

Pediatrics

Pediatrics

- The word ***paediatrics*** and its cognates mean "healer of children"; they derive from two Greek words
 - παῖς (*pais* "child")
 - ἰατρός (*iatros* "doctor, healer")

Pediatrics

- **Pediatrics *is the branch*** of medical science concerned with the physical, mental and social health of children **from birth up to 18 years**
- **Pediatric *care encompasses*** a broad spectrum of health services ranging from preventive health care to the diagnosis and treatment of acute and chronic diseases
- **Pediatrics *is a discipline*** that deals with biological, social and environmental influences on the developing child and with the impact of disease and dysfunction on development

Pediatric subspecialties

- preventive pediatrics
- social pediatrics
- neonatology (new-born - 28 days)
- infantile psychiatry
- pediatric cardiology
- pediatric pneumology
- nutritional and metabolism diseases
- pediatric oncology
- surgery, orthopedy and pediatric traumatology

Pediatric hospitals

- The first pediatric hospital is the ***Hôpital des Enfants Malades*** (Hospital for Sick Children) – Paris in 1802
- In other European countries
 - Berlin – in 1810 (Charité)
 - Sankt-Petersburg – in 1834
 - Viena and Breslau (now Wroclaw) – both in 1837
 - Britain's first pediatric hospital – in 1852
 - Scotland – in 1860 in Edinburgh
 - The USA – in 1855 (Philadelphia), 1869 (Boston)
 - Bucharest – in 1869
- The first pediatric hospital in Chisinau – 1884

Child Rights and International Legal Framework

- Convention on the Rights of the Child (1989)
- United Nations Standard Minimum Rules for the Administration of Juvenile Justice ('Beijing Rules') (1985)
- United Nations Rules for the Protection of Juveniles Deprived of their Liberty ('JDLs' or 'Havana Rules') (1990)
- United Nations Guidelines for the Prevention of Juvenile Delinquency ('Riyadh Guidelines') (1990)
- Guidelines for Action on Children in the Criminal Justice System (Annex to UN Resolution 1997/30 – Administration of Juvenile Justice ('Vienna Guidelines')) (1997)
- United National Common Approach to Justice for Children (2008)

Convention on the Rights of the Child

- **The right to equality:** No child may be discriminated against on the basis of colour, sex, language, religion, political or other status
- **The right to life and development:** Every Member State has to ensure the survival and development of the child by providing access to health care and education, and by protecting the child from economic and social exploitation
- **Respect for children's own views:** Children should be respected and taken seriously, and they should be involved in decision-making processes according to their age and maturity

Basic children's right

- The right to survive
- The right to social and medical services
- The right to education
- The right to rational alimentation

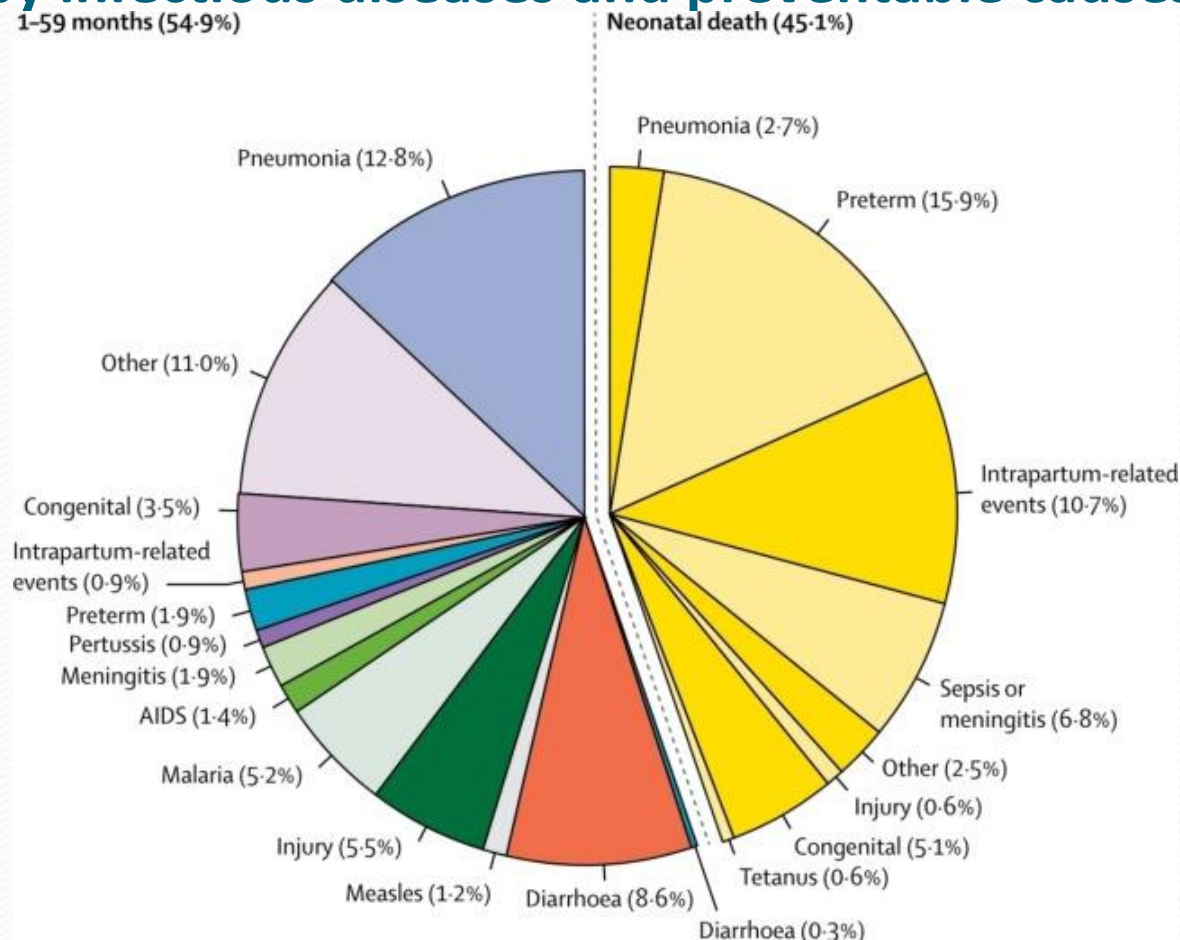
Pediatric healthcare provided in Republic of Moldova, tasks:

- Assessment of physical and neurological development to determine the groups of health and risk in children
- To establish correct diagnosis of acute and chronic diseases based on history, clinical examination and laboratory tests, according to the WHO classification of diseases
- Assessing the volume of investigations and treatment in line with national standards of RM
- The care and nutrition of a healthy and sick child
- Organizing and carrying out preventive, sanitary and epidemiological measures and treatment at home and in preschool and school institutions

Demographic statistics

- The number of population
- The birth rate
- Natural change (births minus deaths)
- Morbidity
- Mortality
 - **Neonatal mortality** – mortality within the 1st month of life
 - **Infant mortality** – mortality before the 1st birthday
 - **Postneonatal mortality** – the difference between infant and neonatal mortality
 - **Under-five mortality** – mortality before the fifth birthday
 - **Child mortality** – mortality between the 1st and 5th birthdays

Approximately 2/3 of all cases of mortality in under-five children are caused by infectious diseases and preventable causes



Causes of death in under-five children worldwide, 2000-2015

WHO Report, 2017

Child health groups

WHO definition of Health

- **Health** is a state of complete *physical, mental* and *social well-being* and not merely the absence of disease or infirmity

Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948

Health criteria

- ***I criterion*** – particularities of the child's ontogenesis;
- ***II criterion*** – physical development of the child;
- ***III criterion*** – neurological development of the child;
- ***IV criterion*** – functional state of the organs and systems;
- ***V criterion*** – resistance and reactivity of the child;
- ***VI criterion*** – presence or absence of chronic diseases.

The 1st group of health

- the period of ontogenesis has evolved normally; unique dysmorphia are admitted (unimportant deformations of the nails, auricle, congenital stains);
- the physical and neurological development is according to the age parameters;
- the functional state of the systems and organs is satisfactory
- the resistance and reactivity is satisfactory, rare acute maladies with mild evolution
- lack of the chronic disease

The 2A group of health

- prenatal and obstetrical antecedents (pathology of pregnancy, complicated evolution of the pregnancy), prematurity without signs of immaturity;
- physical and neurological development is according to child's age;
- the functional state of the systems and organs is satisfactory;
- the reactivity and resistance is good, episodic acute maladies with mild evolution or their absence;
- absence of chronic pathology

The group 2B of health

- The period of the ontogenesis has evolved unfavourably or normally;
- Normal physical development, weight deficit or excess;
- Normal neurological development or mild retention;
- Functional deviations, background, minimal pathological states;
- Altered reactivity and resistance, frequent respiratory infections, repeated bronchitis, pneumonia with drawling evolutions and slow recovery, fatigue, hyper excitability, sleep and appetite disorders, low-grade fever;
- Absence of chronic diseases

3rd group of health

- The period of the ontogenesis often has evolved unfavourably;
- Physical development normal or with malnutrition or obesity;
- Normal neurological development or retention in development;
- Altered functional state of the system or affected organ;
- Mildly altered resistance or reactivity, rare exacerbations of chronic disease;
- Presence of chronic disease in the compensation state.

4th group of health

- The ontogenesis has evolved unfavourably, rarely normal
- The physical development is normal, malnutrition or obesity;
- Deteriorated resistance and reactivity – frequent recurrences of the main disease with important alterations of the general state;
- Disorders of the affected system or other organs and systems;
- The presence of chronic maladies in the subcompensation state

5th group of health

- Ontogenetic pathological evolution, prenatal, obstretical antecedents
- Physical development: weight deficit, rarely normal;
- Normal or delayed neurological development;
- Congenital disorders in the functional state of the affected system;
- Pronounced disturbance in the reactivity and resistance of the organism, frequent and severe recurrences of the chronic diseases;
- Children with serious development malformations and severe chronic diseases, in decompensation state.

Periods of childhood: their characteristics and significance

Periods of childhood

The classification of periods of childhood is useful for pediatricians for their differential attitude to the care for and treatment of children of different age.



Periods of childhood

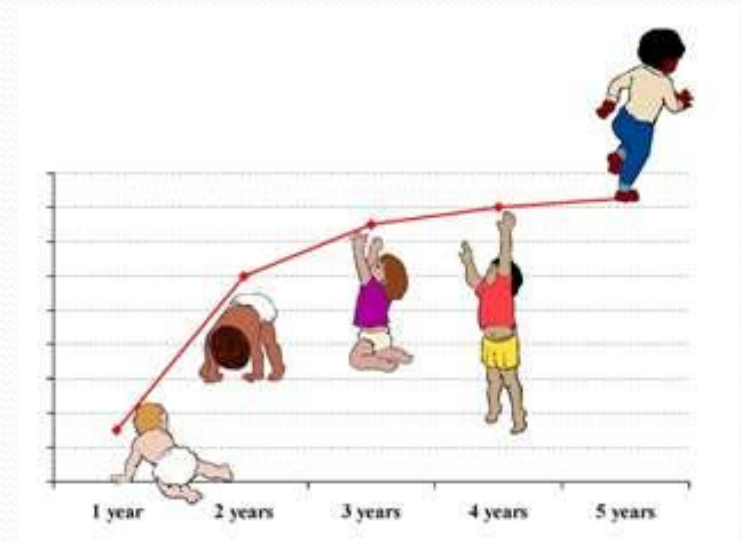
The following periods of childhood are put forward according to the modern classification:

- intrauterine period:
 - embryonic stage (stage of embryonic development) – till 12 weeks of pregnancy
 - fetal stage (stage of placenta development) – from 12 weeks of pregnancy to birth



Periods of childhood

- newborn period – 0-28 days
- infant period – 29 days -1 year
- pre-preschool period – 1-3 years
- preschool period – 3-6 years
- early school period – 7-11 years
- middle school age – 12-15 years
- late school period – 15-18 years

