Growth and Development of Children

Adele Piliterri, Child Health Nursing, Lippincott

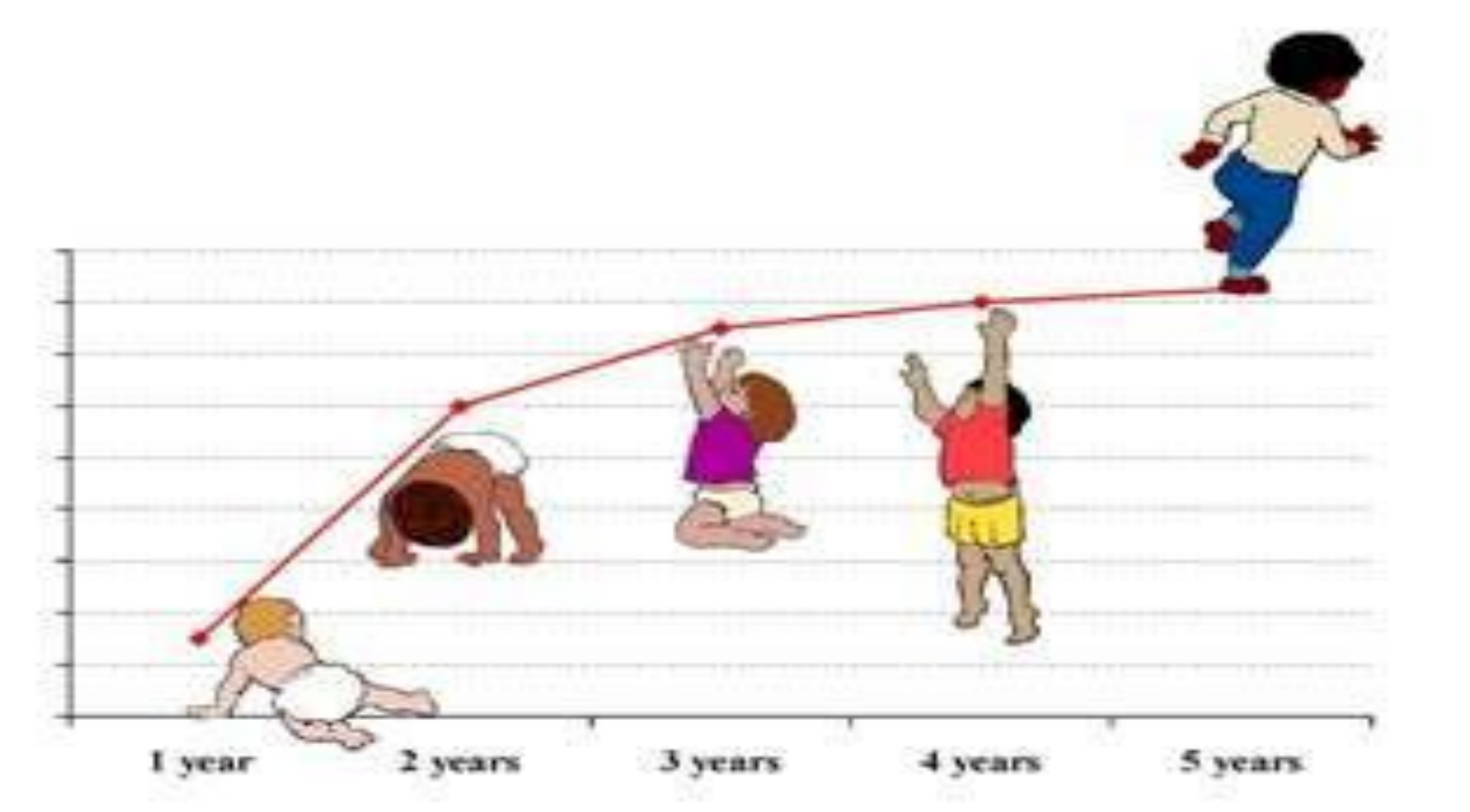
Growth

Growth refers to an increase in physical size of the whole body or any of its parts.

It is simply a quantitative change in the child's body.

It can be measured in Kg, pounds, meters, inches, ... etc

Child Growth (Image: WHO)



