

PAEDEATRICS - Medical

INTRODUCTION AND OVERVIEW OF CHILD HEALTH

What is Child Health?

- Age-related specialty 0 to 14/16 years old
 - Incorporates puberty

Definitions

- Neonate: birth to 28 days
- Infant: 28 days to 1 year
- Child 1 year to 12 years
- Adolescent: 12 years to 18 years (counts as “adult” with regards to resuscitation guidelines – a child is from 1 year to puberty in these guidelines)

Diseases become apparent according to age

Newborn:

- **RDS** (Respiratory distress syndrome): **restrictive lung disease** due to a deficiency of surfactant in the lungs of a baby born prematurely. **Decreased surfactant => increased surface tension of alveoli => decreased lung compliance** => increased work needed to expand/inflate the lungs. Alveoli are collapsed. Occurs mostly in **pre-terms**. Prevent with **maternal steroids** if risk of preterm birth. Tx with **curosurf** (synthetic surfactant) and CPAP (continuous positive airway pressure helps to open alveoli at the end of expiration, when it requires a lot of pressure to open alveoli). CXR appearance: ground glass.
- Transient tachypnoea of the newborn – commonly associated with C-section births. Fluid may be seen in lungs e.g. in horizontal fissure.

Infant:

- Respiratory, GI infections, wheeze (e.g. bronchiolitis – RSV), croup (parainfluenza virus)

Pre-school:

- Erect posture
- **Frankfurt Plane** for reliability and consistency (anatomical position of the human skull)
- Accurate plotting (**small neat dots**)

