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Lifetime body size, physical function and mortality risk

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Body size and physical function

- Height
- Body mass index (BMI)
- Birth weight
- Physical function – systematic review

Height and mortality

Batty et al. Econ Hum Biol, 2009

US life insurance studies relating height to mortality experience according to age of issuants (results are ratio of actual to expected mortality, expressed as a percent).

	Supplement to the Medical Impairment Study (1885–1927)	Medico-Actuarial Mortality Investigation (1909–1912)	Build and Blood Pressure Study (1935–1953[a])
Age 20–29 years			
Short[b]	92	96	105
Medium	104	110	101
Tall	114	122	108
Age 30–39 years			
Short	99	107	107
Medium	100	109	102
Tall	110	113	99
Age 40–49 years			
Short	102	110	110
Medium	102	109	108
Tall	101	120	98
Age 50–59 years			
Short	113	108	116
Medium	96	109	108
Tall	100	101	105

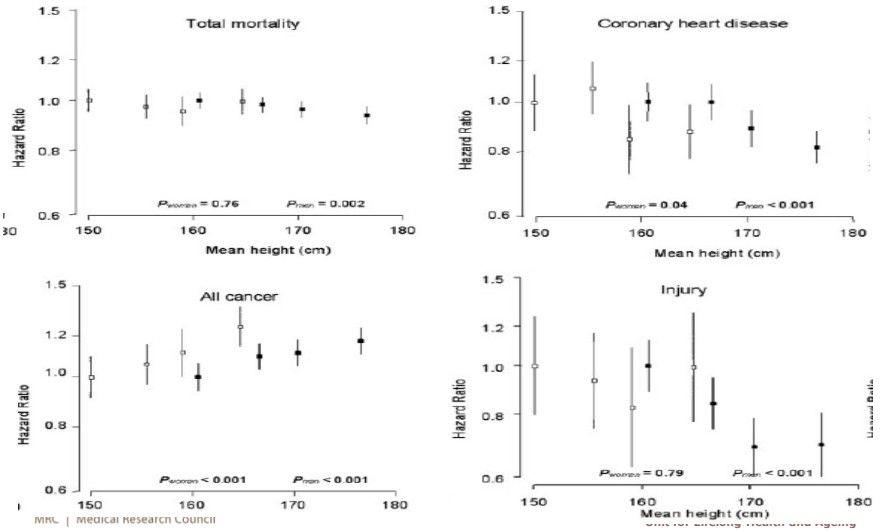
[a] Years in parentheses refer to period of height collection.
[b] Height cut-offs were undefined in the original reports. *Source*: Actuarial Society of America and Association of Life Insurance Directors (1932), Society of Actuaries (1959a,b).

Height and mortality

- Shorter height – higher all cause mortality risk
  - Association possibly weaker in women than men
- Varies by cause of death
  - Shorter height – higher risk of CVD, respiratory disease, (injury/suicide?)
  - Taller height – higher risk of some cancers (colorectum, breast, central nervous system, skin, endometrium, thyroid, blood) - Gunnell et al. Epidemiol Rev, 2001

Asia-Pacific Collaboration – Lee et al. IJE 2009

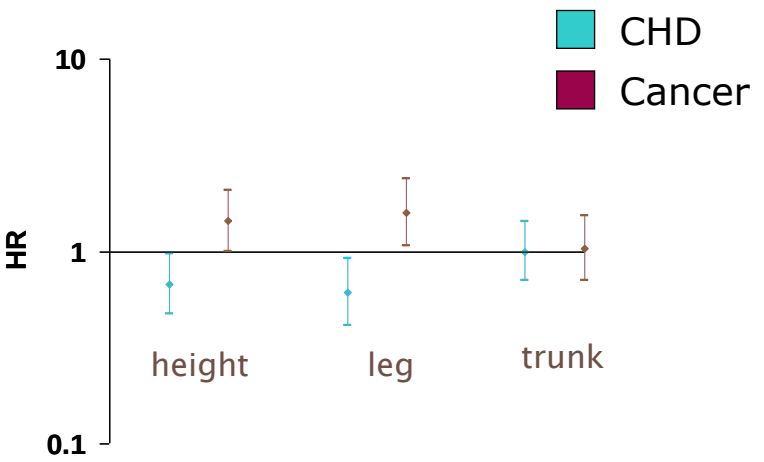
21,000 deaths in 510,000 men and women



How far back in the life course is an effect observed?

