

Adolescent growth

Beyond the 1000 day window

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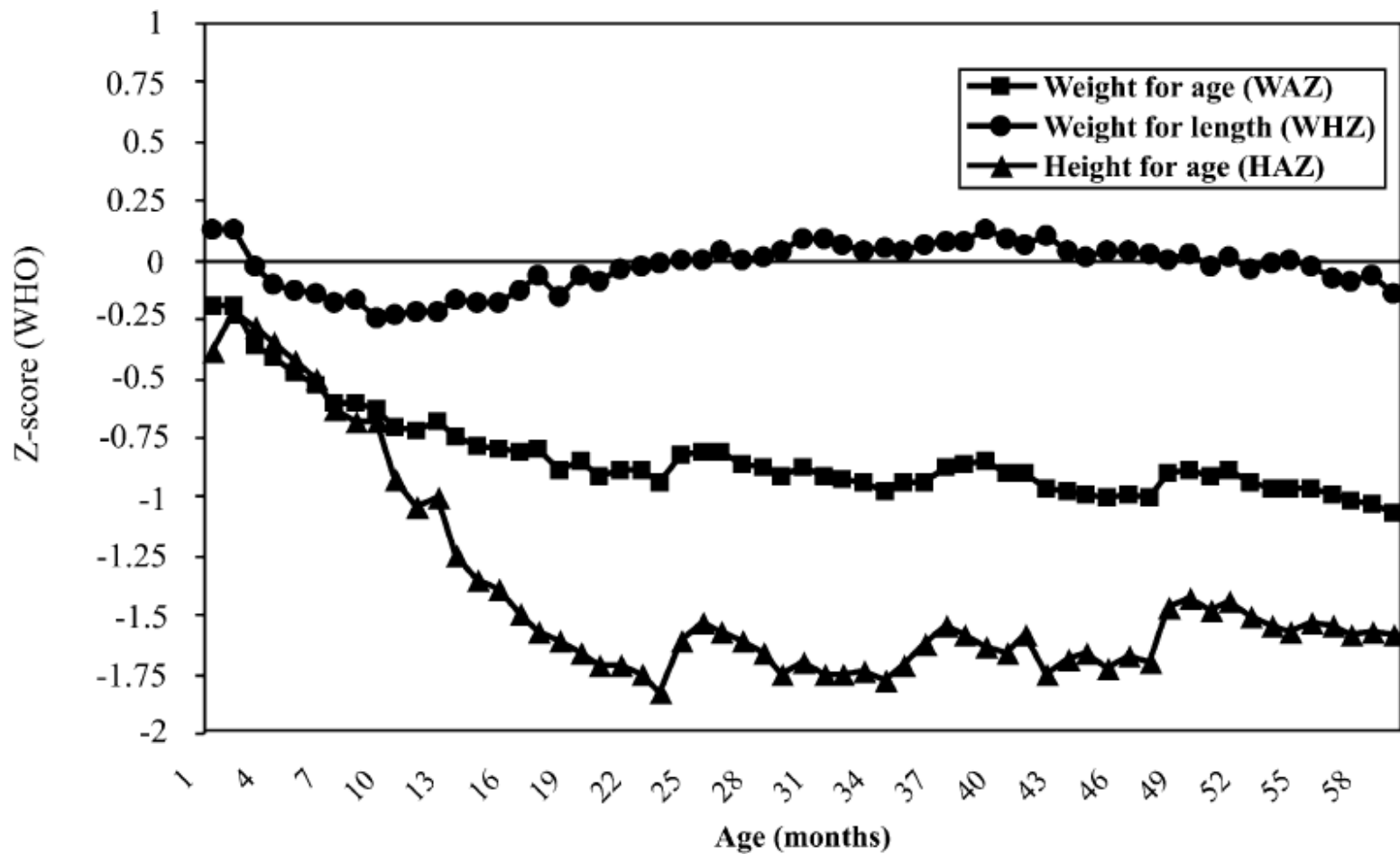
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Outline

- The biological changes of puberty are a profound period of human growth, with major implications for adult height and weight
- Differential impact of secular trends in linear growth and timing of menarche in LIMC
- Importance of overweight and underweight



Anthropometric Z scores in 54 studies of LMIC relative to the WHO standard, Victora et al, 2010

**GIRLS: 2 TO 18 YEARS
HEIGHT PERCENTILE**

MOTHER'S HEIGHT _____
FATHER'S HEIGHT _____

SIMPLIFIED CALCULATION OF BODY SURFACE AREA (BSA)

