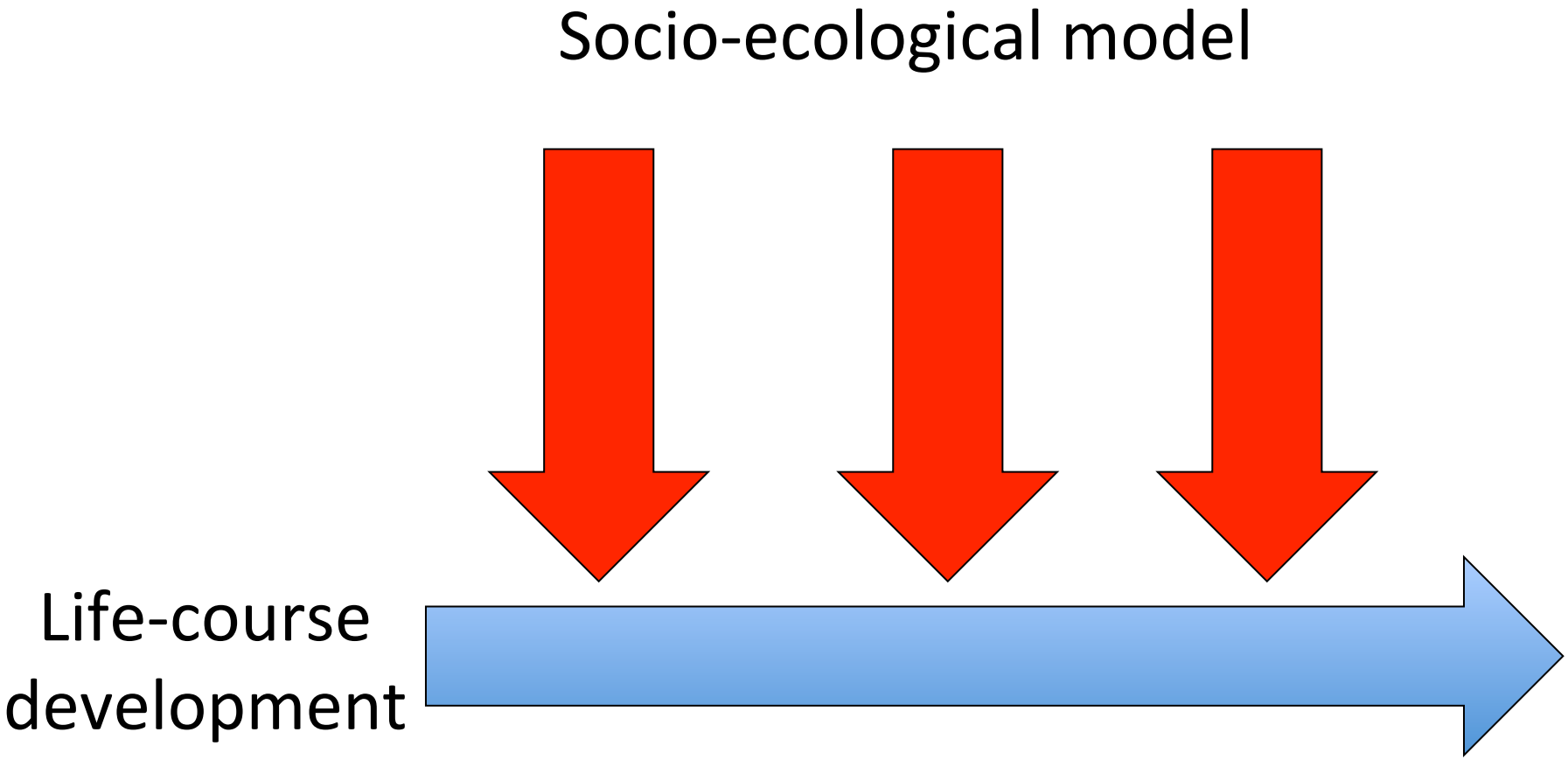
Evolving concept

- Obesity and under-nutrition co-occur:

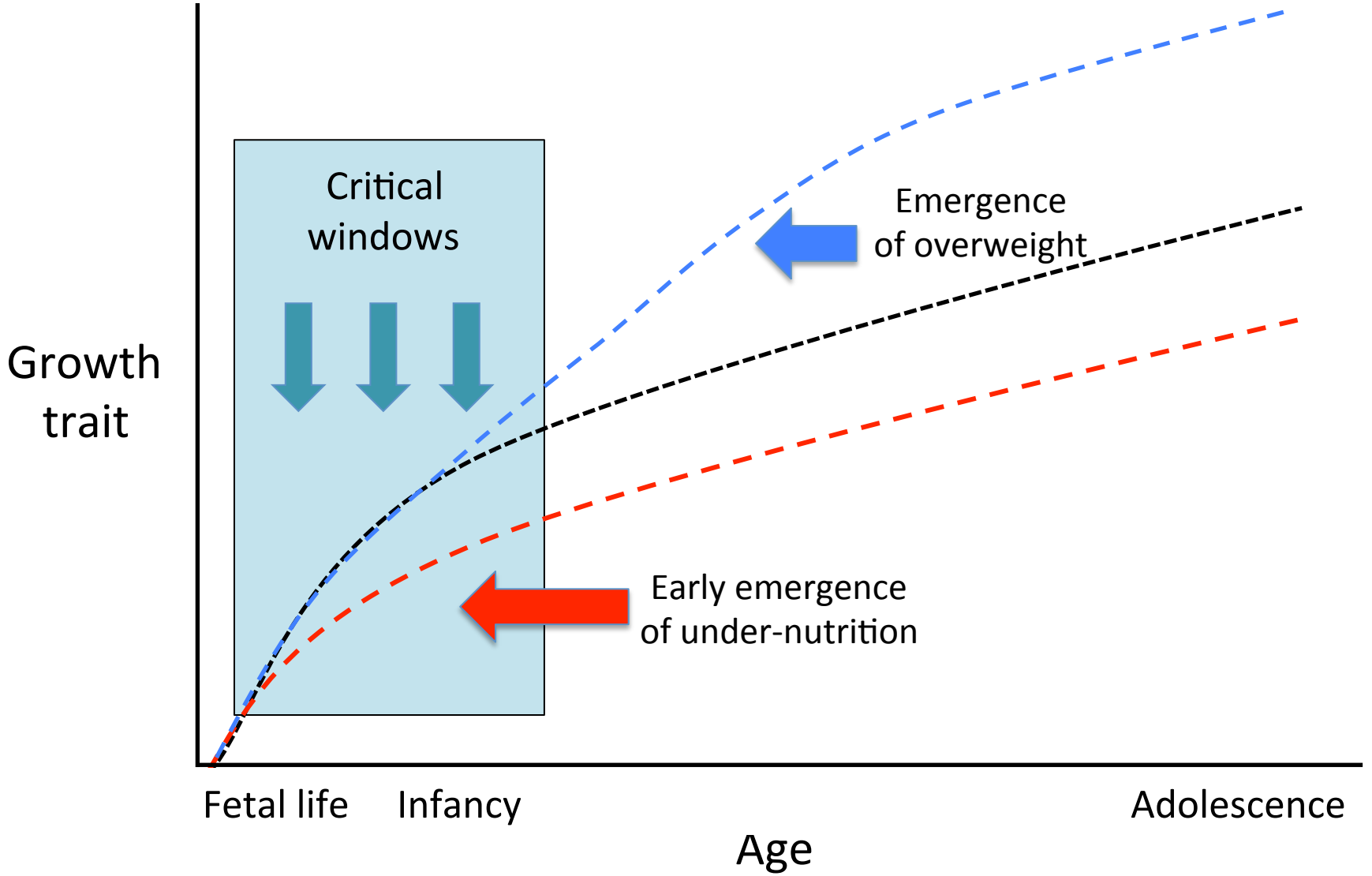
  - within the same country
  - within the same community
  - within the same family (mothers, children)
  - with the same person (stunted, overweight)

Speed of 'nutrition transition'
This shifts explanatory framework from epidemiology to biology