- Height as index of childhood diet, psychosocial stressors, socioeconomic conditions and chronic illness
  - Investigate these factors directly
- Adult leg length is a marker of early childhood growth
  - Leg length more strongly related with CHD risk
  - Less clear for cancers

Components of childhood height (<8 years) and CHD and cancer mortality

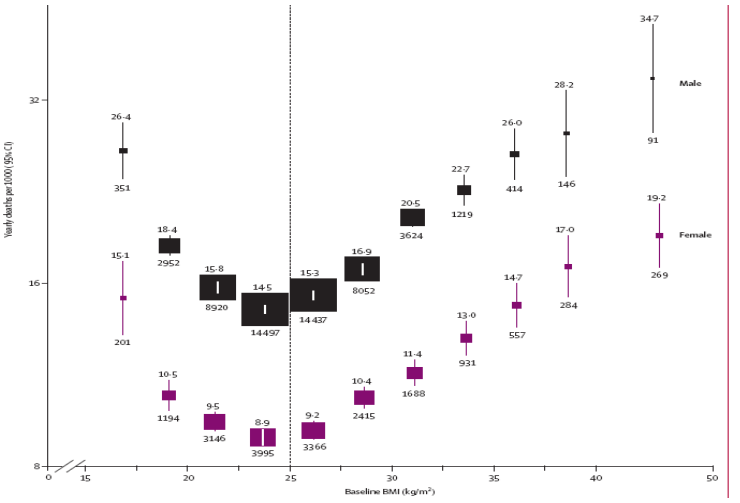


Gunnell et al. JECH, 1998

Socioeconomic inequalities

- Better socioeconomic position – taller height
- Associations with height appear to be independent of socioeconomic position
- Height may explain some of the socioeconomic inequalities in CHD mortality

Body mass index and mortality: 900,000 individuals and 57 studies



Prospective studies collaboration, Lancet 2009

How far back in the life course is an effect observed?

- Studies in adolescence
  - Higher BMI – higher mortality risk
- Studies in childhood/adolescence
  - Positive or J-shape association

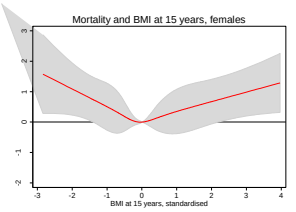
- Tracking of BMI into adulthood
- Locus of fat deposition during adolescence
- Overweight children have unfavourable levels of CHD risk factors, greater arterial stiffness and CIMT

Adolescent and early adult BMI and all cause mortality: 1946 British birth cohort

Females

15 years

Males



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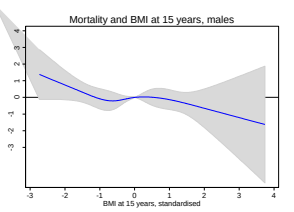

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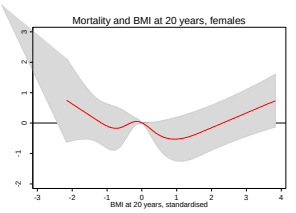
20 years



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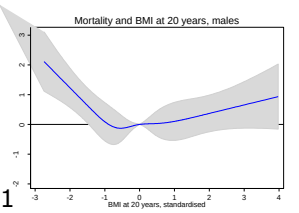

p=0.001

Strand et al. submitted

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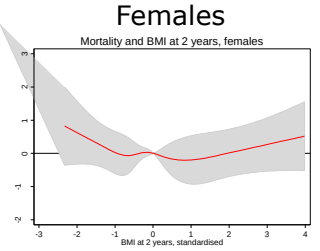
Childhood BMI and all cause mortality: 1946 British birth cohort