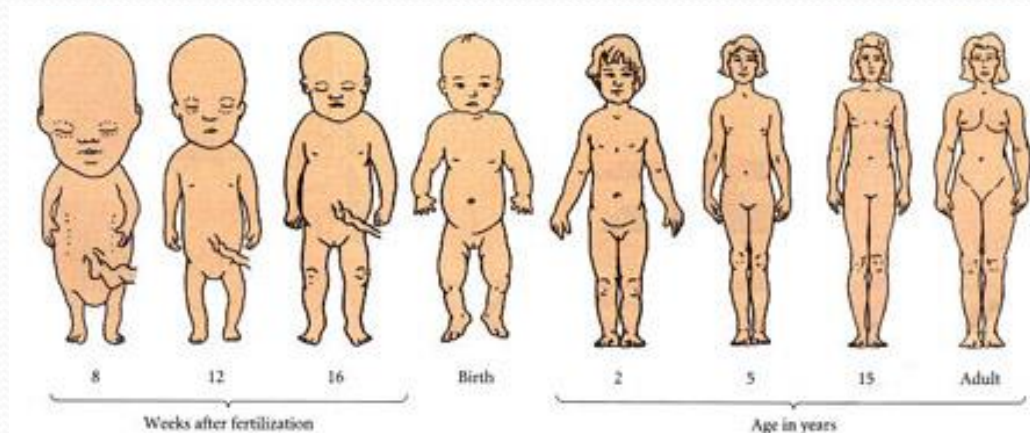


The embryonic stage

- The first trimester of human development is a period of **morphogenesis** – the major organs and basic tissues are laid down
- During the first phase of embryonic differentiation there are a number of spontaneous abortions, often of embryos with major chromosomal defects
- Growth rate is about 1 mm per day
- By 12 weeks, crown-rump length is 5.4 cm and weight is 14 grams

The fetal stage

- Most of the baby's external features that are observed at birth are now apparent
- The fetus not only looks more human; it is possible by 12 weeks to discern its gender
- The head is large in comparison to the body
- Now contains nearly the same number of neurons as an adult, and the nerves from the brain begin to be coated in myelin
- This is a crucial stage in their maturation as it facilitates the passage of messages to and from the brain



The newborn period

- Starts since the moment of birth and separation of the child from the mother
- The duration of the newborn period is about 4 weeks
- *Early neonatal period* (first 7 days of life) – the most responsible for children's adaptation to extra-uterine life
- *Late neonatal period* (since the 8th to 28th days of life) – healthy child during this period is already at the home and followed up by pediatrician

Physical characteristics of newborn

- In medical contexts, **newborn or neonate** refers to an infant in the first 28 days after birth; the term applies to premature infants, postmature infants, and full term infants
- Full term newborn characteristics
 - Is a normal duration of pregnancy between 37-42 weeks of gestation
 - The average birth weight is around 3.5 kg, the normal range is 2.5-4.5 kg
 - Newborns often lose around 230 g (6-8%) in the first 4-5 days after birth but regain it by about 10 to 12 days of age
 - In the first month, the typical newborn gains about 20 g a day, or about 110-230 g a week.
 - The average length of full-term babies at birth is 51 cm, the normal range is 46-56 cm
 - In the first month, babies typically grow 4 cm to 5 cm

Newborn classification

WEIGHT AND PERCENTILE CLASSIFICATIONS

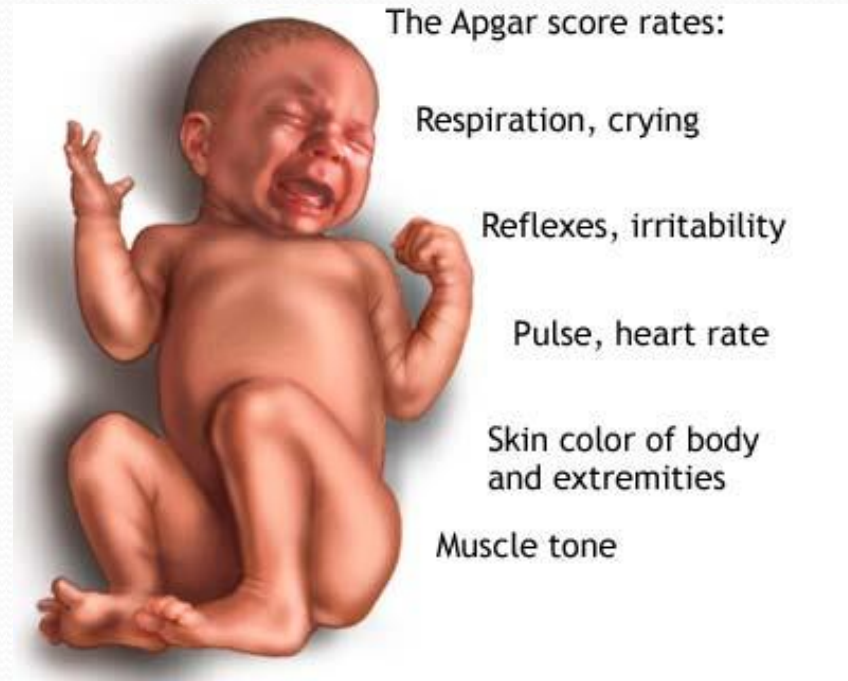
Classification	Birth Weight	Percentile
Small for gestational age (SGA)	<2500 g	10th percentile
Appropriate for gestational age (AGA)	2500-4500 g	10th to 90th percentile
Large for gestational age (LGA)	>4500 g	>90th percentile

GESTATIONAL AGE CLASSIFICATION

Classification	Gestation
Premature	<37 weeks
Full-term	37 to 42 weeks
Post-term	>42 weeks

Apgar score

- In 1953, an anesthesiologist named Virginia Apgar designed a tool for evaluating newborn infants
- The Apgar scores grade the infant's response to extrauterine life in five categories
 - Heart rate
 - Respiratory effort
 - Muscle tone
 - Reflex irritability
 - Color
- There are a maximum of 2 points possible in each category, for a total of 10 possible points
- The Apgar determination is completed at 1 and 5 minutes of life