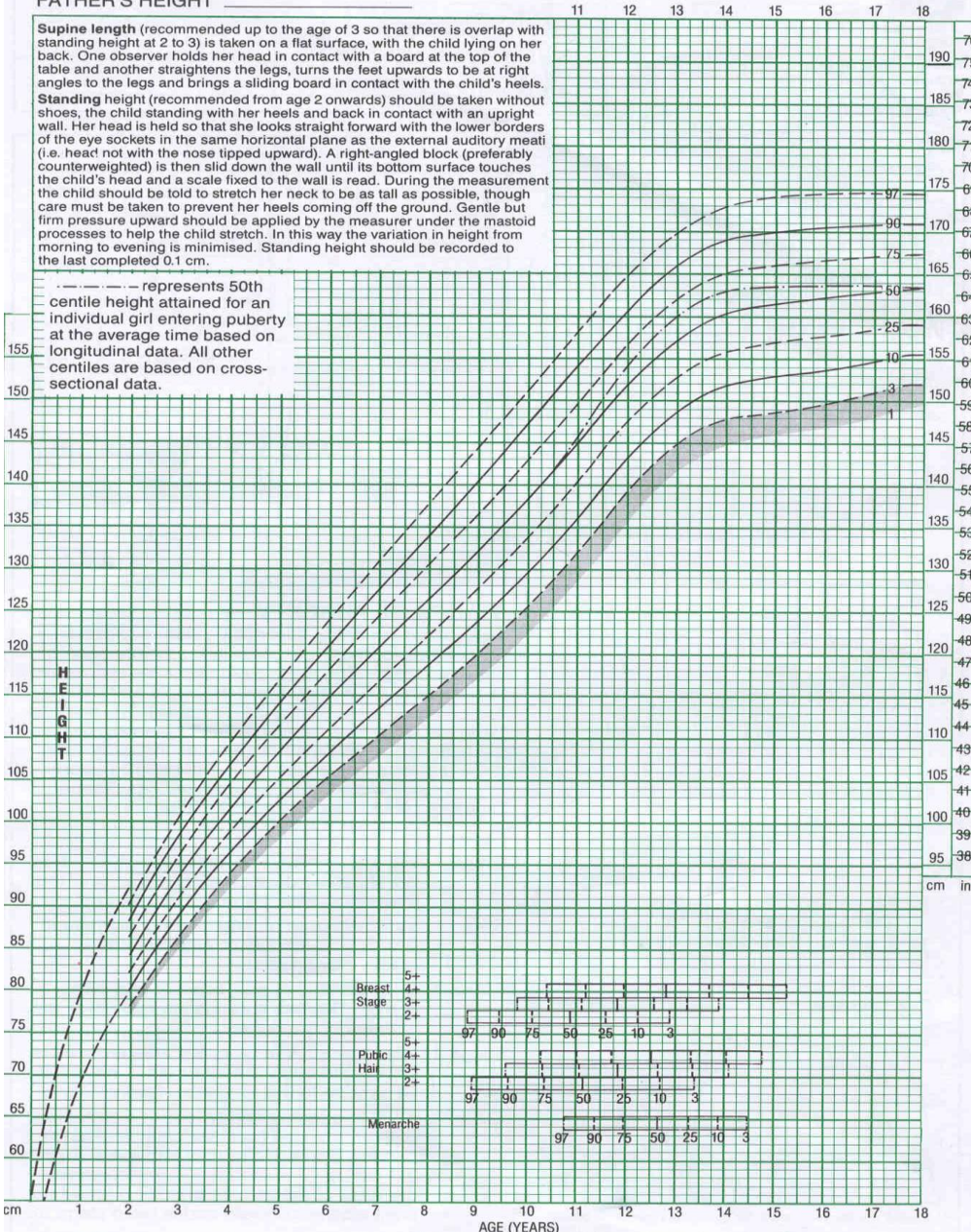
$$BSA (m^2) = \sqrt{\frac{Ht (cm) \times Wt (kg)}{3600}}$$

Ref: Mosteller R.D.
Simplified calculation of body surface area
N.Engl. J.Med. 1987; 317:1098.

Supine length (recommended up to the age of 3 so that there is overlap with standing height at 2 to 3) is taken on a flat surface, with the child lying on her back. One observer holds her head in contact with a board at the top of the table and another straightens the legs, turns the feet upwards to be at right angles to the legs and brings a sliding board in contact with the child's heels.

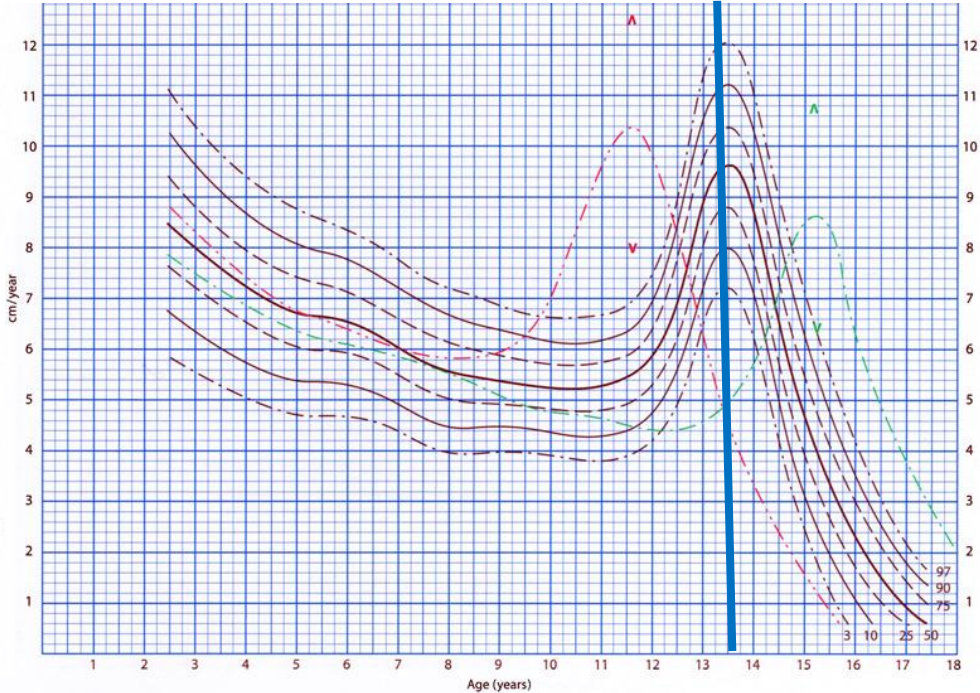
Standing height (recommended from age 2 onwards) should be taken without shoes, the child standing with her heels and back in contact with an upright wall. Her head is held so that she looks straight forward with the lower borders of the eye sockets in the same horizontal plane as the external auditory meati (i.e. head not with the nose tipped upward). A right-angled block (preferably counterweighted) is then slid down the wall until its bottom surface touches the child's head and a scale fixed to the wall is read. During the measurement the child should be told to stretch her neck to be as tall as possible, though care must be taken to prevent her heels coming off the ground. Gentle but firm pressure upward should be applied by the measurer under the mastoid processes to help the child stretch. In this way the variation in height from morning to evening is minimised. Standing height should be recorded to the last completed 0.1 cm.