.Changes in bodily proportions with age

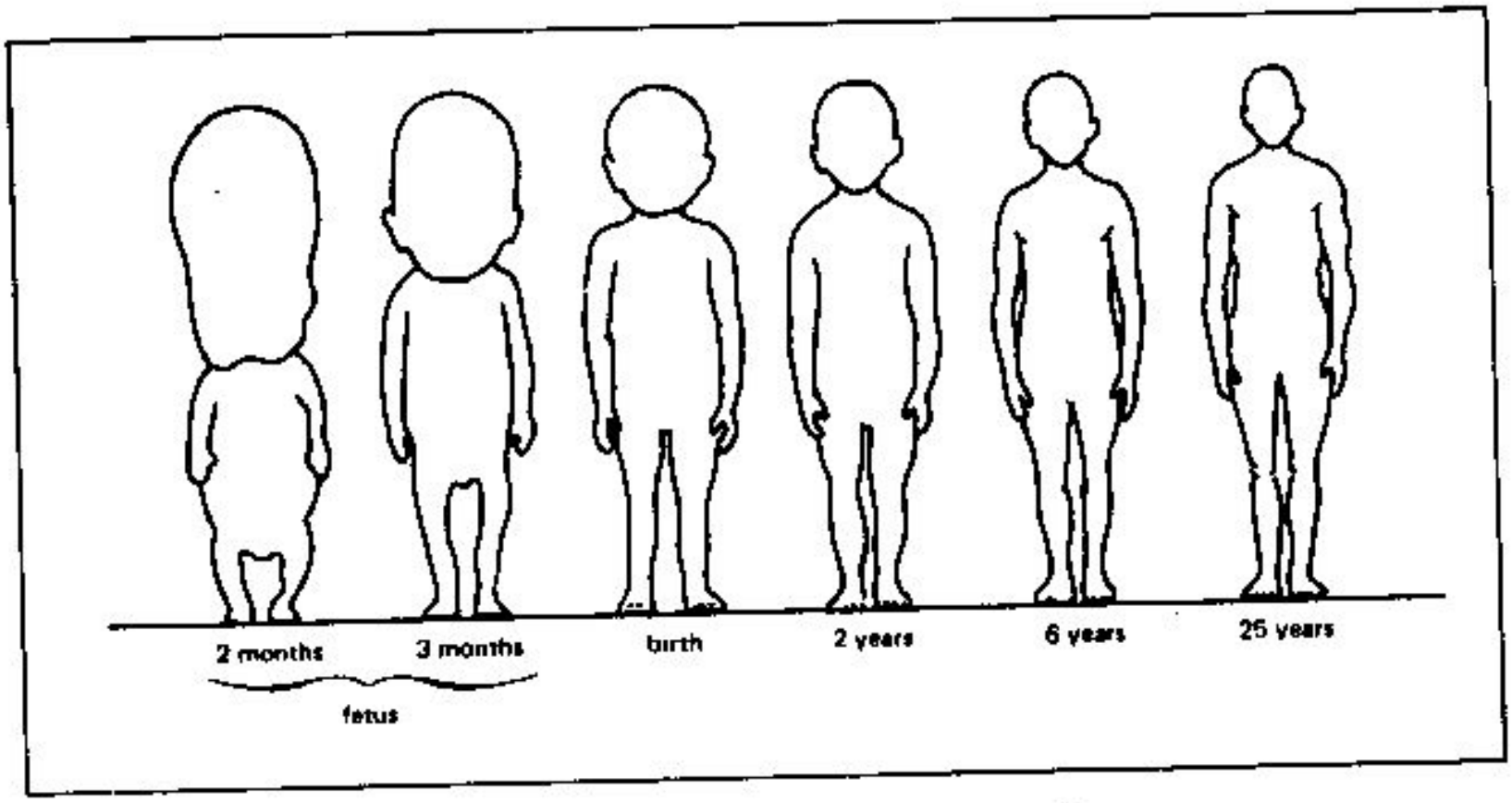


Figure 9. Changes in bodily proportions with age

Development

- Development refers to a progressive increase in skill and capacity of function.
- It is a qualitative change in the child's functioning.
- It can be measured through observation.

By understanding what to expect during each stage of development, parents can easily capture the teachable moments in everyday life to enhance their child's language development, intellectual growth, social development and motor skills.

Maturation

- Increase in child's competence and adaptability.
- It is describing the qualitative change in a structure.
- The level of maturation depends on child's heredity.

Principles of Growth & Development

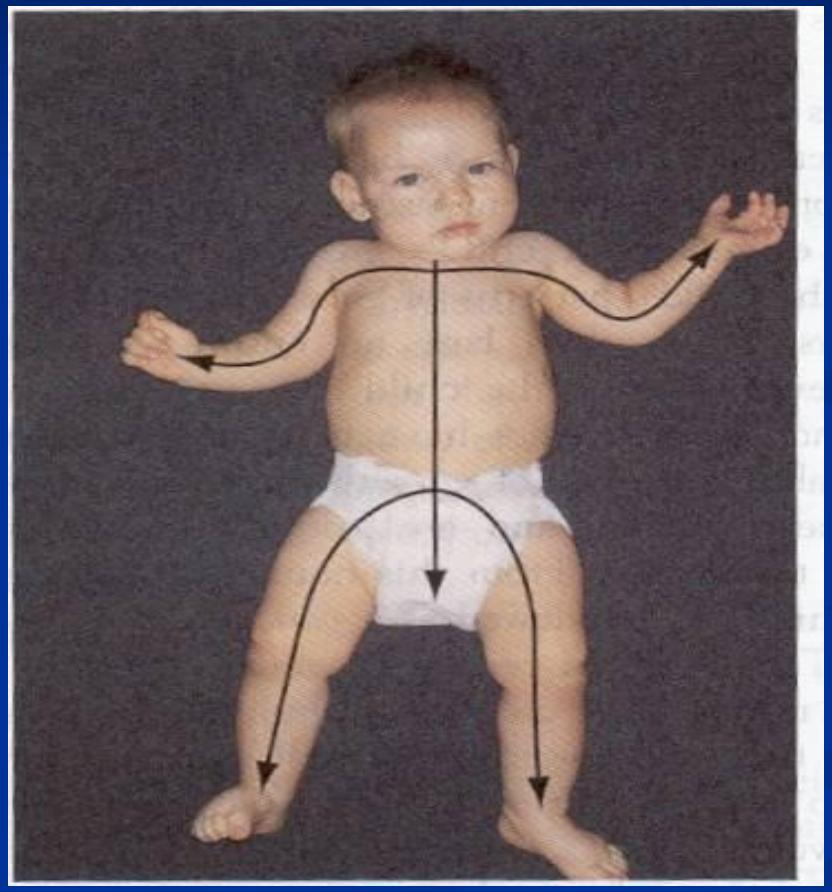
- Continuous process
- Predictable Sequence
- Don't progress at the same rate (↑ periods of GR in early childhood and adolescents & ↓ periods of GR in middle childhood)
- Not all body parts grow in the same rate at the same time.
- Each child grows in his/her own unique way.
- Each stage of G&D is affected by the preceding types of development.

Principles of Growth & Development

G & D proceed in regular related directions :

- Cephalo-caudal(head down to toes)
- Proximodistal (center of the body to the peripheral)
- General to specific

Growth Pattern



Growth Patterns

The child's pattern of growth is in a head-to-toe direction, or cephalocaudal, and in an inward to outward pattern called proximodistal.

Factors affecting growth and development:

- Hereditary
- Environmental factors

Pre-natal environment

1-Factors related to mothers during pregnancy:

- Nutritional deficiencies
- Diabetic mother
- Exposure to radiation
- Infection with German measles
- Smoking
- Use of drugs

2-Factors related to fetus

- Mal-position in uterus
- Faulty placental implantation

Post-Natal Environment

I - **External environment**:

- socio-economic status of the family
- child's nutrition
- climate and season
- child's ordinal position in the family
- Number of siblings in the family
- Family structure (single parent or extended family **...**)

Internal environment

- Child's intelligence
- Hormonal influences
- Emotions

Types of growth and development

Types of growth:

- Physical growth (Ht, Wt, head & chest circumference)
- Physiological growth (vital signs ...)

Types of development:

- Motor development
- Cognitive development
- Emotional development
- Social development

Stages of Growth and Development

- Prenatal
  - Embryonic (conception- 8 w)
  - Fetal stage (8-40 or 42 w)
- Infancy
  - Neonate
    - Birth to end of 1 month
  - Infancy
    - 1 month to end of 1 year
- Early Childhood
  - Toddler
    - 1-3 years
  - Preschool
    - 3-6 years
- Middle Childhood
  - School age
  - 6 to 12 years
- Late Childhood
  - Adolescent
  - 13 years to approximately 18 years

Newborn stage -1

Newborn stage is the first 4 weeks or first month of life. It is a transitional period from intrauterine life to extra .uterine environment

Normal Newborn Infant

Physical growth

- Weight = 2.700 – 4 kg
- Wt loss 5% -10% by 3-4 days after birth
- Wt gain by 10^{th} days of life
- Gain ¾ kg by the end of the 1^{st} month

Weight:

They loose 5 % to 10 % of weight by 3-4 days after birth as result of :

- Withdrawal of hormones from mother.
- Loss of excessive extra cellular fluid.
- Passage of meconium (feces) and urine.
- Limited food intake.