Females

2 years

Males



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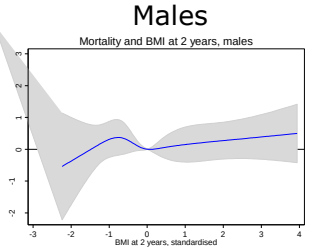

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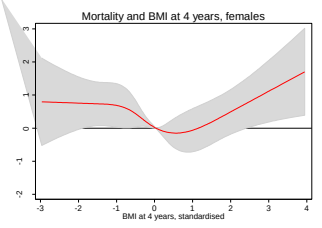
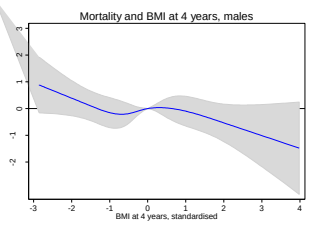


4 years

p=0.02



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Strand et al. submitted

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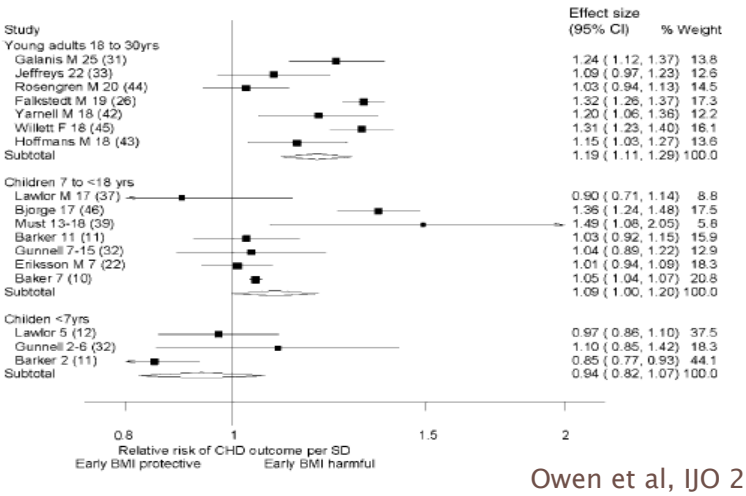
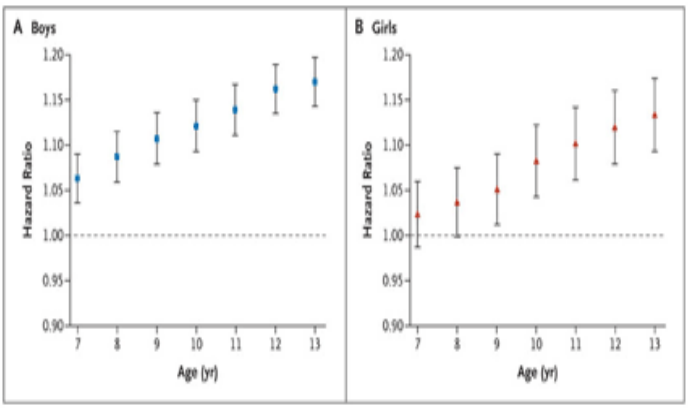
Early life BMI and fatal and non-fatal CHD
(731,337 individuals and 23,894 CHD events)



Owen et al, IJO 2009

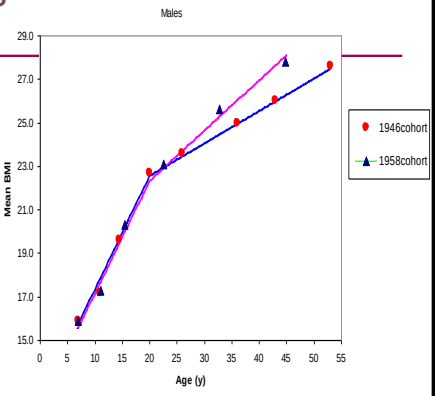
Childhood BMI and fatal and non-fatal CHD



Baker et al. NEJM 2007

Socioeconomic inequalities

- BMI and obesity increasing across all ages



- Strong socioeconomic gradient in obesity
- Current evidence suggests that adult BMI explains some but not all of the SEP inequalities in mortality
- Adjustment usually for single measure of BMI

