Textbook of

Child Health NURSING

2nd Edition

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Section 1: Current Trends and Issues in Child Health Nursing

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4

Growth and Development

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INTRODUCTION

Growth is an essential feature of life of a child. This distinguishes him/her from an adult. The process of growth starts from the time of conception of the fertilized ovum and continues until the child grows into fully mature adult. The period of growth and development extends throughout the life cycle; however, the period in which the principal changes occur is from conception to the end of adolescence. It is important for the nurse to understand this early period as well as the total life cycle of on individual to better understand the behavior of parents and other adults, who provide care for the child.

Definitions

Growth and development are the terms often used interchangeably. Each depends upon the others and in a normal child they parallel each other, but the terms are not the same.

Growth

- Growth refers to an increase in physical size of the whole or any of its parts and can be measured in inches or centimeters and in pounds or kilograms
- An increase in number and size of cell as they divide and synthesize new proteins, results in increased size and weight of the whole or any of its parts
- Growth results because of cell division and the synthesis of proteins. It causes a quantitative change in the child's body.

Development

- Development refers to a progressive increase in skill and capacity to function. It causes a qualitative change in the child's functioning
- A gradual change and expansion; advancement from lower to more advanced stages of complexity, the emerging and expanding of the individuals capacities through growth, maturation and learning
- Development refers to the biological and psychological and emotional changes that occur in human beings between birth and the end of adolescence
- Process of maturation including the refinement of body systems, thought processes and judgment.

Maturation

An increase in competence and adaptability, aging; usually used to describe a qualitative change; a change in the complexity of a structure that makes it possible for that structure to begin functioning to function at a higher level.

Differentiation

Processes by which early cells and structures are systematically modified and altered to achieve specific and

characteristic, physical and chemical properties; sometimes used to describe the trend of mass to specific development from simple to more complex activities and functions.

PRINCIPLES OF GROWTH AND DEVELOPMENT

Growth proceeds from the head down to the tail or in a cephalocaudal direction: This is particularly evident during the period of gestation and 1st year of life. Before birth, the head end of the embryo and fetus enlarges and develops before the tail and does postnatal, the infant control the movement of the head before being able to stand and control the feet.

Growth and development are continuous processes from conception until death: Although there are highs and lows in terms of the rate at which growth and development proceed, at all times a child is growing new skills. An example of how the rate of growth changes is a comparison between that of the first year and later in life. An infant triples birth weight and increases height by 50% during the first year of life. The 5-year-old boy weighs 18.7 kg and height 109.9 cm where as a 5-year-old girl weighs 17.7 kg and height 108.4 cm.

Growth and development proceed in an orderly sequence: Growth in height occurs in only one sequence from smaller to larger. Development also proceeds in a predictable order, for example, the majority of children sit before they creep, creep before they stand, stand before they walk and walk before they run. Occasionally, a child will skip a stage (or pass through it so quickly that the parents do not observe the stage). Occasionally, a child will progress is a different order, but most children follow a predictable sequence of growth and development.

Different children pass through the predictable stages at different rates: All stages of development have a range of time rather than a certain point at which they are usually accomplished two children may pass through the motor sequence at such different rates. For example, one that begins walking at 9 months another only at 14 months, both are developing normally.

All body systems do not develop at the same rate: Certain body tissues mature more rapidly than others. For example, Neurological tissue experiences its peak growth during the first year of life, whereas genital tissue grows little until puberty.

Development proceeds from gross to refined skills: This principle parallels the preceding one. Once children are able to control distal body parts, such as fingers, they are able to perform fine motor skills (a 3-year-old child colors best with a large crayon; 12-year-old child can write with a fine pen).

There is an optimum time for initiation of experiences or learning: Children cannot learn tasks until their nervous system is mature enough to allow that particular learning. A child cannot learn to sit. For example, no matter how much the child's parents have him/her practice, until the nervous system has matured enough to allow back control. Children who are not given the opportunity to learn developmental tasks at the appropriate or 'largest' times for that task may have more difficulty than the usual child learning the tasks later on. A child who is confined to a body cast at 12 months, the time the child would normally learn to walk, may take a long time to learn this skill once free of the cast at, say age 2 years, the child has passed the time of optimal learning for that particular skill.

Neonatal reflexes must be lost before development can proceed: An infant cannot grasp with skill until the grasp reflex has faded, nor stand steadily until the walking reflex has faded. Neonatal reflexes are replaced by purposeful movements.

A great deal of skill and behavior is learned by practice: Infant practice over and over taking a first step before they accomplish this securely. If children fall behind in growth and development because of illness, they are capable of catch-up growth to bring them equal attain with their age group.

Development proceeds from general to specific responses: It moves from a generalized to localized behavior. The newborn moves its whole body at one time instead of moving only one part of it. It makes random kicking with its legs before it can coordinate the leg muscles well enough to crawl or to walk.

Growth proceeds from the center or midline of the body to the periphery or in a proximodistal direction: During the prenatal period, the limb buds develop before the rudimentary fingers and toes. During infancy, the large muscles of the arms and legs are subject to voluntary control earlier than are the fine muscles of the hands and feet. This proximodistal development is bilateral and symmetrical for the most part, on the both sides of the body.

As the child matures, general movements become more specific. Generalized muscle movements occur before fine muscle control is possible. At first, infants can make only random movements of the arms. Gradually they learn to use the whole hand in picking up a small object, they learn to pick it up with a pincer grasp, i.e., between thumb and forefingers. As development progresses, the child can essentially learn to more just one finger or thumb at a time.

PATTERNS OF GROWTH AND DEVELOPMENT

In growth and development, there are definite and predictable patterns that are continuous, orderly and progressive. These patterns or trends are universal and basic to all human beings, but each human being accomplishes these in a manner and time unique to that individual.

Directional Trends

Growth and development proceed in regular, related directions or gradients and reflect the physical development and maturation of neuromuscular functions.

Cephalocaudal or Head-to-Tail Direction

The head end of the organism develops first and is very large and complex, whereas the lower end is small and simple and takes shape at a later period. The physical evidence of this

trend is most apparent during the period before birth, but it also applies to postnatal behavior development. Infants achieve structural control of the head before they have control of the trunk and extremities, hold their back erect before they stand, use their eyes before their hands, and gain control of their hands before they have control of their feet **(Fig. 4.1)**.