Height

- Boys average Ht = 50 cm
- Girls average Ht = 49 cm
- Normal range for both (47.5- 53.75 cm)

Head circumference

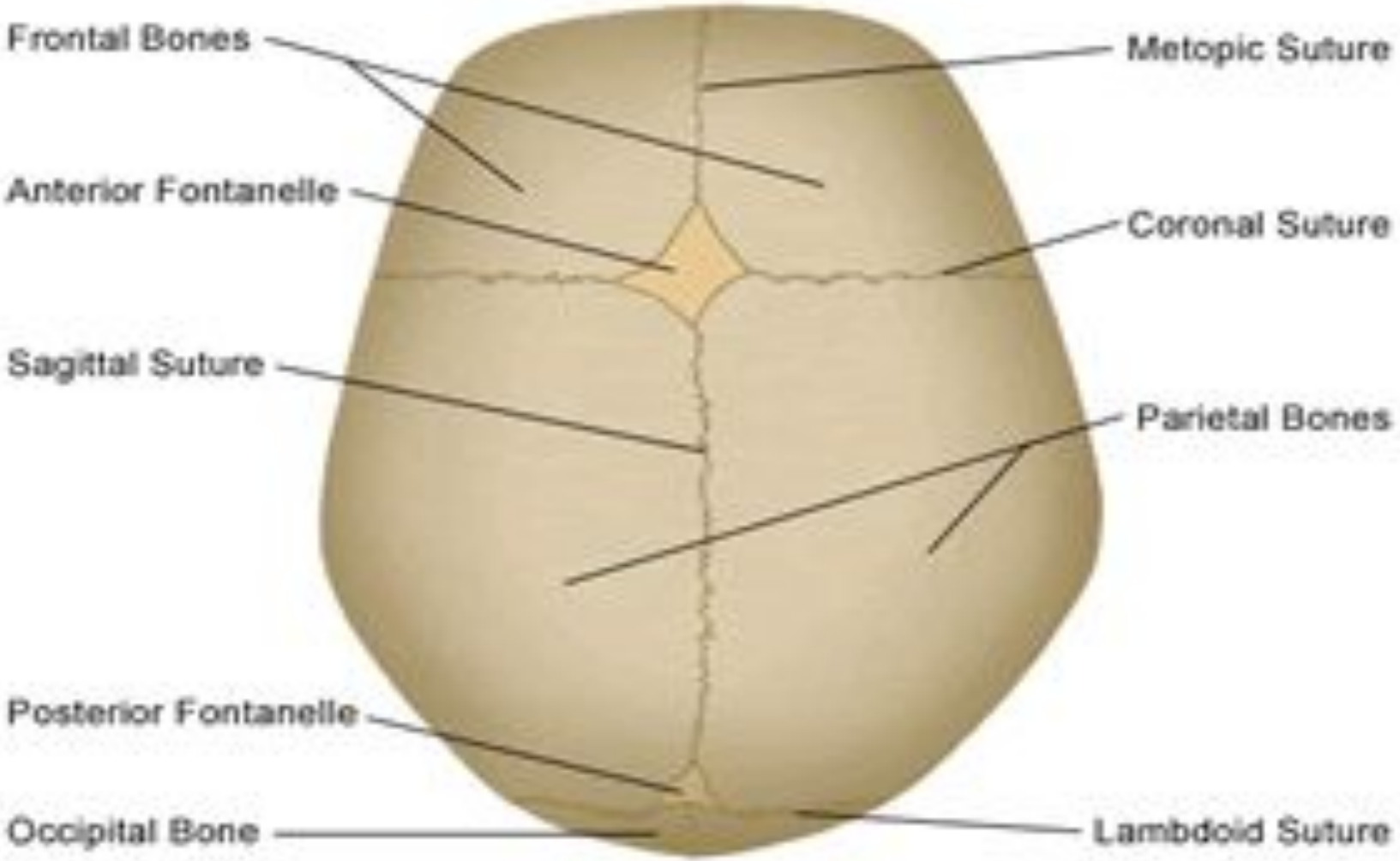
33-35 cm

Skull has 2 fontanels (anterior & posterior)

Anterior fontanel

- Diamond in shape
- The junction of the sagittal, corneal and frontal sutures forms it
- Between 2 frontal & 2 parietal bones
- 3-4 cm in length and 2-3 cm width
- It closes at 12-18 months of age

Normal Skull of the Newborn



Posterior fontanel

- Triangular
- Located between occipital & 2 parietal bones
- Closes by the end of the 1st month of age

Chest circumference

It is 30.5 to 33cm (usually 2-3cm less than head circumference).

Physiological growth

- Vital signs
  - **Temperature (36.3 to37.2°C).**
  - **Pulse (120 to 160 b/min).**
  - **Respiration (35 to 50C/min) .**

RESPIRATION

Normal Variations

30 to 60 respirations per min
Average - 40 respirations per min

HEART RATE (APICAL)

Normal Variations

100 to 160 beats per min
100 while sleeping
160 while crying

TEMPERATURE

Rectal

90.0° F to 99.5° F
(35.6° C to 37.5° C)

Axillary

97.6° F to 98.6° F
(36.5° C to 37.0° C)

BLOOD PRESSURE (AT BIRTH)

Average

75/42

Systolis

60 to 80 mm Hg

Diastolic

40 to 50 mm Hg

Simulation for vital signs

Palpation of pulses

Auscultation

Temperature taking

APGAR scoring chart

SIGN	0	1	2	1 min	5 min
Heart Rate	Absent	Less Than 100	Over 100	2	2
Respiratory Effort	Absent	Slow, Irregular	Good Cry	1	2
Muscle Tone	Limp	Some Flexion	Active Motion	1	2
Reflex Irritability	No Response	Grimace	Cry	1	2
Color	Pale	Body Pink, Extr. Blue	All Pink	1	2
TOTAL SCORE				6	10


The Apgar score rates:
Respiration, crying
Reflexes, irritability
Pulse, heart rate
Skin color of body and extremities
Muscle tone
A.D.A.M.

Newborn Senses

- Senses
  - Touch
  - Vision
  - Hearing
  - Taste
  - Smell

Touch

- It is the most highly developed sense.
- It is mostly at lips, tongue, ears, and forehead.
- The newborn is usually comfortable with touch.

Vision

- Pupils react to light
- Bright lights appear to be unpleasant to newborn infant.
- Follow objects in line of vision

Hearing

- The newborn infant usually makes some response to sound from birth.
- Ordinary sounds are heard well before 10 days of life.
- The newborn infant responds to sounds with either cry or eye movement, cessation of activity and / or startle reaction.

Taste

Well developed as bitter and sour fluids are resisted while sweet fluids are accepted.

Smell

Only evidence in newborn infant's search for the nipple, as he smell breast milk.

Normal Newborn Infant

Gross Motor Development

Motor development:

The newborn's movement are random, diffuse and uncoordinated. Reflexes carry out bodily functions and responses to external stimuli.