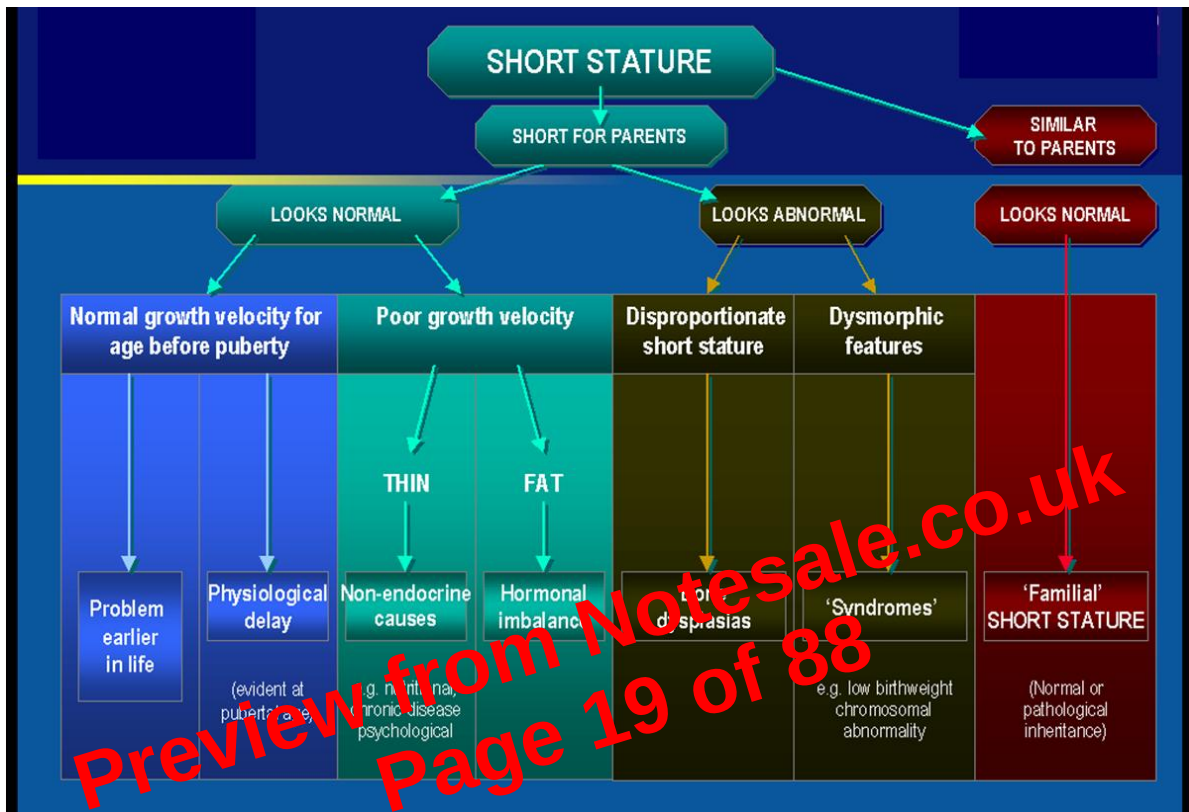
Centile charts

- Current UK child centile charts are available from the Royal College of Paediatrics and Child Health. Centile charts are very useful for plotting changing parameters such as assessing a child's height, weight, BMI, or pubertal developmental over time or head circumference for an infant or fetus.
- Centile charts show the position of a measured parameter within a statistical distribution. **They do not show if that parameter is normal or abnormal.** They merely show how it compares with that measurement in other individuals.
- If a parameter such as height is on the 3rd centile, this means that for every 100 children of that age, 3% would be expected to be shorter and 97 taller. On the 97th centile, 97 would be shorter and 3 taller.
- Because centile charts are usually used to assess a parameter over time, they are normally presented graphically. The parameter such as height, weight or head circumference is shown on the y axis and the age or gestation on the x axis.
- The growth charts show a number of lines representing important centiles. These would usually be the 50th centile (average), 25th and 75th centiles as well as the 3rd and/or 10th centile and the 90th and/or 97th centile.
- **Note that there are different charts for boys and girls (as well as for different age groups)**
- When plotting it is important to draw a **small neat dot** (for accuracy)

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- Girls: Breast size (thelarche), adrenarche and pubic hair (pubarche), menarche

Short stature algorithm



Achondroplasia

- Achondroplasia is a common cause of **dwarfism**. It occurs as a sporadic mutation in approximately 80% of cases (associated with advanced paternal age) or may be inherited as an **autosomal dominant** genetic disorder.
- People with achondroplasia have short stature, with an average adult height of 131 centimeters for males and 123 centimeters for females.

Thyroid deficiency

- The most common manifestation of hypothyroidism in children is declining growth velocity, often resulting in short stature.
- Have low threshold for Ix
- The growth delay tends to be insidious in onset, and it may be present for several years before other symptoms occur, if they occur at all. Thus, any child with declining growth velocity should be evaluated for hypothyroidism
- Another common feature is altered school performance. Performance often declines, but it improves in some children, perhaps because they are less active and, therefore, less easily distracted and better able to concentrate. One reason for delay in diagnosis is that parents see the latter changes as positive.
- Other common symptoms are lethargy, cold intolerance, overweight, constipation, dry skin, bradycardia, brittle hair, facial puffiness, and muscle aches and pains.
- If the cause is hypothalamic or pituitary disease, the child may have headaches, visual symptoms (bitemporal hemianopia), or manifestations of other pituitary hormone deficiencies.
- Goitre
- Note: Cretinism is a condition of severely stunted physical and mental growth due to untreated congenital deficiency of thyroid hormones (congenital hypothyroidism) usually due to maternal hypothyroidism

Growth hormone (GH) deficiency

- Growth hormone deficiency (GHD) is a medical condition, caused by problems affecting the pituitary gland or hypothalamus, in which the body does not produce enough growth hormone (GH)
- Often presents with short stature but normal weight

Congenital cerebral abnormalities with pituitary abnormalities

- Absent pituitary
- Septo-optic dysplasia (rare congenital malformation syndrome featuring underdevelopment of the optic nerve, pituitary gland dysfunction, and absence of the septum pellucidum)
- Craniopharyngioma (type of brain tumor derived from pituitary gland embryonic tissue, that occurs most commonly in children but also in men and women in their 50s and 60s)

- Suspect an underlying medical cause of obesity if a child is obese and also short for their age.