Proximodistal or Near-to-Far

Proximodistal trend applies to the midline-to-peripheral concept. A conspicuous illustration is the early embryonic development of limb buds, which is followed by rudimentary fingers and toe. In the infant, shoulder control proceeds mastery of the hands, the whole hand is used as a unit before the fingers can be manipulated and the central nervous system develops more rapidly than the peripheral nervous system.

These trends or patterns are bilateral and appear symmetric each side develops in the same direction and at the same rate as the other. For some of the neurologic functions, this symmetry is only external because of unilateral differentiation of function at an early stage of postnatal development. For example, by the age of approximately 5 years the child has demonstrated a decided preference for the use of one hand over the other, although previously either one had been used.

Differentiation

Differentiation describes development from simple operations to more complex activities and functions. From very broad, global patterns of behavior, more specific, refined patterns emerge. All areas of development (physical, mental, social and emotional) proceed in this direction. Through the process of development and differentiation, early embryonic cells with vague, undifferentiated functions progress to an immensely complex organism composed of highly specialized and diversified cells, tissues and organs. Generalized development proceeds specific or specialized development; gross, random muscle movements take place before fine muscle control.

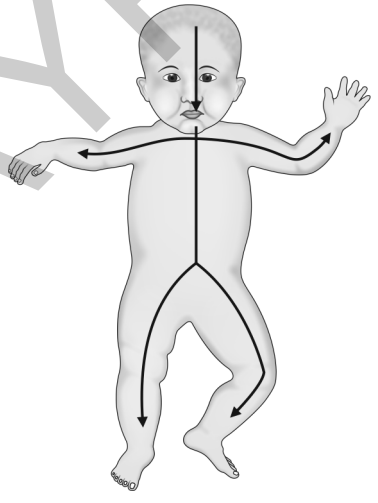

Fig. 4.1: Cephalocaudal direction.

Sequential Trends

In all dimensions of growth and development there is definite, predictable sequence, with each child normally passing through every stage. Children crawl before they creep, creep before they stand, and stand before they walk. Later facets of the personality are built on the early foundation of trust. The child babbles, then forms words and finally, sentences; writing emerges from scribbling.

Developmental Pace

Although, there is a fixed, precise order to development, it does not progress at the same rate or pace. There are periods of accelerated growth and periods of decelerated growth in both total body growth and the growth of subsystems. The rapid growth before and after birth gradually levels off throughout early childhood. Growth is relatively slow during middle childhood, markedly increases at the beginning of adolescence, and levels off in early adulthood. Each child grows at his/her own pace. Marked differences are observed between children as they reach developmental milestones.

Impulses for Acceleration of Growth or Growth Spurts

Early Fetal and Infantile Growth Spurt

Early fetal and infantile growth spurt is primarily a biophysical process. Mass of the zygote increases in relation to its surface area because of repeated division of cells.

Growth Spurt of Puberty

The growth spurt of puberty is attributed to neurohormonal stimulation of the hypophysis by the hypothalamus. Changes in the circulating sex steroids bring about reciprocal changes in the output of gonadotropic because of release in inhibitory feedback. During puberty, threshold of these receptors is placed at a higher level. As a result, even relatively lower levels of sex steroids, which were able to suppress the gonadotropin secretion in early childhood, are no longer able to do so, after the onset of puberty. This results in increased release of hypothalamic luteinizing-hormone releasing hormone (LHRH). As a consequence thereof, more gonadotropic is produced. This stimulates secretion of gonadal steroid.

A constant phenomenon associated with sexual maturation is dramatic increase in growth. The final 20–25% of height is achieved during puberty most of the growth occurs during a 24–36 month period, the adolescent growth spurt. This accelerated growth occur in all children, but as in other cases of development, is highly variable in age of onset, duration and extent.

The growth spurt begins earlier in girls, usually between ages 9.5 and 14.5 years; on the average it begins between ages 10.5 and 16 years in boys. During this period, the average boy gains 10–30 cm (4–12 inches) in height and 7–30 kg (15–65 pounds) in weight, the average girl, in home the growth spurt is slower and less extensive, gains 5–20 cm (2–8 inches) in weight and 7–25 kg (15–55 pounds) in weight. Growth in height typically ceases 2–2.5 years after menarche in girls and at age 18–20 years in boys.

FACTORS INFLUENCING GROWTH AND DEVELOPMENT

Growth and development depends on not one, but a combination of many factors, all interdependent. The relatively typical pattern of growth and development is influenced by hereditary and environment.

Growth and development are regulated a complex balance between the heredity or genetic constitution and the developmental factors, all interdependent. Heredity determines the extent of growth and development that is possible, but environment determines the degree to which the potential is achieved **(Fig. 4.2)**.

Heredity Factors

Heredity refers to the genetic constitution of an individual which is established during conception. It is the property of organic beings by which offspring's have nature and characteristics of parents or ancestors. From the parents, the child receives a new combination of parental genes. Every individual's supply of genes, the bearer of hereditary factors given to him/her once for all at the time of conception.

Color of the eyes, hair, facial features, structure of the body, physical peculiarities, blood group are determined entirely, by heredity. Heredity influences have a bearing on the traits likely to exist in a child. It is because of this that members of a family bear physical resemblance to each other and high degree of correlation exists among siblings than among unrelated persons. To stimulate the hereditary potential, the environmental stimulation must be of the right kind at the time when development normally occurs.

Gender is determined at conception. After birth, the male infant is longer and heavier than the female infant. Boys maintain superiority until about 11 years of age. Girls mature earlier than boys. During the prepubertal growth spurt and thereafter, the boys are again taller than girls.

Environmental Factors

Though heredity and environment are closely inter-related and each human being at birth has a gene determined physical, mental and biochemical potential. This potential may not be reached because of environmental influences. Stimulation to the development of innate abilities comes from the environment. Environment influences this potential only to a limited extent favorably or unfavorably.