New scientific approach

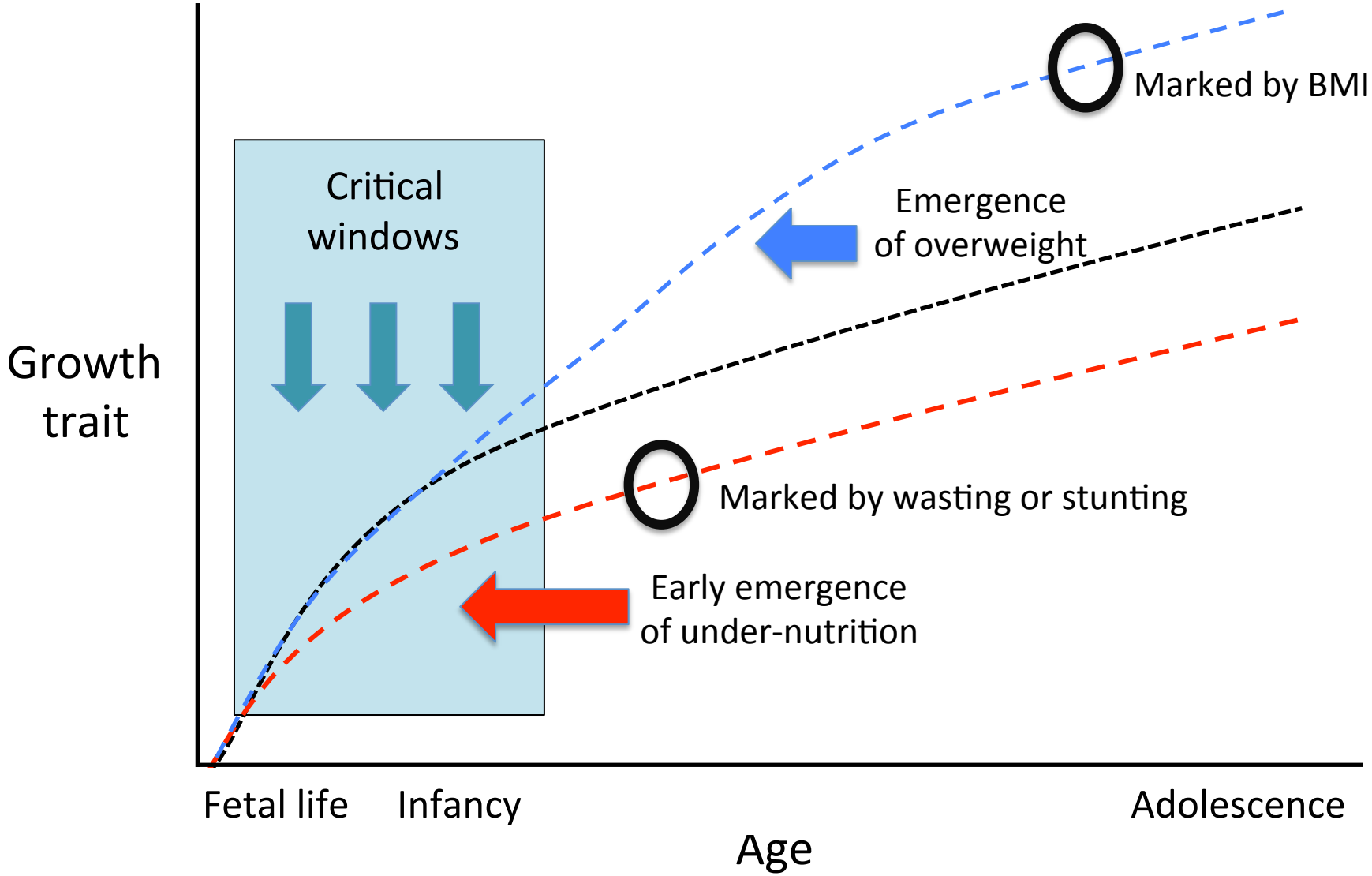


Critical windows



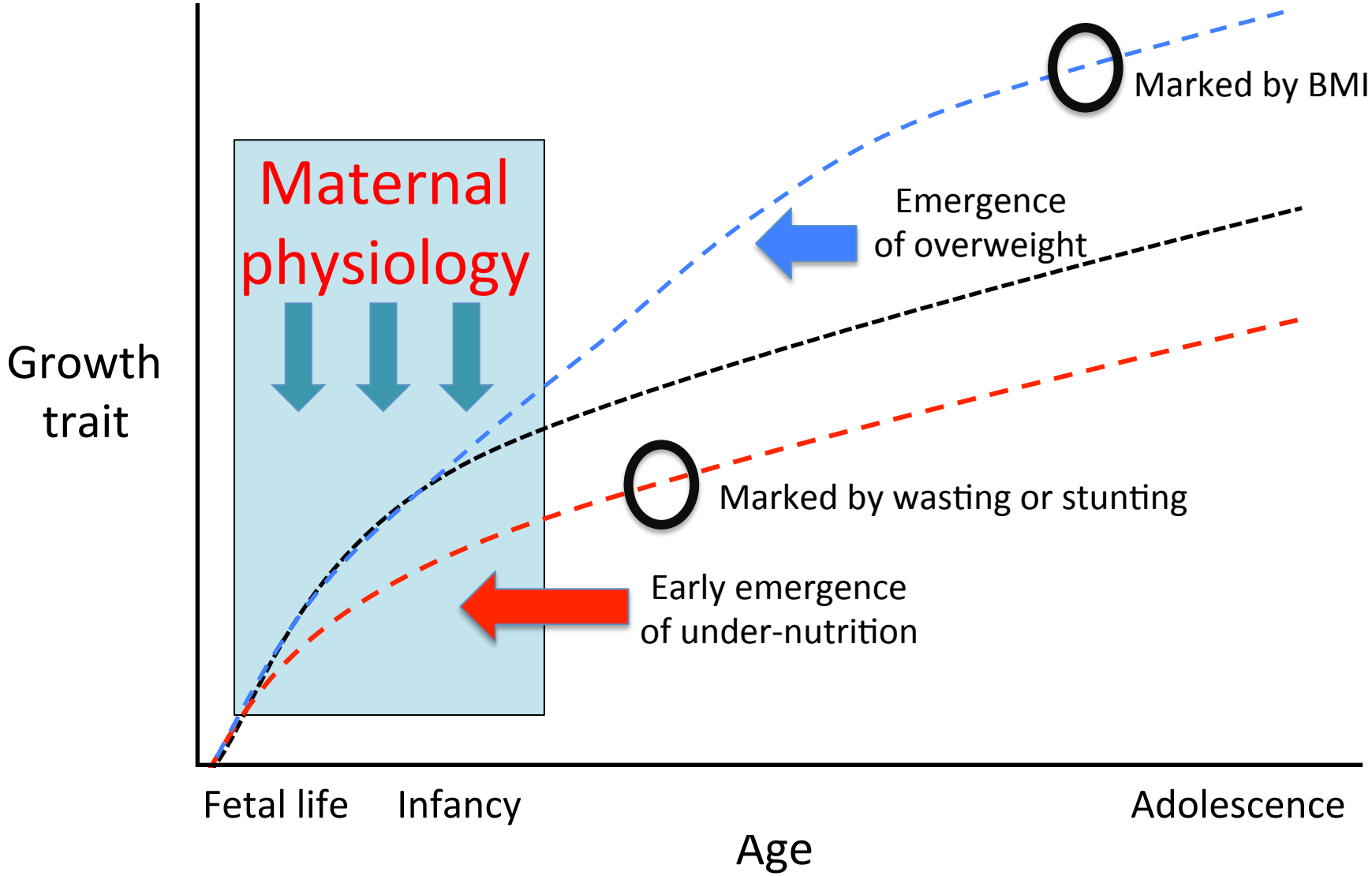
Wells, J Theor Biol 2003

Critical windows



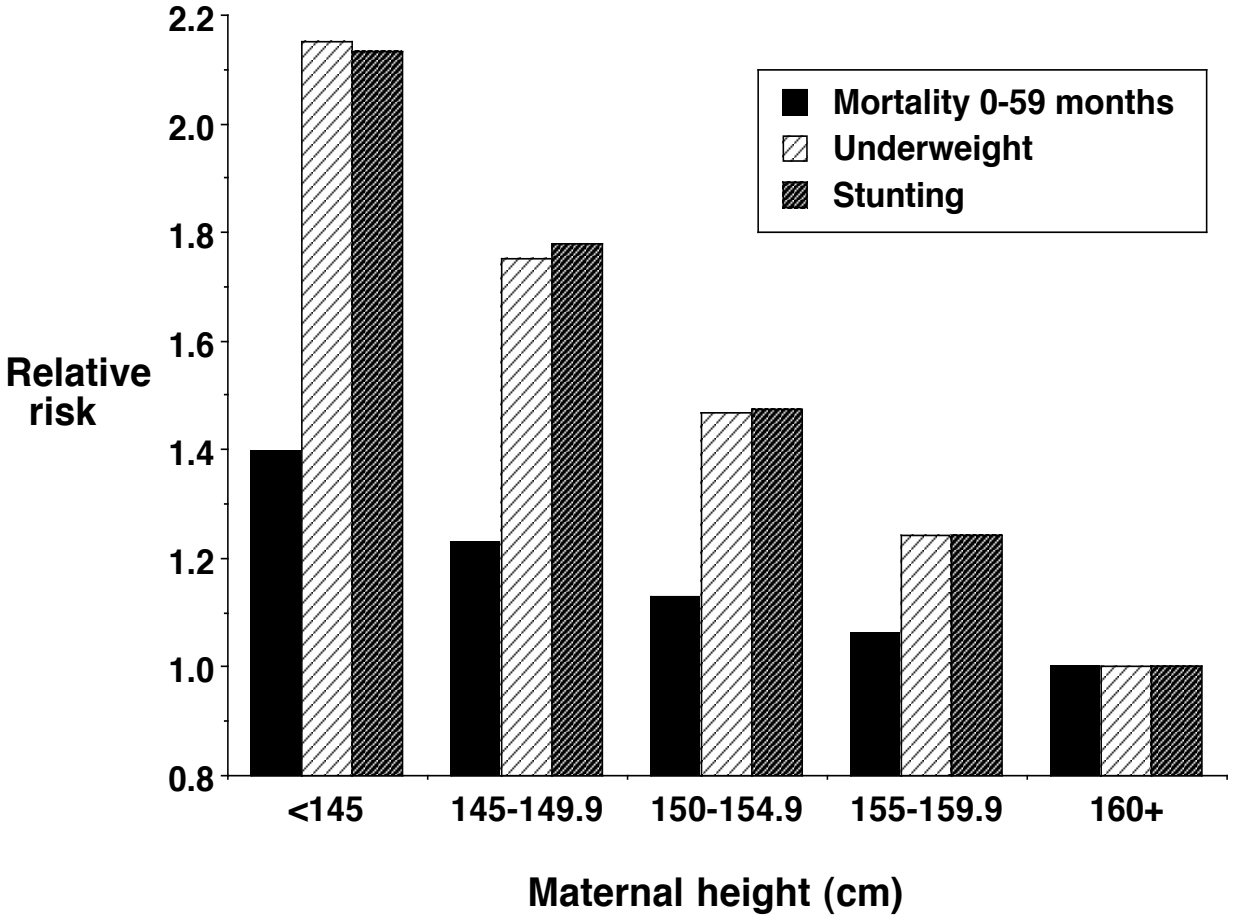
Wells, J Theor Biol 2003

Critical windows



