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Essentials of Pediatric Nursing

Includes Pediatric Nursing Procedures, OSCE & Modules

Semester V and VI

5th Edition



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CHAPTER 6

Growth and Development

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LEARNING OBJECTIVES

After completing the chapter, the students will be able to:

- Discuss the importance of studying growth and development
- Discuss the factors affecting growth and development
- Identify the principles/characteristics of growth and development
- Discuss theories of growth and development
- Understand the aspects of growth and development
- Discuss the growth and developmental milestones
- Learn formulas for anthropometric assessment

INTRODUCTION

Growth is an essential feature of life of a child that distinguishes him or her from an adult. The process of growth starts from the time of conception and continues until child grows into adult. The terms "growth" and "development" are often used together but they represent two different facets of the dynamics of change, i.e., quantity and quality. The entire course is a dynamic process that encompasses several interrelated dimensions.

- **Growth:** Growth refers to an increase in size or mass of the tissues. It is largely attributed to multiplication of cells and increase in intracellular substance. It can be measured in inches, centimeters, kilograms, and pounds. So it is a quantitative term.
- **Development:** Development specifies maturation of functions or physiological maturation. The term "development" is used to refer progressive increase in skills and capacity to function. It is a qualitative change in child's functioning and is difficult to measure. Development is the result of maturation and learning.
- **Maturation:** Maturation is an increase in competence and ability to function at a higher level, depending on child's heredity. It refers to unfolding of human potentialities or hereditary traits, which are carried by genes.

IMPORTANCE OF STUDYING GROWTH AND DEVELOPMENT

The knowledge of growth and development helps the nurse to:

- Understand the behavior of the child so that the child can be handled intelligently.
- Know what to expect of a particular child at any age.
- Assess the children in terms of norms for specific stage of development, which will help in guiding the children into more mature behavior.
- Diagnose undernutrition and overnutrition or any other deficiency disorders that affect growth.
- Ascertain needs of the child at a particular age.
- Plan and provide comprehensive care to the child.
- Assist parents in environmental modification to keep pace with new emerging needs of children so as to enable children to achieve optimum growth levels.

FACTORS AFFECTING GROWTH AND DEVELOPMENT

Growth and development depends not only on one but a combination of many factors **(Fig. 1)**. The typical pattern of growth and development is regulated by a complex balance between heredity or genetic constitution and environmental factors. Heredity determines the extent to which growth and development is possible and environment determines the degree to which the maximum potential is achieved.

Heredity/Genetic Factors

- **Heredity:** It refers to the genetic constitution of an individual, which is established during conception. It is that property by which offsprings have nature and characteristics of parents or ancestors. From parents, the child receives a combination of parental genes. Every individual's supply of genes is given to him at the time of conception. Color of eyes, hair, facial features, structure of body, physical peculiarities, blood group,

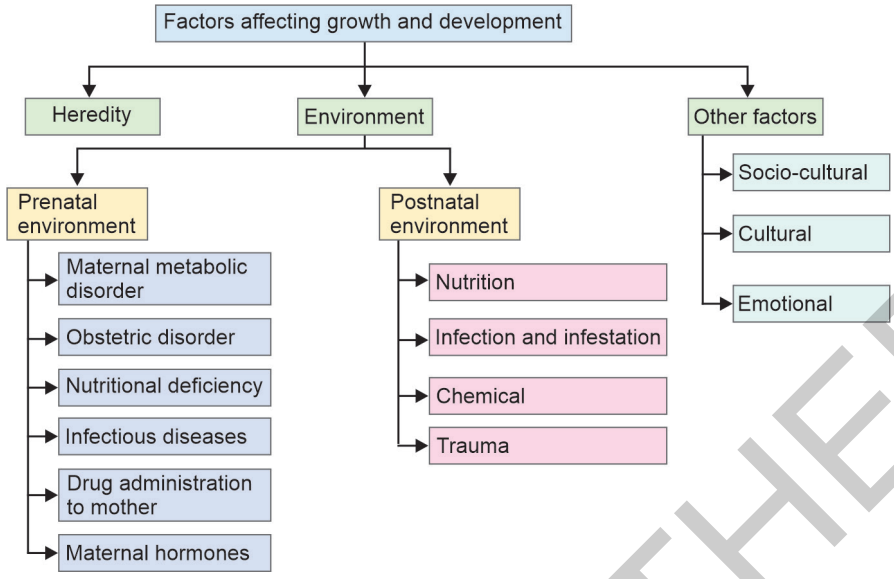


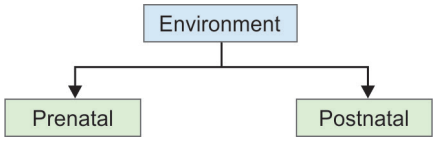
Fig. 1: Factors affecting growth and development.

etc., are determined entirely by heredity. It is because of heredity that members of a family have physical resemblance to each other.

- **Race:** Growth potential of children of different racial groups is different.
- **Sex:** Sex of the baby is determined at conception. After birth, male infant is long and heavier than female infant. At the age of 1 year, there is no difference in the length and weight of male and female infants. During puberty, growth spurt occurs and boys become taller and heavier than girls of their age.
- **Biorhythm and maturation:** Daughters often reach menarche at same age as their mothers had. Also the length of menstrual cycle is same as that of mother.
- **Genetic disorders:** Growth and development are adversely affected by certain genetic disorders. These disorders are of two types:
  a. Chromosomal abnormalities like Turner's syndrome and Down syndrome, which cause growth retardation.
  b. Gene mutations may lead to metabolic defects like galactosemia.

Environmental Factors

Although each human being at birth has a genetically determined physical, mental, and biochemical potential, but this potential may or may not be reached because of environmental influences. Stimulation for development of innate abilities comes from the environment, which may be favorable or unfavorable.



- **Prenatal environment:** The environment which the fetus gets in utero before birth is known as prenatal environment. This environment provides nutrition and does gas exchange also. The uterus protects fetus from adverse effects of external conditions. A substandard or diseased intrauterine environment has an adverse effect on growing fetus. For example, intrauterine rubella infection produces severe reduction in quantity of cells in many organs while toxemia in late pregnancy leads to significant increase in cell size though the number of cells is normal. The factors affecting fetal growth are as follows:
  - *Nutritional deficiency in mother:* Maternal under nutrition and anemia leads to intrauterine growth retardation and consequently small size of fetus.
  - *Obstetric disorders:* Obstetric disorders like pregnancy induced hypertension, preeclampsia, multiple pregnancy, and malposition of fetus produces fetal growth restriction.
  - *Metabolic disorders in mother:* Disorders of metabolism like diabetes mellitus leads to large size of fetus.
  - *Infections:* Maternal rubella infection occurring during first trimester of pregnancy results in congenital malformation in fetus. Children with birth defects cannot grow at an optimal rate. Other maternal infections like syphilis, hepatitis B, human immunodeficiency virus (HIV), *Cytomegalovirus* inclusion, toxoplasmosis, etc., may be transmitted to the fetus, which may arrest or retard the growth of fetus.
  - *Administration of certain drugs:* Consumption of certain drugs like thalidomide by mother during first trimester of pregnancy adversely affects embryo

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and leads to birth defects. These drugs are called teratogenic agents.

- *Influence of maternal hormones:*
  - Thyroxine: Human fetus secretes thyroxine from 12th week of gestation. Thyroxine deficiency in mother retards skeletal maturation in fetus. Maternal myxedema results in hypothyroidism in fetus.
  - Insulin: Insulin stimulates fetal growth. In mothers with diabetes, fetus is usually large with excessive birth weight. As maternal blood sugar level is high, fetal blood sugar is also elevated. This leads to hyperplasia of islet cells of fetal pancreas leading to excessive insulin secretion resulting in macrosomia.

❖ **Postnatal environment:** The environment that the baby gets after birth is known as postnatal environment. This environment determines the pace and pattern of growth and development. Postnatal environmental factors affecting growth and development are:

- *Nutrition:* Growth of children suffering from protein-energy malnutrition, anemia, and vitamin deficiency diseases (like rickets) is severely affected. Also overeating and overnutrition leads to obesity.
- *Infections and infestations:* Persistent or recurrent diarrhea and respiratory tract infections are common causes of growth impairment. Systemic infections and parasitic infestations usually decrease the velocity of growth.
- *Chemical agents:* Consumption of androgenic hormones accelerates skeletal growth.
- *Trauma:* Fracture of end of bone, damages the growing epiphysis and thus hampers skeletal growth. Head injury may cause brain damage and seriously jeopardize mental development of the child.