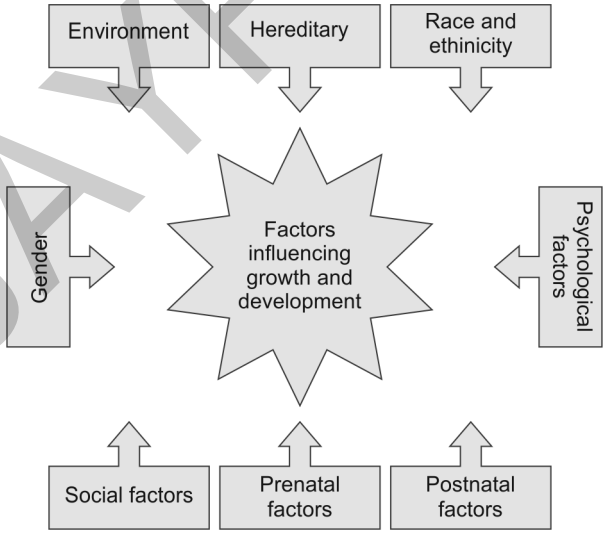

Fig. 4.2: Factors affecting growth and development.

Psychological, social and cultural factors also have a considerable role in the development of personality and behavior. Therefore, inborn capacities must be stimulated by environmental factors. Good seeds planted in poor soil result in stunted growth.

Gender: Gender acts as an important factor of growth and development. There is difference in growth and development of boys and girls. The boys in general taller, courageous than the girls, but girls show rapid physical growth in adolescence and excel boys. In general, the body constitution and structural growth of girls are different from boys. The functions of boys and girls are also different in nature.

Races: The racial factor has a great influence on height, weight, color, features and body constitution. A child of white race will be white and tall, even hair and eye color, facial structure are governed by the same race.

Ethnicity: Ethnicity plays a major role in many people's lives. It can often have a positive influence, providing us with a sense of belonging and identity and helping us to understand who we are and where we came from. However, it can also play a much more negative role in creating and/or sustaining divisions between groups of people that can result in prejudice and discrimination and also, at times, conflicts and wars.

Caucasians and children of developed countries have better growth, due to inherent potential as well as good environmental factors, e.g., good nutrition and less infection.

Psychological Factors

The influence of the child-rearing environment dominates most current models of development. Infants in hospitals and orphanages, devoid of opportunities for attachment, have severe developmental deficits. Attachment refers to biologically determined tendency of a young child to suck, proximity to the parent during times of stress and also the relationship that allows securely attached children to use their parents to re-establish a sense of well-being after a stressful experience.

At all stages of development, children progress optimally when they have adult caregivers, who pay attention to their verbal and nonverbal cues of responds accordingly. In early infancy, such contingent responsiveness to signs of over aroused or under. Overall helps maintain infants in a state of quite alertness and fosters autonomic self-regulation.

Social Factors

Families function as system with internal and external boundaries, subsystems, roles, and rules for interaction, in families with rigidly defined parental subsystems children may be denied. Individuals within system adopts implicit roles, e.g., one child may be the 'troublemaker' whereas another is the 'negotiator' and another is 'quite'.

The following social factors may influence the growth and development of a child:

- Birth order
- Changer in one person's behavior
- Roles shift
- Birth of new child
- Attainment of early developmental mile stones, such as independent walking
- Onset of night time fears
- Death of grandparents
- Culture, subculture
- Economic status.

Parental Factors

- The fetus may suffer from nutritional deficiencies due to mothers insufficient diet (poverty)
- Mechanical problems, malposition in utero
- The mother may suffer from metabolic, endocrine disturbances which affect the fetus
- Cancer treatment may affect the fetus (radiation)
- Infectious diseases during the gestation (rubella)
- Toxoplasmosis, syphilis and herpes during second and third trimesters adversely influence the fetus
- Erythroblastosis fetalis
- Smoking, using certain drugs and alcohol.

Postnatal Factors

The postnatal factors that affecting growth and development are given in **Figure 4.3**.

External Environment

Cultural influences: Groups of human beings create their own cultures, whereas each individual is influenced by the culture of which he/she is a part. The culture of a group consists of shared ways of behavior, feeling and knowing. The uniformities found in a group may be considered a set of ideals or norms that regulate or govern the particular and recurring activities within the group. These values, beliefs, ideas and practices provide a basis for understanding how people behave in their manmade environment and how these behaviors are passed on from one generation to the next.

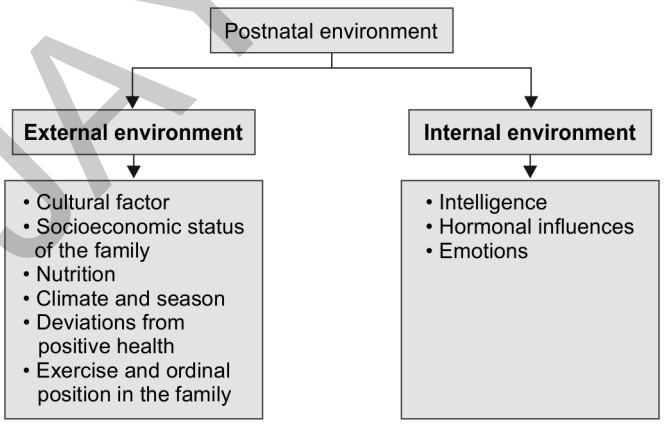

Fig. 4.3: Postnatal factors.

The effect of particular culture on a child begins before birth because of the manner in which the culture views and treats the members of the pregnant women's family.

- The nutrients, the mother is expected to eat during pregnancy are culturally determined
- Whether the mother is expected to deliver her baby in the sterile environment of a hospital with the father in attendance or to deliver her baby alone while she works in a field is culturally determined
- After birth the child is fed the diet that is dictated, dressed in appropriated clothing and given healthcare as defined by the culture
- The child learns the language of the family and begins to internalize the ideals, traits and abstractions of the cultural group of which the family is a part
- The behaviors expected of the child at each stage of growth and development are culturally defined.

Certain developmental behavioral traits of children are universal; others are determined by a particular culture many cultural characteristics are reflected in the child-rearing practices of a group and are transmitted to next generations by the primary group; family neighbors, friends and teachers, among others. Standards in traits like honesty, intellectual inquiry manners aggression, individual industry and achievement generally are culturally determined. The values learned by children are considered 'right' and will be the guideline for their behavior throughout life of those individuals who have a different set of values considered 'different' or 'wrong' in their beliefs.