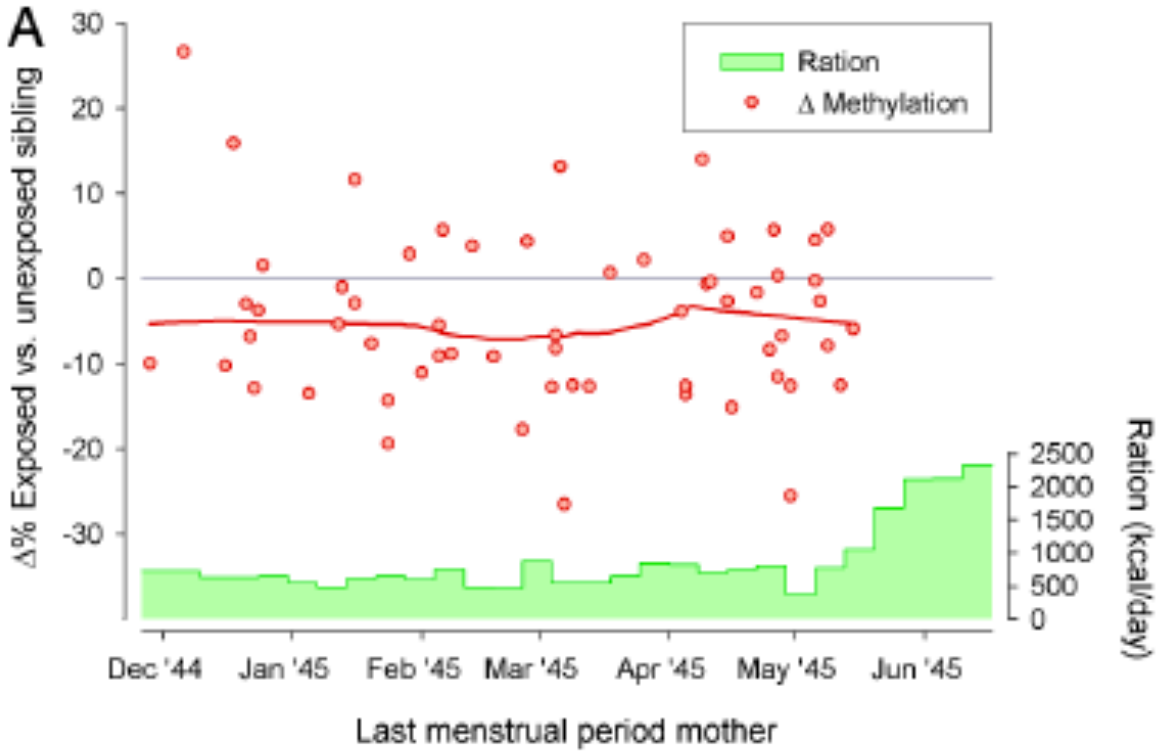
Wells, J Theor Biol 2003

Maternal somatic phenotype



Ozaltin et al., JAMA 2010

Maternal epigenetic effects

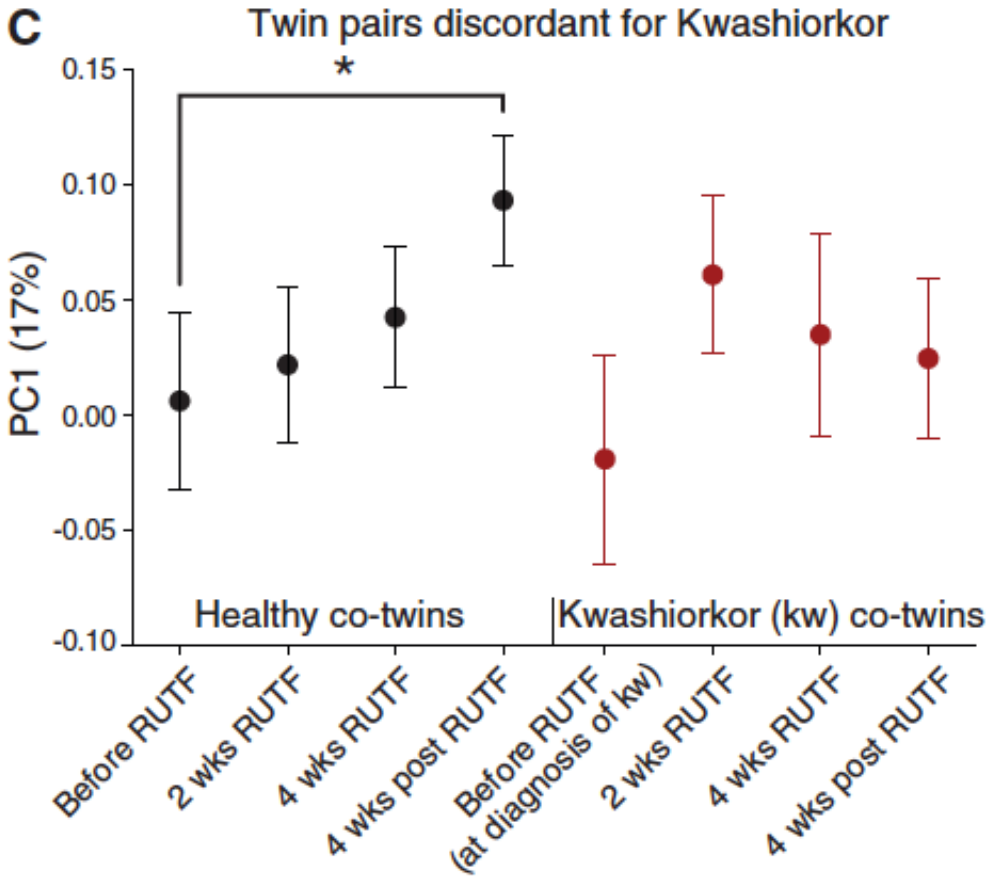


Peri-conceptional exposure to maternal famine and IGF2 gene methylation in Dutch famine

