Trends in obesity development

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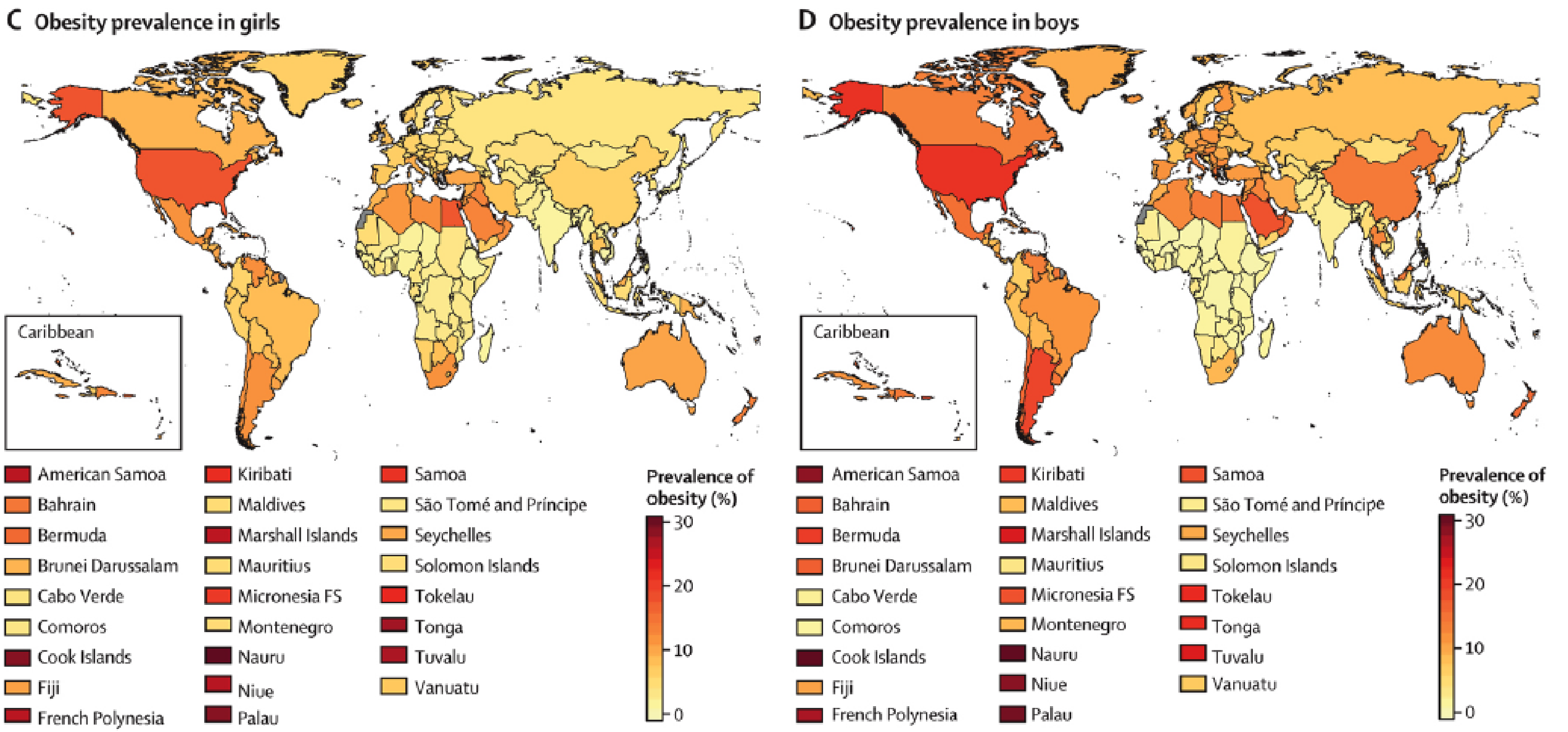
Childhood obesity



NCD-RisC. 2017. Lancet 390(10113)

Development, causes, consequences

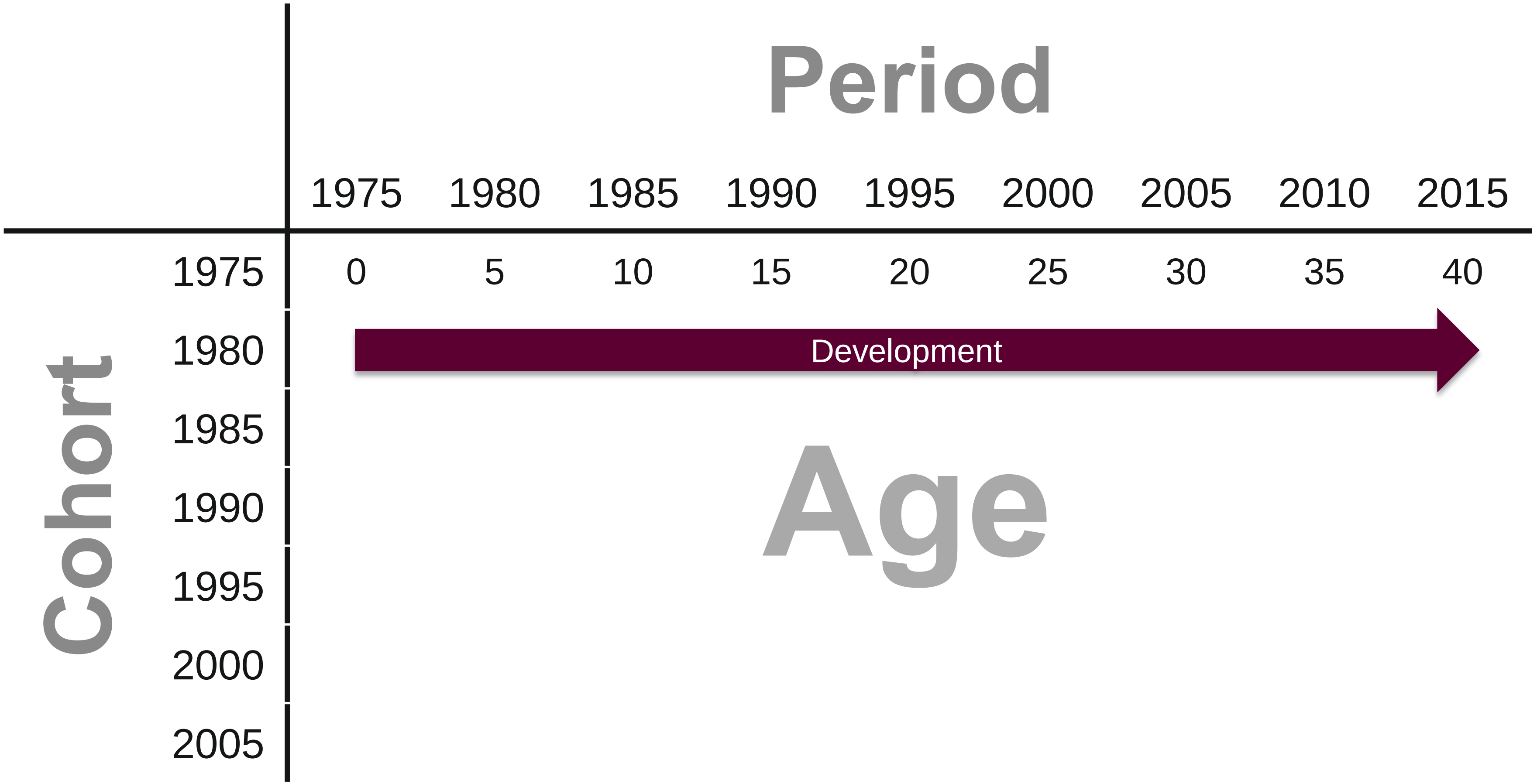
Period

Cohort

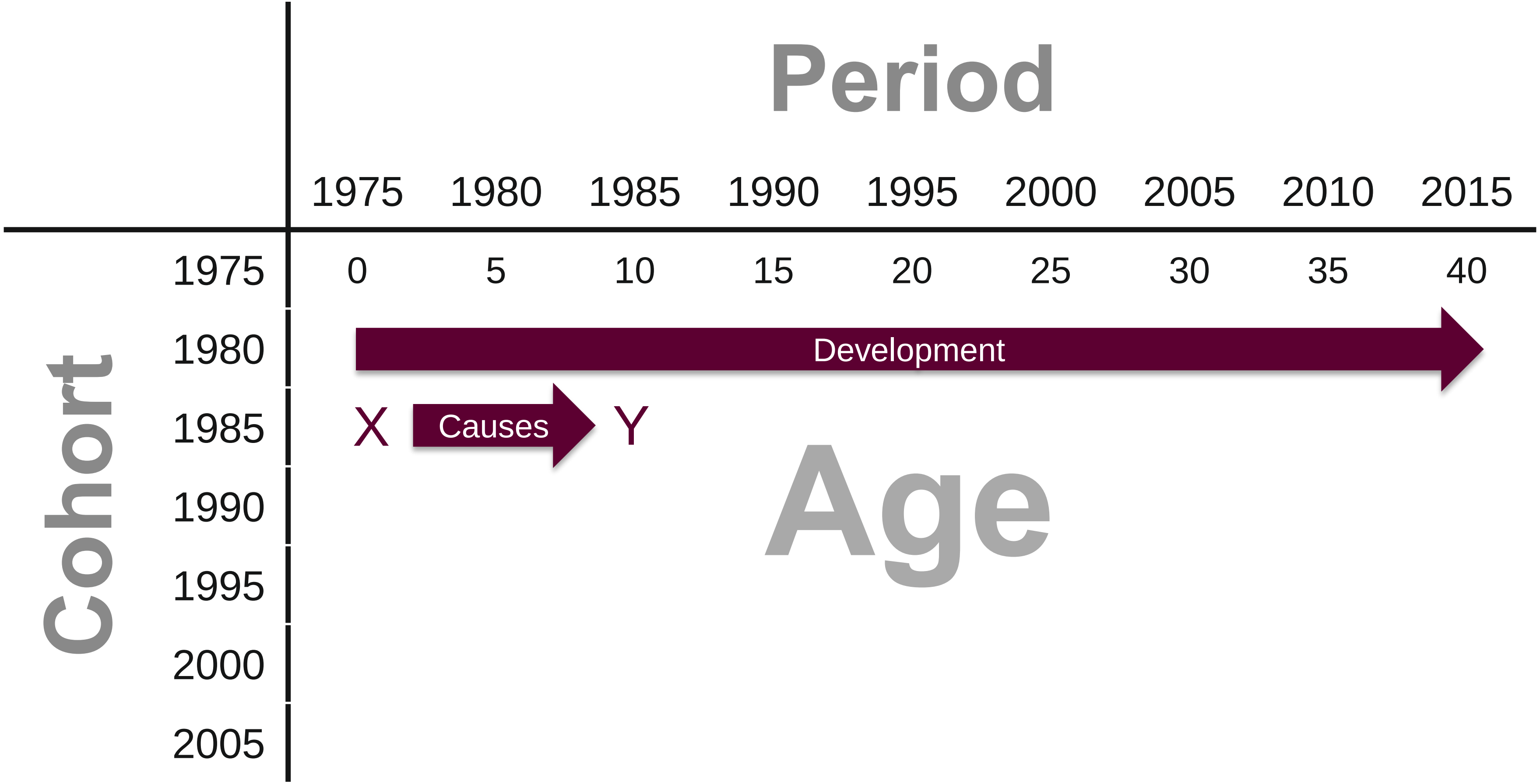
	1975	1980	1985	1990	1995	2000	2005	2010	2015
1975	0	5	10	15	20	25	30	35	40
1980									
1985									
1990									
1995									
2000									
2005									