--- represents 50th centile height attained for an individual girl entering puberty at the average time based on longitudinal data. All other centiles are based on cross-sectional data.

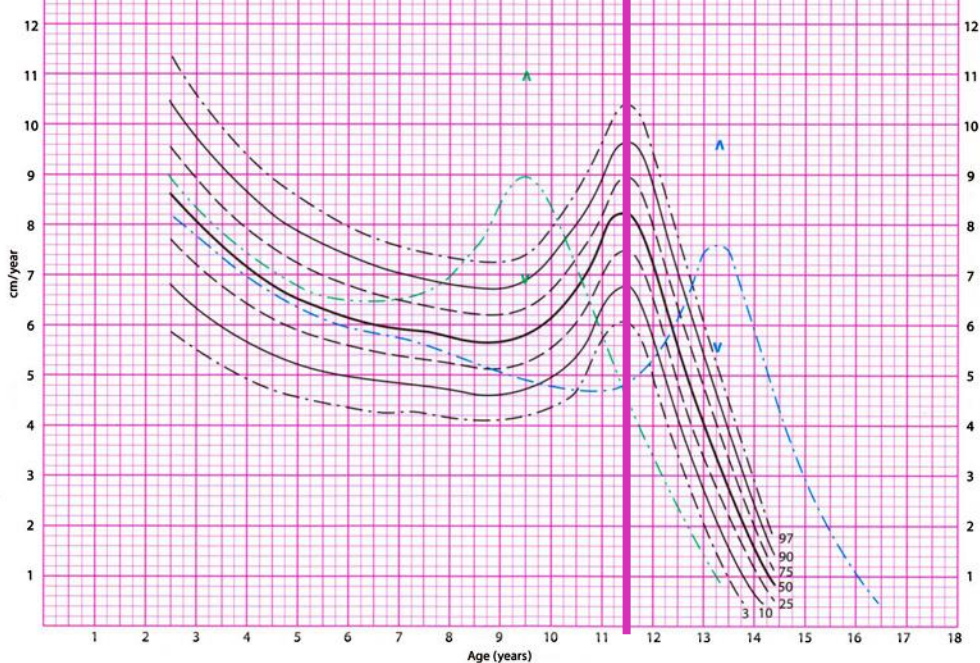


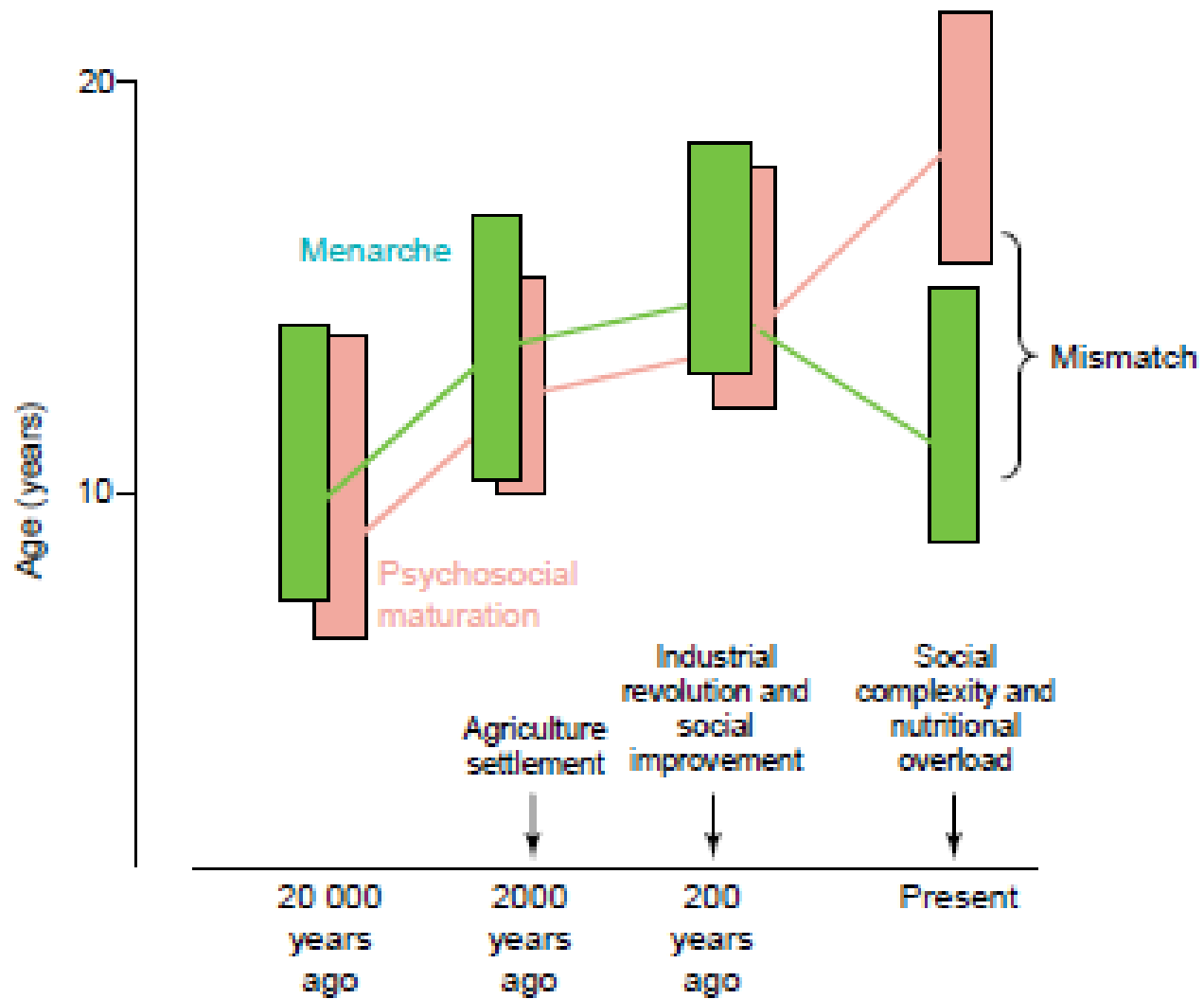
- Sharply decelerating infancy component
 - continuation of fetal growth
- Slowly decelerating component
 - begins around 6 months and continues to maturity
- Sigmoid shaped pubertal phase superimposed on continuing childhood growth