Since, it is not possible for children to be born into a world without cultural restrains, they must conform in large part of their culture's norms when they deviated in their behaviors, they are scolded or ignored. If they continue to act in unapproved ways, as they mature they are punished, or if the culture is sufficiently flexible to permit change, their different behaviors may be accepted as a new cultural trait while appearing to be static; cultures are usually dynamic in their ability to change. This is especially true in modern, technologic societies, such as are found in the more advanced countries.

Socioeconomic Status of the Family

The environment of the lower socioeconomic groups may be less favorable than that of the middle and upper groups. Parents in unfortunate financial circumstances are less likely to understand the principles of modern specific child care; they lack money to buy the essentials of health and diet; and often they are unable, unwilling or unsure of how to obtain medical care and hospital services. Today however, public health and health education programs are gradually assisting such parents to provide better care for their children.

Nutrition

Nutrition is related to both the quantitative and the qualitative supply of food elements—proteins, fats, carbohydrates; minerals and vitamins. If these essential nutrients are received in the balanced amounts necessary to sustain life, to allow for energy expenditure and to promote growth and development of a child, is well-nourished.

- The nutritional needs of a child depend on the age, gender, rate of growth and level of activity
- During periods of rapid growth, such as the prenatal period, infancy, puberty and adolescence, the need for protein and calories is increased; when the metabolic rate is reduced during periods of slower growth, the protein and caloric requirements are likewise reduced
- The effect of inadequate nutrition is especially apparent when the child is growing rapidly utilizing a good diet may be impaired by faulty absorption or assimilation of food substances.

Causes of undernutrition include:

- An inadequate nutritional intake both qualitatively and quantitatively
- Physically hyperactivity or lack of adequate rest. Physical illness that causes an increase in nutritional need
- But at the same time result in poor appetite and poor food absorption
- An emotional illness that causes decreased food intake or inadequate absorption because of vomiting or diarrhea.

Climate and Season

Climate variations influence the infant's health. Summer heat, however is important, where parents may be unable to provide adequate refrigeration's of food and extermination of flies.

- The seasons of the year influence growth rates in height and weight, especially in older children; weight gains are lowest in spring and autumn
- The greatest gains in height among children in United States of America occur in the spring. Their differences are probably due to seasonal variations in the activity levels of children.

Deviations from Positive Health

Deviations from positive health may be caused by hereditary or congenital conditions, illness or injury and may result in altered levels of growth and development. Hereditary or congenital conditions may contribute to growth impairment or to an increase in height condition causing shortened stature include various types of dwarfing, Turner's syndrome and Turner's phenotype (Noonan syndrome) among others.

For example, conditions causing increases in height above normal include Marfan's syndrome and Klinefelter syndrome.

Long-term or chronic illness of any type may have an adverse effect on growth and development. Certainly, illness like cystic fibrosis or malabsorption syndrome, an inability to digest and absorb food, may lead to growth retardation.

Exercise

Exercise by increasing the circulation, promotes physiologic activity and stimulates muscular development, fresh air and moderate sunshine favor health and growth prolonged exposure to sunshine, especially in extremely warm areas, such as Southern India states, however, may cause tissue damage of the skin and even more serious consequences, if the child is unprotected form the rays of the sun.

Ordinal Position in the Family

The behaviors and expectations of parents toward their children are different, yet predictable according to the position of the child in the family. The child's ordinal position has a bearing on the parent-child relationship and child-rearing practices that are followed.

- Although birth order alone does not determine intelligence, personality traits, or methods of coping; it does have a significant influence on all of these
- The first-born child in a family is an only child and receives all the parental attention until the second child is born. The parents of the first-born child are usually inexperienced and may know the successive stage of growth and development their child goes through only form books; they may be overly concerned about care-giving the first-born therefore may be raised rigidly and with anxiety. The child develops a more anxious perfectionist personality than do the later siblings and is more conforming, intelligent, and achievement oriented. The first-born child may learn at an early age to control and organize the behavior of others

  An only child may have higher self-esteem than that other children, but may not be dependent on others. Motor development may be slow, however, because single children do not have older sibling to lead then to various activities and because so much is done for them. When single children are old enough to do things for themselves, parents and other adults may not permit their activities
- The middle child (or children) many times gets less attention from the parents than does the firstborn, especially if their birthdates are close together. Parents of the middle child are more relaxed about their parental roles and stress to the child, the values of responsibility and cooperation with other family members. They learn how to be adaptable and how to compromise traits that will be valuable in the adult life
- The youngest child in a family tends to be more peer-oriented, less intellectually inclined and less achievement oriented than the older siblings. The youngest child may be relatively slow in certain areas of development, because of finding little need for exploring the unknown. The youngest child is the 'baby' and many times is doled upon by all other family members. The youngest child receives a great deal of love and attention and therefore tends to develop a good-natured, friendly, warm personality and high self-esteem.

Internal Environment

Intelligence

Intelligence is correlated to some degree with physical development, i.e., the child of high intelligence is likely to be taller and better developed than is the less gifted child. Also, it influences mental and social development.

Children who have inherited superior level of intelligence may be encouraged by their environments to exceed or such intelligence may be wasted because of lack of stimulation. On the other hand, children who are born with low levels

of intelligence can never excel, no matter how enriched are their environments.

Hormonal Influence

There is evidence that all the hormones in the body affect growth in some manner. Although the hormones—somatotropic hormones, the thyroid hormone and the hormones that stimulate the gonads are very important, other also influence growth to an extent.

- Somatotropic hormone (STH) or growth hormone (GH): The source of this hormone is in the adenohypophysis, the anterior or glandular portion of the hypophysis cerebri.
  - Its major effect is on linear growth in height. It is essential in the proliferation of cartilage cells at the epiphytical plates
  - The growth hormone stimulates skeletal and protein anabolism through the production of somatomedins or intermediary hormones. An excess of the growth hormone causes gigantism; a lack results in dwarfism.
- Thyroid hormone: Thyroxin (T_4) and triiodothyronine (T_3), thyrotrophic hormone (TH) proceed by the adenohypophysis, stimulates the thyroid gland to release triiodothyronine (T_3) and thyroxin (T_4). These thyroid hormones stimulates the general metabolism and therefore are necessary for growth and development after birth. An excess of thyroid hormones produces cretinism with stunted physical growth and development.
- Hormones that stimulate the gonads: The adrenocorticotropic hormone (ACTH), produced by the adenohypophysis, stimulator the hypothalamus, which in turn causes the adenohypophysis to secrete gonadotropic hormones.