Age

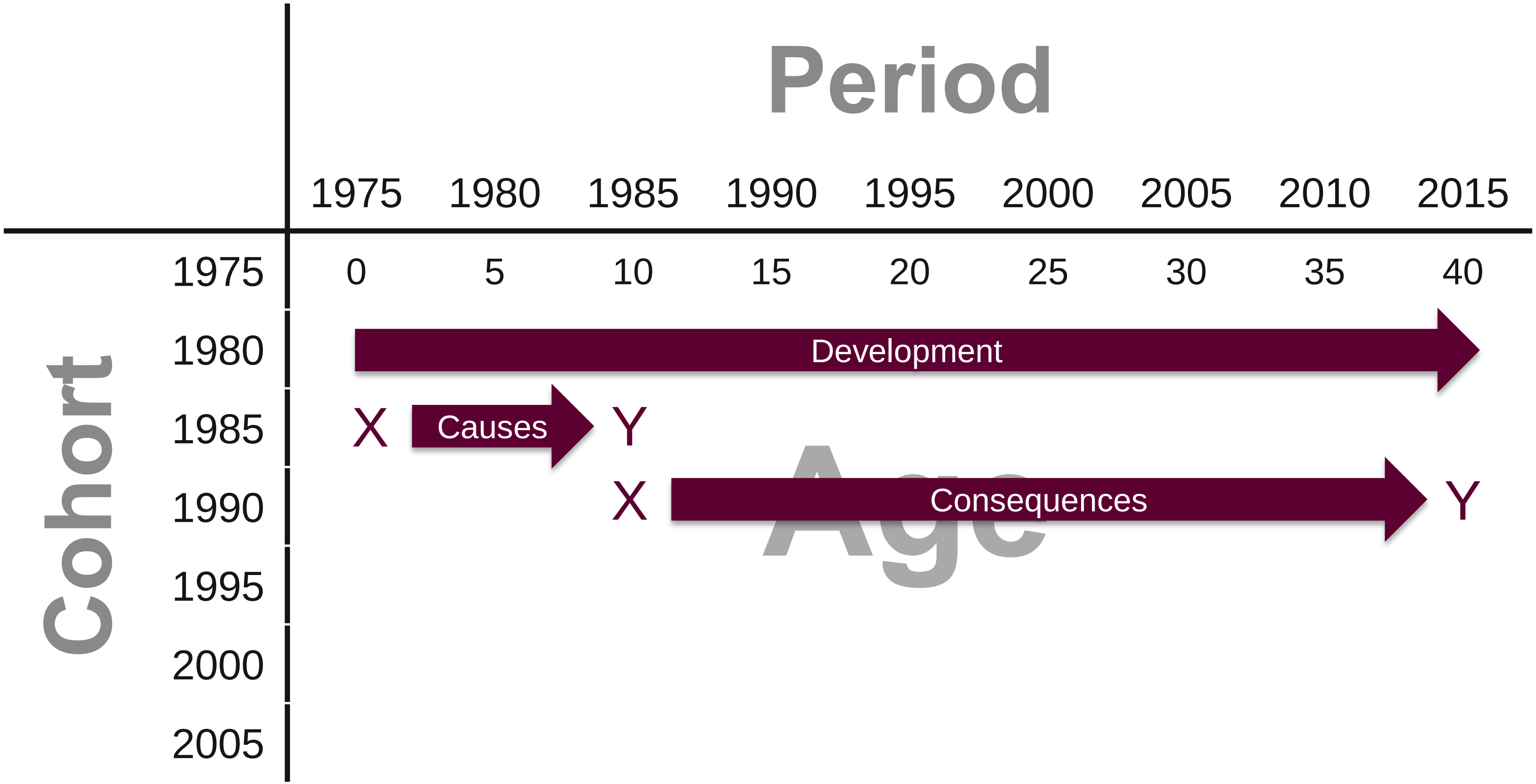
Development, causes, consequences



Development, causes, consequences



Development, causes, consequences



Development, causes, consequences

obesity reviews doi: 10.1111/j.1467-789X.2010.00735.x

Etiology and Pathophysiology

Early-life determinants of overweight and obesity: a review of systematic reviews

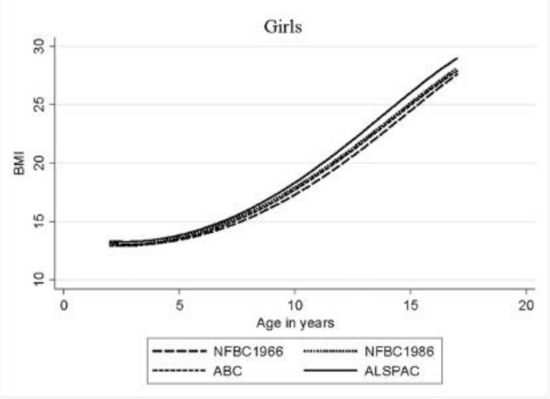
L. Monasta[1], G. D. Batty[2,3], A. Cattaneo[4], V. Lutje[5], L. Ronfani[1], F. J. van Lenthe[6] and J. Brug[7]

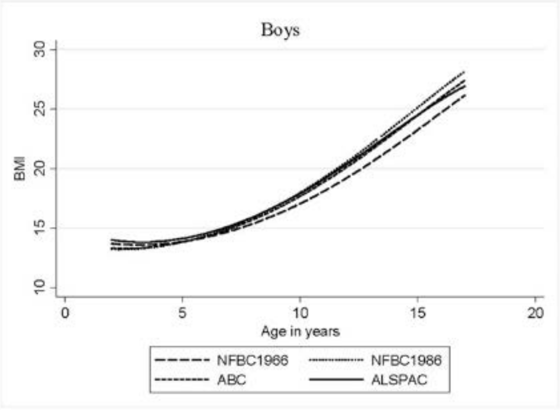
obesity reviews doi: 10.1111/obr.12316

Pediatric Obesity/Adult Etiology

Childhood obesity as a predictor of morbidity in adulthood: a systematic review and meta-analysis

A. Llewellyn[1], M. Simmonds[1], C. G. Owen[2] and N. Woolacott[1]





Graversen et al. 2017. Pediatr Obes 12(2)

Population level heterogeneity

Period

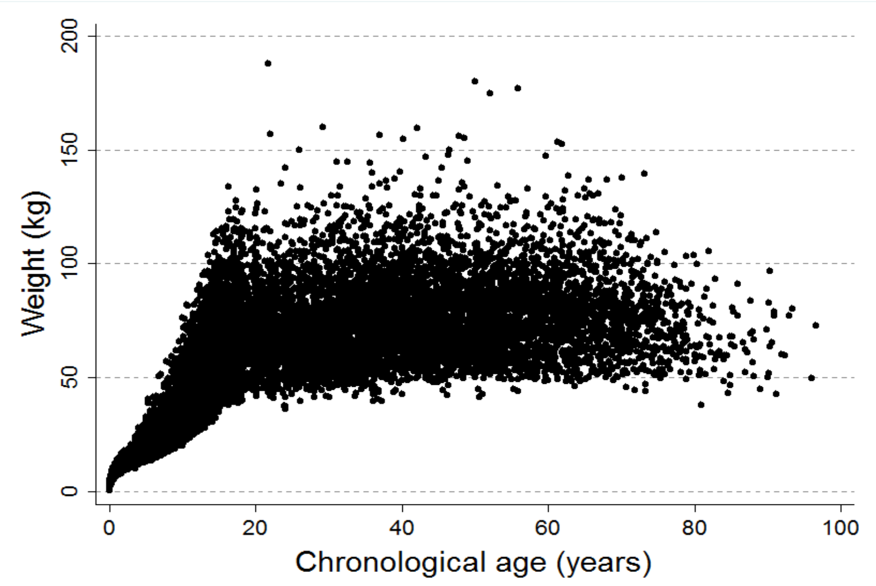
Cohort	1975	1980	1985	1990	1995	2000	2005	2010	2015
1975	0	5	10	15	20	25	30	35	40
1980		0	5	10	15	20	25	30	35
1985			0	5	10	15	20	25	30
1990				0	5	10	15	20	25
1995					0	5	10	15	20
2000						0	5	10	15
2005							0	5	10

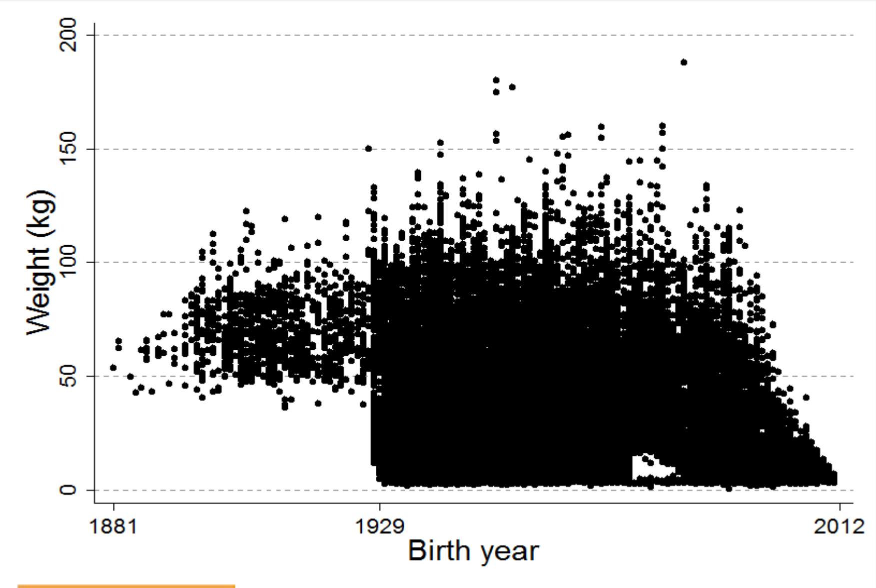
Age

Population level heterogeneity

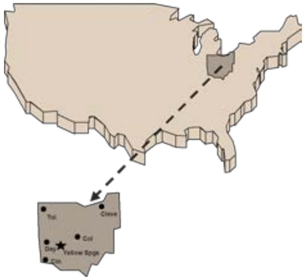
	Period								
Cohort	1975	1980	1985	1990	1995	2000	2005	2010	2015
1975	Causes			Development			Consequences		
1980		0	5			20	25	30	35
1985			0			15	20	25	30
1990						10	15	20	25
1995							10	15	20
2000						0	5	10	15
2005							0	5	10