BOYS

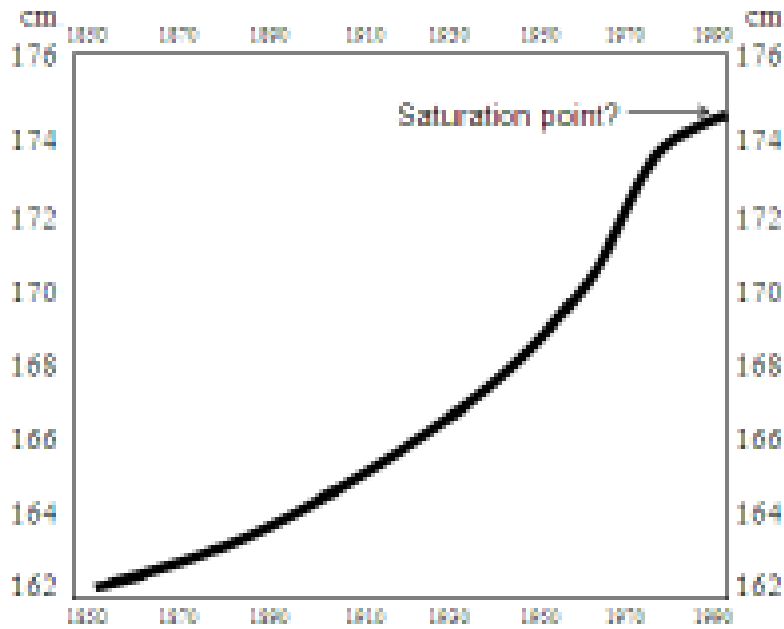


GIRLS

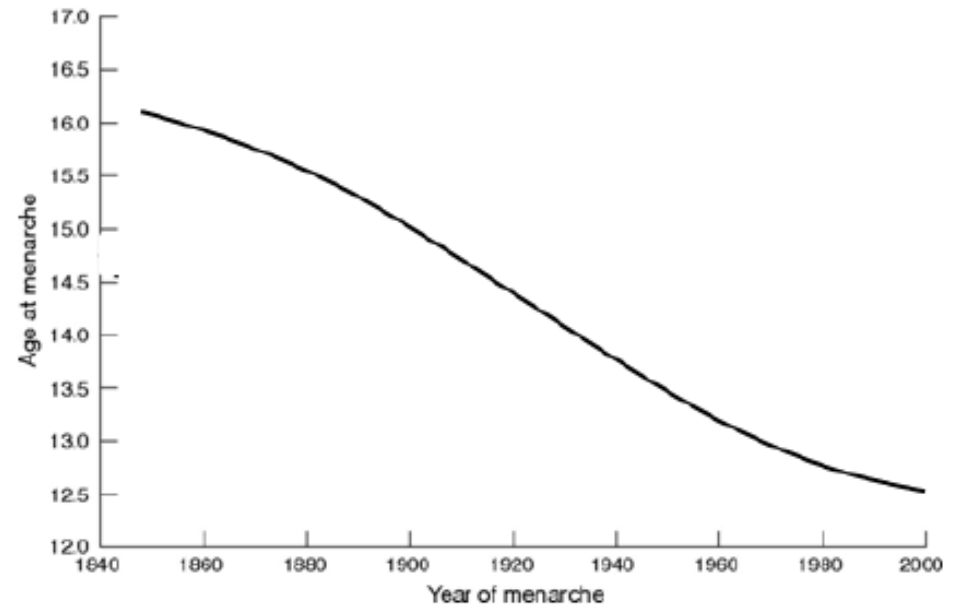




Secular trends in height, menarche



Italian male height
1954-1980



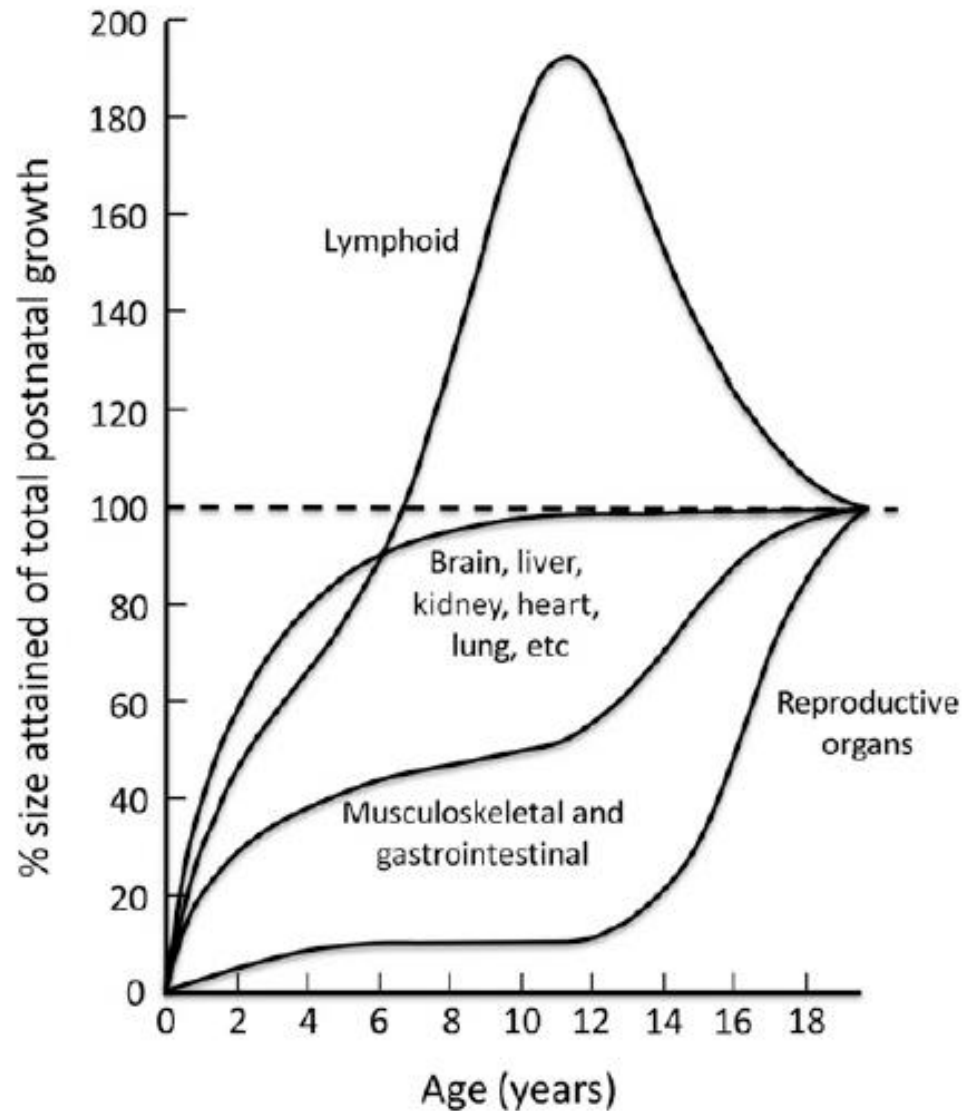
Italian female menarchal age
1840-2000

Secular trends

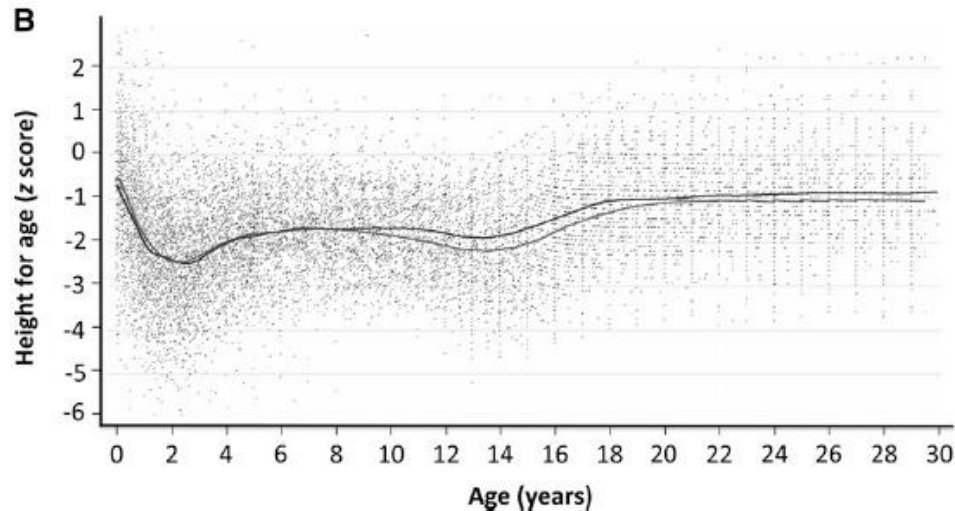