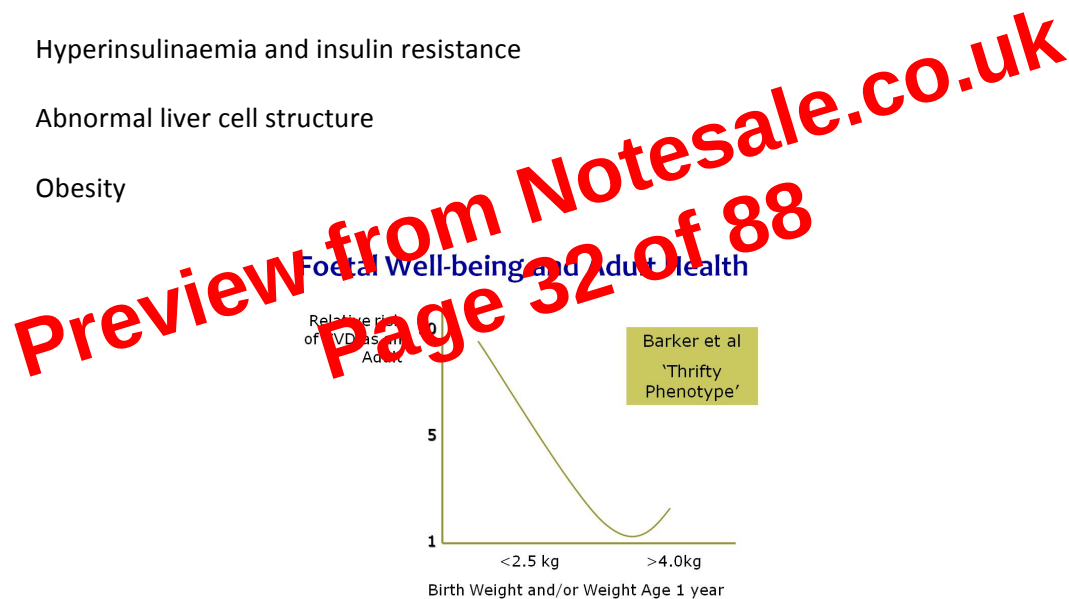
Metabolic programming

Fetal metabolic programming is a concept first suggested by **Barker and Hales** in the early 1990s. On the basis of compelling epidemiological evidence, they hypothesized that fetal and perinatal (period immediately before and after birth) events, such as maternal undernutrition, were central to determine one's risk to develop chronic metabolic diseases. Such conditions, including obesity, diabetes, and cardiovascular diseases, have become a very important population health concern.

The Barker hypothesis states that: fetal and infant malnutrition 'programmes' metabolism through to adulthood.

Low birth weight is a surrogate marker for IUGR (intra-uterine growth restriction). IUGR can contribute to developing many conditions later in life such as:

- Risk of CVD
- Hypertension
- Hyperinsulinaemia and insulin resistance
- Abnormal liver cell structure
- Obesity



Thrifty phenotype

- The thrifty phenotype hypothesis says that reduced fetal growth (IUGR) is strongly associated with a number of chronic conditions later in life.
- These chronic conditions include coronary heart disease, stroke, diabetes, and hypertension i.e. metabolic syndrome
- This increased susceptibility results from adaptations made by the fetus in an environment limited in its supply of nutrients.

Tower of 3 bricks	18 months
Tower of 6, scribble	24 months
Tower of 9 bricks, copies circle	36 months

Remember that vision is important for fine motor development.

Hearing and language (speech and comprehension)

When we are assessing language development, depending on the age of the child, we are looking at a number of different components for communication.

We need to consider the baby's ability to hear, and this is now tested in all babies at birth by the universal neonatal hearing screening programme. It seems obvious, but if you can't hear language, how can you learn its meaning or develop speech?

Next, we think about comprehension, the infant's ability to understand language- does he know his name, can he follow instructions and if so, simple or more complex?

Then expressive language, the ability to communicate verbally – in single words, phrases or sentences, and also articulation – the ability to pronounce words clearly, which can be closely related to motor development.