Heijmans et al., PNAS 2008

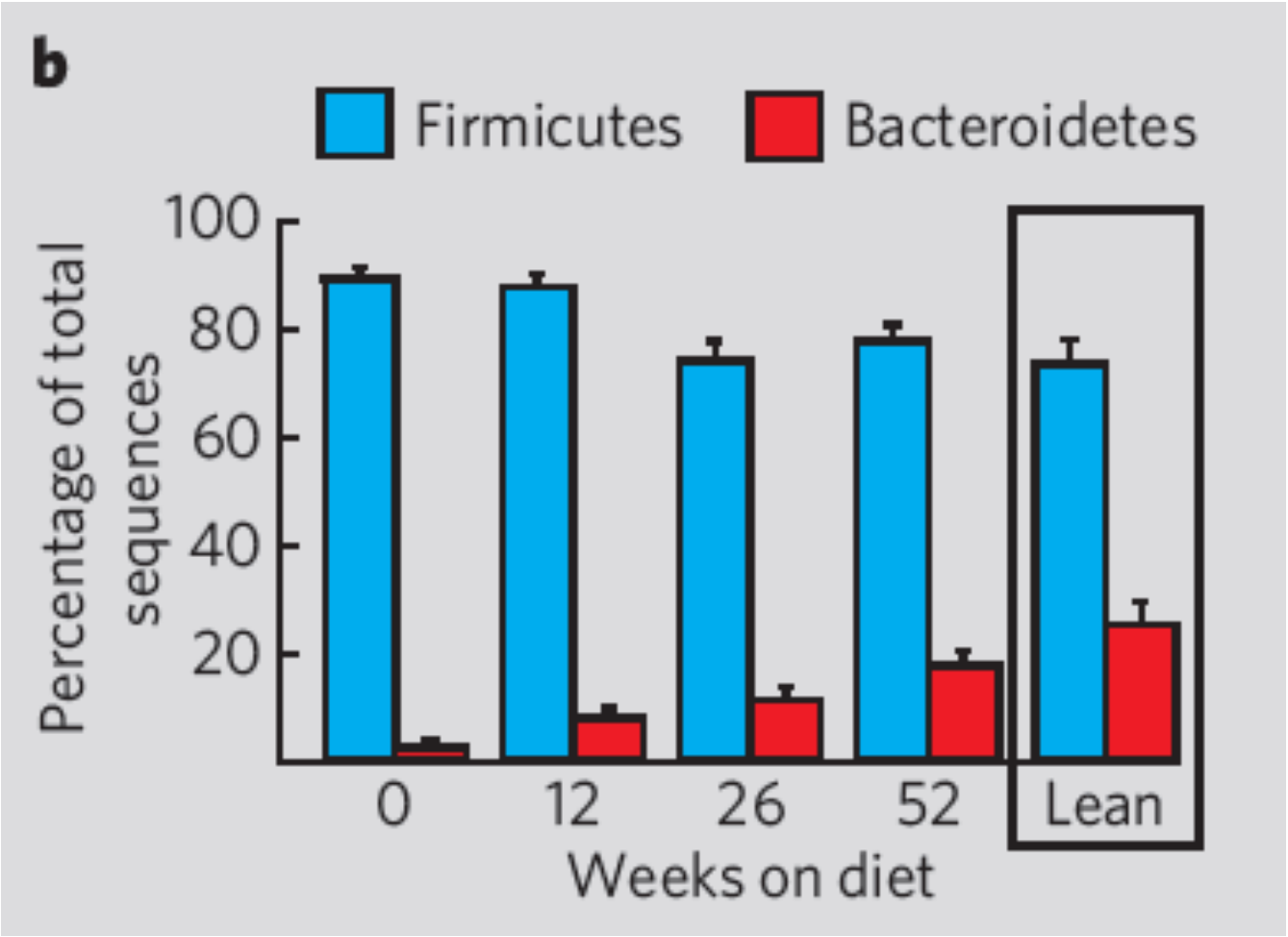
Kwashiorkor and gut biota

Functional development of biome



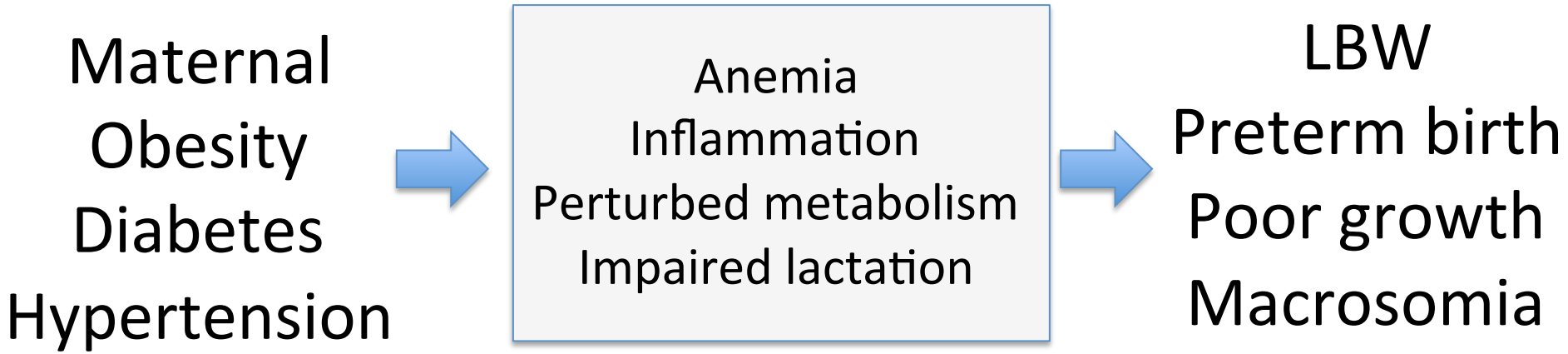
Smith et al., Sci 2013

Obesity and gut biota

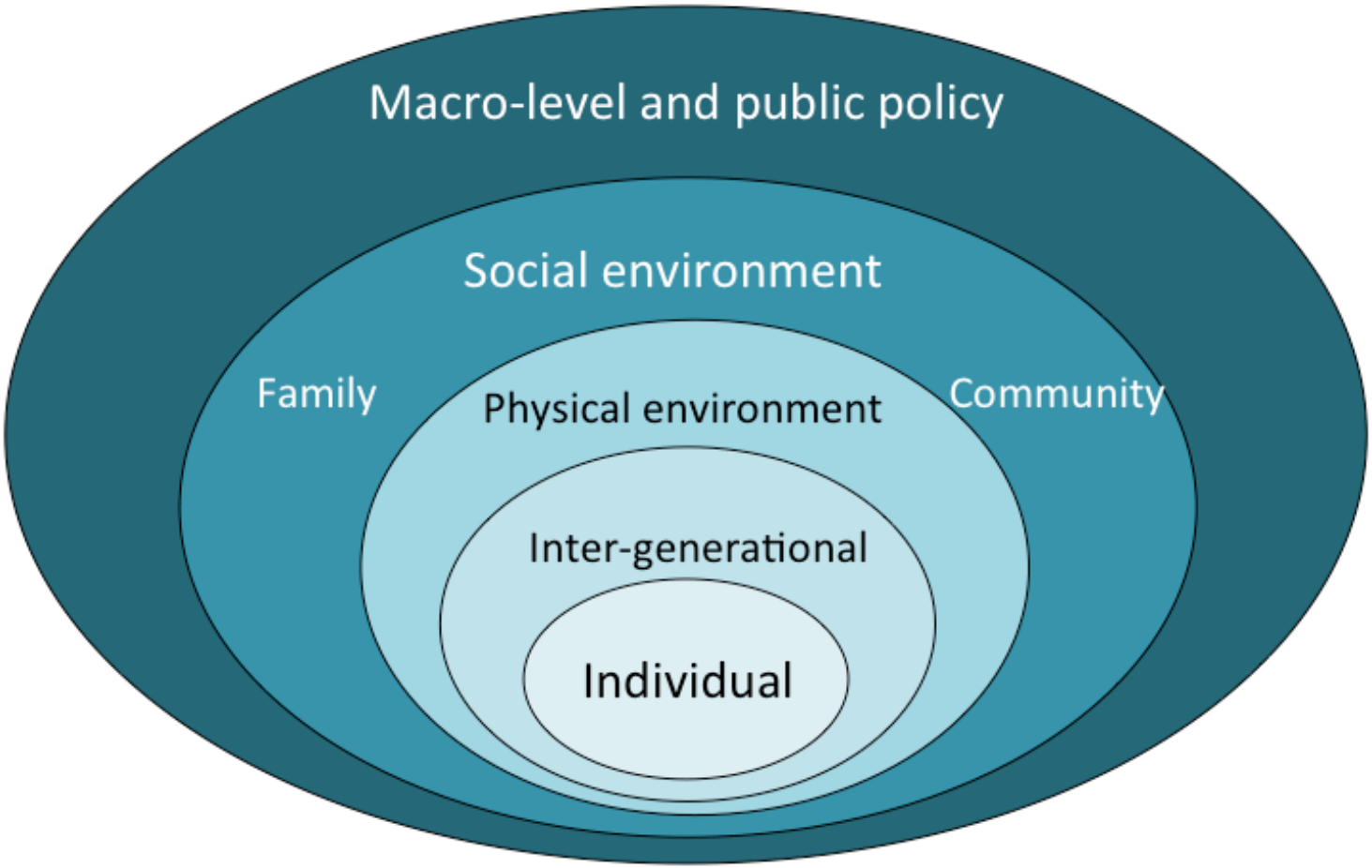


Ley et al., Nature 2006

Maternal obesity and co-morbidities



Socio-ecological model



Are there common factors ?

Food insecurity and child under-nutrition

TABLE 3 Prevalence of child undernutrition, infant and young child feeding practices, and child morbidity by HFI category[1]

	Bangladesh				Ethiopia				Vietnam			
	Food-secure	Mild HFI	Moderate HFI	Severe HFI	Food-secure	Mild HFI	Moderate HFI	Severe HFI	Food-secure	Mild HFI	Moderate HFI	Severe HFI
Stunting	41.7***	54.5	55.2	62.8	45.5***	49.6	53.6	56.9	17.3***	23.2	27.8	25.6
Underweight	39.6***	49.5	48.2	56.9	22.4***	27.9	28.6	30.6	12.1***	19.8	22.7	19.7
Wasting	17.7***	20.4	18.7	25.4	5.3	6.4	5.9	6.4	4.5	4.6	7.1	5.7
Minimum DD	53.4***	41.2	41.5	33.0	9.1**	10.1	7.3	3.3	87.1***	81.0	75.1	73.7
Diarrhea	6.8***	9.4	9.9	11.7	13.4***	13.7	16.7	24.4	7.2***	12.1	11.2	12.6
ARI	30.3***	29.6	40.6	41.1	15.1***	15.1	22.3	30.3	14.1***	18.8	23.9	29.4

[1] Values are percentages. The prevalence of various categories of HFI was compared by using chi-square test. Different from food-insecure households: $^{**}P < 0.01$, $^{***}P < 0.001$. ARI, acute respiratory illness; DD, dietary diversity; HFI, household food insecurity.

Ali et al., J Nutr 2013

SES and fast food intake, Johannesburg

Table III: Demographic variables by frequency of fast food intake

Demographic variables	Frequency of fast food intake				
	Seldom (less than twice per month)	At least two to three times per month	At least once a week	Two to three times a week	Daily
TOTAL SAMPLE (n = 341) (%)	**13 (3.8)**	**126 (37.0)**	**71 (20.8)**	**94 (27.6)**	**37 (10.9)**
SEG; n (%)[A]					
LSEG (n = 117)	1 (0.9)	40 (34.2)	19 (16.2)	36 (30.8)	21 (17.9)
MSEG (n = 106)	7 (6.6)	45 (42.5)	19 (17.9)	26 (24.5)	9 (8.5)
HSEG (n = 118)	5 (4.2)	41 (34.7)	33 (28.0)	32 (27.1)	7 (5.9)