The gonadotropic hormones stimulate the interstitial cells of the testes to produce testosterone. This sequence of events occurs mostly during adolescence.

Testosterone stimulates the development of secondary sexual characteristics and the production of spermatozoa in young men. An excess of any of their hormones result in precocious puberty, where as a deficiency resulting in delayed sexual development.

Other hormones: That less directly influence upon the growth and development includes insulin, parathormone, cortisone and calcitonin.

Emotions

Relationship with significant other persons, mother, father, siblings, peers and teachers, among other, play a vital role in the emotional, social and intellectual development of the child.

Initially, the caregiver, mother, substitute or father has the greatest influence on the child. The person, usually the mother meets the infant's basic needs and provides the stimulation necessary for the growing child to learn, after the infant learns to trust the mother. Trust is intended to other significant person in the environment. For instance, the child learns that it is appropriate to eat with a spoon or with the hand, but that it is not acceptable behavior to throw the spoon or the food on the floor.

- Although the mother, as the first caregiver, is the most significant person in the child's early life, other family members, peers and outside authority figures also play a role in the child's development
- The father assumes the responsibility of providing food and comforting warmth, love and protection as the child develops
- Since, siblings are a child's earliest peer group, the way children in a family interact gives some indication of how they will relate later to peers outside the home
  In addition, the way a child relates to and is influenced by outside playmates and classmates depends largely on the parent-child relationship in the home. As the child grows with others, neighbors, teacher, have increasing influence on emotional, social and personality development
- Lack of tender love and care caused growth and development retardation. Such emotional deprived infants may receive adequate nutrition, but do not gain weight as expected and are listless, pale and unresponsive to social smiling, holding and cuddling.

STAGES OF GROWTH

The different stages of growth are:

1. Ovum (0–14 days).
2. Embryo (2–9 weeks).
3. Fetus (9 weeks–birth).
4. Newborn (first 28 days of life).
5. Infant (first year of life).
6. Toddler (1–3 years).
7. Pre-school (3–5 years).
8. School age:
   a. 6–10 years (girls).
   b. 6–12 years (boys).
9. Adolescence as divided into:
   a. Prepubertal:
      - 10–12 years (girls).
      - 12–14 years (boys).
   b. Pubertal:
      - 12–14 years (girls).
      - 14–16 years (boys).
   c. Postpubertal:
      - 14–18 years (girls).
      - 16–20 years (boys).

Growth of Different Tissues

- Different tissues grow at different rates, somatic growth of the body is very fast in the first 2–3 years of life and then it slows down
- The second spurt is seen in adolescence and then it practically stops
- Brain growth is maximum in the first 2 years of life and then it slows down; it becomes almost 80% by 2 years of age
- Lymphoid growth especially of the tonsils and lymph nodes picks up slowly and peaks before puberty and then it slows down. Gonad growth is noted around puberty only **(Table 4.1)**.

Table 4.1: Important fetal growth events and its duration.

Events	*Duration*
Heart rate	4 weeks
Circulation	8 weeks
External genitalia	10–12 weeks
Bile secretion	12 weeks
Fetal movement	14 weeks
Early swallowing	14 weeks
Meconium	16 weeks
Respiration	18 weeks
Surfactant	20 weeks
Phonation	22 weeks
Early sucking	28 weeks
Coordinated sucking and swallowing	34 weeks

Newborn

- The newborn has around 3 kg weight (2.5–4.5 kg) and 50 cm length (45–55 cm)
- Head circumference is—35 cm (33–37 cm)
- The respiratory rate is—140/min
- Most newborns lose up to 10% weight initially and regain birth weight by 10 days and thereafter the weight gain is around 200 g/week in first 3 months
- In rest 3 months—150 g/week
- In rest 6 months—100 g/week.

Under Five

Children under 5 years of age are a vulnerable group with high morbidity and mortality. Their growth is a direct reflection of their nutritional status.

1. **Weight:**
   a. The birth weight doubles by 5 months.
   b. Triples by 1 year.
   c. Quadruples by 2 years.
   d. Thereafter 2 kg is add on every year till 6 years and there after 3 kg is added on every year till puberty.
2. **Length:**
   a. The birth length is 50 cm.
   b. By 6 months 66 cm.
   c. By 1 year 75 cm.
   d. By 2 years 87 cm.
   e. It doubles 4 years and thereafter 6 cm is added on every year till puberty.
   f. Triples by 12 years.
3. **Head circumference:**
   a. At birth head circumference is 35 cm.
   b. By 3 months 40 cm.
   c. By 6 months 43 cm.
   d. By 9 months 45 cm.
   e. One year 47 cm.
   f. 2 years 49 cm.
   g. 3 years 50 cm.

Table 4.2: Anthropometric measurements.

	Weight (kg)	*Height (cm)*	*Head circumference (cm)*
Birth	3	50	35–35
6 to 12 months	7	66	42–44
1 year	10	75	45–47
2 year	12	87	47–49
3 year	14	94	49–50
4 year	16	100	50–51
5 year	18	106	50–52
6 year	20	112	51–52
7 year	23	118	
8 year	26	124	
9 year	29	130	
10 years	32	136	
11 years	35	142	
12 years	38	150	

The approximate increase is 2.0 cm/month in the first 3 months, 1 cm/month in the next 3 months and 0.5 cm/month in the next 6 months **(Table 4.2)**.

4. **Chest circumference:** At birth chest circumference is more than the head circumference and it equalizes by 1 year, thereafter the chest circumference is more than the head circumference. In malnutrition, chest circumference will remain less than head circumference
   a. Add 2 kg/year in 1–6 years of age and add 3 kg/year thereafter till puberty.
   b. Add 6 cm/years after 2 years of age till puberty.

   The bedside calculation Weech's formula or the National Center for Health Statistics (NCHS) references are used to device the expected weight, height, head circumference, etc., **(Table 4.3)**.

   Formula for Growth Parameters

   The formula for growth parameters are given in **Table 4.3.**
5. **Teeth development:** The temporary, deciduous or milk set has 20 teeth.
   - Incisors—8 teeth
   - Canine – 4 teeth
   - Premolars – 8 teeth

   These appear by two and a half years of age. The first tooth appears by 5–9 months. By 1 year of age 6–8 teeth

Table 4.3: Formula for growth parameters.