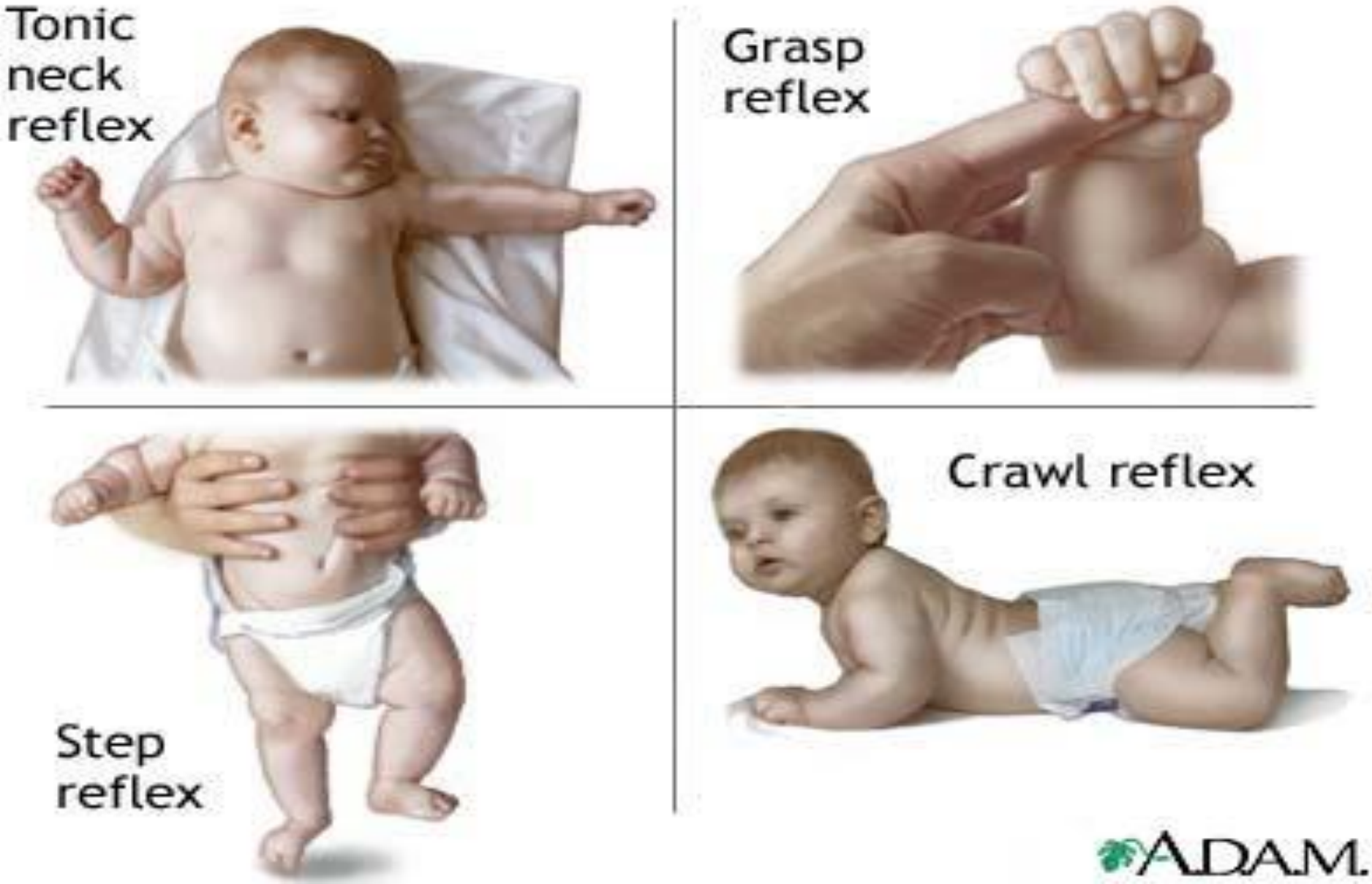
Fine motor development

- Holds hand in fist
- When crying, he draws arms and legs to body

Reflexes

- Swallowing
- Gagging
- Sucking
- Grasp
- Tonic-neck

One month-Reflexes

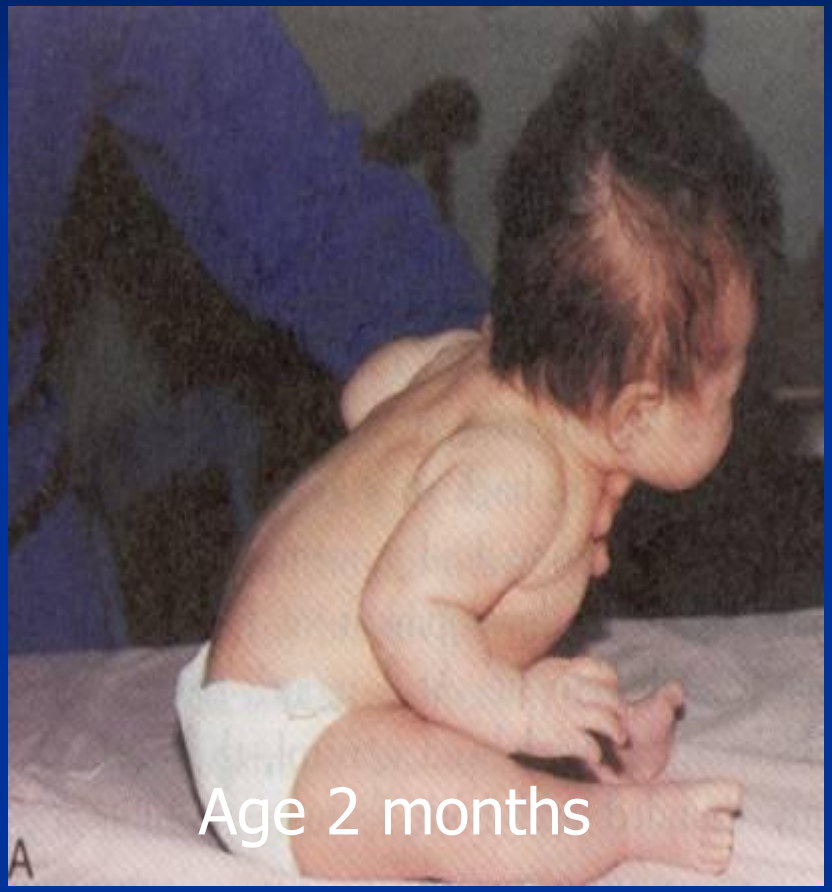


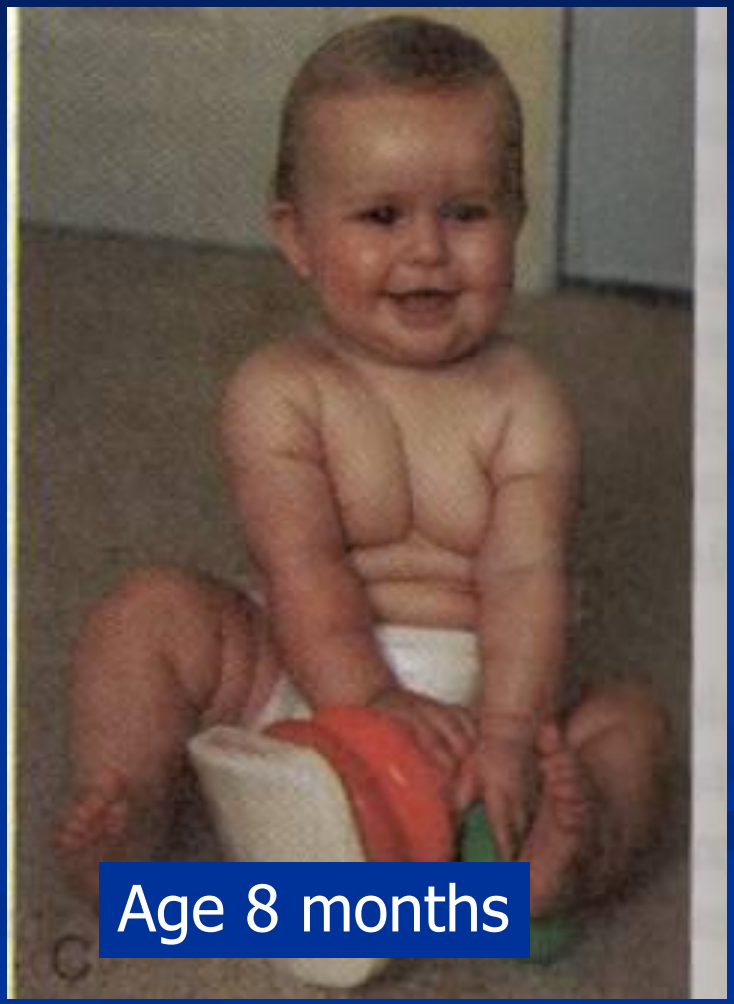
Emotional development

The newborn infant expresses his emotion just through cry for hunger, pain or discomfort sensation