The average milestones to compare with the motor developmental milestones are shown here, but there is a wider variation in normality in this area than in motor development. **Communication is much more closely linked to cognitive development (learning ability) than is motor development.** Being an early walker does not imply that a child is bright, but advanced communication skills suggest good cognitive ability. Delayed communication does not necessarily indicate learning difficulties, as many other factors can contribute e.g. Simple glue ear (common childhood condition in which the middle ear becomes filled with fluid), but can indicate problems such as autism and need to be closely assessed.

Vocalises	3 months
Babbles	6 months
Imitates sounds	9 months
Knows name	12 months
2 body parts / 5-20 words	18 months
Simple instructions / 50+ words	24 months

- Gross motor skills: e.g. head control (usually by 3 months), sitting up (usually by 6 months), crawling (usually by 9 months) or walking (usually by 12 months), running (18 months), trike (24 months), stairs (36 months)
- Fine motor skills and vision: hand midline (3 months), grasping objects (6 months), scissor grasp (9 months), fine pincer grasp (12 months), tower of 3 (18 months), tower of 6 (24 months), tower of 9 (36 months)
- Speech, language and hearing: which also includes phonation (3 months), babbling (6 months), imitating speech and identifying sounds (9 months), knows name (12 months), as well as understanding what other people are trying to communicate to them, 5-20 words (18 months), 50 words and knows short commands (24 months), short sentences (36 months)
- Social, behavioural and emotional skills - interacting with others and development of personal traits and feelings, as well as starting to understand and respond to the needs and feelings of others. Social smile (6 weeks), follows adult (3 months), peekaboo (9 months), drinks from cup (12 months), uses spoon (18 months), gets dressed and symbolic play (24 months), imaginative play and toilet trained (36 months)
- NB: In addition we can include a fifth domain: Cognitive skills - the ability to learn new things, process information, organise their thoughts and remember things

Aetiology of global developmental delay

- Down syndrome
- Fragile X syndrome. everything large and long, associated with Autism
- Cerebral palsy
- Prematurity (being born too early e.g. <37 weeks)
- Childhood infection (for example meningitis)
- Metabolic diseases, such as having an underactive thyroid gland (hypothyroidism)
- Fetal alcohol syndrome
- For some children, the cause of the global developmental delay is never identified

THE ACUTELY ILL CHILD

- Children are not small adults
- Different anatomy and physiology

- Breathing
 - RR
 - Sats/SpO2 (however PaO2 from ABGs is more reliable and can also give us further information)
- Circulation
 - Heart Rate
 - BP
 - Capillary Refill Time
 - Skin Temperature
 - Core body temperature
 - Skin turgor
- Disability
 - Conscious Level (AVPU and GCS)
 - Glucose
 - Posture
 - Pupils (reactivity, size, symmetry)

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IMMUNISATION

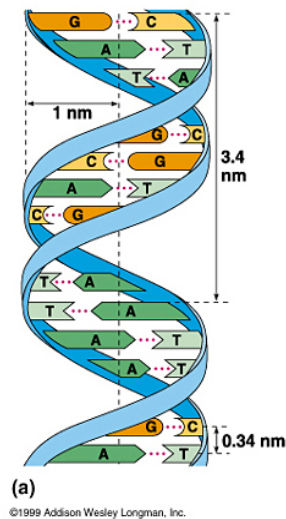
Immunisation is the process by which an individual's immune system becomes sensitised against an immunogen. Immunisation can be an active or passive process

Active:

- Natural infection
- Artificial immunisation (e.g. by vaccination)

Passive :

- Natural transplacental transfer of ABs
- Artificial human Ig's



How big is the human genome?

- 3,000,000,000 base pairs
- 40,000 genes

Genetic abnormality detection methods

Type of Genetic Change	Amount of Genome Affected	Detection Method
Aneuploidy	Entire Chromosome	Standard Karyotype
Chromosomal Translocation	100 Megabases	
Deletion	10 Megabases	
Microdeletion	5 Megabases	Fluorescence In-Situ Hybridisation
Deletion of Part of Gene	1000 bases	
Point Mutation	1 base	Multiplex Ligation Dependant Amplification
		PCR amplification and Sequencing

14 and 15, and occur when the long arms of two acrocentric chromosomes fuse at the centromere and the two short arms are lost.