Other Factors

❖ **Socioeconomic condition:** The environment of children born in lower socioeconomic groups is usually less favorable than those in middle and upper groups. The parents with poor financial condition usually cannot take proper care of their children, as they do not have money to buy essentials of health and diet. Poverty, crowded, and unhygienic living conditions lead to retardation of growth and development in children.

❖ **Cultural influences:** Culture influences the child rearing and infant feeding practices in community. There are many cultural taboos against consumption of particular foodstuffs. This affects the nutritional status and growth of the children. For example, some communities are strictly vegetarian and do not consume egg, meat, etc. The children of these communities do not get proteins of high biologic value due to which their growth may be retarded. Similarly in some communities, colostrum is not fed to the child as it is considered impure yellow milk. This practice devoids the children of many nutritional substances and antibodies present in colostrum, which makes these children susceptible to infections thereby affecting growth.

❖ **Emotional factors:** Children from broken homes and orphanages do not grow and develop at an optimal rate. Anxiety, insecurity, lack of emotional support, and love from the family affects the neurochemical regulation of hormones, which affect growth and development of children. On the other hand, parents who had happy childhood and have cheerful personality transmit these characters to their children.

PRINCIPLES/CHARACTERISTICS OF GROWTH AND DEVELOPMENT (FIG. 2)

Gessel (founder of clinical child psychology) has concluded from genetic studies of children—"although no two children are alike, all normal children tend to follow a general sequence of growth". There are certain basic predictable characteristics or principles of growth and development, which are as follows:

1. **Development is similar for all:** All children follow similar pattern of development with one stage leading into the next. Every child passes through similar stages. For example, baby learns to stand before he walks, similarly, baby draws circle before a square.
2. **Development proceeds from general to specific:** In motor as well as mental responses, general activity always precedes specific activity. Before birth, fetus moves the whole body but is incapable of making specific movements. Generalized body movements occur before fine motor control is achieved. For example, first the infant moves whole body in the womb and later starts moving his hands. Similarly, infants move hands first and then learn using fingers.
3. **Development is continuous:** Development is a continuous process, starting from conception and ending at death. It is continuous but sometimes rapid and at times slow. For example, speech in a child does not develop overnight, the child coos, gurgles, and makes sounds first and then slowly and gradually learns words and then language develops.
4. **Development proceeds at different rates:** Growth and development is a continuous process, which is rapid at times and at times slows down. Rapid growth occurs during fetal life and infancy and it slows down during school age. A growth spurt occurs in puberty and early adolescence, but it slows down during adulthood and old age.
5. **There is correlation in growth and development:** Correlation in physical and mental abilities is especially marked. There is a marked relationship between sexual maturation and patterns of interest and behavior.

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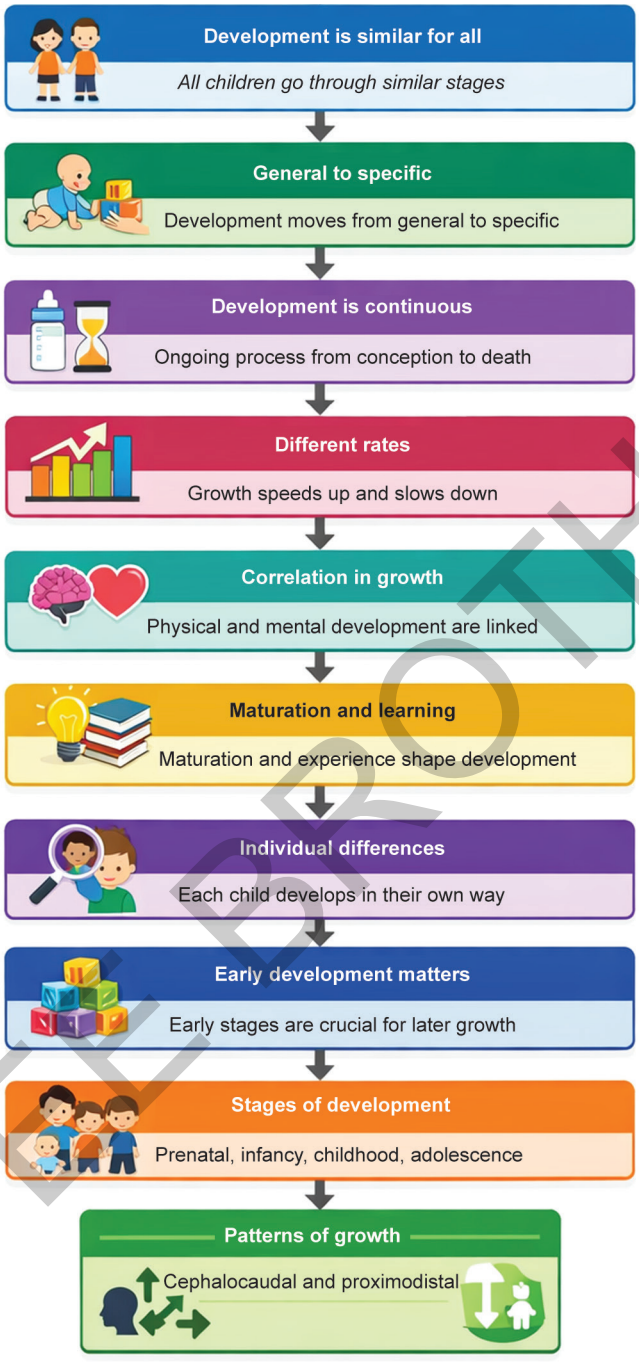

Fig. 2: Principle of growth and development.

6. **Development comes from maturation and learning:** Sudden appearance of certain traits that develop through maturation is quite common. For example, a baby may start walking overnight. Behavioral changes occur at the time of puberty suddenly without any reason. Learning comes from exercise and efforts on part of an individual. Unless the child had opportunity for learning, many of his hereditary potentials will never reach their optimum development. For example, a child may have aptitude for music because of his superior neuromuscular organization, but if he is deprived of opportunities for practice and systematic training, he will not reach his maximum potential. Intrinsic growth is a gift of nature. Innate capacities should be stimulated by positive environmental factors.
7. **There are individual differences:** Although pattern of development is similar for all children, each child follows a predictable pattern in his own way and at his own rate. Each child with his unique heredity and

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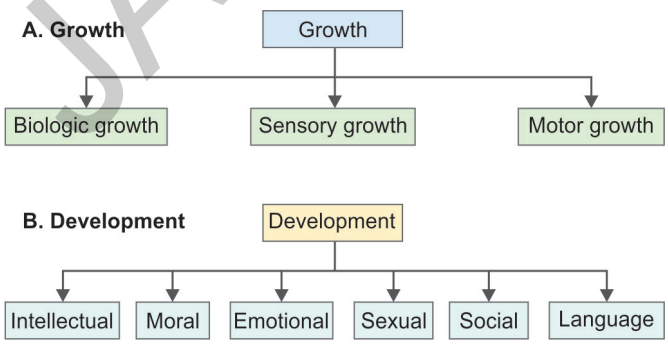
nature (environment) will progress at his own rate in terms of size, shape, capacity, and developmental status.

8. **Early development is more significant than later development:** If the foundation of a building is strong, the building will be strong. Similarly, favorable conditions during infancy lead to growth of child into a healthy adult. If the conditions during prenatal period and postnatal period are unfavorable, there is a damaging effect on later growth and development of the child.
9. **Development proceeds in stages:** Development is not abrupt, it proceeds in stages that are as follows:
   - Prenatal period: From conception to birth
   - Neonatal Period: Birth to 4 weeks
   - Infancy: 4 weeks to 1 year
   - Toddler: From 1–3 years
   - Preschool: 3–6 years (early childhood)
   - School age: 6–12 years (late childhood)
   - Adolescence: From puberty to beginning of adulthood (13–18 years)
10. **There are predictable patterns of growth and development:** Both during prenatal and postnatal period, growth and development follow two patterns:
    - Cephalocaudal
    - Proximodistal

According to cephalocaudal pattern, development spreads over the body from head to foot. This means that improvement in structure and functions of the body comes first in head region, than in trunk, and lastly the legs. According to proximodistal pattern, development proceeds from near to far, i.e., from central axis of body towards the periphery or extremities. During prenatal period, the head and trunk develop fully and then the limb buds appear. Slowly the arms lengthen, followed by forearms and lastly the fingers. Functionally also, the baby starts using his arms before his hands and fingers.