	Age	*Formula*
Weight (kg) Weech's	Infant 0–1 Year	$\frac{\text{Age in months} + 9}{2}$
	1–6 years	Age in years × 2 + 8
	7–12 years	$\frac{\text{Age in years} (7–5)}{2}$
Height (cm) Weech's	2–12 years	Age in years x 6 +77
Head circumference (cm) (Dine's)	Infant	$\frac{(\text{Length} + 9.5) + 2.5}{2}$

are present. Eruption of the second molar marks puberty. The eruption of the third molar (wisdom tooth) is variable and occurs after 18 years **(Tables 4.4 and 4.5)**.

Maturation

In full-term newborn babies, six ossification centers are present namely,

1. Lower end of the femur.
2. Upper end of the tibia.
3. Knee.
4. Three tarsal bones namely, talus, calcaneus, cuboids in the ankle.
5. The head of the humorous is presented by 1 month, the head of the femur by 4–6 months.

Table 4.4: Deciduous teeth.

Maxillary	*Eruption*	*Root competed*
Central incisors		1 year
Lateral incisors	9 month	2 year
Canine	18 month	8 year
First molar	14 month	2 year
Second molar	24 month	5 year
Mandible	***Eruption***	***Root competed***
Central incisors	6 month	2 year
Lateral incisors	7 month	1 year
Canine	10 month	8 year
First molar	12 month	2 year
Second molar	20 Month	3 year

Table 4.5: Permanent dentition.

Maxillary	*Eruption*	*Root competed*
Central incisors	7–8 years	10 years
Lateral incisors	8–9 years	11 years
Canine	11–12 years	13–15 years
I premolar	10–11 years	12–13 years
II premolar	11–12 years	11–13 years
I molar	6–7 years	10–11 years
II molar	6–12 years	12–14 years
III molar	17–21 years	18–25 years
Mandible	***Eruption***	***Root competed***
Central incisors	6–7 years	9 years
Lateral incisors	7–8 years	10 years
Canine	9–10 years	13–14 years
I premolar	10–12 years	12–13 years
II premolar	11–12 years	13–14 years
I molar	6–7 years	9–10 years
II molar	11–13 years	14–15 years
III molar (wisdom teeth)	17–21 years	18–25 years

6. Two carpel bones in 5–6 month. (Capitates and hamates)
   a. Three carpel triangular appear by 3–4 years, and thereafter, one carpel bone appears every year.
   b. Eight carpel bone pisiform appears by 12 years, except for the first two, there is high variability in the appearance of the other carpal bones.
   c. These ossification centers are useful in assuring the bone age of the child.

GROWTH CHARTS

The growth or 'Road to Health Chart' (first designed by David Morley and later modified by WHO) **(Fig. 4.4)**.

- Growth chart is visible display of the child's physical growth and development
- It is designed primarily for the longitudinal follow-up (growth monitoring) of a child, so that the changes over time can be interpreted
- It is important to note that in the weight-for-age chart, the height of the child is not considered; this is because weight is the most sensitive measure of growth and any deviation from 'normal' can be detected easily by comparison with reference curves and a child can lose weight, but not height
- In short, the growth chart offers a simple and inexpensive way of monitoring weight gain and in turn child health over time.

WHO Child Growth Standards

The WHO growth chart prototype-home based. It has two references curves, upper and lower reference curve.

Upper reference curve represents the median (50th percentile) for boys slightly higher than that for girls and the lower reference curve the 3rd percentile for girls (slightly lower than that for boys). Thus, it can be used for both gender.

The space between the two growth curves (weight channel) has been called 'Road to Health', this will include the zone of normality. About 95% of normal healthy children fall within this area. If the child is growing normally, its growth line will be above the 3rd percentile, and will run parallel to the 'Road to Health Curves'.

Space is also provided on the growth chart for recording and presenting information on the following:

- Identification and registration
- Birth date and weight
- Chronological age
- History of siblings health
- Immunization
- Introduction of supplementary foods
- Episodes of sickness
- Child spacing
- Reasons for special care.

The home chart is easily understood by the mother as well as the health workers. It provides the mother with a visual record of the health and nutritional states of her child. It is kept by the mother in a plastic envelop and brought to the health center at each visit