Birth weight and all cause mortality
– Baker et al. Epidemiol 2008

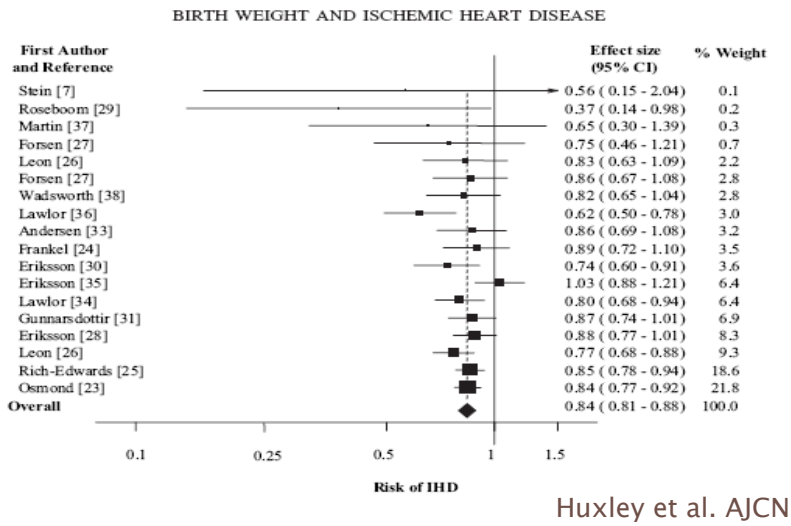
- Fetal programming (Barker)
- Birth weight used as a proxy of fetal growth

- Danish study of 216,464 men and women born 1936-1979
- U-shaped relationship
  - Lowest birth weight category compared with average 17% increased risk
  - Highest birth weight category compared with average 7% increased risk

Birth weight and cause-specific mortality
– Baker et al. Epidemiol 2008

- Positive linear for cancer
- U-shaped for circulatory disease and all other causes
- No sex differences

Birth weight and IHD (fatal and non-fatal)



Huxley et al. AJCN 2007

Beyond body mass index

- Association with BMI unclear at older ages
- Cohort changes in association between BMI and mortality

- Other measures of obesity
- Length of time overweight/obese
- Weight loss in adult life
- Life course patterns of fat and muscle mass

Physical capability and mortality – systematic review – Cooper, Kuh, Hardy et al.

- The ability to perform physical tasks in order to function independently in daily life

- Objective measures include: grip strength, chair rises, gait speed and standing balance



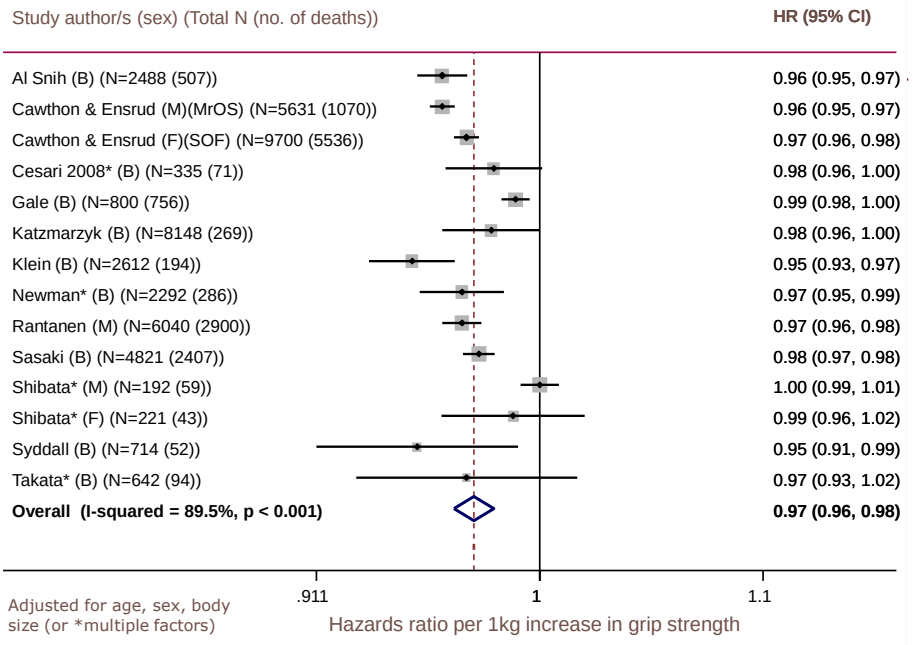

Objective measures of physical capability

- Useful indicators of current status
- Are they also useful predictors of future health and mortality?