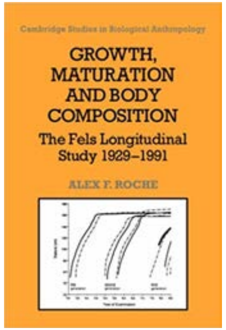
Fels Longitudinal Study – USA

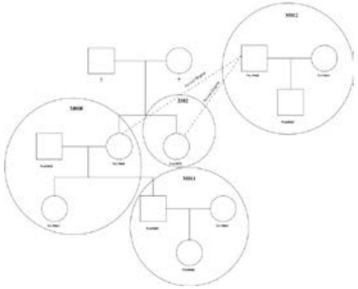




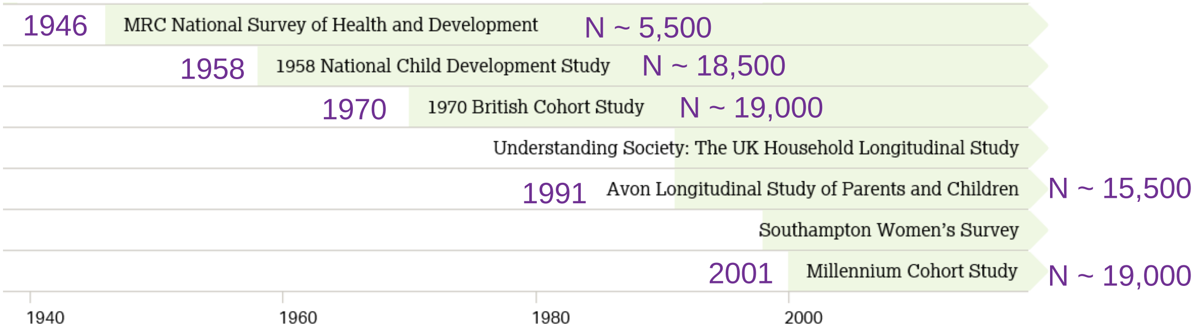
N ~ 2500





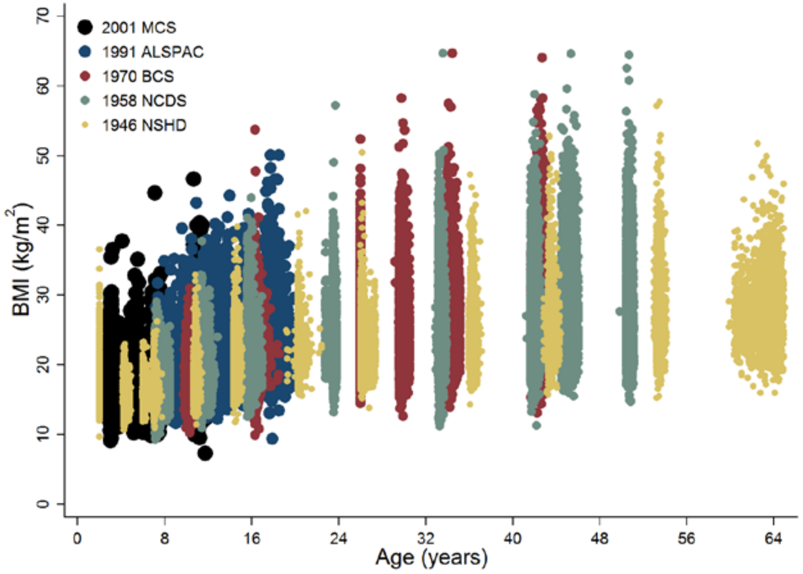


CLOSER – UK

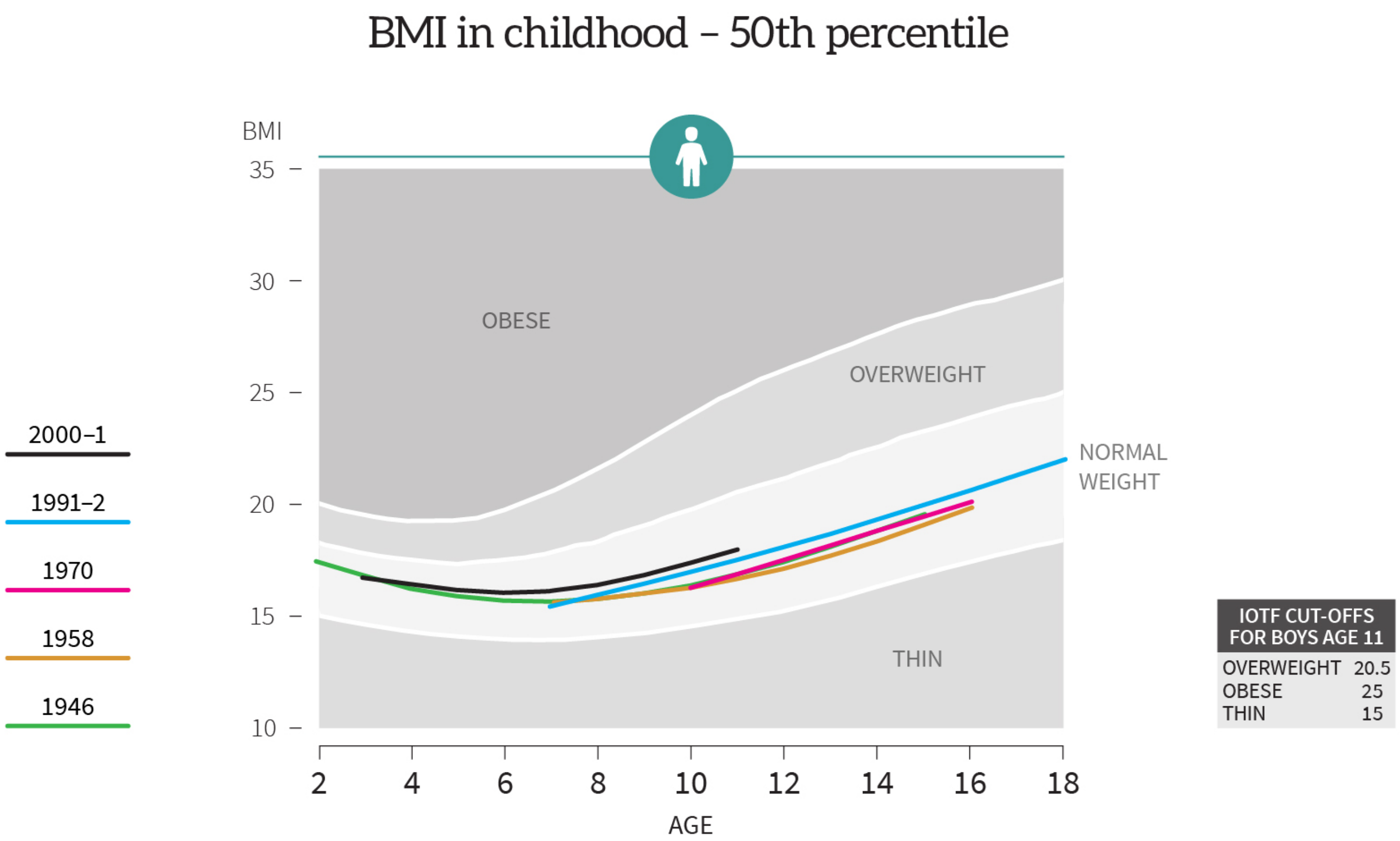


closer
Cohort & Longitudinal Studies Enhancement Resources

"Harmonisation"