ASPECTS OF GROWTH AND DEVELOPMENT

Growth and development have the following aspects:



THEORIES OF GROWTH AND DEVELOPMENT

A. Growth

❖ **Biologic growth:** Changes in body result from growth of different parts of body. The National Center for Health Statistics (NCHS) made a massive survey of characteristics of growth—length or height, weight, and head circumference. These are the parameters for assessing growth in children.

- *Length or height:* Length or height increases from birth to maturity. Rapid increase in height occurs during infancy and adolescence. The average length of a newborn is 45–50 cm and it increases at the rate of 2–2.5 cm/month for first 6 months and then 1.25 cm/month during next 6 months. At the age of 1 year length is 75 cm. The height of infant doubles at the age of 4 years and triples at 13 years.
- *Weight:* Weight is the best gross index of health and nutritional status of children. The average weight of a newborn is 2.5–3.5 kg. There is initially loss of weight during first 10 days of life due to adjustment to extrauterine life, inadequate feeds, and digestive adaptation. After 10 days of life, baby gains about 30 g weight per day for 5–6 months so weight doubles at 6 months of age and becomes about 5–6 kg. Thereafter weight gain becomes 15 g per day during next 6 months. So at the age of 1 year weight becomes triple of birth weight (about 7.5–8 kg). At the age of 2½ years weight becomes four times the birth weight that is 10–12 kg.
- *Head circumference:* The head circumference is an important measurement since it is related to intracranial volume. An increase in head circumference indicates rate of brain growth. At birth, the normal head circumference is 33 cm approximately and it increases at the rate of about ½ inch per month during first 6 months and then at the rate of ¼ inch per month during next 6 months. The head circumference is 40 cm at 3 months and 45 cm at 1 year of age.
- *Chest circumference:* The chest is barrel shaped at birth and the anteroposterior and transverse diameters are equal. Gradually the transverse diameter increases, causing width to become greater than the anteroposterior diameter. At birth chest circumference is 31 cm and at the end of 1 year head circumference becomes equal to chest circumference, thereafter only chest circumference increases.

❖ **Motor growth:** Motor development depends on maturation of muscular, skeletal, and nervous system. The motor development follows cephalocaudal and proximodistal pattern. Motor development is of two types:

1. *Gross motor:* Gross motor development leads to acquisition of increasing mobility and

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independent movements. Gross motor activities include turning, sitting, standing, and walking.

2. *Fine motor:* Fine motor development leads to acquisition of motor dexterity like use of hand and fingers, palmar grasp and release, pincer grasp, etc.

❖ **Sensory growth:** Although sensory system is functional at birth, the child gradually learns the process of associating meaning with a perceived stimulus. Most active senses at birth are sense of taste and smell. As myelinization of nervous system occurs, the child is able to respond to specific stimuli. The visual system is last to mature, at about 6–7 years of age.

B. Development

Many theories have been devised to study development of different aspects in children.

❖ Intellectual development theory by Jean Piaget
❖ Moral development theory by Jean Piaget and Kohlberg
❖ Psychosocial development theory by Eric H Erikson
❖ Spiritual development theory by James W Fowler
❖ Sexual development theory by Sigmund Freud
❖ Emotional development theory by Eric H Erikson

Intellectual Development

Although tests of intelligence and mental development have been standardized, there is no way of measuring genetically carried trait of intelligence. Mental development is demonstrated in problem solving and in general understanding of what to do in a given situation. It is important to let children solve problems that they can, by themselves and to teach them how to solve the problems that are within their abilities but for which they lack the necessary experience and practice. Also problems which are too difficult for them should be solved for them.

Infants at first are confronted with physical problems and the normal reflex actions of their bodies help them to solve those problems. Infants are more expert at solving problems than we realize. Intellectual development occurs from infancy onwards as behavior changes, due to:

❖ Maturation of innate capacities
❖ Conditioning (learning by association of a stimulus with response)
❖ Reinforcement of appropriate behaviors
❖ Imitation of behavior of others
❖ Insight

Although potential mental ability is inherited and fixed at birth, the rate and extent of its development are very much influenced by child's environment. As the structure of nervous system grows, changes can be seen in infant's mental reactions. These reactions indicate progression from the ability to respond to simplest stimuli towards functioning in complex ways.

Piaget's Theory of Intellectual or Cognitive Development

According to Piaget (Gruber Voneche, 1977) maturation and growth have certain sign posts. Although, newborn baby perceives the world as a vague mass, the child gradually develops an integration or coordination of various sensory inputs from touch, taste, smell, sight, and sound into an organized and objective understanding of reality. Also the child does not understand that objects which cannot be seen still exist. The adult knows that house is there, even when the house is not present to be observed. To a young child the concept of constancy comes slowly.

The ability to use symbols to represent reality is another important stage in development. The use of symbols leads to language development in child.

A child less than 7 years of age can focus on only one aspect of a situation and cannot relate other information and observations to it. For example, an elder sibling who puts on a horrifying mask can easily frighten a young child because the child cannot understand that, even though dressed differently, the elder sibling is still the same person. Advanced cognitive functioning is required to understand this.

For advanced cognitive functioning to occur, child must pass through various stages of development.

According to Piaget, four major stages of development are **(Fig. 3)**:

a. **Sensorimotor stage (0–2 years):** In this stage, children are mainly concerned with learning about physical objects.
b. **Preoperational stage (2–7 years):** In this stage, they are preoccupied with symbols in language, dreams, and fantasy.
c. **Concrete operational stage (7–11 years):** In this stage, they move into abstract world mastering numbers, relationships, and reasoning.
d. **Formal operational stage (11–15 years):** In this stage, the children have purely logical thoughts.

Moral Development

Piaget and Kohlberg gave their theories discussing the complicated process by which values are formed, how they affect behavior, and how they are changed through experience.

Kohlberg's Theory of Moral Development (Figs. 4 and 5)

Kohlberg believed that development of moral reasoning occurs step by step in sequence. Kohlberg postulated six stages of potential moral development, organized within three levels—preconventional morality, conventional morality, and postconventional morality.

Level 1: Preconventional morality (ego centricity): Children make moral judgments only on the basis of what will bring them reward (a right act) or punishment (a wrong act). This level is divided in three stages.

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Fig. 3: Piaget stages of intellectual development.

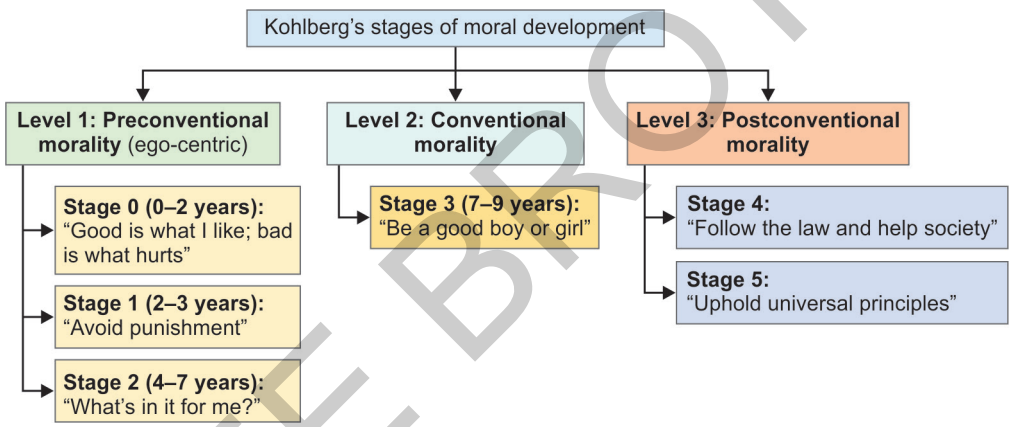

Fig. 4: Levels in Kohlberg's stages of moral development.

a. **Stage 0 (0–2 years):** In this stage the child feels that good is what I like and want and bad is what hurts.
b. **Stage 1 (2–3 years):** This stage is punishment-obedience oriented. The older toddler and preschool children believe that if they are not punished, the act was right and if they are punished the act was wrong.
c. **Stage 2 (4–7 years):** Instrumental Hedonism and Concrete Reciprocity—In this stage child considers those actions right that meet their own needs or those of others. They carryout rules to satisfy themselves or because what others might do or think if they do not carry them out.