The Apgar score rates:

Respiration, crying

Reflexes, irritability

Pulse, heart rate

Skin color of body
and extremities

Muscle tone

APGAR SCORING SYSTEM

	0 Points	1 Point	2 Points	Points totaled
Activity (muscle tone)	Absent	Arms and legs flexed	Active movement	↓
Pulse	Absent	Below 100 bpm	Over 100 bpm	
Grimace (reflex irritability)	Flaccid	Some flexion of Extremities	Active motion (sneeze, cough, pull away)	
Appearance (skin color)	Blue, pale	Body pink, Extremities blue	Completely pink	
Respiration	Absent	Slow, irregular	Vigorous cry	

Severely depressed	0-3
Moderately depressed	4-6
Excellent condition	7-10

Newborn reflexes

- Survival Reflexes:

- Sucking
- Swallowing
- Rooting – this is the reflex that occurs when the cheek or the corner of the mouth is stroked slightly

- Safety Reflexes:

- Tonic neck reflex – this is when baby lies in a “fencing” position
- Moro reflex – this is when baby will thrust out both arms when he is startled
- Grasp reflex – if you place your finger in the baby’s palm hand, he or she will grasp very tightly

The typical pathology of newborn period

The following pathology is typical for the newborn period:

- *sequelae of intrauterine development disorders* (malformation, prematurity)
- *sequelae of birth injury*
- *immunologic maternal-foetal incompatibility* (Rh factor, ABO system – hemolytic jaundice)
- *prenatal infection diseases* (toxoplasmosis, CMV infection, syphilis, and others)
- *acquired diseases* (sepsis, gastroenteritis, meningitis, etc.)
- *newborn infant death rate* is higher in comparison with other childhood periods

Newborn period needs

- proper medical observation
- special care
 - hygienic regimen
 - nutrition that must be adequate to their morphofunctional peculiarities

The infant period

- Its duration is about 1 year
- The connection between an infant and its mother does not break off completely due to breastfeeding
- During the infant period the growth and morphofunctional development are very intensive

The infants characteristics

- Everything is new and interesting to one-year-olds. They enthusiastically use their five senses to actively explore the world around them. They find pleasure in causing things to happen and in completing basic tasks.
- During this year, language skills typically progress from grunting and pointing to speaking single words and experimenting with simple word combinations
 - Pronunciation is quite difficult, familiar adults almost always need to "translate" for others
 - One-year-olds steadily build their vocabularies by absorbing the language around them
 - They are able to understand common phrases and simple directions used in routine situations
- Most infants typically move from crawling to running by about 20 months
- They use their new mobility to push and pull toys, dance and climb
- One-year-olds also improve in hand and finger coordination, but skills at this age are still immature

The typical pathology and the needs of infant period

The following pathology is typical for the infant period:

- Infants are predisposed to *acute and chronic disorders of nutrition and digestion, rickets, anemia*
- Infections can develop due to *transient immunodeficiency*
- Prophylactic vaccination of infections must be followed in the infant period
- There is functional immaturity of the digestive system, which demands the proper organization of nutrition

The preschool period

- The duration is from 1 to 7 years
- It is possible to divide this period into 2 parts:
 - pre-preschool period (toddler) – the first 3 years
 - preschool period – from 4 to 7 years
- These periods have some morphological and functional difference, but without any quality difference

The importance of preschool period

- Gradual perfection of basical functions of child's organism is marked in this period
- The functions of the thymus, hypophysis and epiphysis dominate in the endocrine system within this period
- In general children during the first two years of life quadruple their weight and increase their height by two-thirds, this rate slows down between 2-3 years
- Quick development of movement activity, perfection of coordination, increase of strength are typical for children in this period
- Their central and peripheral nervous systems become more differentiated, the analyzer synthesis function of the cortex becomes more perfect. The increasing activity of the cerebral hemispheres has a violent tempo and a grand scale.

The typical pathology of preschool period

- Due to often contacts with other children, environment and domestic animals, children at this period suffer from
 - *infectious diseases* (measles, scarlet fever, whooping cough)
 - *parasites* (ascariasis, lambliasis, hymenolipidosis, trichocephaliasis,)

The school period

- After 7 years follows the school period
- It may be divided into:
 - the young school age (7-11 years)
 - the middle school age (12-15 years)
 - older school age (15-18 years)

The importance of school period

- Many systems and organs within this period develop both morphologically and functionally
- The accomplishment of functions needs more time than intensive growth
- At that time a change in the balance of functions of endocrine organs occurs:
 - the dominating role of the thymus decreases
 - functions of the thyroid and sex glands increase
- It leads to changes in the body's forms, with the formation of the psychosocial and sexual orientation of boys and girls
- The age from 7 to 11 years is the quietest one for the central nervous system development. Neural processes are quite powerful and balanced
- Self-criticism is quite well expressed

The typical pathology of school period

- Peculiarities in the growth and development during this period result in specific pathology
- Disorders of normal affectivity can develop quite often due to inadequate progress of studies
- Quite common are diseases caused by disorders of school hygiene regimen (myopia, habit scoliosis)
- Acute infections occur as a pathology of children at the school age
- Endocrinopathy and asthenia can be frequently diagnosed
- It is necessary to note the increasing frequency of rheumatic fever and functional disorders of the cardiovascular and nervous systems
- Some diseases have clinical manifestations like in adults

The period of sexual maturity (adolescence)

- in girls since 12 to 16 years
- in boys since 13-14 to 18-19 years

The importance of adolescence period

- The period of adolescence, like the newborn or infant periods, is a stage of development, when children are very sensitive to a harmful environment
- It is the period within which the organism starts to have new physiological changes and a lot of organs and systems rearrange their activity
- As a result of this rearrangement, the child's organism turns into the adult's one