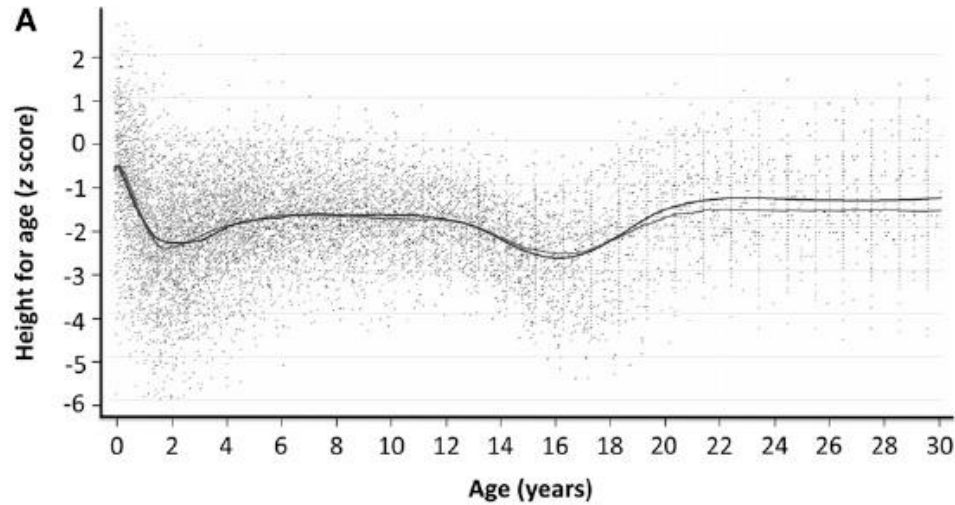
Stature and pubertal timing

- In developing countries, earlier age at menarche is associated with taller adult stature
- In industrialised societies, earlier age at menarche is associated with shorter adult stature

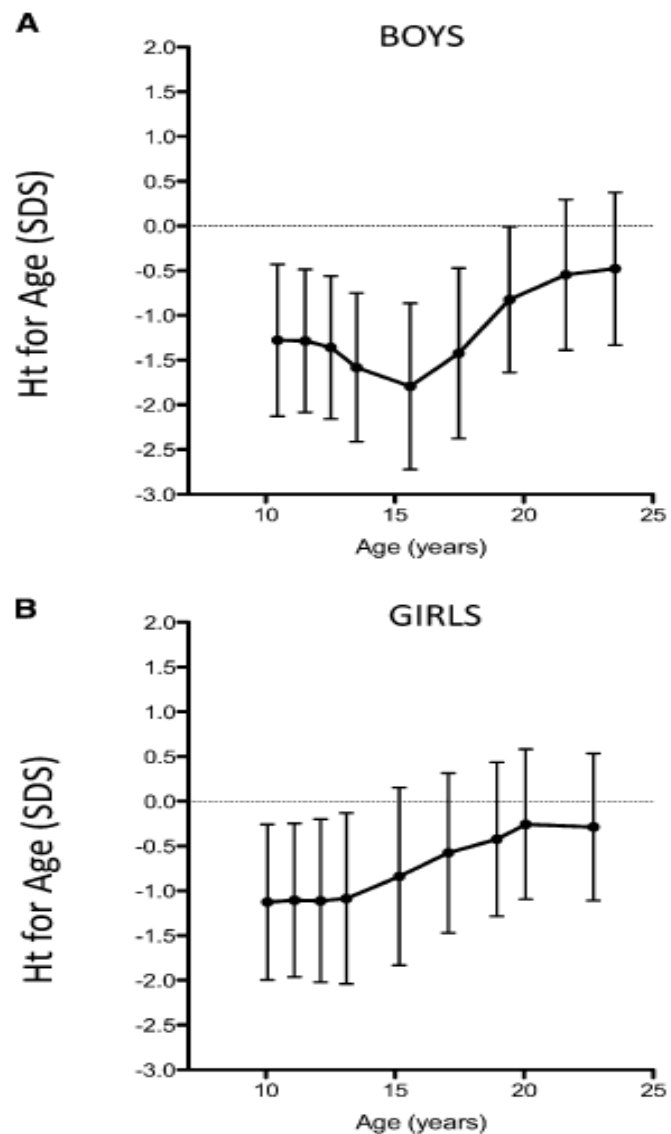
Differential timing of growth of human body systems



Pubertal delay, pubertal catch up



Cross sectional growth data for males (A) and females (B) in poor subsistence farming communities. 35828 data points collected between 1951 and 2006, shown before and after 1970. Prentice 2013