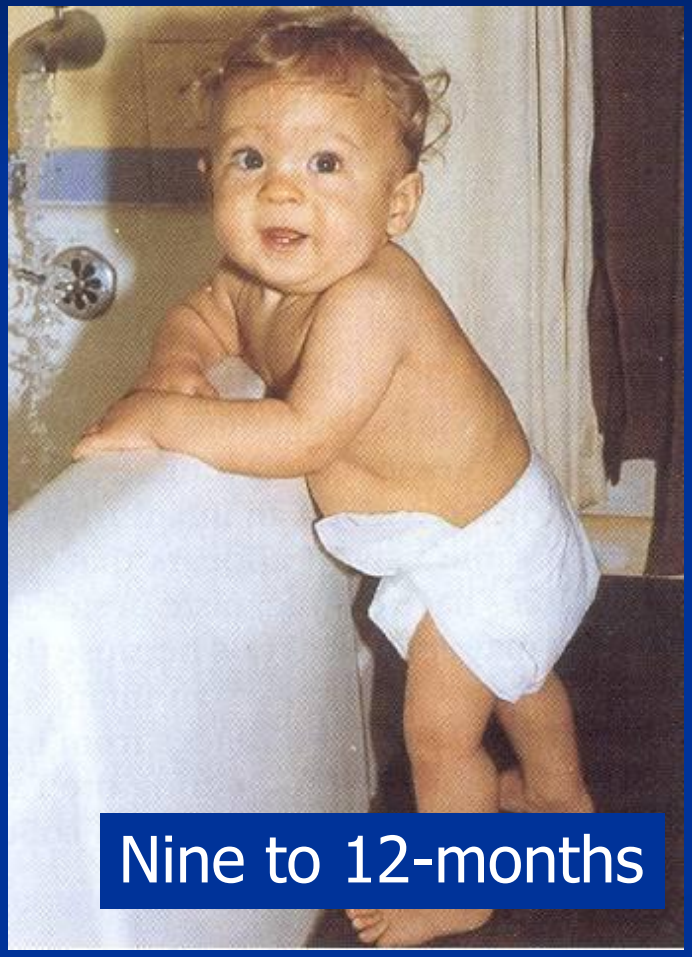
Infancy

Sitting Up

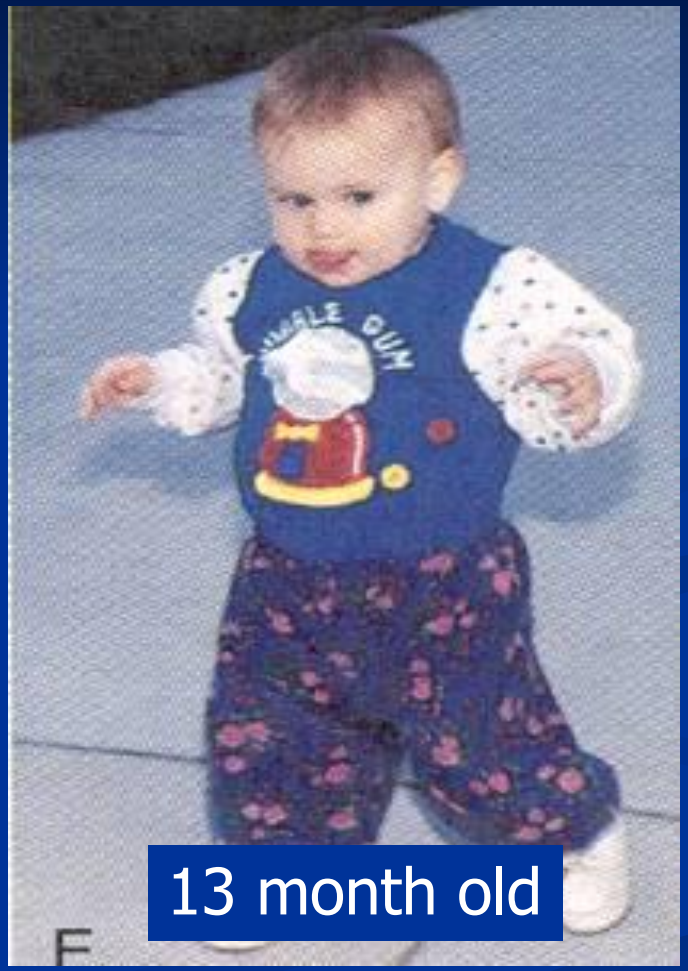




Ambulation



Nine to 12-months



13 month old

Fine Motor Development in infancy

-:Definition of normal infant

It is the period which starts at the end of the first month up to the end of the first year of age. Infant's growth and development during this period are .rapid

Physical growth of normal infant

Weight : the infant gains :

- Birth to 4 months → ¾ kg /month
- 5 to 8 months → ½ kg / month
- 9 to 12 months → ¼ kg /month

The infant will double his birth wt by 4-5 months and triple it by 10-12 months of age

Calculating infant's weight

Infants from 3 to 12 months

$$\text{Weight} = \frac{\text{Age in months} + 9}{2}$$

$$\text{Wt of 7 months old infant} = \frac{7+9}{2} = \frac{8}{} \text{ kg}$$

Height

- Length increases about 3 cm /month during the 1st 3 months of age,
- then it increases 2 cm /month at age of 4-6 months,
- Then, at 7 - 12 months, it increases 1 ½ cm per month

Head circumference

- It increases about 2 cm /month during the 1st 3 months,
- Then, ½ cm/month during the 2nd 9 months of age.
- Posterior fontanel closes by 6-8 w of age.
- Anterior fontanel closes by 12-18 months of age.

Chest circumference

By the end of the 1st year, it will be equal to head circumference.