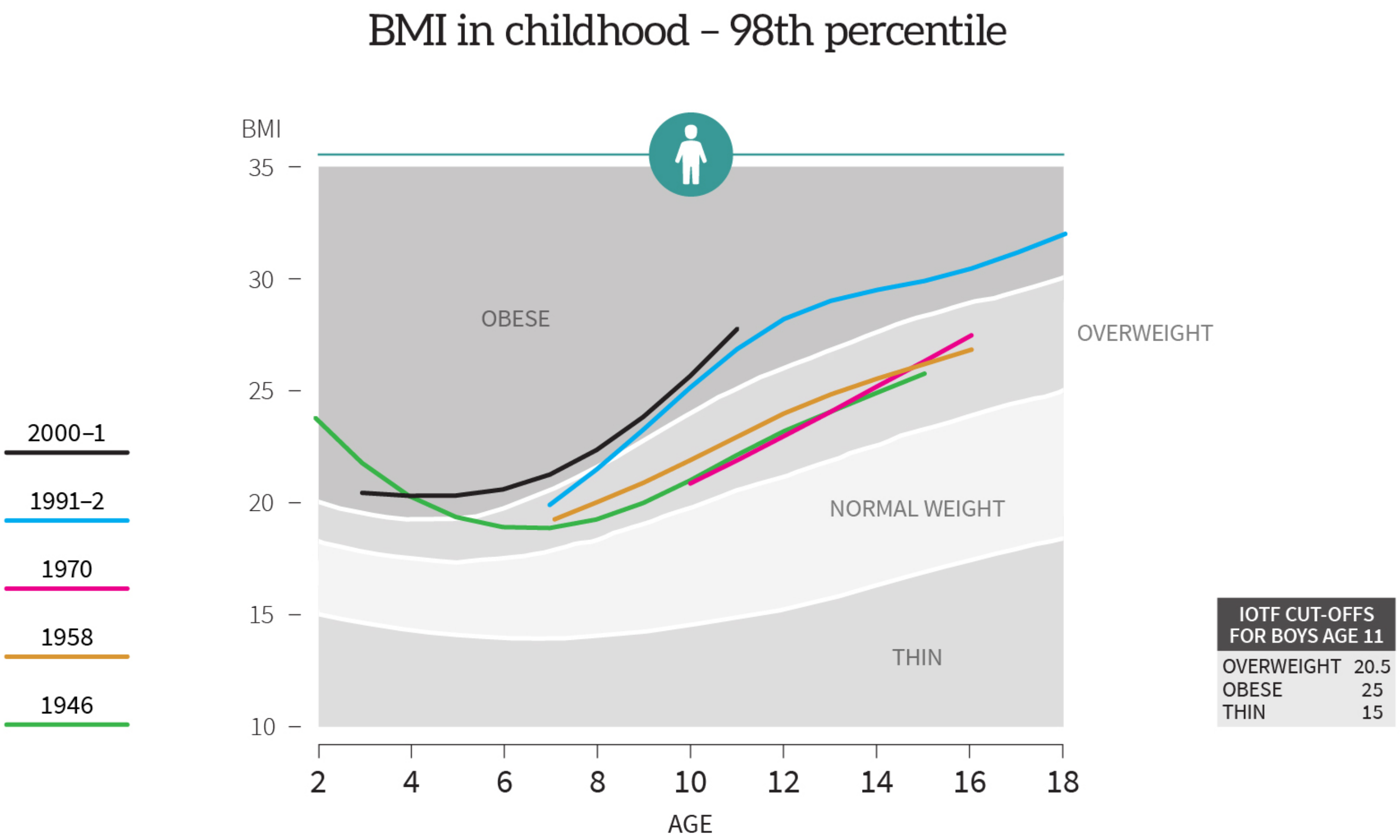


Development



Johnson et al. 2015. Plos Med 12: e1001828

Development



Johnson et al. 2015. Plos Med 12: e1001828

Development

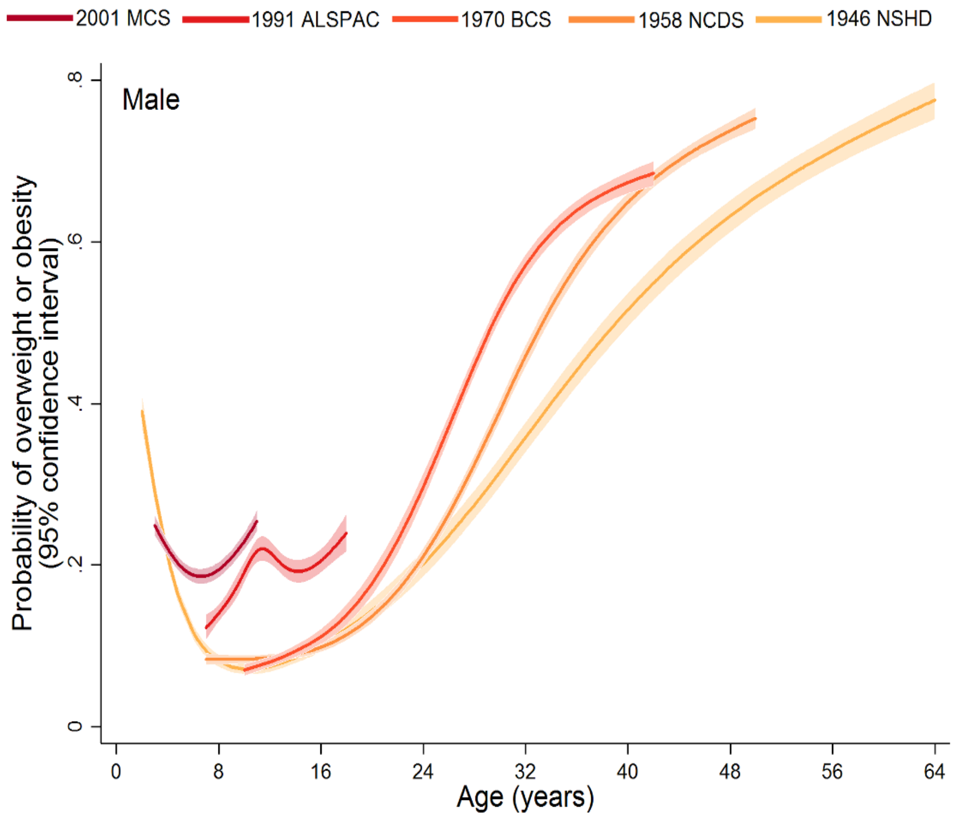


Table 2. Estimated probabilities of overweight or obesity (versus normal weight) from sex- and study-stratified multilevel logistic regression models.

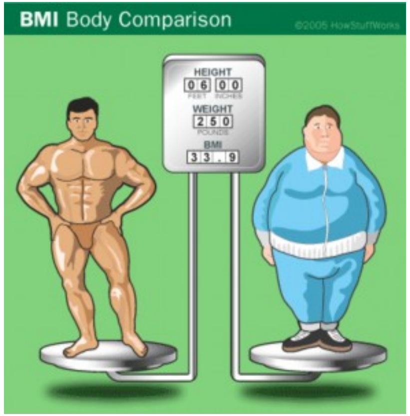
	Age	Male	Female
		Estimate (95% Confidence Interval)	
1946 NSHD	10	0.071 (0.065, 0.078)	0.108 (0.099, 0.119)
	20	0.144 (0.131, 0.158)	0.123 (0.111, 0.135)
	30	0.316 (0.298, 0.334)	0.190 (0.175, 0.206)
	40	0.516 (0.495, 0.537)	0.350 (0.330, 0.370)
	50	0.655 (0.636, 0.674)	0.519 (0.498, 0.539)
	60	0.746 (0.724, 0.766)	0.661 (0.638, 0.684)
1958 NCDS	10	0.083 (0.078, 0.089)	0.115 (0.109, 0.121)
	20	0.137 (0.129, 0.145)	0.135 (0.127, 0.143)
	30	0.392 (0.379, 0.405)	0.269 (0.258, 0.280)
	40	0.649 (0.638, 0.661)	0.449 (0.437, 0.462)
	50	0.753 (0.740, 0.766)	0.585 (0.569, 0.600)
1970 BCS	10	0.070 (0.063, 0.078)	0.117 (0.107, 0.126)
	20	0.177 (0.163, 0.193)	0.165 (0.154, 0.177)
	30	0.517 (0.503, 0.530)	0.341 (0.329, 0.353)
	40	0.674 (0.660, 0.687)	0.492 (0.477, 0.506)
1991 ALSPAC	10	0.191 (0.178, 0.205)	0.245 (0.231, 0.261)
2001 MCS	10	0.229 (0.219, 0.240)	0.288 (0.276, 0.300)

Johnson et al. 2015. Plos Med 12: e1001828

Development

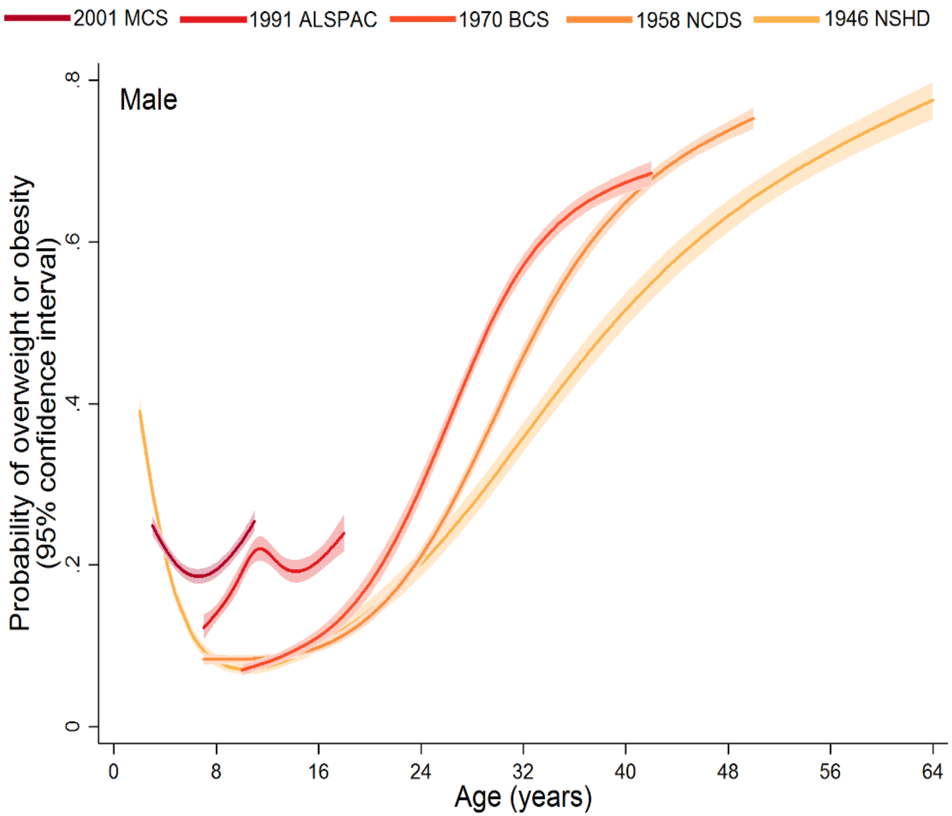
Is the secular increase in adolescent BMI (in boys) due to a change in fat mass or fat-free mass?

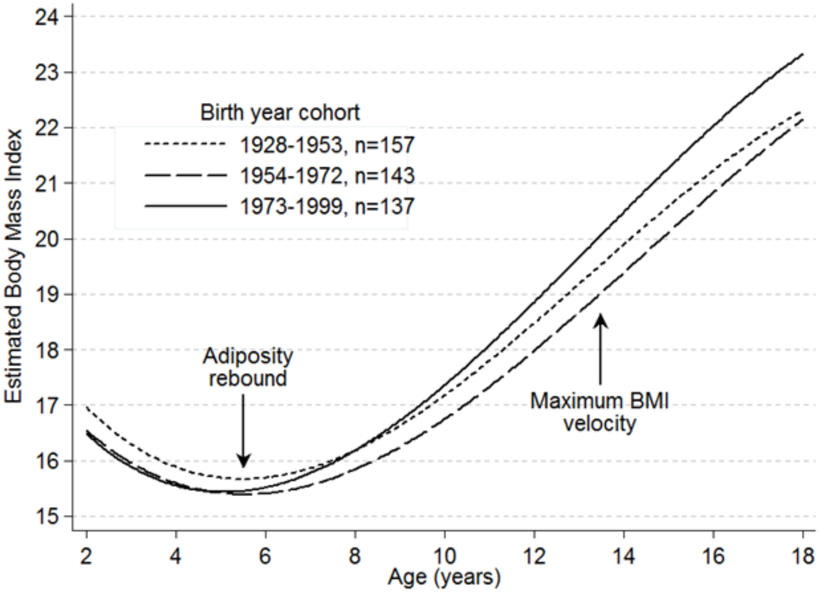
Cohort 3 (1984-1995) vs. Cohort 1 (1958-1970)	
BMI (kg/m^2) beta	1.970
Fat Mass Index (FMI; kg/m^2) beta	1.652
Fat-free Mass Index (FFMI; kg/m^2) beta	0.202
Change in BMI due to change in FMI	**84%**
Change in BMI due to change in FFMI	**10%**



Johnson et al. 2013. Ann Hum Biol 40

Development





Johnson et al. 2015. Plos Med 12: e1001828

Johnson et al. 2012. Am J Clin Nutr 95(5)

Development

Children born during (compared to before) the obesity epidemic have lower BMI early in life, early rebound, and then accelerated BMI gain. In agreement with:

- Barker hypothesis and empirical evidence, largely from historical cohorts

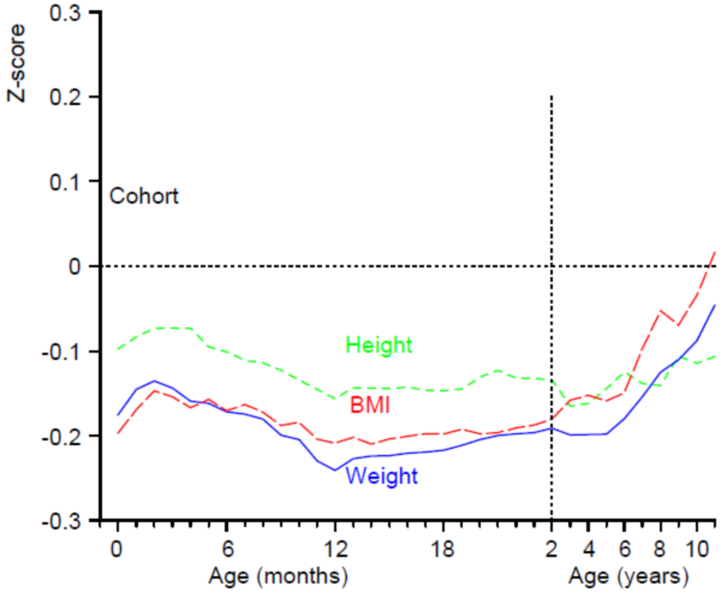
(Barker et al. 2009. Ann Hum Biol 36(5))