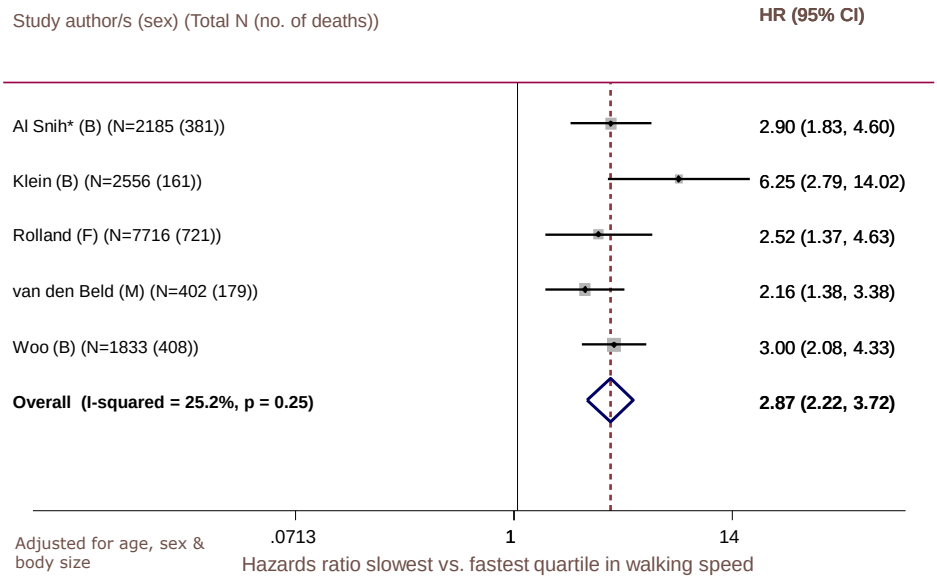
Systematic review to establish whether the associations of these measures with mortality:

- are found consistently
- are found in samples who are healthy and community-dwelling at baseline
- vary by sex, length of follow-up, age at measurement

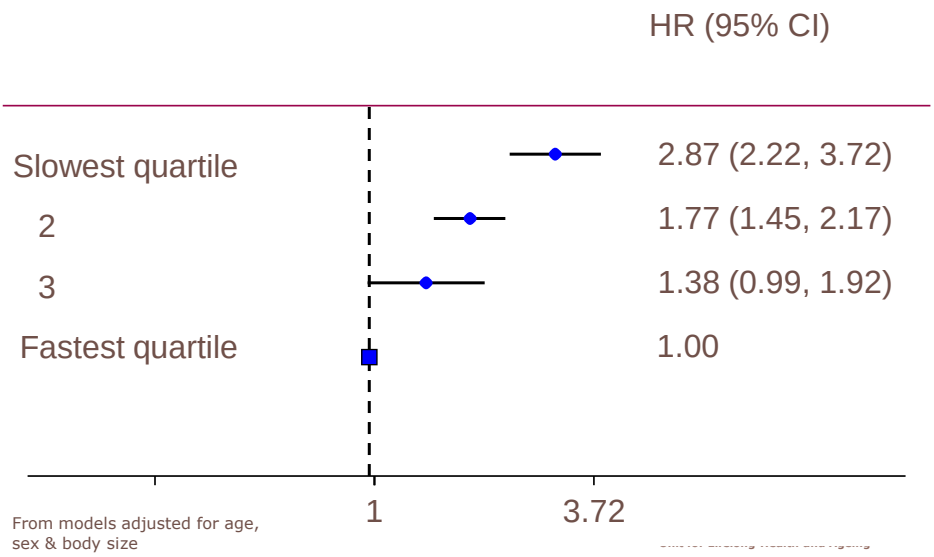
Hazards ratios of mortality per 1 kg increase in grip strength