Van Zyl et al., S Afr J Clin Nutr 2010

Food insecurity and overweight

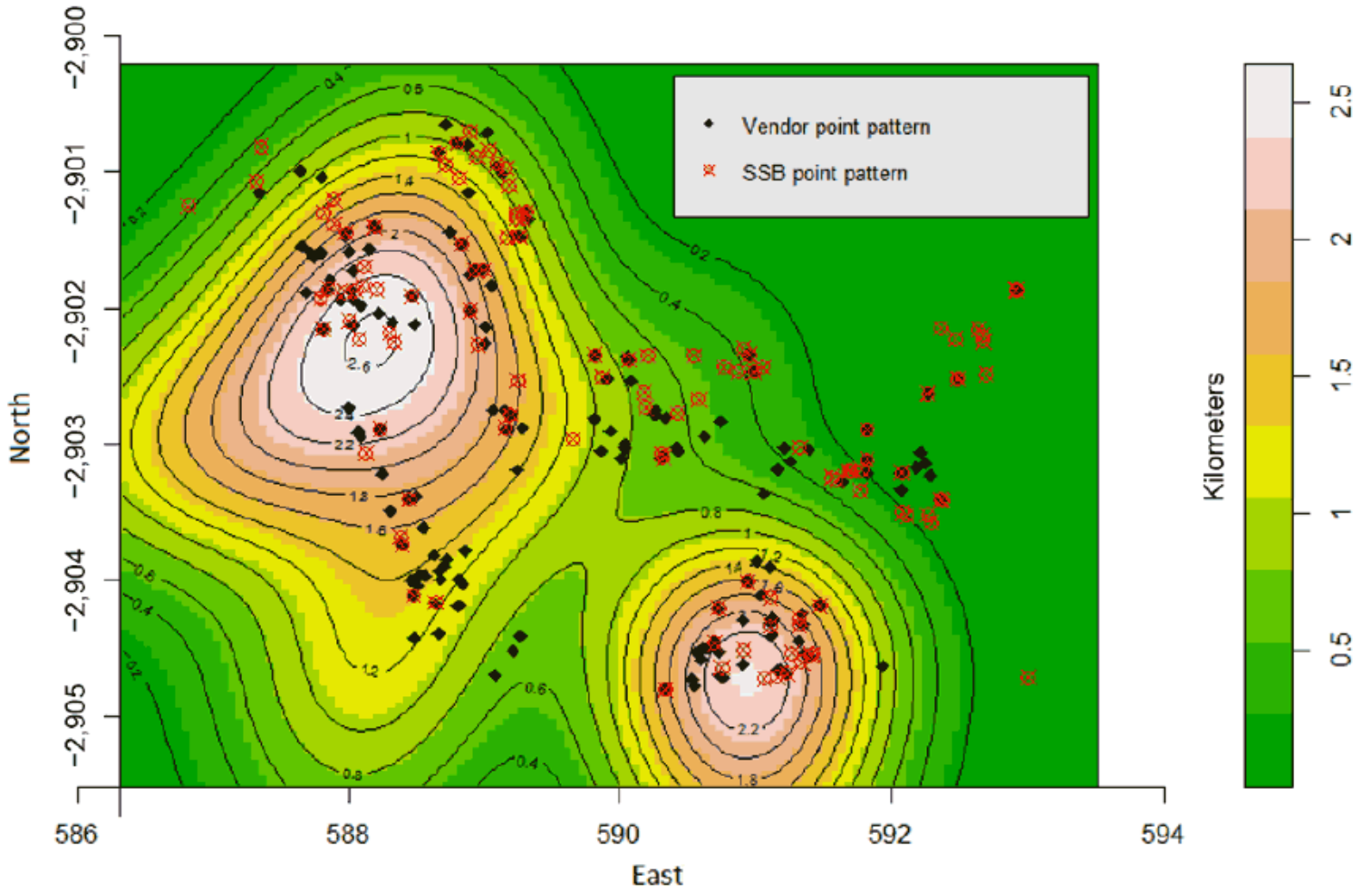
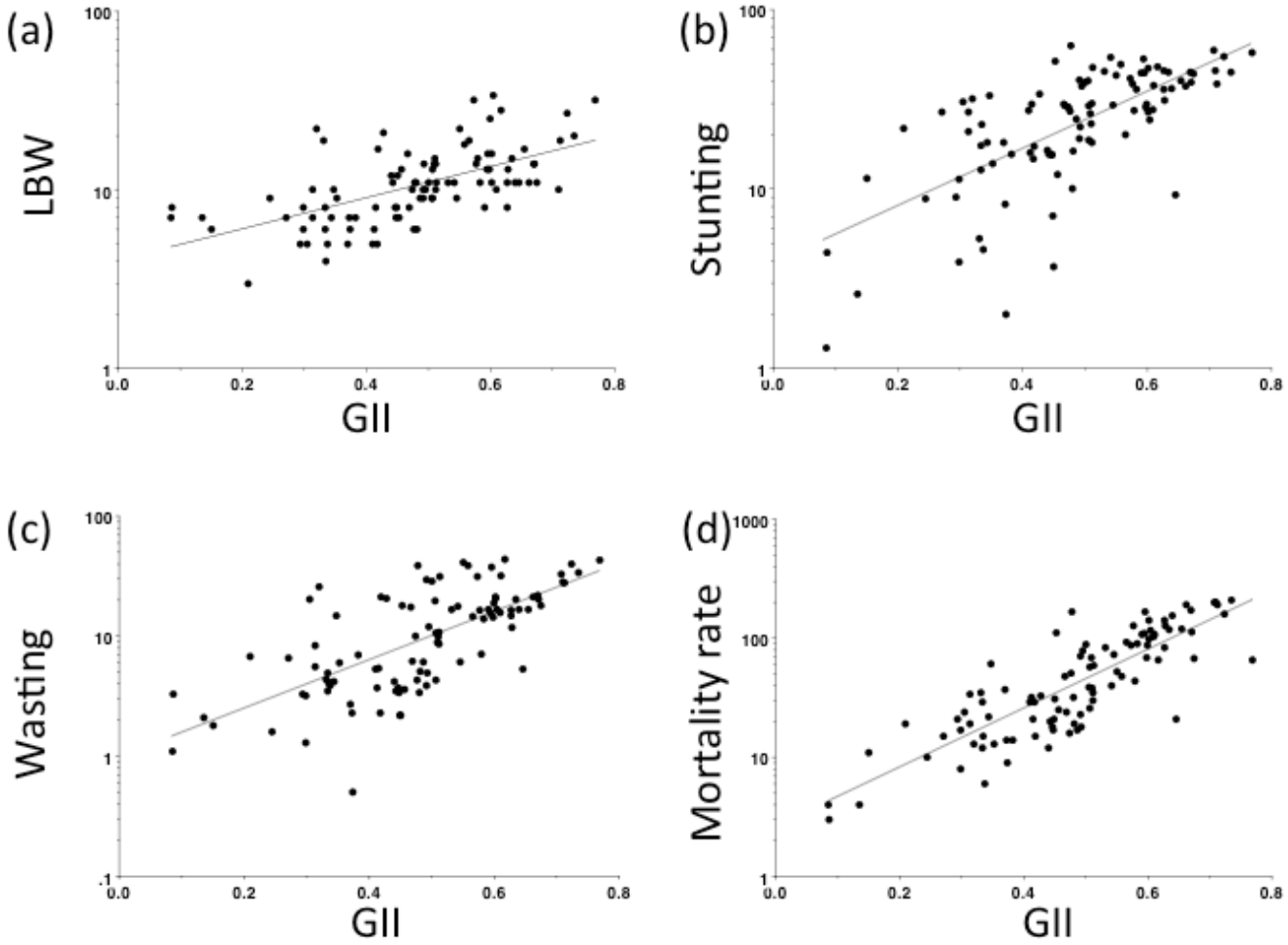


Figure 2 Kernel density and contour plots of school point pattern overlayed on vendor and sugar-sweetened beverage point patterns, Soweto, South Africa, 2013. [A text description of this figure (14_0559a.htm#2) is also available.]