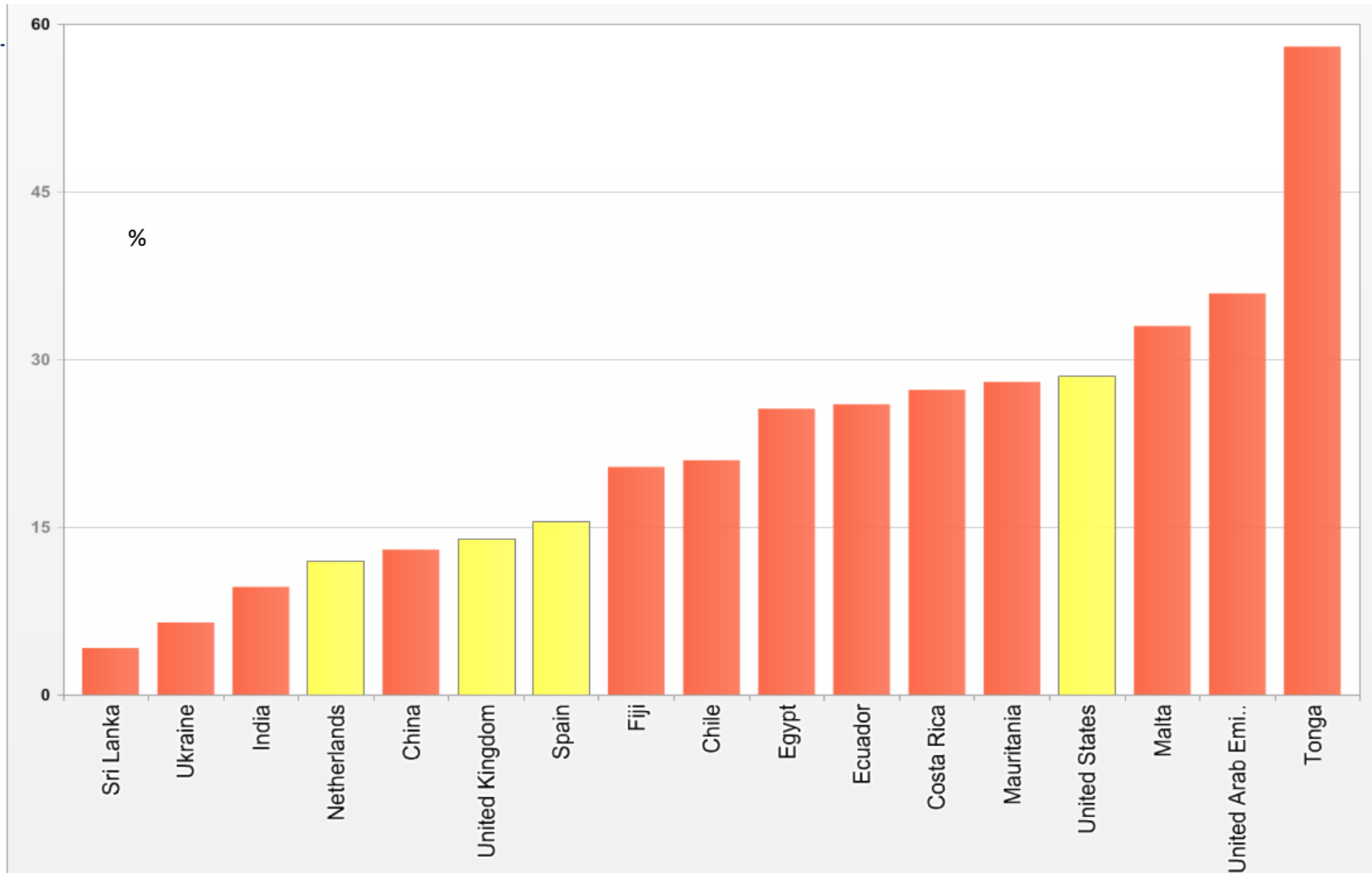


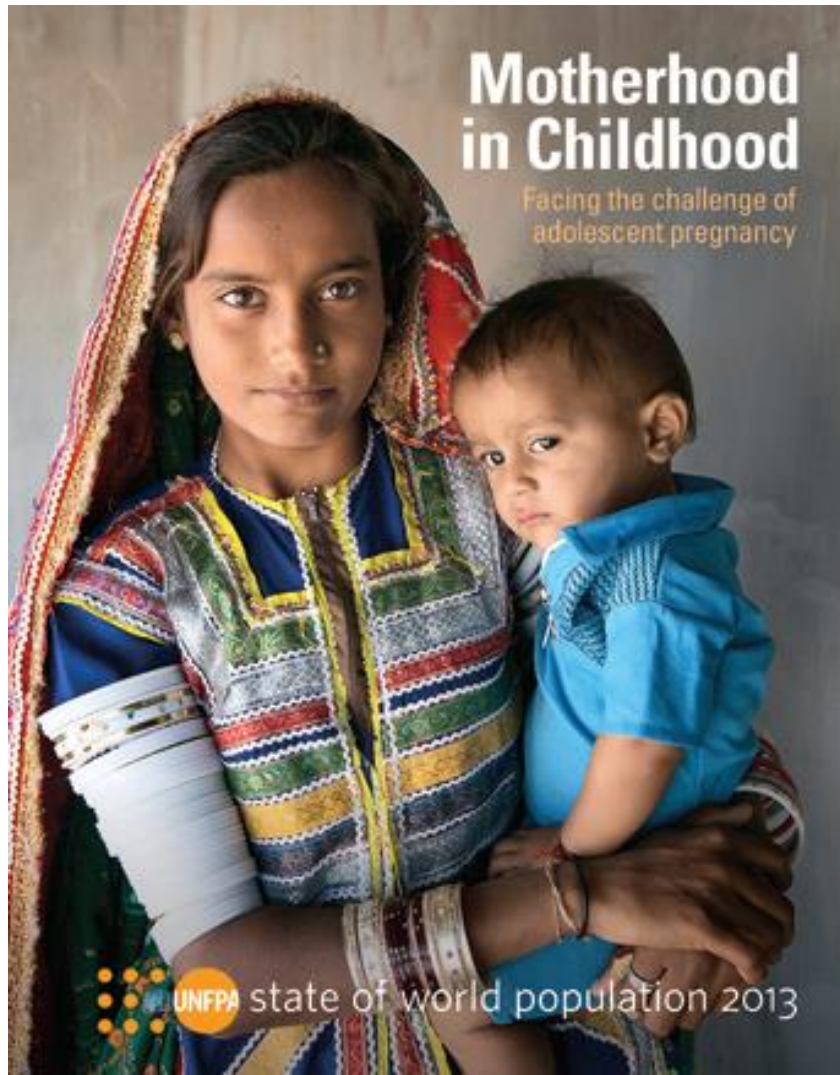
Boys, n: 80,80,80,80,80,78,76,64,54
 Girls, n: 80,80,80,80,77,79,54,53,58