- Secular trends in infant weight gain and BMI peak in the Fels Longitudinal Study

(Johnson et al. 2013. Am J Hum Biol 25; Johnson et al. 2012. J Pediatr 160)

- Secular trends in BMI trajectories in other studies in other countries

(Deheeger & Rolland-Cachera. 2004. Arch Pediatr 11)



1. Summary of key findings 2006/07 to 2015/16[a]

	Reception		Year 6	
	Boys	Girls	Boys	Girls
Changes in prevalence of obesity Page 7	Downward trend, decreasing at a slower rate compared with last year	No upward or downward trend	Upward trend, rate of increase speeding up compared with last year	
Changes in prevalence of excess weight Page 7	Downward trend, decreasing at a faster rate compared with last year	No upward or downward trend	Upward trend, rate of increase speeding up compared to last year	Upward trend, rate of increase slowing down compared to last year
Changes in prevalence of overweight Page 7	Downward trend, decreasing at a faster rate compared with last year	No upward or downward trend	No upward or downward trend	

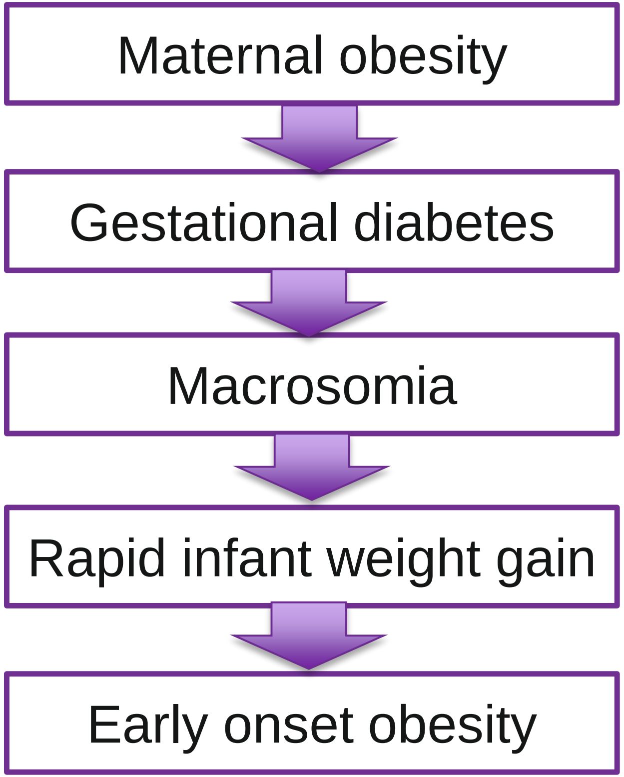
National Child Measurement Programme 2017

Development

1. Summary of key findings 2006/07 to 2015/16[a]

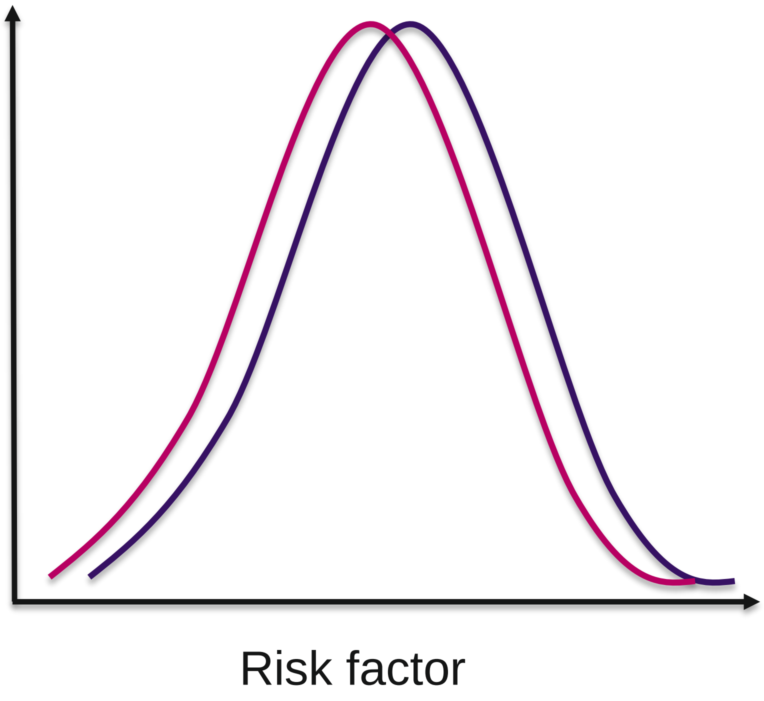
	Reception		Year 6	
	Boys	Girls	Boys	Girls
Changes in prevalence of obesity Page 7	Downward trend, decreasing at a slower rate compared with last year	No upward or downward trend	Upward trend, rate of increase speeding up compared with last year	
Changes in prevalence of excess weight Page 7	Downward trend, decreasing at a faster rate compared with last year	No upward or downward trend	Upward trend, rate of increase speeding up compared to last year	Upward trend, rate of increase slowing down compared to last year
Changes in prevalence of overweight Page 7	Downward trend, decreasing at a faster rate compared with last year	No upward or downward trend	No upward or downward trend	

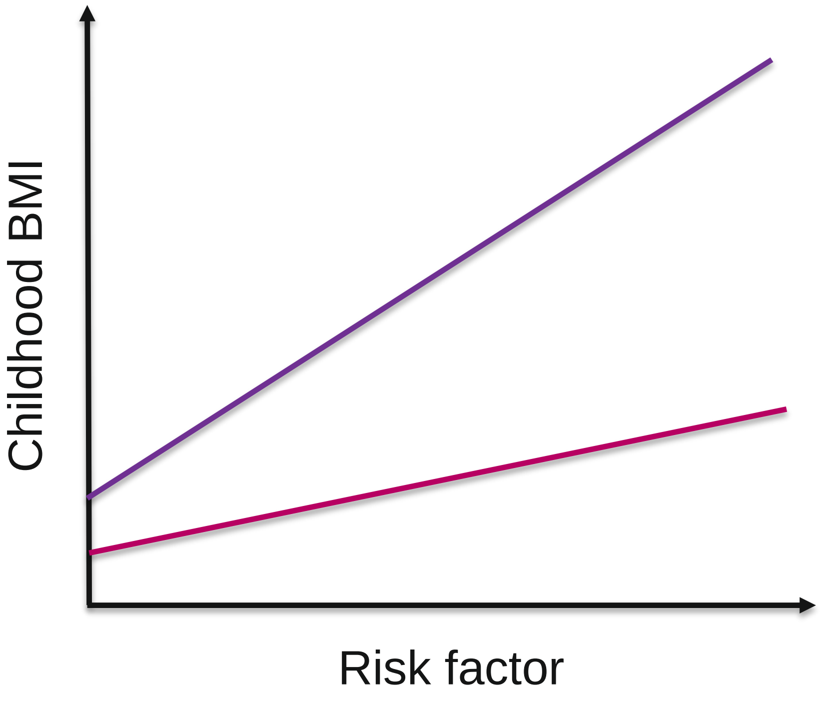
National Child Measurement Programme 2017



Causes

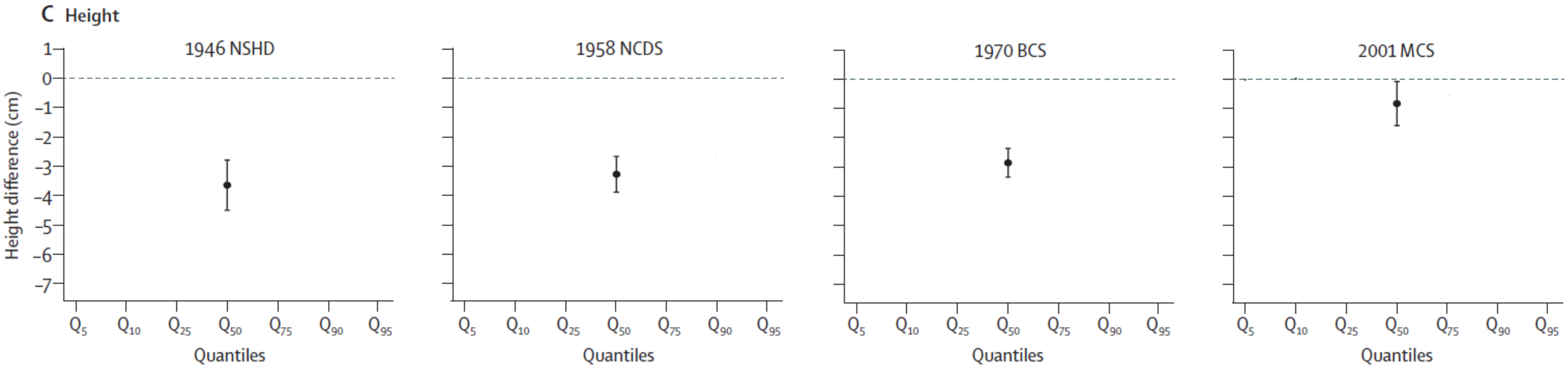
Cohorts born before obesity epidemic
Cohorts born during obesity epidemic





Causes – socioeconomic

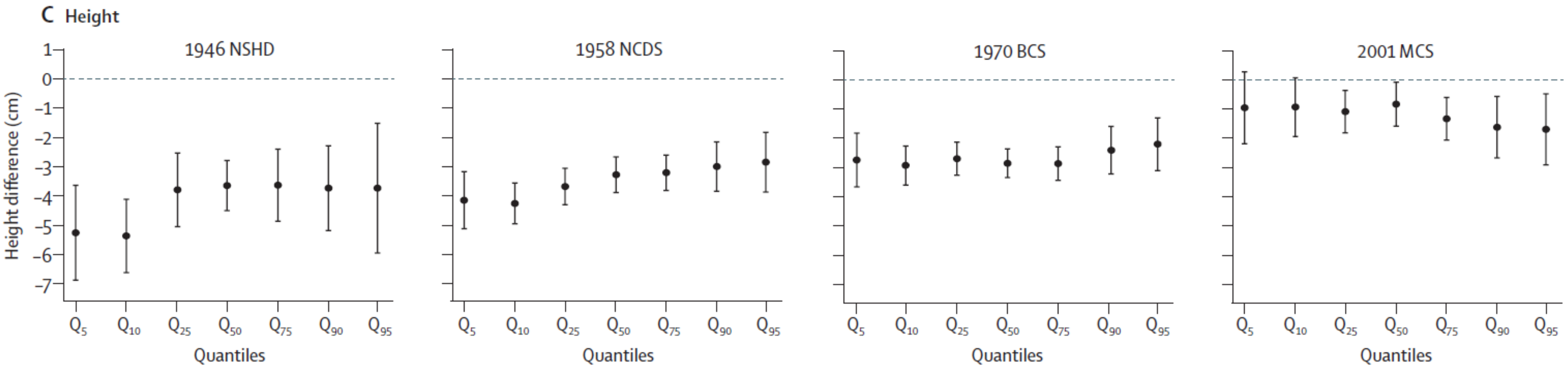
Estimated differences in **height** between children aged 11 years in the lowest social class compared to those in the highest social class (slope index of inequality)