- A Robertsonian translocation in balanced form results in no excess or deficit of genetic material and causes no health difficulties. In unbalanced forms, Robertsonian translocations cause chromosomal deletions or addition and result in syndromes of multiple malformations, including trisomy 21 (Down syndrome).

Robertsonian Translocation

Increased risk of trisomy in a pregnancy



Why would you call a geneticist

- Child with unusual clinical presentation
- Facial appearance
- Malformations e.g. congenital heart disease
- Neurological problems
- Complex phenotype
- Child with learning difficulties

History

- Start at the beginning

Energy Reference Values

0-12 months

- Estimated average requirement (EAR)= Energy deposited in new tissue for growth + TEE (total energy expenditure)

1-18 years:

- Estimated average requirement (EAR)= Energy deposited in new tissue for growth + TEE (total energy expenditure)
- TEE (using factorial model)= BMR (basal metabolic rate) x PAL (physical activity level)
- Energy deposit = 1% increase in PAL
- EAR (estimated average requirement) calculated at median PAL values for best estimates of healthy body weights
- Calculated for less active or more active children by the 25th & 75th centile PAL values

Energy

Percentage of boys & girls, by age, exceeding the Estimated Average Requirement (EAR) for energy:

	Age (months)			
	4-6	7-9	10-11	12-18
Percentage of boys exceeding EAR (%)	50	81	71	85
Percentage of girls exceeding EAR (%)	45	52	70	92

Vitamins

Vitamin A

- Intakes above the RNI for all age groups (175-283%)
- Similar to results found in Scotland sample
- Vitamin A is a group of **fat soluble** (Vitamins K, A, D and E) nutritional organic compounds, that includes retinol, and several provitamin A carotenoids, among which beta-carotene is the most important.

- 180 minutes throughout the day
- Minimise time spent sedentary for extended periods (except sleeping)

UK DoH Physical Activity Guidelines (5-18 years)

- ≥ 60 minutes/day of moderate to vigorous intensity physical activity
- 3 days/week - vigorous intensity activities
- Minimal time being sedentary (sitting)

Milk feeding: breastfeeding

- Exclusive breastfeeding is recommended for the first six months of an infant's life (recommended up to 2 years by WHO)
- Weaning from 6 months
- 22% of infants never breastfed
- 57% who have been breastfed were not breastfed past 3 months of age
- 68% were reported to have been breastfed in Scotland - significantly less than UK sample (78%)

Milk feeding: infant milks

Regulation

- Infant Formula & Follow-on Formula (Scotland) Regulations 2007
- WHO Code on marketing of breast milk substitutes 1981

Infant formula

- Modified cows milk
- Whey or casein based formulae
- No antimicrobial or bioactive substances from breast milk
- Whey based formula recommended for first year
- Change of brand or from whey to casein not recommended

- Primary immunisation with DPT (diphtheria, pertussis, tetanus), polio and Hib (the five in one vaccine DTaP/IPV/Hib) vaccine is given at **two, three and four months of age**.
- Pneumococcal vaccine (PCV) is given at **two and four months**.
- Rotavirus: 2 and 3 months
- MenC (meningococcal or Neisseria meningitidis) vaccine is given at **three and four months**.
- This ensures completion of the primary course at an appropriate age to provide protection against infections such as whooping cough, pneumococcal, Hib and meningococcal serogroup C, which are most dangerous for the very young.
- Every effort should be made to ensure that all children are immunised, even if they are older than the recommended age range; no opportunity to immunise should be missed.
- If any course of immunisation is interrupted, it should be resumed and completed as soon as possible. There is no need to start any course of immunisation again.

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- Rotavirus: 2 and 3 months

By 13 months:

- A booster dose of Hib/MenC and PCV - all the ones that can cause meningitis
- The first dose of MMR.

At 2, 3 and 4 years

- Influenzae

By school entry

- Fourth dose of DTaP/IPV or dTaP/IPV (diphtheria, tetanus, pertussis and polio e.g. the 5 in 1 excluding Hib)
- Second dose of MMR.

Before leaving school

- DPT – but here P is for polio and not pertussis
- Three doses of HPV vaccine
- Men C booster

Summary

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