Physiological growth of infants:-

- Pulse 110-150 b/min
- Resp 35 ± 10 c/min
- Breath through nose.
- Blood pressure 80/50 ± 20/10 mmHg

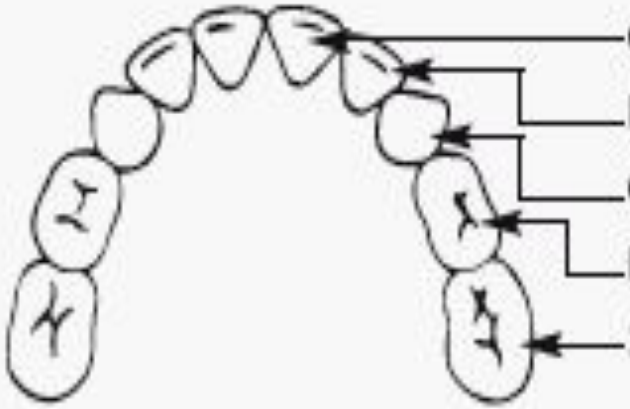
Eruption of the Primary Teeth*

Tooth	Upper Jaw †	Lower Jaw †
Central incisor	8-12 months	6-10 months
Lateral incisor	9-13 months	10-16 months
Cuspid	16-22 months	17-23 months
First molar	13-19 months	14-18 months
Second molar	25-33 months	23-31 months

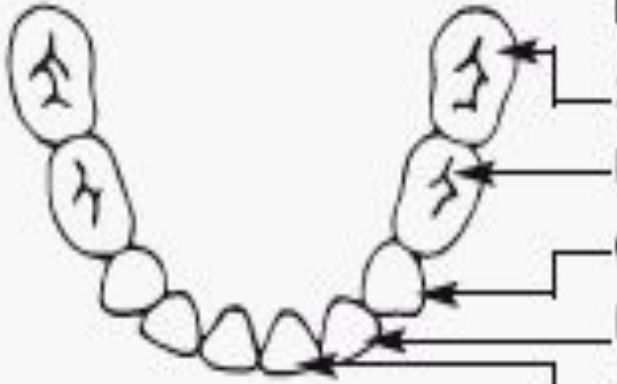
Compiled from information furnished by the American Academy of Pediatric Denistry

†*These eruption times are average and can normally vary by two months.*

PRIMARY DENTITION



Upper Teeth	Erupt	Exfoliate
Central incisor	8-12 months	6-7 years
Lateral incisor	9-13 months	7-8 years
Canine (cuspid)	16-22 months	10-12 years
First molar	13-19 months	9-11 years
Second molar	25-33 months	10-12 years



Lower Teeth	Erupt	Exfoliate
Second molar	23-31 months	10-12 years
First molar	14-18 months	9-11 years
Canine (cuspid)	17-23 months	9-12 years
Lateral incisor	10-16 months	7-8 years
Central incisor	6-10 months	6-7 years

:Dentition

Eruption of teeth starts by 5-6 months of age. It is called "Milky teeth" or "Deciduous teeth" or "Temporary teeth".

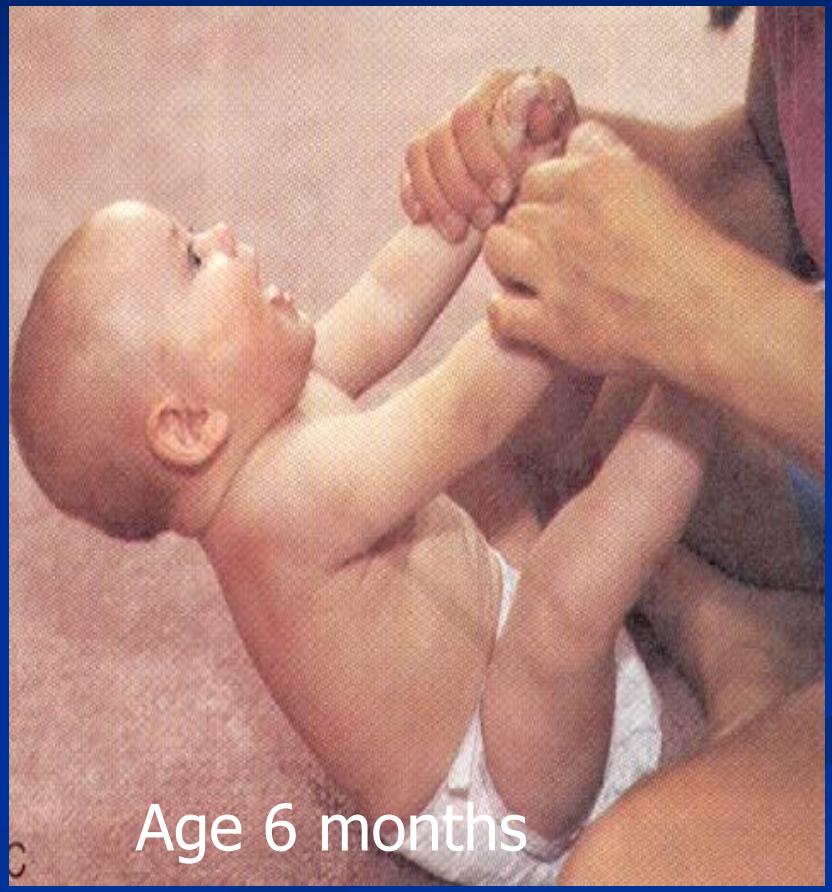
:Average age for teeth eruption

Lower central incisors	Erupt at 6 months
Upper central incisors	Erupt at 7.5 months
Upper lateral incisors	Erupt at 9 months
Lower lateral incisors	Erupt at 11 months
Lower first molars	Erupt at 12 months
Upper first molars	Erupt at 14 months
Lower cuspids	Erupt at 16 months
Upper cuspids	Erupt at 18 months
Lower 2nd molars	Erupt at 20months
Upper 2nd molars	Erupt at 24 months.

Motor Development

- **At 2 months**
  - Hold head erects in mid-position.
  - Turn from side back.
- **At 3 months,** the infant can
  - Hold head erects and steady.
  - Open or close hand loosely.
  - Hold object put in hand

Head Control



:At 4 months, the infant can

- Sit with adequate support.
- Roll over from front to back.
- Hold head erect and steady while in sitting position.
- Bring hands together in midline and plays with fingers.
- Grasp objects with both hands.

:At 5 months, **the infant can**

- Balance head well when sitting.
- Site with slight support.
- Pull feet up to mouth when supine.
- Grasp objects with whole hand (Rt. or Lt.).
- Hold one object while looking at another

:At 6 months, the infant can

- Sit alone briefly.
- Turn completely over (abdomen to abdomen).
- Lift chest and upper abdomen when prone.
- Hold own bottle.

:At 7 months, the infant can

- Sit alone.
- Hold cup.
- Imitate simple acts of others.

:At 8 months, the infant can

- Site alone steadily.
- Drink from cup with assistance.
- Eat finger food that can be held in one hand.

:At 9 months, the infant can

- Rise to sitting position alone.
- Crawl (i.e., pull body while in prone position).
- Hold one bottle with good hand-mouth coordination

:At 10 months, the infant can

- Creep well (use hands and legs).
- Walk but with help.
- Bring the hands together.