Bann et al. 2018. Lancet Public Health 3(4)

Causes – socioeconomic

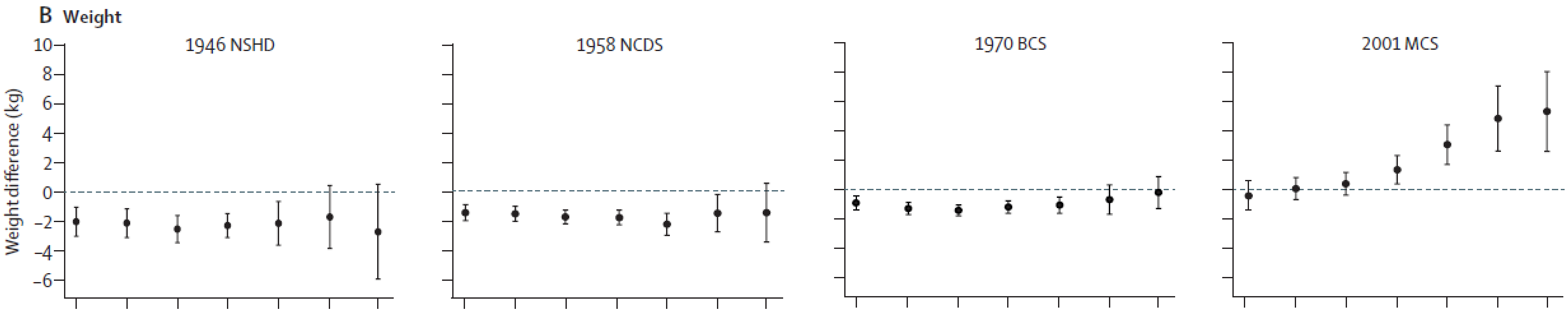
Estimated differences in **height** (at different quantiles)



Bann et al. 2018. Lancet Public Health 3(4)

Causes – socioeconomic

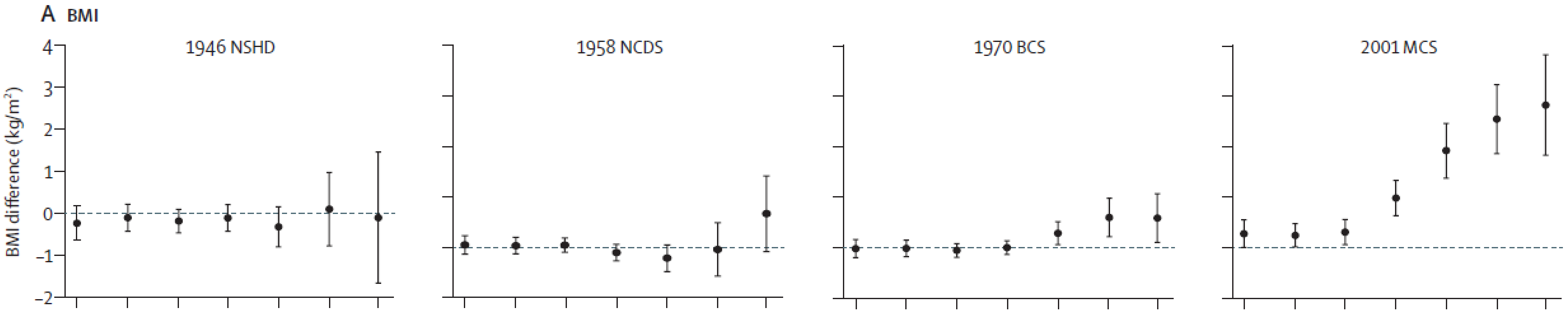
Estimated differences in **weight** (at different quantiles)



Bann et al. 2018. Lancet Public Health 3(4)

Causes – socioeconomic

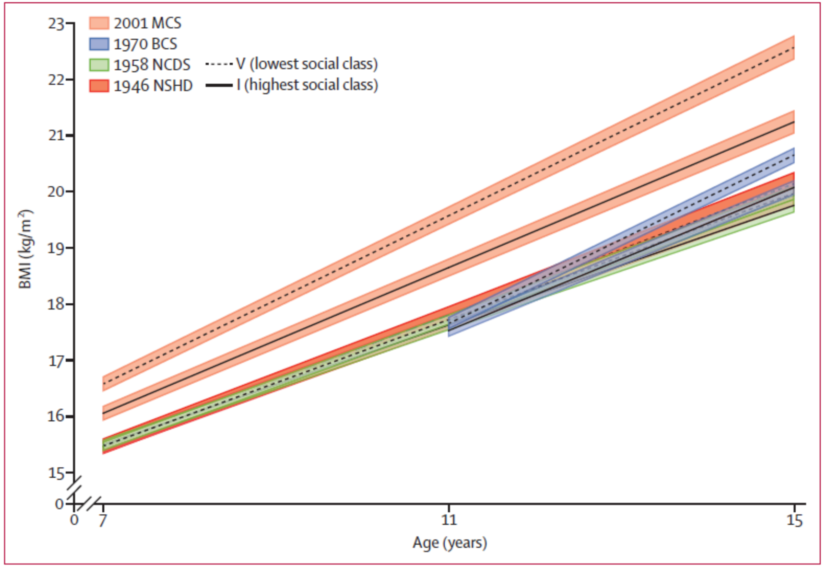
Estimated differences in **BMI** (at different quantiles)



Bann et al. 2018. Lancet Public Health 3(4)

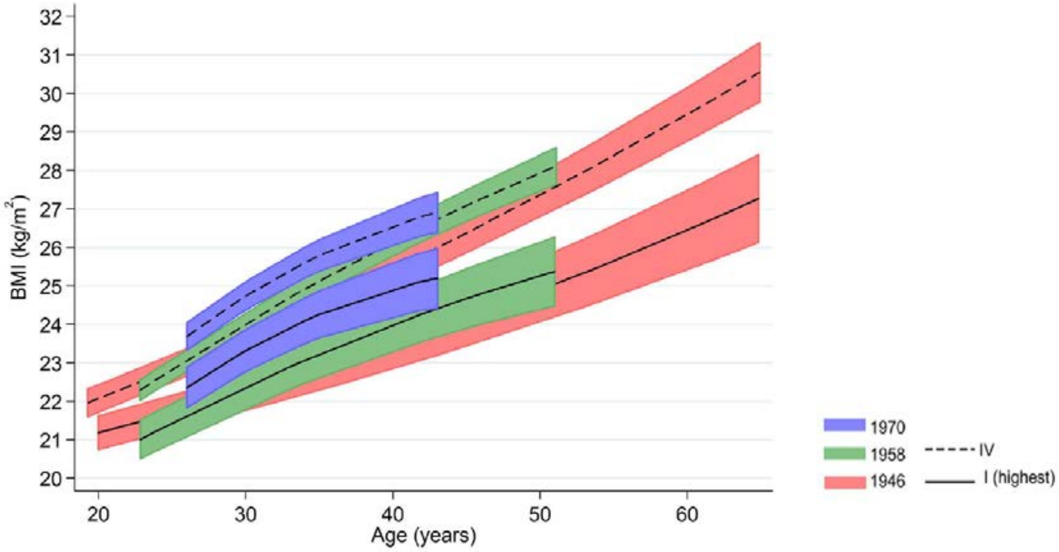
Causes – socioeconomic

Socioeconomic inequality in BMI from age 7 years only in 2001 cohort



Bann et al. 2018. Lancet Public Health 3(4)

Socioeconomic inequality in adulthood BMI in all cohorts (1946, 1958, and 1970)

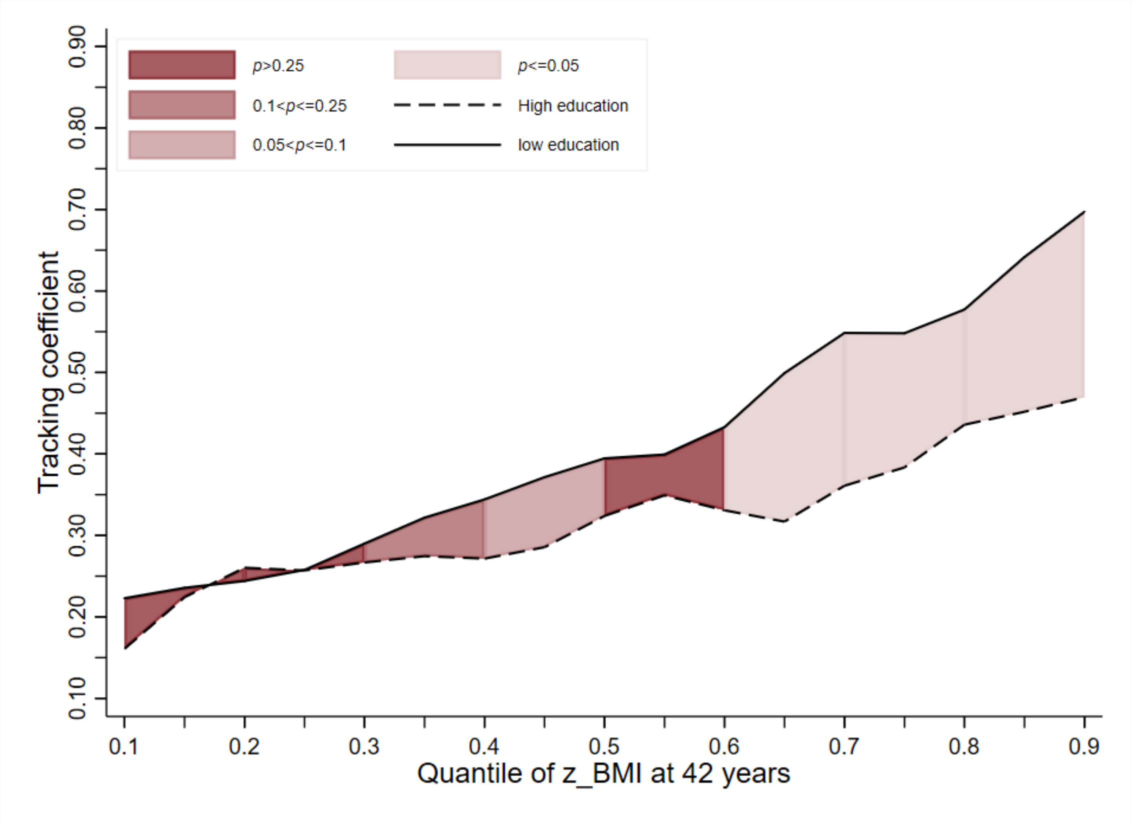


Bann et al. 2017. Plos Med 14(1): e1002214

Causes – socioeconomic

Socioeconomic inequality in BMI tracking between 10-42 years of age…

…particularly in females in the 1970 cohort at the upper part of the distribution