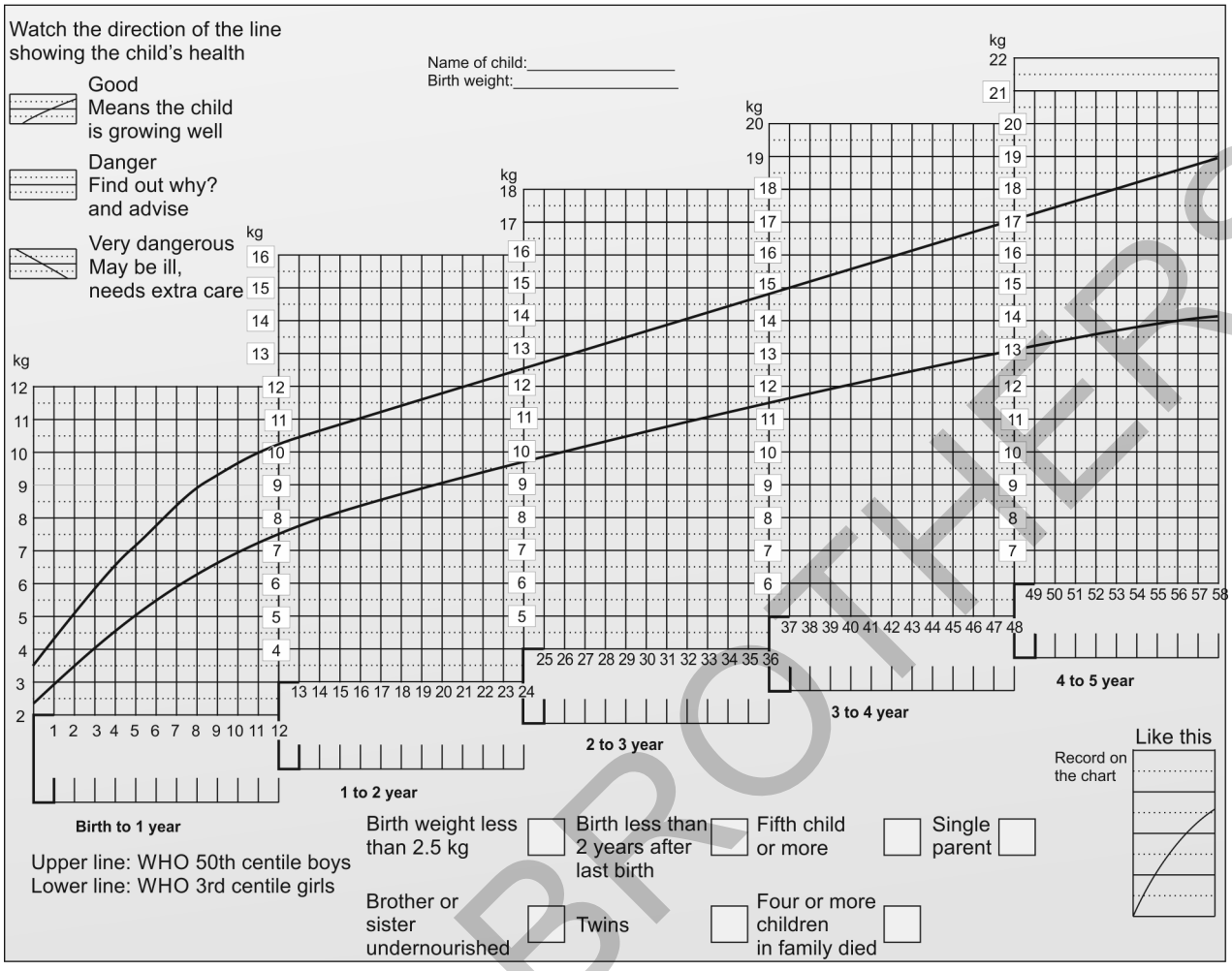

Fig. 4.4: Growth chart.

Growth Chart Used in India

In India, there are 49 different types of growth charts in use. The growth chart recommended by the Government of India has four reference curves. The top most curve corresponds to 80% of the median (50th percentile) of the WHO reference standard.

The lower lines represent 70%, 60% and 50% of that standard 80% median weight is approximately equivalent to 2 S.D below the median (or mean), which is the conventional lower limit of 'normal range'. The purpose of these lines is to indicate the degree of malnutrition, as recommended by the **Indian Academy of Pediatrics.**

The growth chart recommended by the Government of India shows three degrees of malnutrition.

1. First degree (grade I).
2. Second degree (grade II).
3. And third degree (grade III) malnutrition.

If the child's weight is between the 80% and 70% lines, it indicates first degree or mild malnutrition

If 70–60% is 2nd degree/moderate malnutrition.

Below 60–30% is severe malnutrition.

Grade IV is below 50%, has also been added any weight between the top two lines is considered satisfactory.

Uses of Growth Chart

A growth chart has many potential uses, they are listed as follows:

1. **Growth monitoring:** Which is of great value in child health care.
2. **Diagnostic tool:** For identifying 'high risk' children, e.g., malnutrition.
3. **Planning and policy making:** By grading malnutrition, it provides an objective basis for planning and policy making in relation to child health care at the local and central levels.
4. **Educational tool:** Because of visual character, the mother can be educated in the care of her own child, encourage her to participate more actively in growth monitoring.
5. **Tool for action:** It helps the health worker on the type of intervention that is needed; it will help to make referrals easier.
6. **Evaluation:** It provides a good method to evaluate the effectiveness of corrective measures and the impact of a program or of special interventions for improving child growth and development.
7. **Tool for teaching:** It can also be used for teaching, e.g., importance of adequate feeding, the deleterious effects of

diarrhea and so on. The growth chart has been described as a passport to child health care.

STAGES AND THEORIES OF DEVELOPMENT

Development occurs in five areas namely,

1. Motor development:
   a. Gross motor development.
   b. Fine motor development.
2. Language development.
3. Personal and social development.
4. Sensory development.
5. Emotional development.

Motor Development

Motor development depends upon maturation of muscular, skeletal and nervous system, it is usually termed as:
Gross motor development and fire motor development

Gross Motor Development

Involves control of the child over his/her body by increasing mobility. It is assessed by ventral suspension, supine position, prone position, turning, reaching to the object, etc. The important gross motor developmental milestones are listed in **Table 4.6**.

Fine Motor Development

Depends upon neural tract maturation. Initial neurological reflexes are replaced by purposeful activities **(Table 4.7)**. Fine motor development promotes adaptive activities with fine sensory motor adjustments and include eye coordination, hand-eye-coordination, hand-to-mouth coordination, hand skills as fingers thumb opposition, grasping, driving, etc.

Language Development

Language development depends upon level of understanding, power of imitation and encouragement. It is skill of communication with development of their speech **(Table 4.8)**.

Table 4.6: Gross motor development (milestones).

Age	*Milestone (motor development)*
3 month	Head holding
4 month	Sits with adequate support
6 month	Sits without support
8 month	Stand with support
9 month	Crawl
10 month	Walk with support
11–12 month	Walk without support and walk few steps with support
15 month	Walk without support
18 month	Walk upstairs with one hand held runs stiffly
24 month	Walks up and down stairs runs more quickly, jump
30 month	Rides or walker or pedal car
3 year	Rides tricycle

Table 4.7: Fine motor development (Milestones).

Age	*Milestone (motor development)*
1 month	Holds hands in tight fists
2 month	Holds a rattle briefly when placed in hand
3 month	Holds object put in hand
4 month	Brings hands together in midline plays with fingers, grasp object
6 month	Use fingers to self-feed, transfer object from one hand to the another
7 month	Holds 2 toys at once
8 month	Releases objects from hands voluntarily
9 month	Good hand-mouth coordination, drinks from cup with some spilling
10 month	Picks small objects up with index finger and thumb (pincer grasp)
11 month	Takes toy out of box or cup, beginning to hold a crayon and make mark on paper
12 month	Turns pages in a book (but no one at a time) Holds crayon adaptively
15 month	Builds tower of 2–3 cubes, makes a line with crayon, parts pictures in books and being to turn pages
18 month	Builds tower of 3–4 cubes
24 month	Builds tower of 6–7 cubes, limitates a circle, turns pages of book one at a time
30 month	Tower of 8 cubes, good hand finger coordination
3 year	Tower of 9–10 blocks copies circle

Table 4.8: Language development.