The typical problems of adolescence period

- The pathology of puberty includes 2 groups of diseases
 - *first group of diseases is typical only for this period* – pathologic conditions of the sexual and endocrine systems, causing significant disorders of puberty
 - precocious puberty, delayed puberty, disorder of sexual differentiation (intersexualism, homosexuality, genuine and false hermaphroditism, transsexualism and other sexual psychopathology, chlorosis of young girls, juvenile mastopathy)
 - *The second group of diseases of the puberty period* includes various diseases which can take place at any age; however, these have clinical peculiarities during the puberty period (tuberculosis, rheumatic fever)

Risk factors
Sensitive periods
Critical periods

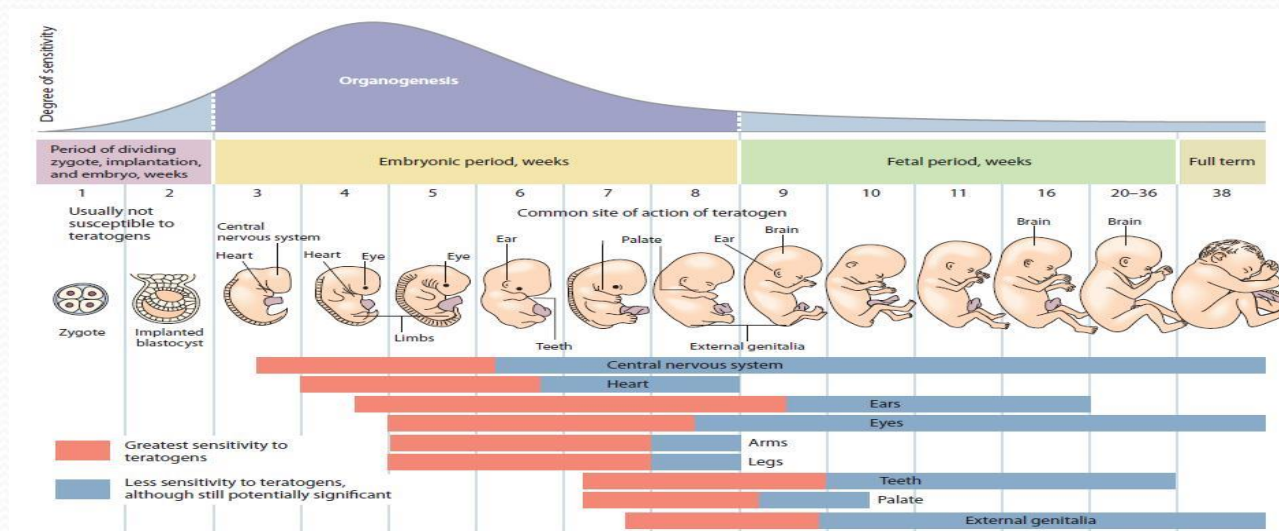
Risk factors

- There are numerous factors which can influence the development of the embryo and foetus:
 - condition of the parents' health
 - pathology of pregnancy
 - effects of environmental factors
- The factors, considered potentially toxic or harmful to cell growth and differentiation, are termed **teratogens**
- Many teratogens cause harmful results in developing congenital anomalies, diseases and intrauterine death

Risk factors

It is possible to estimate anomalies caused by:

- damage of the gamete – “**gametopathy**”,
- by damage of fertilized ovum (blastocyst) – “**blastopathy**”,
- by damage of the embryo (4 weeks to 3 months) – “**embryopathy**”
- by damage of the foetus – “**foetopathy**”