***Level 2: Conventional morality*:** In this stage, children think that correct behavior is that, which those in authority approve and accept. In this level, there is one stage.

d. **Stage 3 (7–9 years):** Orientation to interpersonal relationships occur in this age. Children of early school age are becoming socially sensitive, so they try to do actions which help them to gain approval in their family, peers, and teachers.

Level 3: Postconventional morality (adolescents and adults): Adolescents make choices on the basis of principles that are taught to them about acceptable behaviors. Whatever actions conform to these principles are considered right. This level includes two stages.

e. **Stage 4:** Higher laws and conscience orientation: Adolescents follow culturally appropriate values and perform actions that benefit the society involving good of all.
f. **Stage 5:** Universal ethical principle orientation: This is the highest level of moral values and standards. Adolescents develop internalized standards and self-actualization.

According to Kohlberg, moral sense is not acquired by simply following the rules of the society. It is acquired through an internal and personal series of changes in the attitude.

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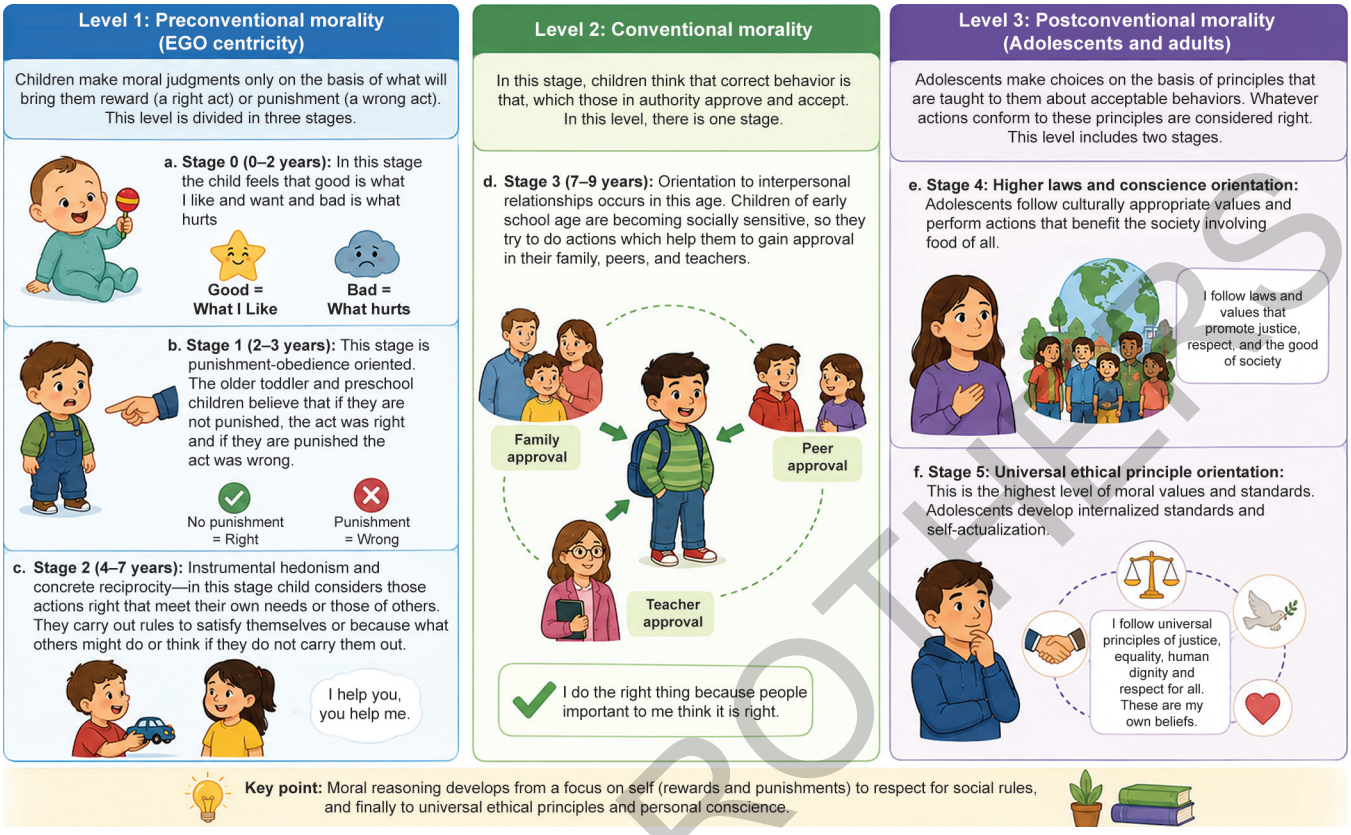

Fig. 5: Kolhberg's six stages of moral development.

Psychosocial Development (Fig. 6)

The theory of Erikson Concerning "Psychosocial Development" states that emotional or personality development is a continuous process, which has the following stages:

i. **Trust versus mistrust (birth to 1 year—infant):** Infants learn to trust the adults, usually the parents who care for them and are sensitive to their needs. A negative outcome of the period of infancy is the sense of mistrust, which develops if the basic needs of infant are not met.

ii. **Autonomy versus shame (1–3 years—toddler):** Infants develop from clinging, dependent creatures into individuals with mind and will of their own. The three major psychosocial tasks of toddlerhood are gaining self-control, developing autonomy, and increasing independence. If the child succeeds in development of autonomy, he develops feeling of self-esteem, but if he does not succeed, he doubts his abilities and develops a sense of shyness and shame.

iii. **Initiative versus guilt (3–6 years—preschool child):** This is a period of very energetic play and active imagination. The child can develop a sense of accomplishment and satisfaction in his or her activities. As the child oversteps his or her limits, he or she experiences a feeling of guilt.

iv. **Industry versus inferiority (6–12 years—school age child):** Children in this age have a strong sense of duty. Their energy is channeled into activities such as school projects, sports, and hobbies. These concrete endeavors become the child's work and bring a sense of accomplishment. If the children are not able to achieve a sense of industry, feeling of inferiority may develop.

v. **Identity versus role diffusion (12–15 years—beginning of adolescence):** Two major tasks for adolescents are figuring out who they are and what is their place in the world. Success in this period makes the individual well adjusted, stable, and mature. Individuals who have not experienced any active exploration nor made a commitment to any occupation, develop identity diffusion.

vi. **Intimacy versus self-absorption (late adolescence):** In this stage, the adolescents focus on forming intimate relationships with others. They develop a sense of intimacy with peers. Failure to establish such intimacy results in psychological isolation, i.e., keeping relations without warmth.