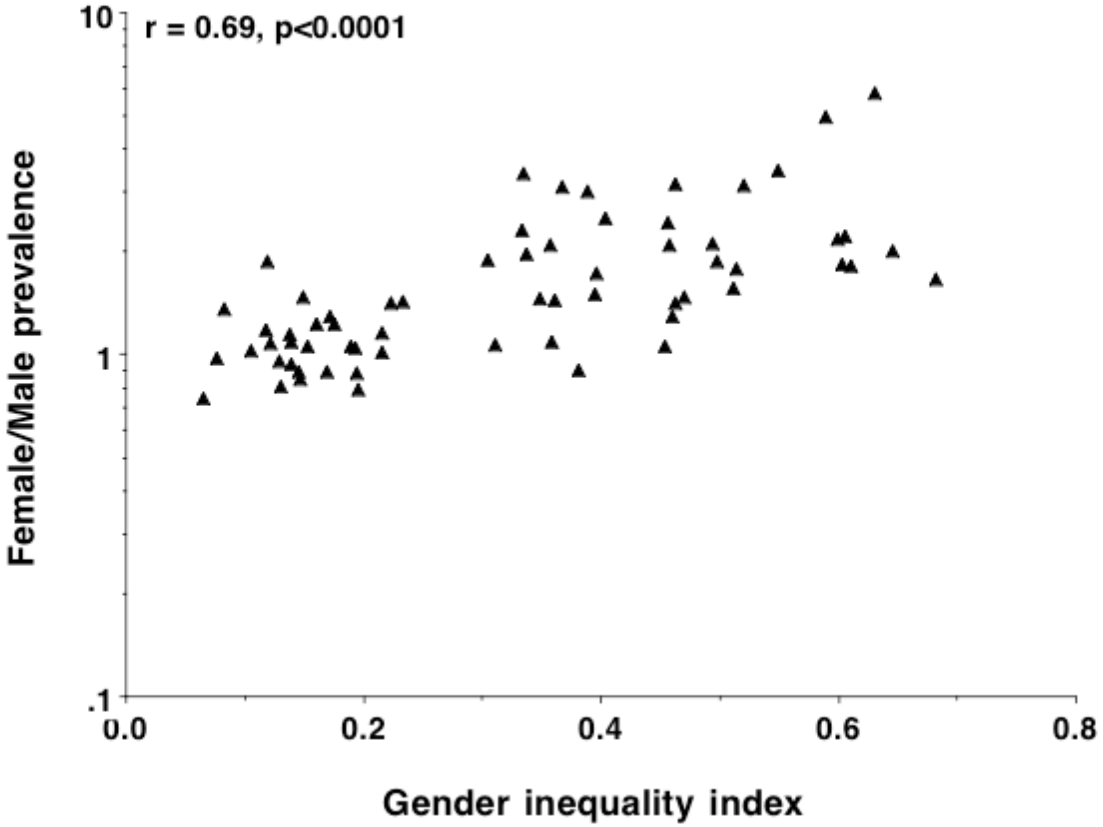
Moodley et al., Prev Chronic Dis 2015

Gender inequality and under-nutrition



Marphatia et al., Global Health Epidemiol Genom 2016

Gender inequality and ‘excess’ female obesity