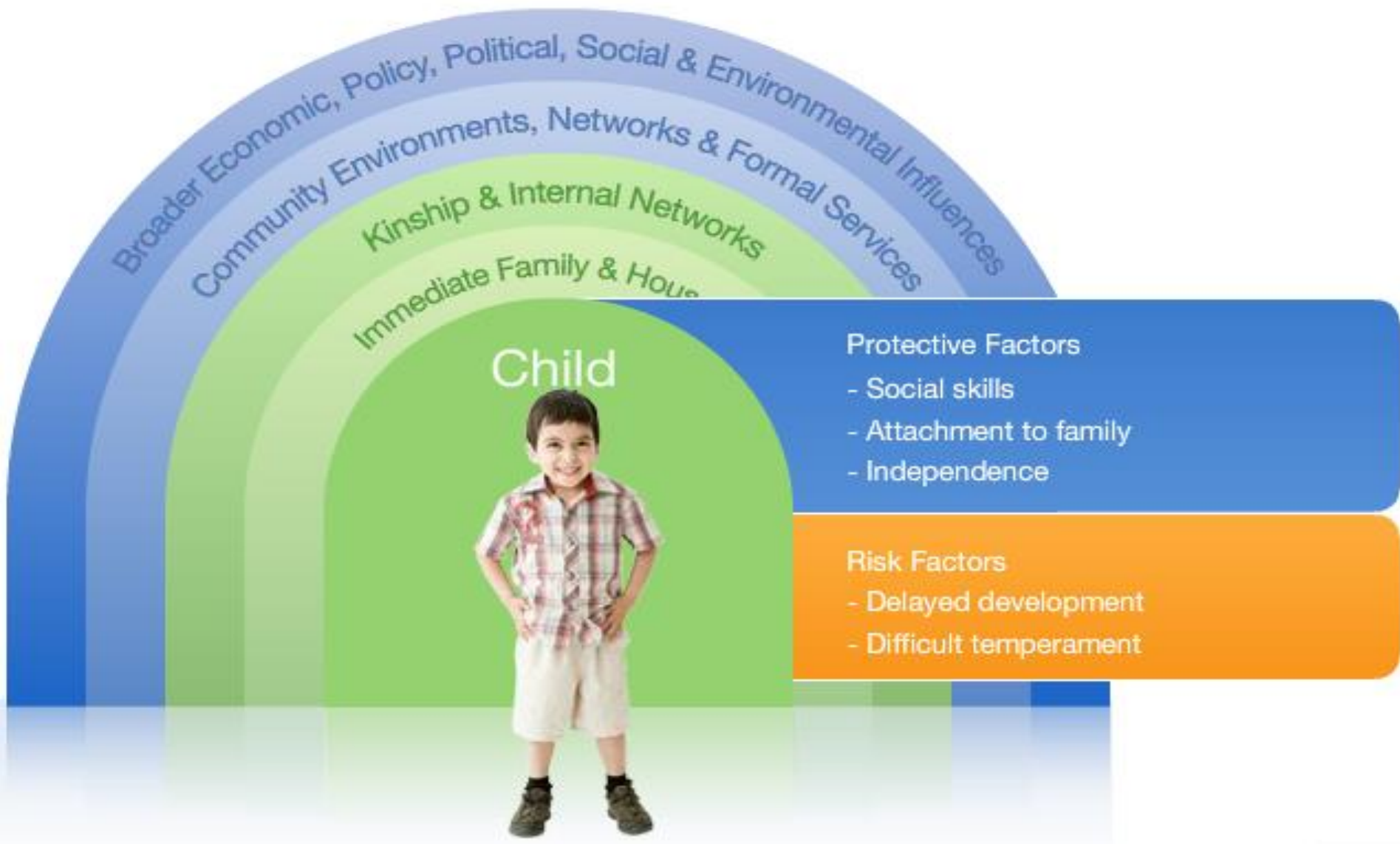
Risk and protective factors

- There are a wide range of factors that make a child especially vulnerable; these factors can be distinguished in ***individual, family*** and ***community risk factors***
- Other environmental factors might have an enabling or mitigating/protecting impact on the child
- It is important to note that a single risk factor at any level does not necessarily lead to impairments developmental
- The combination of risk factors can make a child vulnerable
- Risk factors are cumulative and interactive, and tend to reinforce each other

Risk and protective factors



Child risk and protective factors



Family risk and protective factors



Extended family risk and protective factors



School risk and protective factors



Social risk and protective factors



Special groups of vulnerable children

- There are some groups that deserve particular attention, because their needs require special services
- Especially vulnerable are children affected by:
 - HIV/AIDS
 - Disabilities
 - Abuse or neglect
 - Child labor
 - Civil war

Child's growth and development – characteristics, peculiarities

Mechanism of growth and development

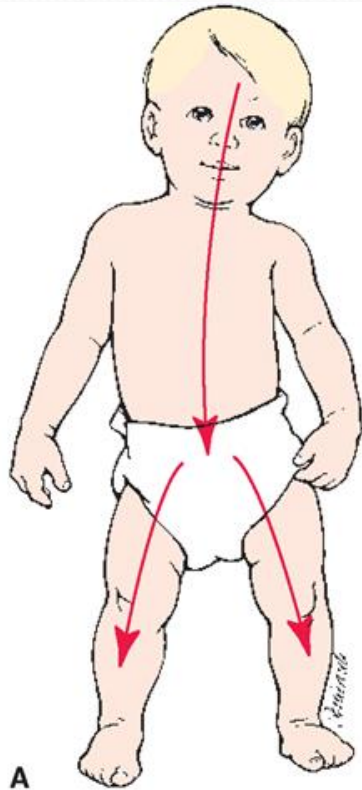
- The process of growth and development is a dynamic action starting from the moment of child's conception until maturity
- The growth presents two parts:
 - **Quantitative part** is equal to accumulation of organic substance and is manifested through the process of replacing of the organic mass through life with increase in weight and height
 - cellular proliferation (epithelium, lymphatic organs)
 - cellular hypertrophy with cellular volume growth
 - **Qualitative** includes functional and structural differentiation

Factors influencing child's growth

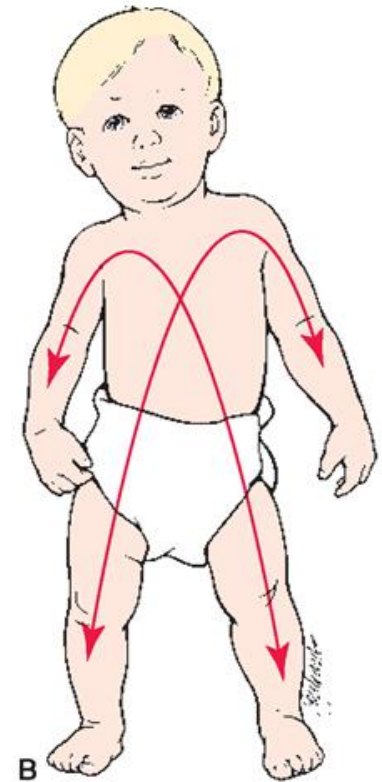
- **Genetic factors** (Growth potential)
 - gender
 - race and nationality
- **Prenatal factors**
 - maternal malnutrition
 - maternal infection
 - maternal substance abuse
 - maternal illness
 - hormones
 - miscellaneous
- **Postnatal factor**
 - hormonal influence
 - birth order of the child
 - child's nutrition
 - childhood illness
 - physical environment
 - psychological environment
 - cultural influence
 - socio-economic status
 - climate and season
 - play and exercise

Growth patterns

Cephalocaudal pattern
(head down to toes)



Proximodistal pattern
center of the body to peripheral



General to Specific

Children at first are able hold the big things by using both arms, In the next part able to hold things in a single hand, then only able to pick small objects

Child's growth

- Although infancy and adolescence are characterized by rapid growth, **growth occurs in spurts**, with rapid growth followed by slower growth



Methods of physical development assessment in children

- **Somatoscopy** – shape of the thorax, back, sole, muscle development, fat development, skin elasticity, biological maturation
- **Somatometry** – anthropometric parameters (weight, height, head and chest circumference)
- **Functional** – spirometry, dynamometry

Somatoscopy

- Somatoscopy permits formation of a general impression about physical development of a body proportionally, presence of functional or pathological modification.
- Somatoscopy includes examination of
 - locomotor system (skull, chest, spine)
 - muscular system
 - teguments and subcutaneous tissue

Somatoscopy of muscular system

3 degrees of development:

- ***First degree*** – low development, decreased elasticity, plate thorax, abdomen is extended and there is low muscular strength
- ***Second degree*** – well muscular development, medium elasticity, cylindrical thorax, abdomen in tonus, medium muscular strength
- ***Third degree*** – very good muscular development