Norris et al. In Review. Int J Obes

Causes – genetic

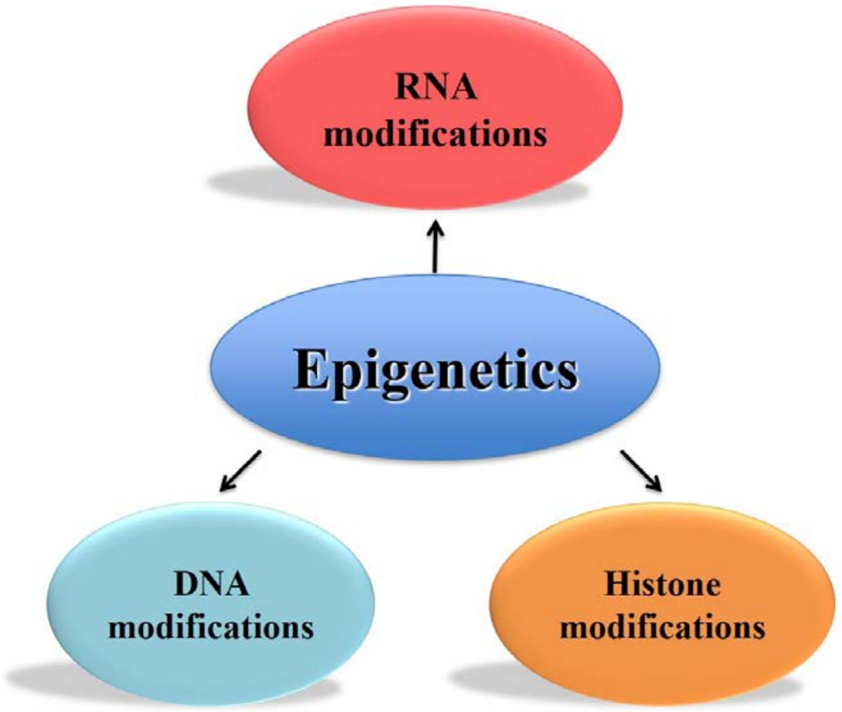
The positive association of obesity variants with adulthood adiposity strengthens over an 80-year period: a gene-by-birth year interaction

Table 4. Predicted effects of an obesity GRS on adiposity traits for individuals born in1930 versus 1970[a]

Trait	Effect of a 1-allele increase in the GRS on adiposity traits		
	birth year: 1930	birth year: 1970	fold-change in GRS effect
Weight, kg	0.62	1.78	2.89
BMI	0.16	0.47	2.87
WC, cm	0.47	1.24	2.64
WHtR	0.002	0.006	2.71
Sum of skinfolds, mm	0.86	2.56	2.96

Demerath et al. 2013. Hum Hered 75

Causes – genetic

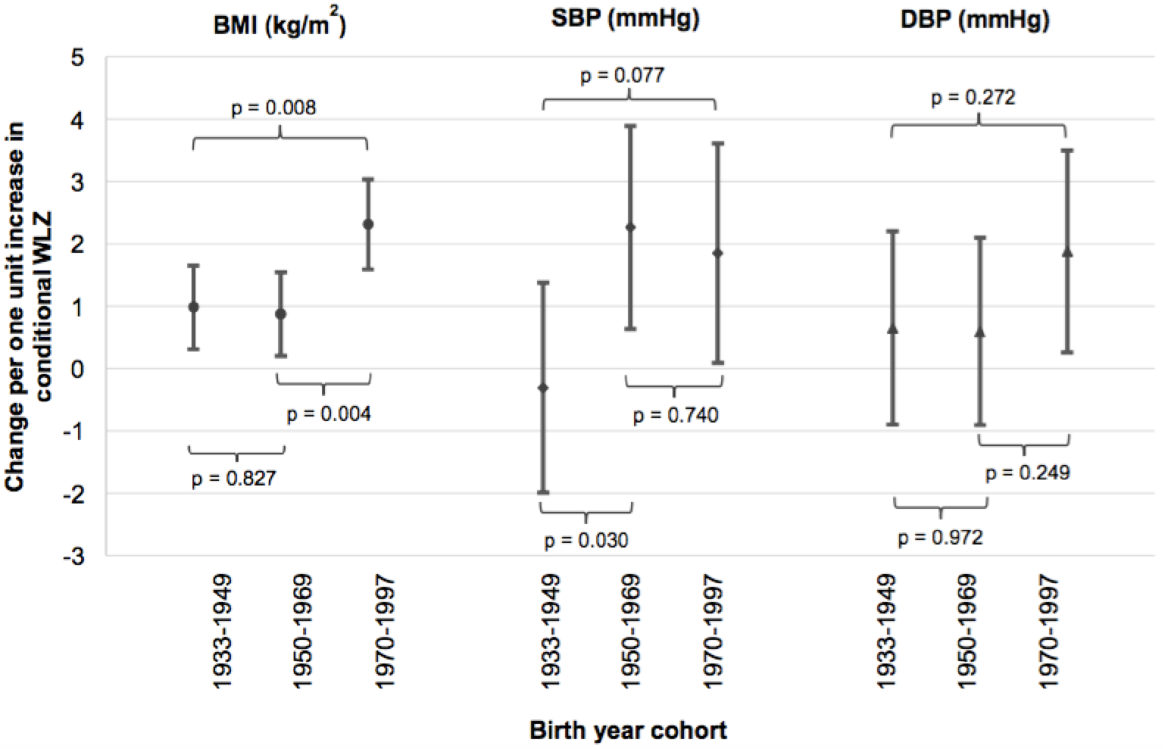


An emerging realm of biological regulation (Delatte et al., Science 2016)

"It is likely that typical patterns of epigenetic regulation of gene expression are being altered by shifts in the human environment and may be partly responsible for the gene-by-year of birth interactions on obesity we reported above"

Demerath et al. 2013. Hum Hered 75

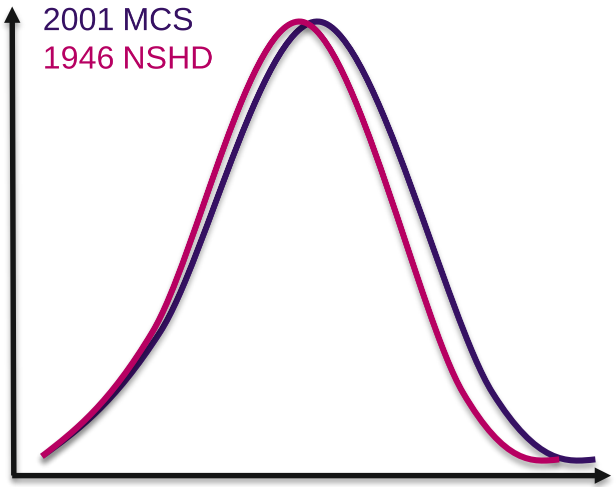
Causes – early-life risk factors



The positive association of **infant weight gain** with adulthood BMI has strengthened over time

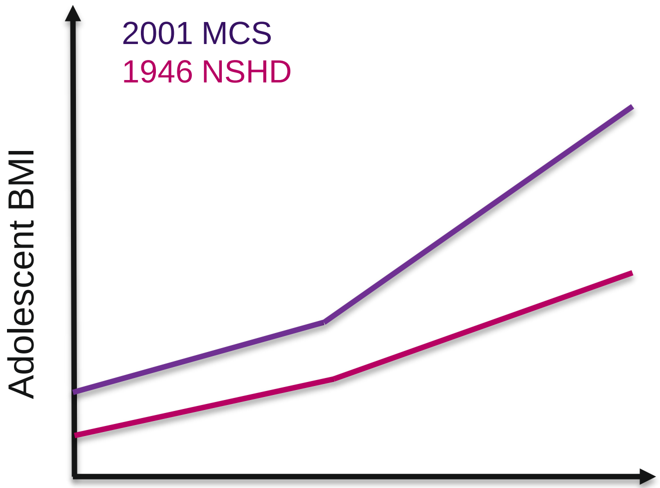
Lucas et al. 2018. Pediatr Obes

Causes – early-life risk factors



Infant weight gain

Explains 9% of the secular increase in BMI at age 11 years between 1957 and 2012



Infant weight gain

Explains 23% of the secular increase in BMI at age 11 years between 1957 and 2012

Johnson et al. 2018. Arch Dis Child

Causes

Stability of the Association between Birth Weight and Childhood Overweight during the Development of the Obesity Epidemic

Susi Rugholm, Jennifer L. Baker,* Lina W. Olsen,* Lene Schack-Nielsen,† Jenny Bua,* and Thorkild I. A. Sørensen**

Original Article
EPIDEMIOLOGY/GENETICS

Obesity

Stable Intergenerational Associations of Childhood Overweight During the Development of the Obesity Epidemic

Teresa A. Ajslev[1], Lars Ängquist[1], Karri Silventoinen[2], Jennifer L. Baker[1,3], and Thorkild I.A. Sørensen[1,3,4]

Findings implicate rapid infant weight gain, low socioeconomic position, and high genetic susceptibility in the development of the paediatric obesity epidemic

frontiers in GENETICS

ORIGINAL RESEARCH ARTICLE
published: 18 July 2012
doi: 10.3389/fgene.2012.00125

Assortative marriages by body mass index have increased simultaneously with the obesity epidemic

Teresa A. Ajslev[1†], Lars Ängquist[1†], Karri Silventoinen[2], Michael Gamborg[1], David B. Allison[3], Jennifer L. Baker[1] and Thorkild I. A. Sørensen[1]*

Consequences

Few studies have conducted cross-cohort research to explicitly model the consequences of the childhood obesity epidemic

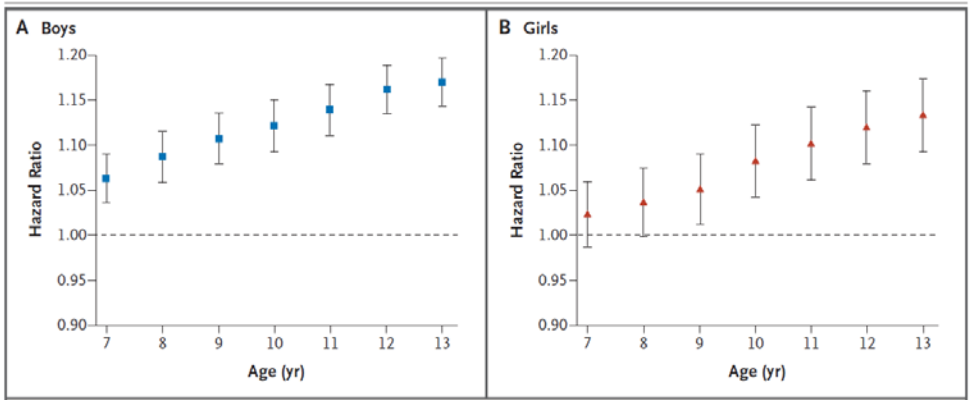


Figure 1. Body-Mass Index (BMI) in Childhood and the Risk of Coronary Heart Disease (CHD) in Adulthood.
The graphs depict the association between childhood BMI and the risk of having a CHD event (nonfatal or fatal) in adulthood. Hazard ratios and 95% confidence intervals are given for a 1-unit increase in BMI z score at each age from 7 to 13 years. The data are from 139,857 boys (Panel A) and 136,978 girls (Panel B) in the Copenhagen School Health Records Cohort. The associations were linear within each age, since trend tests resulted in the rejection of the alternative of nonlinearity modeled as a restricted cubic spline with five knots (all P values >0.15).