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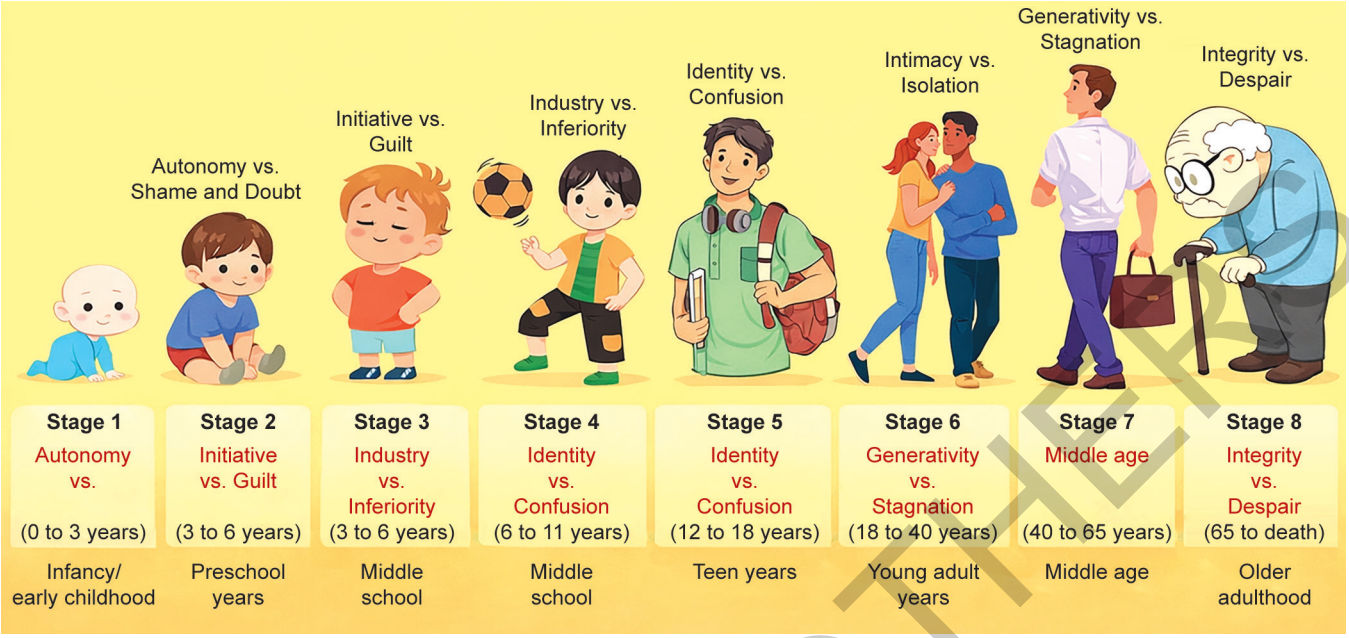

Fig. 6: Erikson's theory of psychosocial development.

vii. **Generativity vs. stagnation (Middle Adulthood: 40–65 years):** This stage focuses on the individual's desire to contribute to society and guide the next generation. It reflects a shift from self-centered goals to altruism, productivity, and legacy building. There is active involvement in parenting, mentoring, teaching and contribution through career, social service, community roles. Negative resolution leads to stagnation characterized by self-centeredness and lack of productivity, feeling unfulfilled, disconnected, or bored, dissatisfaction with achievements leading to self-absorption, lack of purpose, minimal contribution. The outcome of stagnation is emotional distress and possible depression.

viii. **Ego integrity vs. despair (Late Adulthood: 65+ years):** This stage involves reflection on one's life. Individuals evaluate whether their life has been meaningful and satisfying. Ego integrity leads to acceptance of life with a sense of fulfilment, feeling of wholeness, peace, satisfaction and acceptance of death as a natural process whereas despair is characterized by regret, dissatisfaction and fear of death.

Spiritual Development

Religious beliefs are based on theories of atheism or agnosticism. Fowler (1974, 1980, 1983) has given "Stage theory of faith" which parallels the formal developmental process proposed by Piaget and Kohlberg. According to Fowler, faith is a universal feeling that is expressed through beliefs, rituals, and symbols, specific to religious traditions. It is multidimensional and a way of learning about life. As described by Fowler, faith is an ongoing process in which individuals form and reform their way of seeing the world. People may acquire their religious beliefs and preferences in childhood and may deepen those convictions as their faith develops or they may change religious beliefs in adulthood.

Stage I: Primal faith (infancy): Paralinguistic and preconceptual, this stage embodies trust between parents and infants. Parents and child form mutual attachment and progress through a period of give and take. The primary caregiver provides the infant and young child with a variety of experiences that encourage the development of mutual trust, love, and dependence progressing to autonomy.

Stage II: Intuitive—projective faith (farly childhood age 3–7 years): This stage is characterized by child forming long lasting images and feelings. Imagination, perception, and feelings are the mechanisms by which child explores and learns about the world at large.

Stage III: Mythic—literal faith (childhood and beyond): Beginning at about age of 7 years, children's beliefs are derived from perspective of others. During this stage, they are able to differentiate their thinking from that of others.

Stage IV: Synthetic—conventional faith (adolescence and beyond): In this stage, a person's experience extends beyond the family to peers, teachers, and other members of society. As a result of cognitive abilities, the individual becomes aware of emotions, personality patterns, ideas, thoughts, and experiences of self and others. As a result, the individual has a cluster of values and beliefs concerning others.

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Psychosexual Development (Fig. 7)

In accordance with the view that basic human motivation is sexual drive, Sigmund Freud developed a psychosexual theory of human development from infancy onwards, divided into series of psychosexual stages. Freud named these stages asoral, anal, phallic, latency, and genital. Each stage focuses on gratification of libido through a particular erogenous zone of the body. If a child does not successfully complete a stage, he or she would develop a fixation that would later influence adult personality and behavior.

- **Oral stage (Infancy, the first year of life):** This is the first stage exemplified by infant's pleasure in nursing. Gratification of needs center around feeding.
- **Anal stage: (Toddler period, 2–3 years):** This stage revolves around interest in body functions and gratification of needs is by retaining and expelling faces.
- **Phallic stage (Preschool period, end of third year of age up to 5 years):** In this stage, the site of greatest sensual pleasure is genital region. In this stage oedipal conflict arises, wherein a boy desires for his mother but has a fear of castration by rival father. In this stage, the boys fixate on the mother as a sexual object (known as Oedipus Complex) but the child eventually overcomes and represses this desire because of its taboo nature. Freud attempts to formulate a comparable process for girls fixating on fathers (known as Electra Complex). During this stage, the child loves parents of opposite sex and takes them as provider of sensual satisfaction.
- **Latency stage (School age, 6–12 years):** This is repressive or dormant stage of psychosexual development.
- **Genital stage (About 12 years to adulthood):** During this stage, developing human matures from pleasure seeking infant into sexually mature adult who is free to enter heterosexual relationships.

Development of Language and Speech

The ability to communicate is a significant factor in child's intellectual, emotional, and social development. Broadly speaking, the term language development refers to increasing quantity, range, and complexity of speech over a period of time. Language is a complex system of grammatical semantic properties and the actual utterance of language is speech. Children are able to understand language before they are able to speak it.

Children are born with physiologic ability to speak, if they have normal oral and nasal cavities and speech control center in brain. They can learn to speak if they have intelligence and motivation and are stimulated by other people's speech in their environment.

Prelingual speech is same for all children, which includes reflex vocalization, babbling, imitation of sounds, and finally verbal utterances. The rate of language and speech development and use of grammatical rules depends on child's level of intelligence.

The child's articulation or ability to pronounce words correctly develops along with language ability. Auditory discrimination or ability to differentiate sounds is also

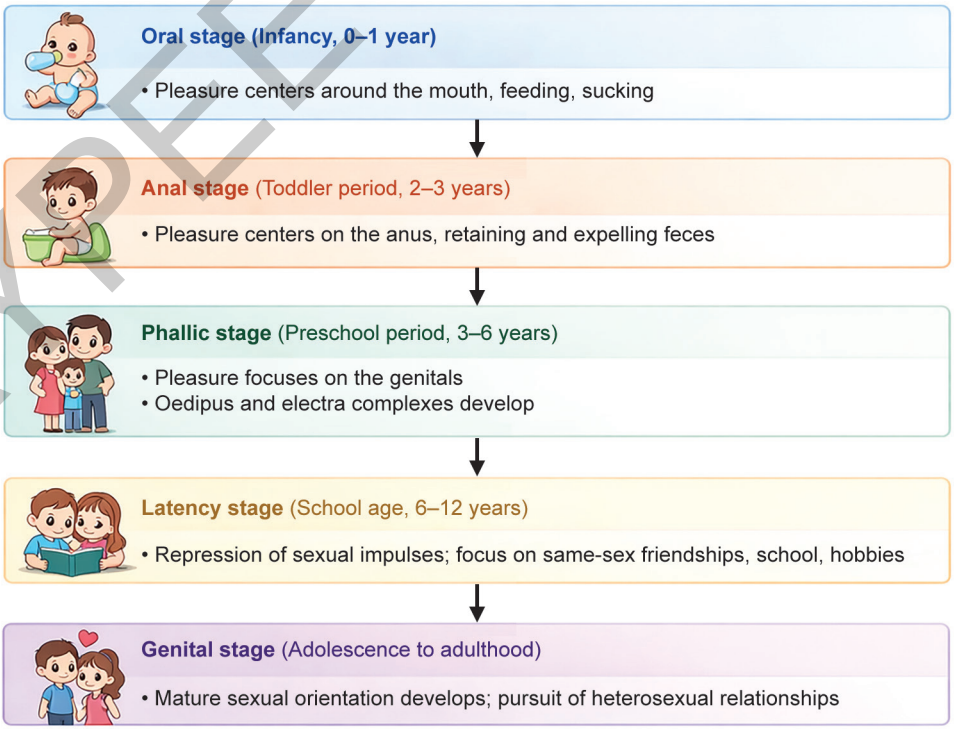

Fig. 7: Freud's stage of psychosexual development.