Examination of adipose tissue

- Is made by appreciation of skin fold thickness in following regions:
 - Thorax – on medioclavicular line, at the level of third rib
 - Abdomen – 5 cm left from umbilicus
 - On shoulder – on the triceps muscle and the line between acromion and olecranon
 - Under scapula – at inferior angle of scapula
- **4 degrees of development:**
 - 1st degree – the adipose tissue is 5 mm
 - 2nd degree – 5-9 mm
 - 3rd degree – 10-15 mm, in adults till 20 mm
 - 4th degree – 15 mm

Skin examination

- Color, elasticity, turgor, humidity, temperature
- Presence of hypo- or hypertrichosis
- Mucousa of eyes and oral cavity

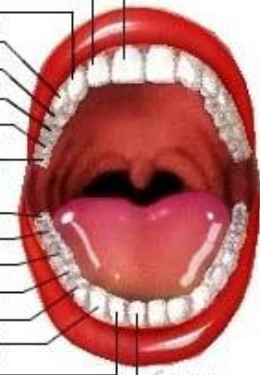


Biological age

- Appearance of temporary and permanent teeth
- Ossification points on X-ray examination of the first
- Assessment of sexual maturity degree and – secondary sexual sign



		Primary eruption	Permanent eruption
Upper teeth	central incisor	8 - 12 mos.	7 - 8 yrs.
	lateral incisor	9 - 13 mos.	8 - 9 yrs.
	canine	16 - 22 mos.	11 - 12 yrs.
	first premolar		10 - 11 yrs.
	second premolar		10 - 12 yrs.
	first molar	13 - 19 mos.	6 - 7 yrs.
	second molar	25 - 33 mos.	12 - 13 yrs.
	third molar		17 - 21 yrs.
Lower teeth	third molar		17 - 21 yrs.
	second molar	23 - 31 mos.	11 - 13 yrs.
	first molar	14 - 18 mos.	6 - 7 yrs.
	first premolar		11 - 12 yrs.
	second premolar		10 - 12 yrs.
	canine	17 - 23 mos.	9 - 10 yrs.
	lateral incisor	10 - 16 mos.	7 - 8 yrs.
	central incisor	6 - 10 mos.	6 - 7 yrs.



Somatometry

- **General** investigation of a large group of children to determine the regional standards of age and sex and to form some evaluation tables used for particular case
- **Individual** measures of a patient according to the morphofunctional level of development
- Somatometry includes the appreciation of:
 - body weight
 - height/length
 - chest circumference
 - head circumference

The formula for estimating ideal weight in the first year

- 0-6 month

$$W_i = BW + 800 * n$$

- 6-12 month

$$W_i = BW + 800 * 6 + 400 (n-6)$$

(n – number of month)

The formula for estimating ideal weight after first year

- The weight after 1 year

$$W_i = 9 + 2 * n$$

(n – number of years)

Ideal height

- The height after 1 year

$$H_i = 75 + 5 * n \text{ (n – number of years)}$$

- The height of a 4-year-old child = 100 cm
 - before 4 years = $100 - 8(4 - n)$
 - after 4 years = $100 + 6(n - 4)$ (n – number of years)

The formula for estimating the head circumference in the first year

$$\begin{aligned} &\text{Normal range of the head circumference (5}^{\text{th}} - 95^{\text{th}} \text{ percentile)} = \\ &= \left[\frac{\text{length}(cm)}{2} + 9.5 \right] \pm 2.5. \end{aligned}$$

Percentile method

- **Centilic or percentilic method** – to compare a child to other children of the same age
- Main parameters of physical development of healthy children of different age are arranged into a line from minimal up to maximal value

Body weight (kg) according to age the (boys)

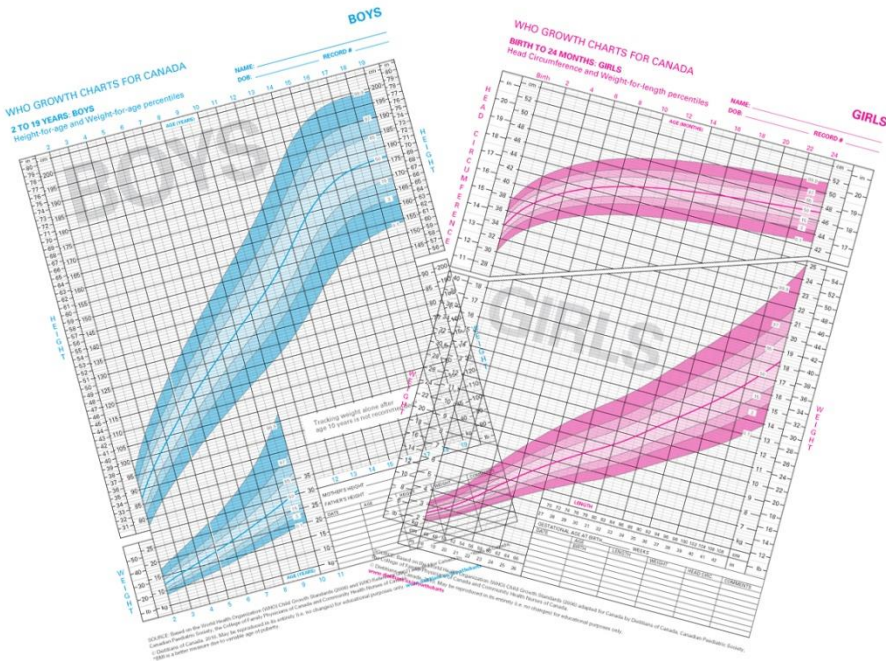
Vårsta	Centile					
	3	10	25	75	90	97
0 luni	2,4	2,7	3,0	3,7	4,0	4,4
1»	3,1	3,5	3,8	4,5	5,2	5,6
2»	3,9	4,3	4,6	5,5	6,2	6,6
3»	4,5	4,9	5,4	6,4	7,0	7,5
4»	5,2	5,6	6,2	7,2	7,9	8,4
5»	5,8	6,2	6,8	7,9	8,6	9,1
6»	6,4	6,8	7,4	8,6	9,2	9,7
7»	6,9	7,4	7,9	9,1	9,8	10,3
8»	7,4	7,8	8,4	9,6	10,3	10,8
9»	7,8	8,3	8,9	10,1	10,9	11,3
10»	8,0	8,6	9,2	10,6	11,3	11,8
11»	8,3	8,9	9,5	11,0	11,8	12,3
12»	8,6	9,1	9,8	11,5	12,2	12,7
15»	9,2	9,6	10,5	12,2	12,9	13,5
18»	9,6	10,2	11,0	12,8	13,6	14,2
21»	10,1	10,6	11,5	13,5	14,3	14,9
24»	10,6	11,1	12,0	14,1	14,9	15,4
27»	11,1	11,6	12,4	14,6	15,4	15,9
30»	11,5	12,0	12,8	15,1	16,0	16,5
33»	11,9	12,4	13,2	15,6	16,5	17,0
36»	12,1	12,8	13,6	16,0	16,9	17,5
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4»	13,3	14,2	15,1	18,0	19,1	20,0
4,5»	14,0	14,9	15,9	19,0	20,6	21,7
5»	14,8	15,7	16,8	20,1	22,0	23,2
5,5»	15,5	16,6	17,8	21,4	23,4	25,1
6»	16,3	17,6	18,9	22,6	24,9	27,0
6,5»	17,2	18,4	20,0	24,0	26,4	29,0
7»	18,2	19,6	21,3	25,5	28,0	31,1
8»	20,0	21,5	23,4	28,4	31,7	35,1
9»	22,0	23,4	25,6	31,4	35,4	39,2
10»	24,0	25,6	28,0	35,1	39,5	45,0
11»	26,0	28,0	31,0	39,2	44,5	50,5
12»	28,3	30,4	34,4	43,8	50,0	57,0
13»	31,0	33,4	39,8	49,0	56,2	63,6
14»	34,0	35,2	42,2	54,6	62,2	70,6
15»	37,8	40,8	46,9	60,2	65,1	76,5
16»	41,2	45,5	51,8	65,9	73,0	82,5
17»	46,4	50,5	56,8	70,6	78,0	86,2