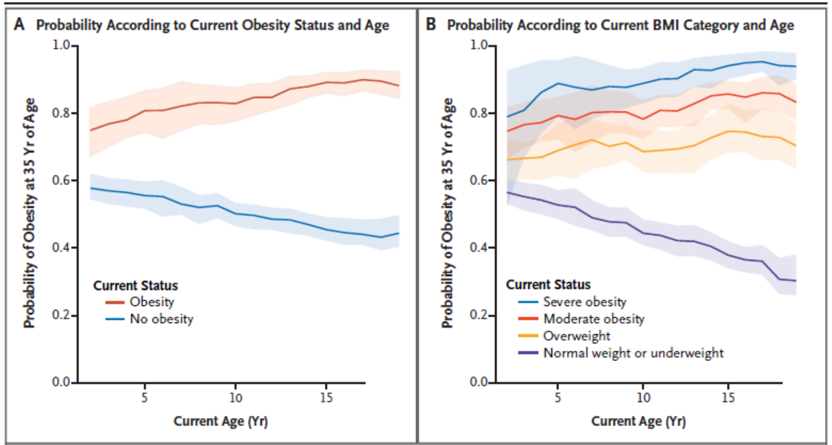
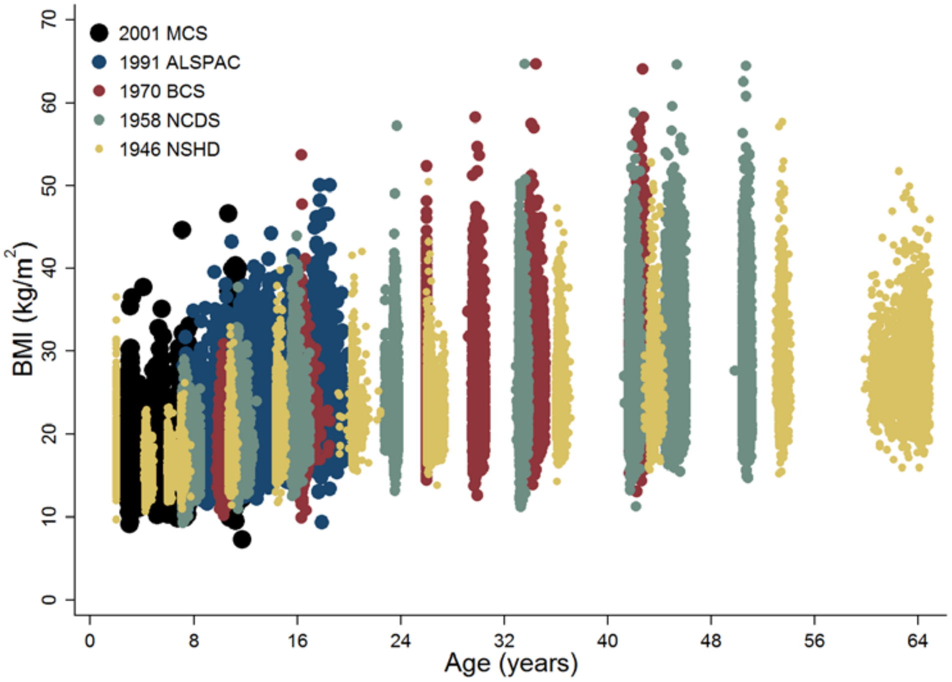


Figure 4. Predicted Probability of Obesity at the Age of 35 Years, According to Current Age, Obesity Status, and BMI Category.
Shown is the probability of obesity at the age of 35 years, according to current age and obesity status (Panel A) and BMI category (Panel B). The shaded areas indicate 95% uncertainty intervals.

Baker et al. 2007. NEJM 357(23)

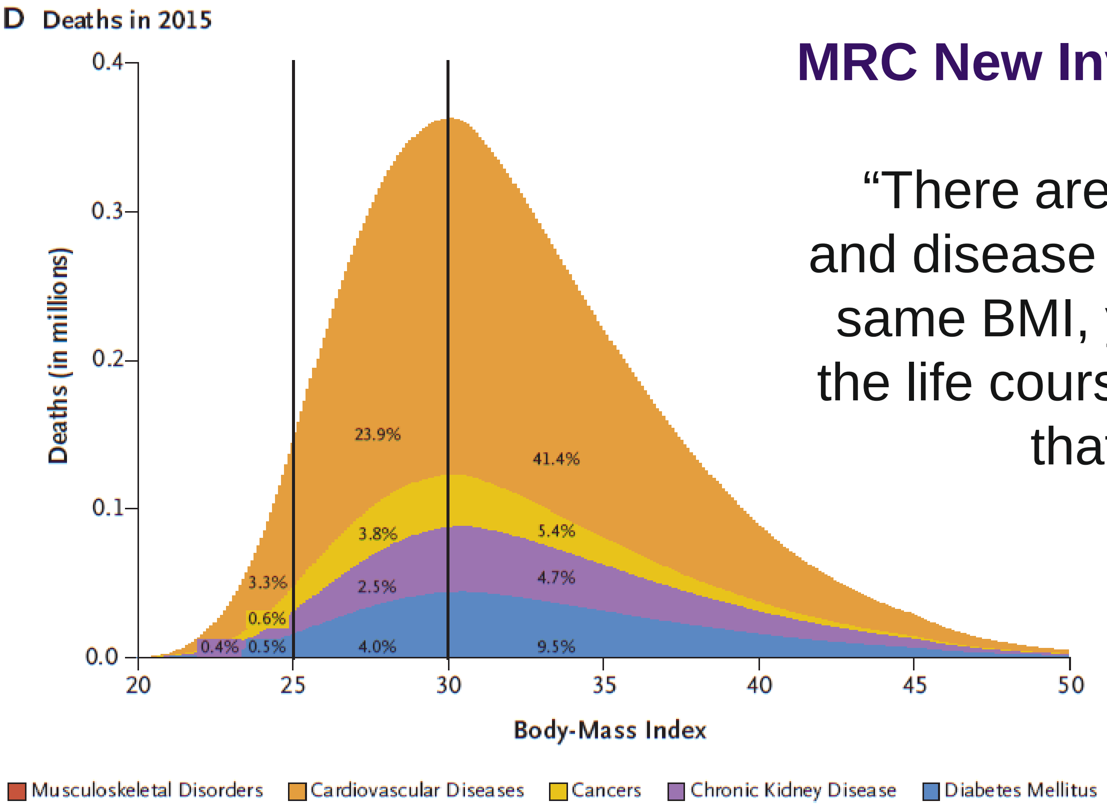
Ward et al. 2017. NEJM 377(22)

Consequences



Cohort & Longitudinal Studies Enhancement Resources

Consequences

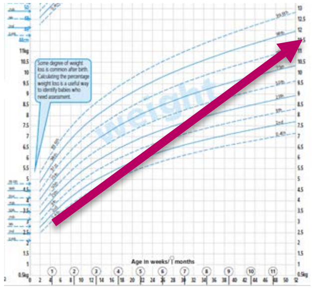


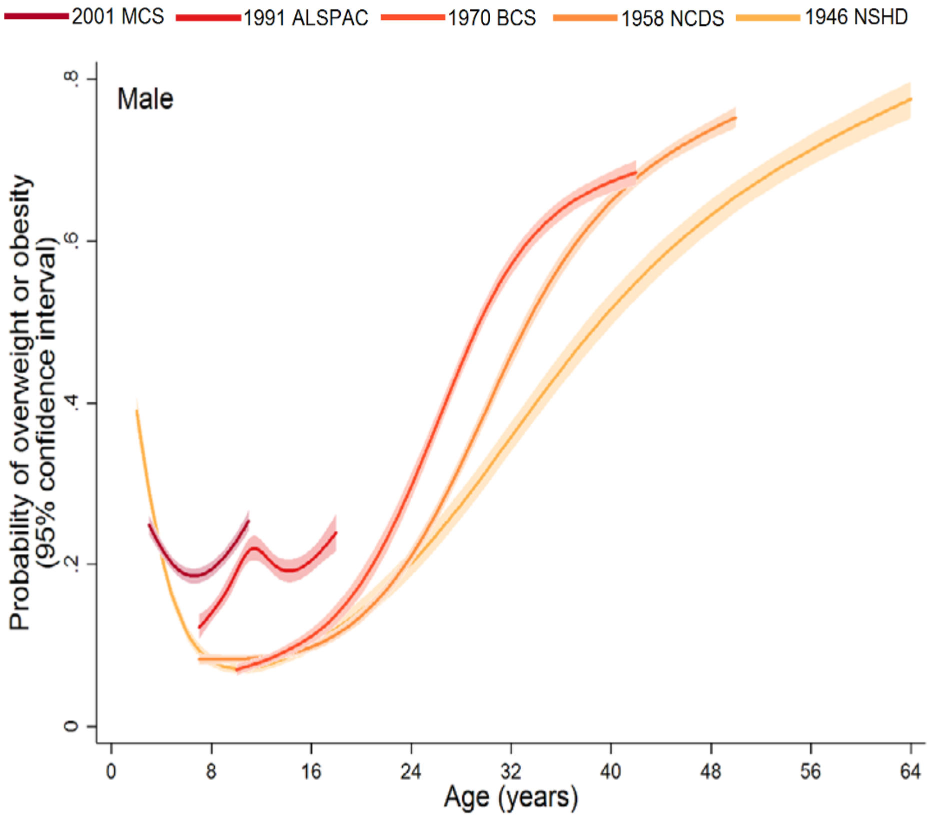
MRC New Investigator Research Grant

"There are clearly differences in health and disease risks among people with the same BMI, yet very little is known about the life course exposures and processes that explain that individual-level heterogeneity"

GBD 2015 Obesity Collaborators. 2017. N Engl J Med 377(1)

Conclusions





Acknowledgements

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MRC Medical Research Council

NHS
National Institute for Health Research

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