Wells et al., Soc Sci Med 2012

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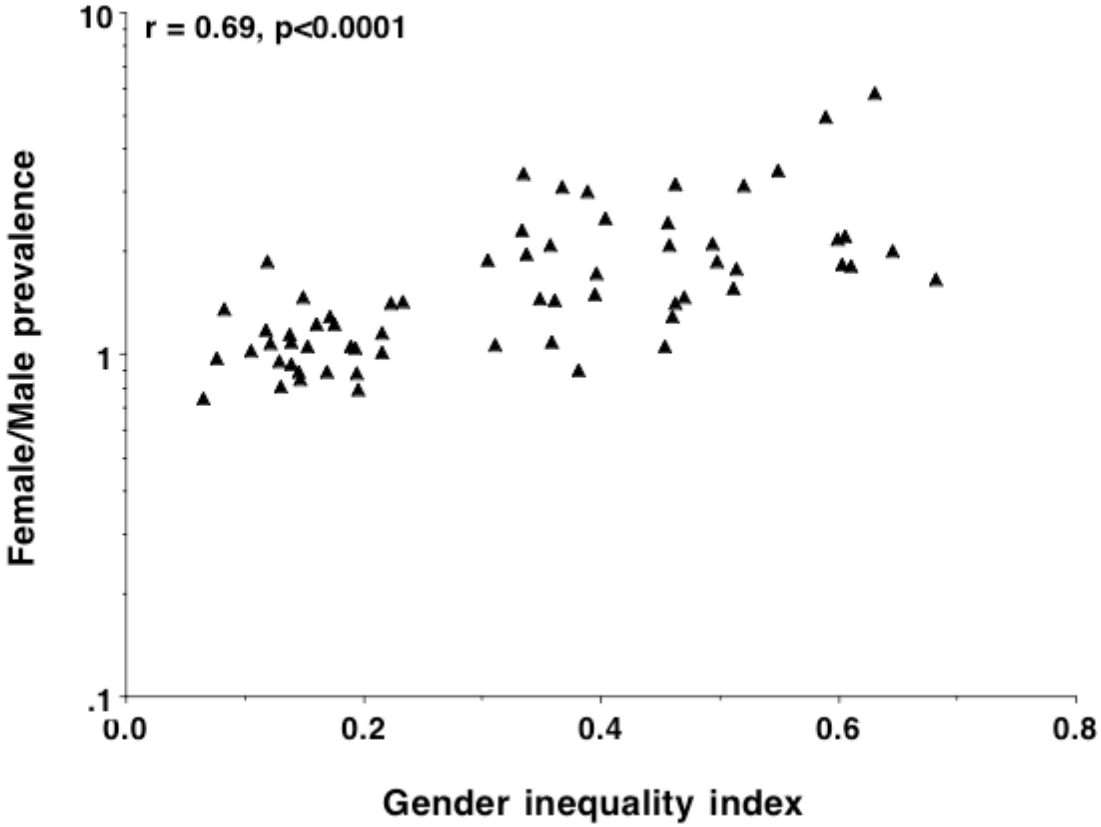
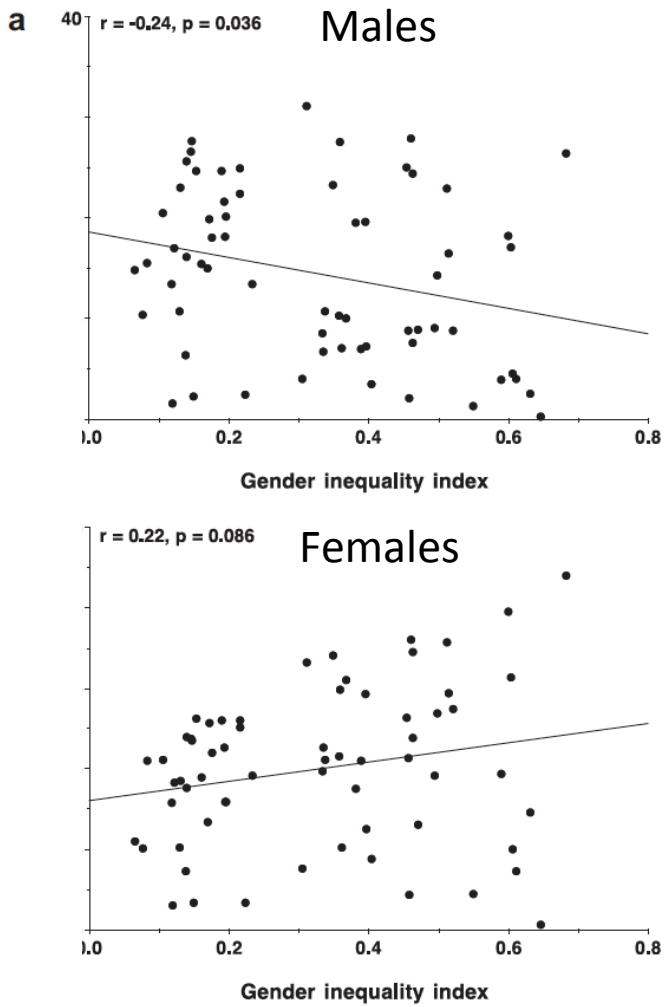
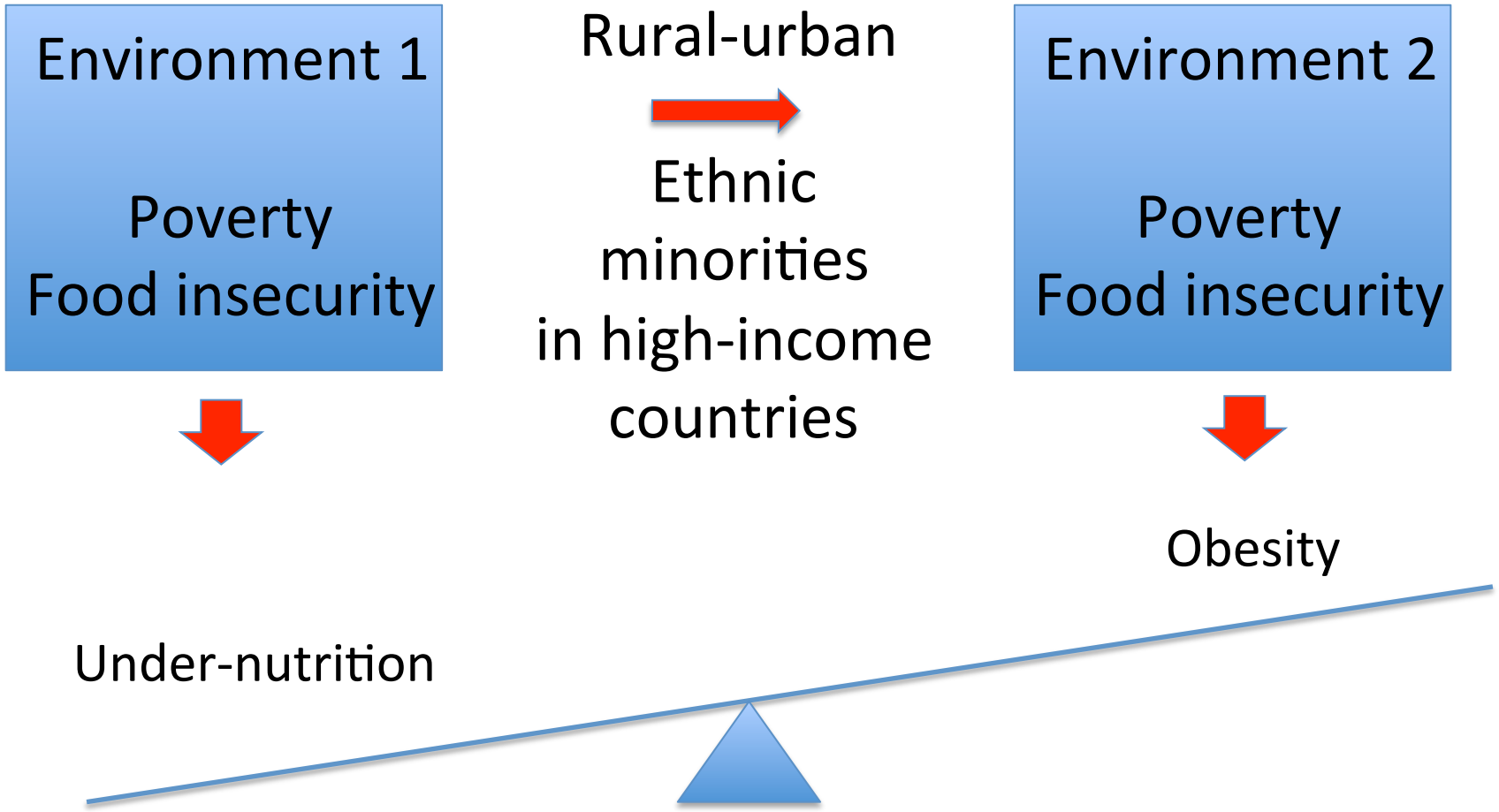