FIGURE 6. Changes in height relative to the UK 1990 reference (11) in cohorts of 80 boys and 80 girls (17, 18) measured longitudinally in rural Gambia. Loss-to-follow up rates were low, as indicated at the base of the figure. Ht, height; SDS, SD score.

Lifecycle perspectives on weight

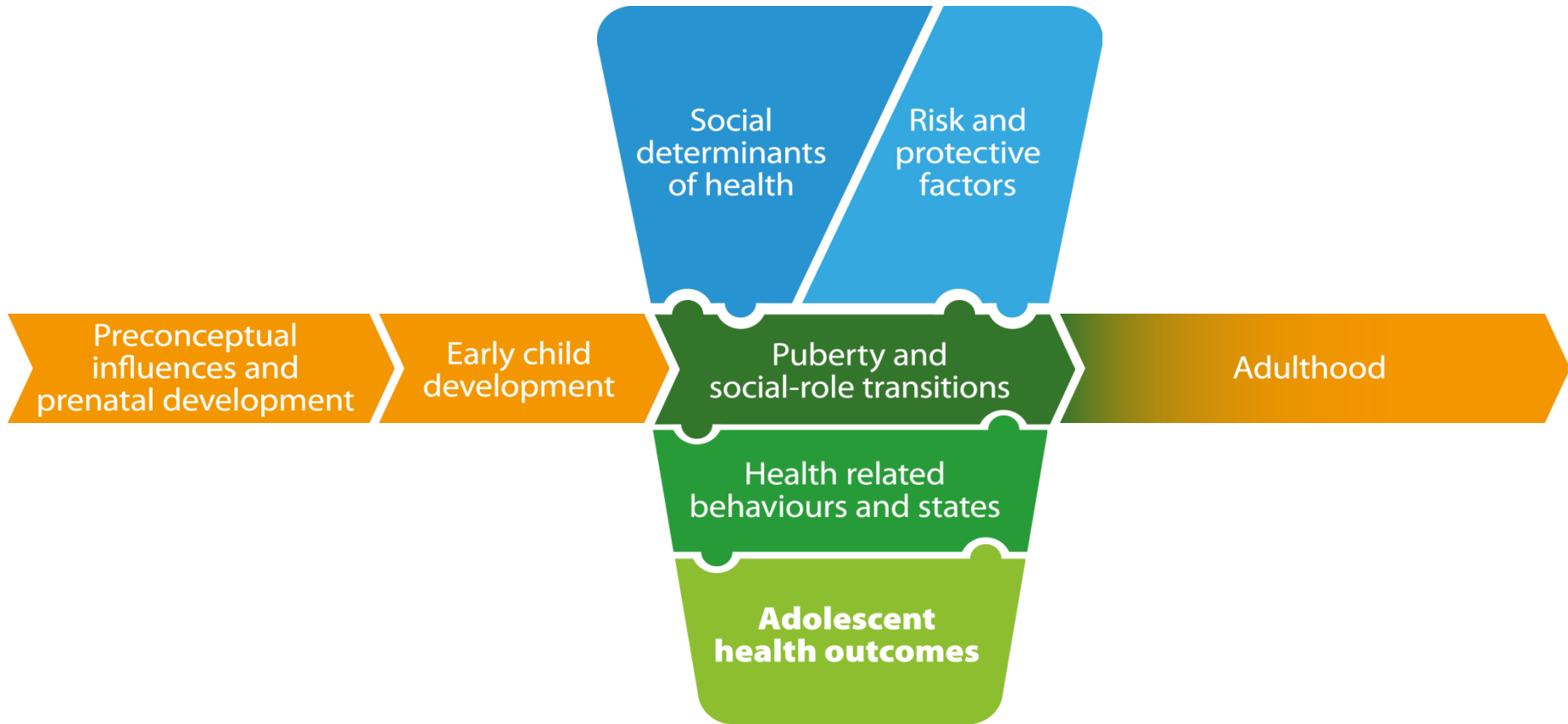
Overweight in 13-15 yr old girls





- Impact of pregnancy in adolescence on adolescent growth
 - Height
 - Pelvic size
 - Nutrition
- Adolescent pregnancy risks
 - Prematurity
- Nutritional and metabolic risks for next generation
 - Underweight
 - Overweight

Economic, Social, Educational Policies & Interventions



Health Policies & Interventions Preventive Care, Health Services

Prevalence of overweight & obesity