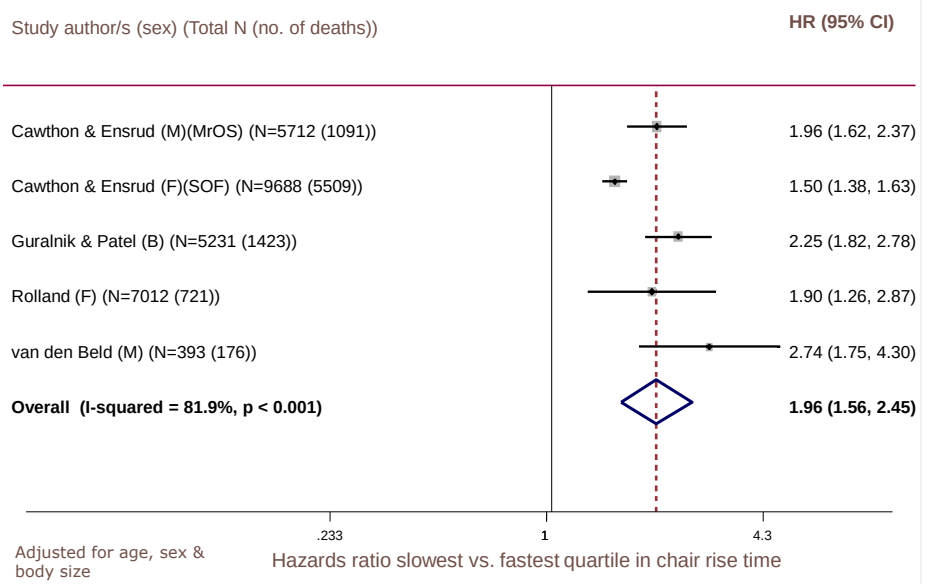
Hazards ratios of mortality comparing slowest with fastest quartile of walking speed



Results from meta-analyses of hazards ratios of mortality comparing each quartile of walking speed with the fastest quartile (n=5)



Hazards ratios of mortality comparing slowest with fastest quartile of chair rise time



Standing balance and all-cause mortality

5 sets of results (each from a unique study)

- method of measuring standing balance not consistent and so unable to meta-analyse results
- all studies found evidence to suggest that poorer performance associated with higher mortality rates

How far back in the life course is association observed?

Stratification		Grip (unit)	Grip (q)	Walking speed	Chair rises
None		14	14	5	5
Age (y)	**≤ 60**	3	4	0	0
	61-70	4	2	1	0
	>70	7	8	4	5
Follow-up (y)					
	≤ 5	5	5	4	1
	6-10	4	2	1	3
	11-20	2	2	0	1
	>20	3	5	0	0
Region					
	N. America	8	7	2	3
	Japan	2	1	0	0
	Other	4	6	3	2
Sex	**Male**	10	12	4	3
	Female	9	10	4	3

How far back in the life course is association observed?

Stratification		Grip (unit)	Grip (q)	Walking speed	Chair rises
None		14	14	5	5
Age (y)	**≤ 60**	3	4	0	0
	61-70	4	2	1	0
	>70	7	8	4	5
Follow-up (y)			p<0.01		
	≤ 5	5	**2.16 (1.70, 2.75)**	4	1
	6-10	4	**2.26 (1.88, 2.72)**	1	3
	11-20	2	**1.43 (1.33, 1.54)**	0	1
	>20	3	**1.39 (1.15, 1.70)**	0	0
Region					
	N. America	8	7	2	3
	Japan	2	1	0	0
	Other	4	6	3	2
Sex	**Male**	10	12	4	3
	Female	9	10	4	3

Explanations

- Publication bias
- Confounding
- Sub-clinical disease (reverse-causality)
- Underlying ageing process
- Developmental risk factors e.g. growth, social environment

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