At 11 months , the infant can:

- Walk holding on furniture.
- Stand erect with minimal support

nths , the infant can

- Stand-alone for variable length of time.
- Site down from standing position alone.
- Walk in few steps with help or alone (hands held at shoulder height for balance).
- Pick up small bits of food and transfers them to his mouth

Ambulation(motor growth)

- 9 month old: crawl
- 10 month old: creep
- 1 year: stand independently from a crawl & creep position

- 13 month old: walk and toddle quickly

- 15 month old: can run

:Emotional development

- His emotions are instable, where it is rapidly changes from crying to laughter.
- His affection for or love family members appears.
  - **By 10 months**, he expresses several beginning recognizable emotions, such as anger, sadness, pleasure, jealousy, anxiety and affection.
  - **By 12 months** of age, these emotions are clearly distinguishable.

Social development

- He learns that crying brings attention.
- The infant smiles in response to smile of others.
- The infant shows fear of stranger (stranger anxiety).
- He responds socially to his name.
- According to **Erikson, the infant develops sense of trust.** Through the infant's interaction with caregiver (mainly the mother), especially during feeding, he learns to trust others through the relief of basic needs.

As an infant's vision develops, he or she may seem preoccupied with watching surrounding objects and people

Speech Milestones

- 1-2 months: coos
- 2-6 months: laughs and squeals
- 8-9 months babbles: mama/dada as sounds
- 10-12 months: “mama/dada specific
- 18-20 months: 20 to 30 words - 50% understood by strangers
- 22-24 months: two word sentences, >50 words, 75% understood by strangers
- 30-36 months: almost all speech understood by strangers

Hearing

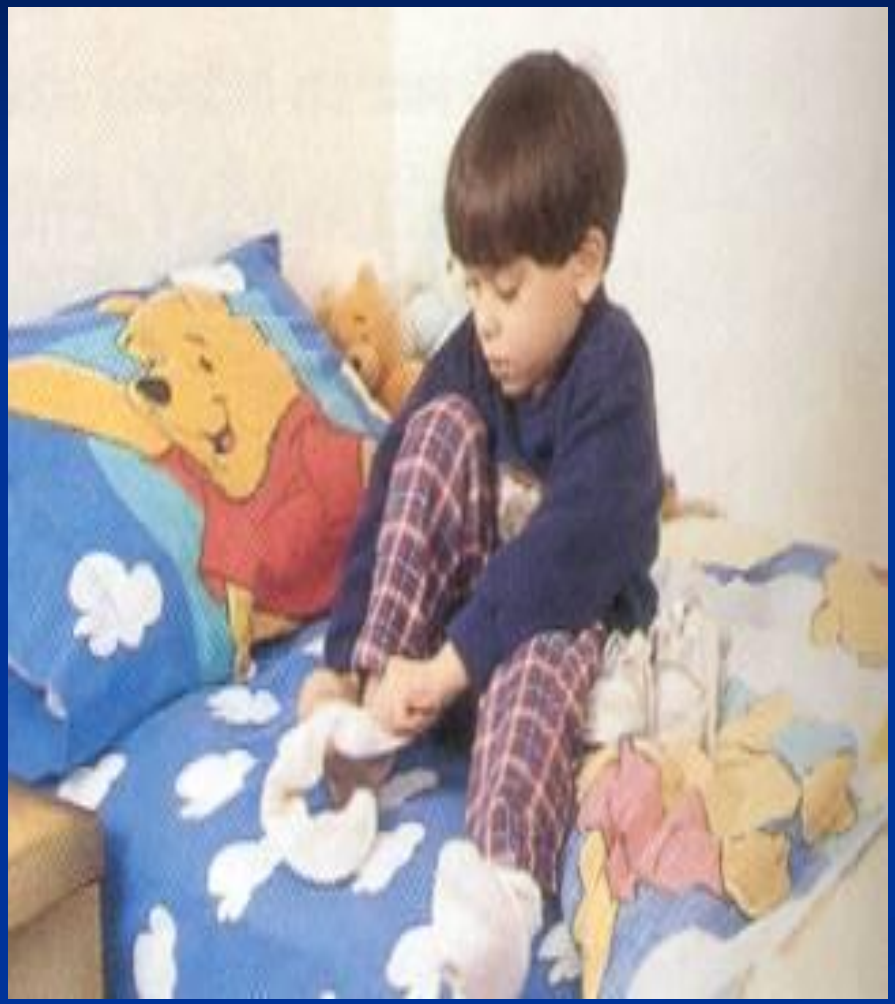
- BAER hearing test done at birth
- Ability to hear correlates with ability enunciate words properly
- Always ask about history of otitis media - ear aiding devices.
- Early referral to MD to assess for possible fluid in ears (effusion)
- Repeat hearing screening test
- Speech therapist as needed

Red Flags in infant development

- Unable to sit alone by age 9 months
- Unable to transfer objects from hand to hand by age 1 year
- Abnormal pincer grip or grasp by age 15 months
- Unable to walk alone by 18 months
- Failure to speak recognizable words by 2 years.

Vision in toddler age

Toddlers



:Normal toddler

Toddler stage is between 1 to 3 years of age. During this period, .growth slows considerably

Physical growth

:Weight

The toddler's average weight gain is 1.8 to 2.7 .kg/year

Formula to calculate normal weight of children over 1 year of age is

.Age in years X 2+8 = ... kg

e.g., The weight of a child aging 4 years

X 2 + 8 = 16 kg 4 =

:Height

- During 1-2 years, the child's height increases by 1cm/month.
- The toddler's height increases about 10 to 12.5cm/year.

Formula to calculate normal height

Age in years X 5 + 80 = cm.

e.g., the length of 2 years old child

= 2 X 5 + 80 = 90cm

:Head and chest circumference

- The head increases 10 cm only from the age of 1 year to adult age.

- During toddler years, chest circumference continues to increase in size and exceeds head circumference.

:Teething

- By 2 years of age, the toddler has 16 temporary teeth.

- By the age of 30 months (2.5 years), the toddler has 20 teeth

:Physiological growth

Pulse: 80-130 beats/min (average .110/min)

.Respiration: 20-30C/min

:Bowel and bladder control

Daytime control of bladder and bowel .control by 24-30 months

Fine Motor - toddler

- 1 year old: transfer objects from hand to hand
- 2 year old: can hold a crayon and color vertical strokes
  - Turn the page of a book
  - Build a tower of six blocks
- 3 year old: copy a circle and a cross - build using small blocks

Gross - Motor of toddler

:**At 15 months,** the toddler can

- **Walk alone.**
- Creep upstairs.
- Assume standing position without falling.
- Hold a cup with all fingers grasped around it.

:**At 18 months**

- **Hold cup with both hands**.
- Transfer objects hand-to hand at will.

Continuous

:At 24 months

- Go up and down stairs alone with two feet on each step.
- **Hold a cup with one hand.**
- Remove most of own clothes.
- Drink well from a small glass held in one hand.

:**At 30 months:** the toddler can

- Jump with both feet.
- Jump from chair or step.
- Walk up and downstairs, one foot on a step.
- Drink without assistance.

:Social development

- The toddler is very social being but still egocentric.
- He imitates parents.
- Notice sex differences and know own sex.

Pre-School

Preschool stage

Definition:-

It is the stage where child is 3 to 6 years of age. The growth during this period is relatively **slow**.

Physical growth:-

Weight: The preschooler gains approximately 1.8kg/year.

Height: He doubles birth length by 4-5 years of age.