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very important aspect of speech development. Children are able to recognize correctly articulated sounds before they can pronounce them. Vocabulary or semantic development progresses from infancy throughout life. By 10–12 months of age, the infant usually says the first word having meaning. Vocabulary development slows down while the child is learning to walk. The most dramatic vocabulary development takes place between 18 months to 3 years of age.

In general, the firstborn child in the family develops language and speech earlier than those born later, probably because of attention received from adults. Girls learn language and speak earlier than boys, probably because boys have slower rate of neurophysiologic maturation. The development of language may be impaired or retarded if there are congenital defects of oral or nasal cavity, maternal deprivation, deafness, mental retardation, and emotional problems.

GROWTH AND DEVELOPMENTAL MILESTONES

Milestones are the accomplishment of different biological functions at an anticipated age, with a margin of few months on either side **(Fig. 8)**.

The developmental milestones of children include following aspects:

- Physical development
- **Motor:**
  - Gross
  - Fine
- Sensory development
- Cognitive development
- Language development
- Social development

From Birth to 1 Year (Infants)

Newborn

- **Physical growth**
  - Weight: Average birth weight of newborn is 2.5 kg. It decreases by 10% in first 10 days of life and then increases at the rate of 500–600 g per month during first 6 months.
  - Length: At birth, the length of newborn is 45–50 cm. It increases approximately 2–2.5 cm per month during first 6 months.
  - Head circumference: At birth, it is approximately 33–35 cm and increases at the rate of 1.5 cm per month during first 6 months.
  - Chest circumference: It is about 31–33 cm.
  - Pulse rate is 130 + 20 beats/minute.
  - Respiration is 35 + 10 breaths/minute.
  - Blood pressure is 80/50 + 20/10 mm Hg.
  - Reflexes: The baby has well-developed sucking, rooting, swallowing, and extrusion reflex. Baby also has Moro's, tonic neck, and crossed extensor reflex.
- **Motor development**
  - *Gross motor*
    - Lies in flexed position with hands clenched **(Fig. 9)**.
    - Turns head when in prone position.
    - Head lags behind when baby is pulled up from supine to sitting position **(Fig. 10)**.
  - *Fine motor*
    - Grasp reflex is strong.
    - Baby can grasp an object placed in hand but drops it immediately.
- **Sensory development**
  - Protective blinking reflex is present.
  - Indefinite stare at surroundings.
  - Notices faces and bright objects but only if they are in line of vision.
- **Language development**
  - Startles to loud noises.
  - Responds to human voice.
  - Makes comfort sounds during feeding.
  - Begins to coo.
- **Newborn 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 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.

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Domain	0–6 Months	6–12 Months	1–2 Years	2–3 Years	3–4 Years	4–5 Years
						
Physical development	• Lifts head when on tummy • Moves arms and legs • Begins to roll over	• Sits without support • Crawls • Pulls to stand • Starts to cruise	• Walks alone • Climbs on and off furniture • Begins to run • Feeds self with fingers	• Runs well • Climbs stairs with help • Kicks a ball • Builds towers (6–8 blocks)	• Climbs stairs alternating feet • Jumps with both feet • Pedals a tricycle • Throws a ball overhand	• Hops on one foot • Skips • Catches a ball • Uses scissors
Cognitive development	• Explores objects with mouth and hands • Shows interest in new things	• Looks for hidden objects • Imitates actions • Begins problem solving	• Finds hidden objects easily • Matches shapes and colors • Begins pretend play	• Sorts by shape and color • Completes simple puzzles • Understands cause and effect	• Counts a few objects • Knows some colors • Understands size (big/small)	• Counts to 10 or more • Recognizes letters and numbers • Solves simple problems
Language development	• Coos, babbles • Turns to sounds • Smiles and responds to voices	• Says "mama", "dada" • Babbling with intonation • Understands simple words	• Says 10–50 words • Follows simple directions • Points to objects	• Uses 2–3 word sentences • Vocabulary grows quickly • Asks simple questions	• Speaks in sentences • Tells stories • Uses "I", "me", "you" correctly	• Speaks clearly • Knows many words • Understands time concepts
Social-emotional development	• Bonds with caregivers • Smiles at familiar faces • May show fear of strangers	• Shows preferences for people • May have separation anxiety	• Shows independence • Tests limits • Shows affection to familiar people	• Plays beside other children • Shows a range of emotions • Begins to share and take turns	• Plays cooperatively • Shows empathy • Follows rules with reminders	• Has strong friendships • Understands others' feelings • Follows rules more consistently
Self-help skills	• Eats with help • Sleeps in regular pattern • Needs diaper changes	• Drinks from a cup • Feeds self finger foods • Helps with dressing	• Feeds self with spoon • Drinks from open cup • Helps remove clothes	• Washes hands with help • Puts on some clothing • Uses spoon well	• Dresses with little help • Brushes teeth with help • Uses toilet with help	• Dresses self • Brushes teeth independently • Uses toilet independently

Every child develops at their own pace.
These milestones are general guidelines

Fig. 8: Growth and development—milestone chart.



Fig. 9: Flexed posture of newborn.



Fig. 10: Head lag when pulled to sit (1 month age).

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2 Months

- **Physical development**
  - Posterior fontanel closes at 6–8 weeks age.
  - Tears start appearing.
  - Drooling begins.
  - Obligate (preferential) nose breathers.
- **Motor development**
  - *Gross motor*
    - Less fixed prone position—arms flexed, hip flat, and legs extended.
    - Lifts head almost to 45° above flat surface when lying prone.
  - *Fine motor*
    - Hands may be open.
    - Holds a rattle when placed in hand.
- **Sensory development**
  - Turns head to side when sound occurs at ear level.
  - Eyes follow moving objects and persons nearby.
  - Visual acuity is hyperoptic.
- **Language development**
  - Laughs and squeals.
  - Crying becomes differentiated, varying with reason for crying, e.g., hunger, sleep, pain, etc.
  - Utters single vowel sounds such as "ah" and "eh"
- **Social development**
  - Smiles to mother/caregiver **(Fig. 11)**.
  - Knows that cry will bring attention.

3 Months

- **Physical development**
  - Flexion posture is reduced.
  - Grasping, crossed extensor and Moro's reflex disappears.
  - Landau reflex appears.
- **Motor development**
  - *Gross motor*
    - Able to lift head to 90° when in prone position.
    - Able to hold head erect but head still bobs forward.
    - Rolls over from back to side.
  - *Fine motor*
    - Can grasp a toy but lacks firm hold.
    - Hands open and closed loosely.
    - Carries objects and hands to mouth at will.
- **Sensory development**
  - Turns head and looks in same direction to locate sound.
  - Blinks at objects that threaten the eyes.
  - Beginning of ability to coordinate various sensory stimuli.
- **Language development**
  - Cries less
  - Shows pleasure in making sound
  - Chuckles and coos.
- **Social development**
  - May laugh loud.
  - Looks in direction of speaker.

4 Months

- **Physical development**
  - Drooling indicates appearance of saliva.
  - Tonic neck and rooting reflex disappears.
- **Motor development**
  - *Gross motor*
    - Holds head erect and steady when placed in sitting position.
    - Sits for short time with adequate support.
    - Lifts head and shoulders at 90° when prone and looks around **(Fig. 12)**.
    - Head lag disappears when pulled to sit.
  - *Fine motor*
    - Brings hands together in midline and plays with fingers.
    - Reaches for objects **(Fig. 13)**.



Fig. 11: Social smile in newborn.



Fig. 12: Lifts head to almost 90° in prone position at (4 months).

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Fig. 13: Bidextrous grasp.