Centile levels

- **P₀₋₃** – Very low development
- **P₃₋₁₀** – Low development
- **P₁₀₋₂₅** – Decreased development
- **P₂₅₋₇₅** – Medium development
- **P₇₅₋₉₀** – Increased development
- **P₉₀₋₉₇** – High development
- **P₉₇₋₁₀₀** – Very high development

Growth charts

Growth chart are used to keep track of a child's progress



Centile levels

- P_{0-3} – Very low development
- P_{3-10} – Low development
- P_{10-25} – Decreased development
- P_{25-75} – Medium development
- P_{75-90} – Increased development
- P_{90-97} – High development
- P_{97-100} – Very high development

The peculiarities of CNS in children

The peculiarities of CNS in infants

- immaturity of cellular elements and nervous fibers, which determines a diffuse brain affection
- increased sensibility to different toxic factors and decreased threshold of excitability, which can provoke the convulsive state
- increased hydrophilia of nervous tissue which contributes to rapid development of cerebral edema
- intolerance of CNS to the immune system, which leads to development of anticerebral autoantibodies in the case of hematoencephalic barrier affection
- plasticity and great compensatory possibilities of the brain

Peculiarities of the brain

- The mass of newborn's encephalon is greater than in adults, constituting respectively $\frac{1}{8}$ and $\frac{1}{40}$ from body mass
- In newborns only gyri and big (basic) convolutions are good evidenced, but they are less profound, and small convolutions are few
- Cerebellum in children is localized upper than in adults, at birth is underdeveloped
- The differentiation of neurons in postnatal period is realizing through axons growing and myelinization
- Increased permeability of hemato-encephalic barrier for different agents (infectious, toxic, medicamentous)
- In newborn is a predominance of inhibition processes, the sleeping constitutes in medium 22 hours from 24

Peculiarities of spinal cord

- In newborn the spinal cord is a relatively more developed comparatively to encephalon
- Spinal cord doesn't have cervical and lumbar thickening
- The growing of spinal cord is more rapidly than the growing of vertebral column

The peculiarities of sense organs development in children

Vision

- infant's sight is monocular until 3 weeks of life, then the binocular sight is initiating (the infant fixes with both eyes for 2-3 sec);
- in the 2nd month of life – begins to differentiate some bright colors
- spatial perception begins to develop at 6-9 month

Hearing

- in newborn the hearing is the best developed sense

Smell

- response to pleasant and unpleasant smells at 2-4 months

Taste

- Undeveloped

Stages of NS development

- **1 month** – maintenance of the head for a few sec, reflexes
- **2 month** – maintenance of the head for a few min, smiles as a response, begins to vocalize
- **3 month** – catches an object placed in hand for short time; laughs, prattles
- **4 months** – keeps well the raised head; rolls from belly to back
- **5 months** – is sitting with support
- **6 months** – is sitting without support
- **7 months** – crawls in all directions, vocalizes syllables
- **8 months** – stands for short time in ortostatic position with support, beginning of lalalization (da-da, ma-ma)
- **9-10 months** – can walk with the hand support
- **12 month** – he can to walk alone, says 2-4 words with sense

Speech development in children

Preverbal stage

- ***prattling*** (“a”, “g”, “u”) at 1-1,5-2,5 months
- ***lalization*** (“ba”, “da”) in 2,5-5 months

Verbal stage

- ***sensory speech*** at 7-8 months, when the infant associates the word with the object/concrete phenomenon and reacts to word looking for the sight
- ***motory speech*** at 10 -11 months, when the infant pronounces simple words, formed from 2 syllables (“ma-ma”, “ta-ta”, “ba-ba”, “pa-pa”)
- At the age of one year majority of healthy infants pronounce 10-12 words. The girls usually acquire motor speech earlier than boys.

NS examination

- Anamnesis and clinical examination
- Transfontanellar neurosonography
- Encephalography – cerebral electric activity
- CT scan
- MRI
- Reoencephalography – makes evident cerebral vascular network;
- X-ray of the skull and column
- examination of cerebrospinal fluid