Wells et al., Soc Sci Med 2012

Vulnerable groups – migrants



Vulnerable groups - Refugees

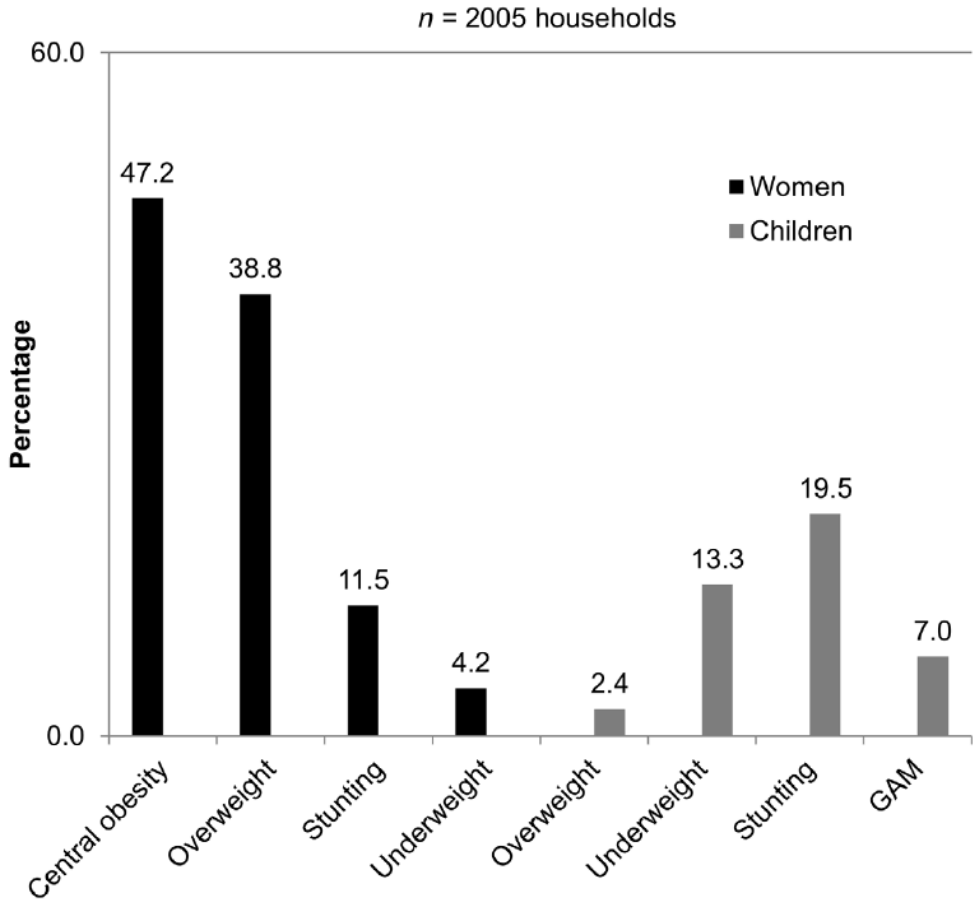


Figure 2. Malnutrition in refugee households. Proportions of households with a member affected by malnutrition in women and children, Western Sahara refugee camps.
doi:10.1371/journal.pmed.1001320.g002

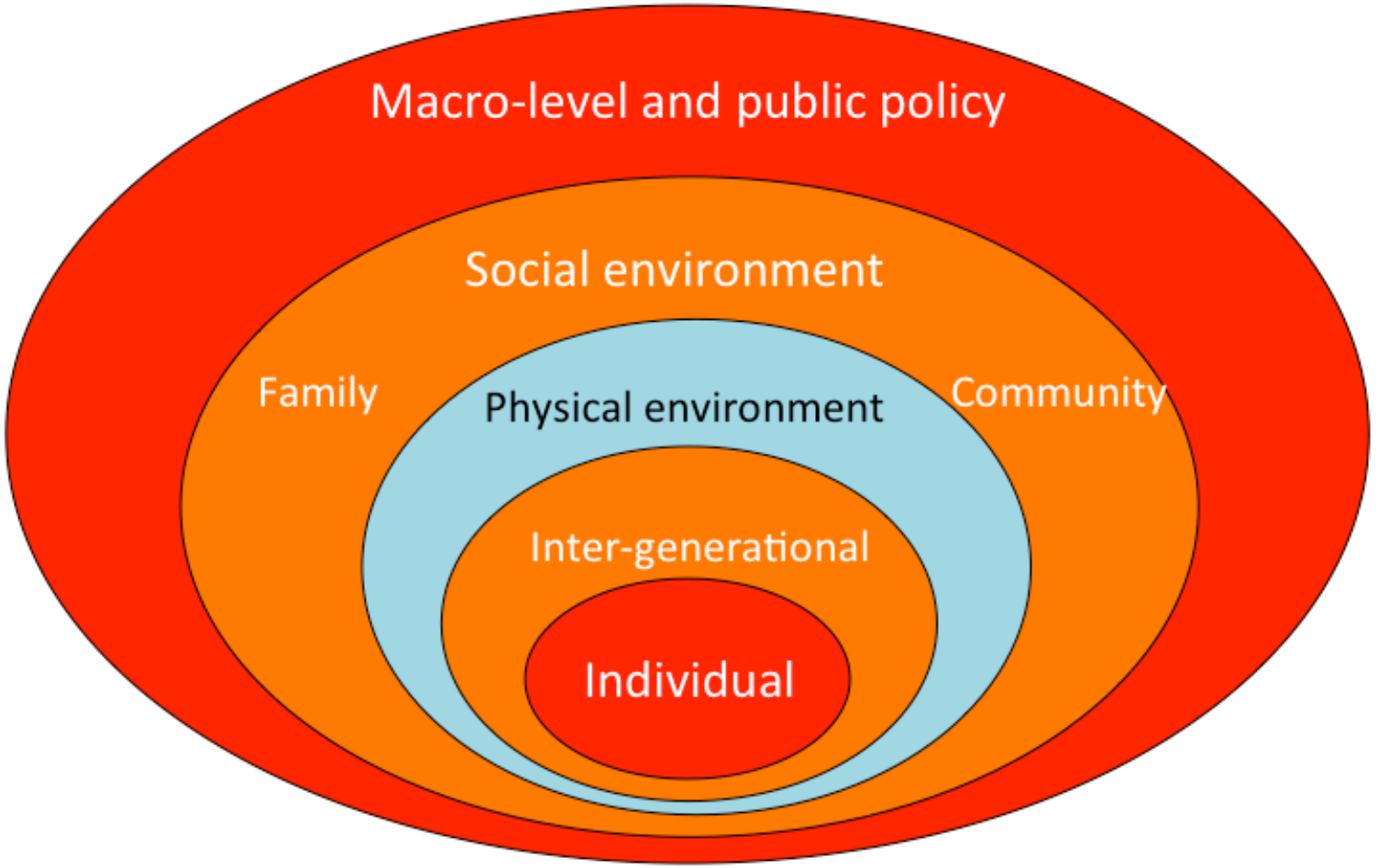
Poverty

Food aid

Restricted physical activity

Grijalva-Eternod et al., PlosMed 2012

Multi-level connections



Trade Policies

Personal agency

Food Insecurity

Gender Equality

Gut biota

Maternal metabolism

Thank you for your attention