- **Sensory development**
  - Follows objects to 180°.
  - Fairly good binocular vision.
  - Beginning of hand-eye coordination.
- **Language development**
  - Utters two syllable vowel sounds.
  - Can vocalize consonants like "m, b, and g".
  - Responds differently to pleasant and angry voice.
- **Social developmen:** Initial social play by smiling.

5 Months

- **Physical development**
  - Weight almost double of birth weight.
  - Can breathe through mouth when nose is obstructed.
- **Motor development**
  - *Gross motor*
    - Sits with slight support.
    - Holds back straight when pulled to a sitting position **(Fig. 14)**.
    - Pulls feet up to mouth when in supine.
    - Rolls from back to abdomen.
  - *Fine motor*
    - Attempts to "catch" dangling objects with two hands.
    - Begins use of forefinger and thumb in a pincer grasp.
    - Tries to obtain objects beyond reach.
    - Can hold one object while looking at another.
- **Sensory development**
  - Looks in direction of sound made below ear.
  - Stops crying in response to music.
  - Visual acuity is 20/20.
- **Language development**
  - Responds to his/her name.
  - Vocalizes displeasure when desired object is taken away.
  - Begins to mimic sound.
  - Cries on seeing strangers.
- **Social development**
  - Smiles to self in mirror.
  - Differentiates strangers from family members.

6 Months

- **Physical development**
  - Weight gain is about 300–400 g/month during next 6 months.
  - Length increases at the rate of 1.25 cm/month.
  - Head circumference increases at the rate of 0.5–1 cm/month.
  - Pulse rate is 120 + 20 beats/minute.
  - Respiration is 31 + 9 breaths/minute.
  - Blood pressure is 90/60 + 28/10 mm Hg.
  - Teeth eruption starts with lower two central incisors.
- **Motor development**
  - *Gross motor*
    - Sits leaning forward on both hands **(Fig. 15)**.
    - Moves from place to place by rolling.
    - Back is straight when sitting in high chair.
  - *Fine motor*
    - Can grasp at will.
    - Drops one object when offered another.



Fig. 14: Sits with slight support.



Fig. 15: Sits leaning forward with support of hands (6 months of age).

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- Begins to transfer objects form one hand to another.
- Manipulates small objects.
- Bangs objects that are held.

❖ **Sensory development**
- Localizes sound made above ear level.
- Enjoys more complex visual stimuli.
- Moves in order to see an object.

❖ **Language development**
- Babbling
- Vocalizes monosyllable like ma, da, and ba.
- Recognizes familiar words.
- Talks to own image in mirror.

❖ **Social development**
- Recognizes parents.
- Extends arms to be picked.

7 Months

❖ **Physical development**
- Parachute reflex appears.
- Ultimate color of iris is established.
- Mashes food with jaws.

❖ **Motor development**
- *Gross motor*
  - Lifts head as if trying to sit-up when in supine position.
  - Rolls more easily from back to abdomen.
  - Sustains all weight on feet when held in standing position **(Fig. 16)**.
  - Early stepping movements.
- *Fine motor*
  - Holds two toys together.
  - Transfers a toy from one hand to another.
  - Bangs objects that are held.

❖ **Sensory development**
- Has preference in taste for food.
- Depth perception is beginning to develop.

❖ **Language development**
- Recognizes own name.
- Responds with gestures to words such as "come".
- Vocalizes "baba" and "dada".

❖ **Social development**
- Shows fear of strangers.
- Closes lips tightly when disliked food is offered.

8 Months

❖ **Physical development**
- Begins to show pattern in bladder and bowl elimination.
- Eruption of upper central incisors.

❖ **Motor development**
- *Gross motor*
  - Pulls to standing position with help.
  - Raises self to sitting position **(Fig. 17)**.
  - Palmar grasp disappears.
- *Fine motor*
  - Holds two objects while looking at third.
  - Releases objects from hands at will.
  - Uses index finger and thumb like pincers.
  - Feeds self with finger foods.
  - Drinks from cup with assistance.

❖ **Sensory development**
- Depth perception is developing.
- Recognizes familiar words and sounds.

❖ **Language development**
- Begins to understand meaning of "NO".
- Continues syllable "dada and mama" without specific meaning.
- Babbles to produce consonant sounds.
- Vocalizes to toys.

❖ **Social development**
- Fear of strangers.
- Dislike dressing and diaper change.
- Separation anxiety develops.



Fig. 16: Whole weight on legs when supported (7–8 months).



Fig. 17: Sitting without support (8 months).

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9 Months

- **Physical developmen:** Eruption of upper lateral incisors.
- **Motor development**
  - *Gross motor*
    - Sits down.
    - Drinks from cup or glass with help.
    - Crawls and creeps **(Fig. 18)**.
    - Holds own bottle.
  - *Fine motor*
    - Rings bell.
    - Holds bottle and places nipple in mouth when wants it.
- **Sensory development**
  - Head turns directly to source of sound.
  - Recognizes by looking or moving towards familiar objects when named.
- **Language development:** Stops activity in response to "NO".
- **Social development**
  - Dislikes face wash.
  - Cries when scolded.
  - Wants to please caregiver.

10 Months

- **Physical development**
  - Drooling stops.
  - Macula is well-developed and fine visual discrimination can be made.
- **Motor development**
  - *Gross motor*
    - Walking skill development continues.
    - Creeps and cruises well.
    - Does not want to lie down unless sleepy.
    - Makes stepping movements forward when two hands are held.



Fig. 18: Creeping position (9 months).



Fig. 19: Picking up pillet finger-thumb appositior (10 months).

  - *Fine motor*
    - Fine pincer grasp of tiny objects **(Fig. 19)**.
    - Brings hands together and plays.
    - Bangs two cubes together.
- **Sensory development**
  - Tilts head backward to see up.
  - Localizes sound from above or below ear.
  - Searches for a lost toy.
- **Language development**
  - Says dada, mama with meaning.
  - Comprehends "Bye–Bye".
  - Imitates sounds of animals.
- **Social development:** Plays social games with adults **(Fig. 20)**.

11 Months

- **Physical development:** Sleeps 14–16 hours per day and still naps.



Fig. 20: Plays social games with adults.

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- **Motor development**
  - *Gross motor*
    - Stands erect with minimum support **(Fig. 21)**.
    - Walks holding on to furniture.
    - Pushes toys.
    - Cruises well.
  - *Fine motor*
    - Explore objects carefully.
    - Removes covers from boxes and takes toys out of box.
    - Beginning to hold pen and make marks on paper.
- **Sensory development:** Can follow rapidly moving objects.
- **Language development**
  - Responds to simple questions.
  - Understands simple directions.
  - Imitates specific sounds of others.
- **Social development**
  - Reacts to restriction with frustration.
  - Enjoy playing with empty dish and spoon after meals.

12 Months

- **Physical development**
  - Weight becomes triple of birth weight.
  - Height is increased about 50% of birth.
  - Head circumference is about 46 cm, increased by one-third since birth.
  - Chest circumference becomes equal to head circumference.
  - Pulse rate is 115 + 20 beats per minute
  - Respiration is 30 + 10 breaths per minute
  - Blood pressure is 96/66 + 30/24 mm Hg
  - Babinski reflex disappears.
  - Landau reflex also disappears.
  - Has 6–8 deciduous teeth.



Fig. 21: Stand holding onto furniture (11–12 months).

- **Motor development**
  - *Gross motor*
    - Stands alone for variable length of time **(Fig. 22)**.
    - Walks few steps with help or alone **(Fig. 23)**.
    - Can sit down from standing position without help.
    - Improved competence in motor skills through practice.
  - *Fine motor development*
    - Good pincer grasp.
    - Picks up small bits of food and transfer to mouth.
    - Enjoys eating with fingers.
    - Can drink himself with cup.
    - Tries to feed himself/herself with spoon but spills contents.
    - Releases one or more objects inside another object or container.
- **Sensory development**
  - Full binocular vision well-established.
  - Follows fast moving objects with eyes.



Fig. 22: Stands alone for variable length of time.



Fig. 23: Walks one hand held (1 year).

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❖ **Language development**
- Has one word or a few in vocabulary.
- Comprehends "give" and stops when told "no".
- Has receptive vocabulary of several words.
- Says three to five words besides dada and mama.
- Recognizes object by name.
- Imitates animal sounds.
- Vocalization decreases as walking increases.