Physiological growth

- **Pulse:** 80-120 beat/min. (average 100/min).
- **Respiration:** 20-30C/min.
- **Blood Pressure:** 100/67±24/25.

Fine Motor – Older Toddler

- 3 year old: copy a circle and a cross – build using small blocks
- 4 year old: use scissors, color within the borders
- 5 year old: write some letters and draw a person with body parts

Fine motor and cognitive abilities pre-school

- Buttoning clothing
- Holding a pencil
- Building with small blocks
- Using scissors
- Have child draw picture of himself

Emotional Development of Preschooler

- Fears the **dark**
- Tends to be **impatient and selfish**
- Expresses **agression** through physical and verbal behaviours.
- Shows signs of **jealousy of siblings.**

Social development

According to **Erikson theory:**

- The preschooler is in the stage where he **develops a sense of initiative**, Where he wants to learn what to do for himself, learn about the world And other people.

Red flags: preschool

- Inability to perform self-care tasks, hand washing simple dressing, daytime toileting
- Lack of socialization
- Unable to play with other children
- Unable to follow directions during exam

Pool Safety

School-Age

:Normal school-age child

- School-age period is between the age of 6 to 12 years. The child's growth and development is **characterized by gradual growth.**

Physical growth

Weight:

- School-age child gains about **3.8kg/year.**
- Boys tend to gain slightly more weight through **12 years.**
- **Weight Formula for 7 - 12 yrs**

$$= \frac{(\text{age in yrs} \times 7) - 5}{2}$$

:Height

- The child gains about 5cm/year.
- Body proportion during this period: Both boys and girls **are long-legged**.

Dentition:

- **Permanent teeth** erupt during school-age period, **starting from 6 years**, usually in the same order in which primary teeth are lost.
- The child acquires permanent molars, medial and lateral incisors.

:Physiological growth

- **Pulse:** 90±15 beats/min (75 to 105).
- **Respiration:** 21±3C/min (18-24).
- **Blood Pressure:** 100/60±16/10.

School Years: fine motor

- Writing skills improve
- Fine motor with more focus
  - Building: models - logos
  - Sewing
  - Musical instrument
  - Painting
  - Typing skills
  - Technology: computers

Motor development

At 6–8 years, the school-age child:

- Rides **a bicycle**.
- Runs Jumps, climbs and hops.
- Has improved eye-hand coordination.
- Prints word and **learn cursive writing**.
- Can brush and comb hair.

At 8–10 years, the school-age child:

- Throws balls skillfully.
- Uses to participate in organized sports.
- Uses both hands independently.
- Handles eating utensils (spoon, fork, knife) skillfully.

At 10–12 years, the school-age child:

- Enjoy all physical activities.
- Continues to improve his motor coordination.

School Age: gross motor

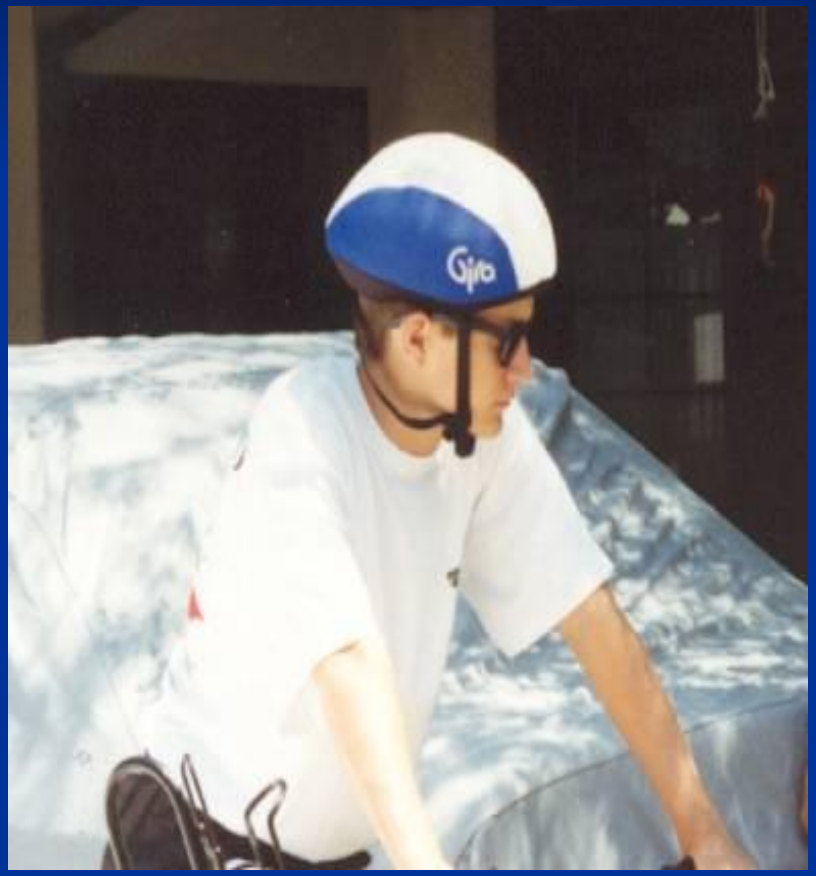
- 8 to 10 years: **team sports**
- Age ten: **match sport** to the physical and emotional development

School Age

Red flags: school age

- School failure
- Lack of friends
- Social isolation
- Aggressive behavior: fights, fire setting, animal abuse

to 18 Year Old 13



Adolescent age

- Physical growth
- Physiological growth
- Secondary sex characteristics
- Cognitive development
- Emotional development
- Social development

:Definition of adolescent

Adolescence is a transition period from childhood to adulthood. Its is based on childhood experiences and accomplishments.

It begins with the appearance of secondary sex characteristics and ends when somatic growth is completed and the individual is psychological mature.

:Physical growth

Weight:

- Growth spurt begins earlier in girls (10-14 years, while it is 12-16 in boys).
- Males gains 7 to 30kg, while female gains 7 to 25kg.

Height:

- By the age of 13, the adolescent triples his birth length.
- Males gains 10 to 30cm in height.
- Females gains less height than males as they gain 5 to 20cm.
- Growth in height ceases at 16 or 17 years in females and 18 to 20in males

:Physiological growth

Pulse: Reaches adult value 60-80 beats/min.

Respiration: 16-20C/minute.

NB: The sebaceous glands of face, neck and chest become more active. When their secretion accumulates under the skin in face, **acne will appear**.

Appearance of secondary sex characteristics

1- Secondary sex characteristics in girls:

- Increase in transverse diameter of the pelvis.
- Development of the breasts.
- Change in the vaginal secretions.
- Growth of pubic and axillary hair.
- Menstruation (first menstruation is called menarche, which occurs between 12 to 13 years).

Body image

2- Secondary sex characteristics in boys:

- Increase in size of genitalia.
- Swelling of the breast.
- Growth of pubic, axillary, facial and chest hair.
- Change in voice.
- Rapid growth of shoulder breadth.
- Production of spermatozoa (which is sign of puberty).

Adolescent behavioral problems

- Anorexia
- Attention deficit
- Anger issues
- Suicide

Thank you

Magda Abd-El Aziz