Age	*Language development*
1 month	Begins to coo, cries when hungry or turns head to sound
2 month	Crying becomes differentiated varying with the reason for crying, e.g., hunger, sleep; responds vocally to caregivers voice 'ah', 'eh', 'uh', cool
3 month	Cries less, shows pleasure in making sounds coos and chuckles, may laugh aloud
4 month	Can vocalize consonants b, g, h, k, n, p
5 month	Sounds like vowels appear with consonants, e.g., goo
6 month	'Talk' to image, in minor vocalize several will –defined syllables
7 months	Vocalizes 'do', 'ma', 'ba' some jargon (own language)
8 month	Shouts for attention. Continues syllable 'da-da', 'ma-ma' can vocalize consonants d, t and w
10 months	Understand meaning of bye-bye and ways, imitates sounds of animals
12 month	Knows names of increasing number of objects, vocalization decreases as walking increases
15 month	Recognizes names of various parts of body says 2–6 words. Shakes head to communicate 'no'.
18 month	Speak 10 words
24 month	Knows 300 words, uses pronouns such as I, me, price
30 month	Gives full name, uses 4–5 words, sentences
3 year	Tells gender, full name, names of figures in a picture.

Personal and Social Development

Personal and social development includes personal react to child's own social and cultural situations, with neuron motor maturity and environmental stimulation. It is related to interpersonal and social skills as listed in **Table 4.9**.

Sensory Development

Sensory development depends upon hyalinization of nervous system and responds specific stimuli of:

- Taste
- Smell
- Touch
- Hearing. There are initial senses present in newborn babies. The visual system is the last to mature at about 6–7 years.

Emotional Development

Emotional development and personality development is a continuous process. It is the subtotal of physiologic, psychologic and sociologic qualities of the individual.

Adequate guidance and problem solving at different stages help for the healthy prognoses to next stage of personality development, which promotes emotional maturation in a adulthood.

The emotional needs also considered as emotional development, are essentials for healthy development of personality. The emotional needs includes:

- Effective mothering
- Love and affection
- Safety and security
- Protection, play, faith, achievement of potentialities, guidance and counseling.

THEORETICAL APPROACHES TO CHILD DEVELOPMENT

Child development that occurs from birth to adulthood was largely ignored throughout much of history. Children were often viewed simply as small versions of adults and little attention was paid to the many advances in cognitive abilities, language usage, and physical growth that occur during childhood and adolescence.

Interest in the field of child development finally began to emerge early in the 20th century, but it tended to focus on abnormal behavior. Eventually, researchers became increasingly interested in other topics including typical child development as well as the influences on development.

An understanding of child development is essential, allowing us to fully appreciate the cognitive, emotional, physical, social and educational growth that children go through from birth and into early adulthood. Some of the major theories of child development are known as grand theories; they attempt to describe every aspect of development, often using a stage approach. Others are known as mini theories; they instead focus only on fairly limited aspects of development. The following are just a few of the many child development theories that have been proposed by theorists and researchers.

Table 4.9: Personal and social development.

Age	*Personal and social development*
1 month	Eye contact
2 month	Social smile
3 month	Smiles at self in mirror, begins to discriminate family members from strangers
6 month	'Recognizes parents
7 month	Responds socially to own name
9 month	Know 'no', play simple games, bye-bye
11 month	Recognizes emotions, anger, sadness, jealousy, anxiety, pleasure, etc.
12 month	Cooperative in dressing, put arms through sleeves
15 month	Hugs and kisses parents, begins to imitate parents doing
18 month	Begins to have temper tantrums, bedtime rituals begin
30 month	Temper tantrums decrease, knows own gender
3 year	Dreams and night mares, fears the dark

Freud's Psychoanalytic Theory

Sigmund Freud (1856–1939) an Austrian neurologist and founder of psychoanalysis offered the first theory of personality development, based on his theory of development, on his observations of mentally disturbed adults. He described adult behavior as being the result of instinctual drives (libido) from within the person and the conflicts that develop between these instincts (represented in the individual as the id), reality (represented in the individual as the ego), and society (represented in the individual as the superego). He described child development as being a series of psychosexual stages in which the child's interests become focused on a particular body site **(Table 4.10)**.

Definitions of Terms Frequently used in Freud's Concept of Personality

Id: Aspect of the personality that is concerned with immediate gratification of needs. No impulse control exists. Needs fulfillment of wishes, desires and wants, first and foremost for feeling of satisfaction.

Ego: Aspect of the personality that acts as a mediator between the individual's fantasies, dreams, and desires and the demands and expectations of society. The ego can be conceptualized as the individual's sense or ability to reason logically.

Superego: Aspect of the personality that is considered to be conscience. It is concerned with differentiating

Table 4.10: Freud's stages of child development.

Child development	*Stages*
Infant : 0–1 year	Oral stage
Toddler : 1–3 year	Anal stage
Preschooler : 3–5 year	Phallic stage
School-age : 5–12 year	Latent stage
Adolescent : 12–19 year	Genital stage

Textbook of
CHILD HEALTH NURSING

Child health nursing is one of the sensitive fields in which professional nursing students need to develop sound knowledge and exhaustive training in clinical skills in caring for children. *Textbook of Child Health Nursing* is aimed to fulfill this need. The primary objective of this book is to prepare nurses who combine the highest level of scientific knowledge and technological skills with responsible caring practice.

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- Chapters 10–21 focus on health deviations. Chapters are arranged according to system-wise approach. Each system follows a similar format in order to facilitate presentation of the information as well as reduce repetition. The chapter begins with presentation of differences in children, nursing process overview applicable to children, common laboratory and diagnostic tests for each system, drug guide about commonly used drugs for each system. Individual disorders are addressed with pathophysiology, nursing assessment, nursing management and special considerations. Common pediatric disorders are covered in greater depth than less common disorders
- Chapters illustrated with figures wherever necessary
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Printed in India

Available at all medical bookstores
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JAYPEE BROTHERS
Medical Publishers (P) Ltd.
EMCA House, 23/23-B, Ansari Road,
Daryaganj, New Delhi - 110 002, INDIA
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