❖ **Social development**
- Responds to request for affection such as kissing.
- Attachment developed to primary caregiver.
- Cooperates in dressing, e.g., puts arms through sleeves, feet into shoes, etc.

Toddlers (1–3 Years)

15 Months

❖ **Physical development**
- Legs appear bowed.
- Height increases at the rate of 3 inches per year for next 7 years.
- Weight increases 4–6 pounds per year.

❖ **Motor development**
- *Gross motor*
  - Stands without help **(Fig. 24)**.
  - Walks well.
  - Creep-up stairs.
- *Fine motor*
  - Scribbles.
  - Builds tower of two blocks.
  - Pokes finger in hole.
  - Turn pages.
  - Holds cup.
  - Removes socks.

❖ **Language development**
- Comprehends more than communicating.
- Recognizes names of body parts.
- Says two to six words.
- Responds to simple commands.

❖ **Social development**
- Egocentric
- Hugs and kisses.
- Imitates parents.

18 Months

❖ **Physical development**
- Anterior fontanel closes.
- 10–14 deciduous teeth present.
- Toilet training may begin as voluntary control of anal and urethral sphincter occurs.

❖ **Motor development**
- *Gross motor*
  - Wild gait.
  - Walk upstairs **(Fig. 25)**.
  - Pulls and pushes toys.
- *Fine motor*
  - Can make tower of three to four cubes.
  - Turns two to three pages at a time.
  - Can eat with spoon **(Fig. 26)**.
  - Plays with food.
  - May untie shoes.
  - Removes simple garments.

❖ **Language development**
- Uses gestures more than words to make needs known.
- Use of words may be quite inconsistent.

❖ **Social development**
- Imitates adult roles.
- Imitates house work.
- Enjoys solitary play.



Fig. 24: Standing without help.



Fig. 25: Walks stairs up and down (24 months).

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Fig. 26: Feeding with spoon (18 months of age).



Fig. 27: Drinks with glass (24 months).

24 Months

- **Physical development**
  - Has 16 temporary teeth.
  - Weight gain is 1.8–2.7 kg.
  - Average weight is 12 kg.
  - Height increases about 10–12.5 cm of birth length.
  - Pulse rate is 110 + 20 beats/minute.
  - Respiration is 26–28 breaths/minute.
  - Blood pressure is 100/65 + 25/20 mm Hg.
- **Motor development**
  - *Gross motor*
    - Steady gait.
    - Walks on heel-toe.
    - Walks up and down stairs holding wall.
  - *Fine motor*
    - Picks up objects from floor.
    - Can build tower of six to seven cubes.
    - Imitates vertical line.
    - Turns pages, one at a time.
    - Drinks with glass **(Fig. 27)**.
    - Pulls garments, e.g., socks.
    - Can brush teeth with help.
- **Language development**
  - Enjoys story.
  - Knows at least four body parts.
  - Has vocabulary of 300 words.
  - Refers to self by name.
- **Social development**
  - Enjoys parallel play.
  - Enjoys play with doll.
  - Will do simple household tasks.

30 Months

- **Physical development**
  - Average weight is 13 kg.
  - Average length is 92 cm.
- **Motor development**
  - *Gross motor*
    - Can stand on one foot.
    - Jumps well.
  - *Fine motor*
    - Can make tower of six to eight cubes.
    - Can feed self.
    - Can throw large ball overhead.
    - Can button and unbutton clothes.
    - Places simple shapes in correct holes.
- **Language development**
  - Knows at least five body parts.
  - Can speak sentence of four to five words.
  - Uses plural.
  - Ask "why".
- **Social development**
  - Knows own sex.
  - Parallel play continues.
  - Shows temper tantrums.

Red Flags in Infant and Toddler 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.

Preschool Child (3–6 Years)

3 Years

- **Physical development**
  - Physical growth is relatively slow. They become tall and thin without gaining much weight.
  - At the age of 3 years, weight is approximately 14 kg.
  - Height is about 95 cm.
  - Heart rate is similar to adults.

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- Respiration is same as adults.
- Walks erect and swings arms.
- Rapid skeletal development.
- Loses baby fat and tummy.

❖ **Motor development**
- *Gross motor*
  - Hops on one foot.
  - Rides tricycle.
  - Can undress self in most situations.
  - Catches soft objects with both hands.
  - Goes upstairs using alternate feet but may still come down by placing both feet on each step.
- *Fine motor*
  - Can build tower of 9–10 cubes.
  - Puts beads on string.
  - Copies a circle.
  - Can go to toilet alone.
  - Brushes teeth with help.
  - Begins to use blunt scissors.

❖ **Cognitive development**
- Egocentric.
- Thinking is concrete and tangible.
- Able to follow directional commands.
- Omnipotence (inability to distinguish between one's own perception and that of someone else).
- Centration (inability to consider several aspects of situation simultaneously).

❖ **Language development**
- Vocabulary of 800–1,000 words.
- Asks many questions.
- Names body parts.
- Uses four to five word sentences.
- Recognizes colors.

❖ **Psychosocial development**
- Separates easily from mother.
- Knows own sex and that of other.
- Begins to share.
- Learns simple games but follows own rules.
- Fears dark.

❖ **Sensory development**
- Vision is 20/30.
- Color vision fully intact.

4 Years

❖ **Physical development**
- Weight is about 16 kg.
- Growth is slow.

❖ **Motor development**
- *Gross motor*
  - Skips and hops on foot.
  - Catches bounced ball (two out of three tries).
  - Dresses without supervision.
  - Walks downstairs using alternate feet.
- *Fine motor*
  - Cuts pictures with scissors.
  - Copies a square.

❖ **Cognitive development**
- Highly imaginative.
- Obeys commands because of parents fear and not because of understanding between right and wrong.

❖ **Language development**
- Uses sentence of four to six words.
- Questioning is at peak.
- Tells exaggerated stories.
- Knows nursery rhymes and simple songs.

❖ **Psychosocial development**
- Very independent.
- Tends to be selfish and impatient.
- Is aggressive.
- Tells family talks to others without any restraints.
- Sibling rivalry present.

5 Years

❖ **Physical development**
- It is half of adult height.
- Average weight is 18 kg.
- Tooth decay may be present.

❖ **Motor development**
- *Gross motor*
  - Walks backward heel to toe.
  - Skips and hops on alternate feet.
  - Throws and catches ball well.
  - Jumps rope.
- *Fine motor*
  - Copies a square, triangle, and diamond shape.
  - Ties shoe laces.
  - Uses scissors and simple tools.

❖ **Cognitive development**
- Accurately describes events.
- Classify objects according to relationships that are similar.
- Time orientation present.

❖ **Language development**
- Uses sentences of four to six words with all parts of speech.
- Describes pictures with much comments and description.

❖ **Psychosocial development**
- Play is associative.
- Tries to follow rules but may cheat to avoid losing.
- Very industrious.
- Independent and looks for parental support and encouragement.

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Rimple Sharma RN RM MSc (N) PhD (N) is a convent-educated nursing postgraduate from College of Nursing, Christian Medical College, Ludhiana, Punjab, India. She did her Bachelors in Nursing from Government College of Nursing, Sawai Man Singh Medical College, Jaipur, Rajasthan, India. She is one of the university toppers of 1999–2004 batch. She completed her PhD Nursing from Indira Gandhi National Open University, New Delhi, India. Presently, she is Professor-cum-Principal in College of Nursing, All India Institute of Medical Sciences (AIIMS), Jammu, India. She has 20 years of experience in clinical care, supervision, and teaching postgraduate and graduate nurses and guiding research projects. She is a simulation expert, master trainer for Infant and Young Child Feeding, and regional trainer for Neonatal Resuscitation Program of National Neonatology Forum and Indian Academy of Pediatrics. She has been Inspector for Rajasthan University of Health Sciences, Jaipur, Rajasthan and Baba Farid University of Health Sciences, Faridkot, Punjab and an external examiner and paper setter for many universities, conducting nursing examinations across India. She has participated as Resource Person and Panelist in various national- and state-level workshops and conferences. She has contributed chapters in many books and has publications in national and international journals. She is a lifetime member of many professional associations of repute.

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