

School Health for All

A STEP TO A BETTER WORLD



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Preface

This school health textbook, “School Health for All - A Step to a Better World,” is the first full-fledged school health textbook to be published for teacher education in Cambodia, corresponding to the Memorandum of Understanding (MoU) between the Ministry of Education, Youth and Sport and Tokyo Gakugei University. This textbook has been developed under the financial support as a generous grant from the Nippon Foundation to enable student teachers to teach school health classes in response to the decision of the Royal Government of Cambodia to introduce school health education to primary and lower secondary schools under the School Health Policy. The school health textbook consists of an introduction and 16 chapters with selected topics necessary for learning the fundamentals of school health education. Furthermore, these chapters are comprehensive and can contribute to Cambodia's efforts to achieve the Sustainable Development Goals (SDGs).

The textbook was developed by school health experts from Tokyo Gakugei University (representative) and Ibaraki University, Jumonji University, Saitama University, and Yokohama National University. The experts worked in close collaboration to complete a draft in Japanese, which was then translated into English. The Khmer version of the textbook was later developed with the great support of lecturers from both Teacher Education Colleges in Phnom Penh and Battambang, with regard to the accurate use of Khmer terminology. The school health textbook in Khmer was finalized after a review by the School Health Department of the Ministry of Education, Youth and Sport of the Kingdom of Cambodia. Tokyo Gakugei University Cambodia Office coordinated the Khmer translation, illustration creation, and layout work of the textbook.

The English edition of the school health textbook was created in parallel with the Khmer edition.

It is strongly hoped that this textbook can be used to contribute to the enhancement of student teachers' capacities in the field of health education in the Cambodian teacher education colleges. As a result, they will be able to effectively teach school health subjects when they become teachers upon graduation. This will have a positive impact on school students, resulting in healthy human resources for Cambodia.

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Message from The Nippon Foundation

I am delighted at the completion of the textbook for school health teachers, [School Health for All – A step to a better world].

The outbreak of Covid-19 spread throughout the world in no time and our daily lives have changed drastically from what we knew since before the outbreak. Infection prevention methods such as obligatory masks, thorough washing of hands, alcohol disinfection, and maintaining distance from one another have been recommended. On the other hand, there were quite a number of cases of infection arising from a lack of awareness of the importance of infection prevention measures.

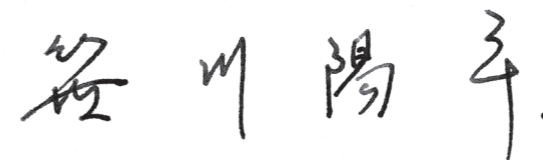
Today, with diverse information surrounding us related Covid-19 it is even more important for individuals to further pursue and be equipped with correct health and hygiene knowledge.

This textbook [School Health for All- A step to a better world] comes with important information necessary for leading a healthy life. It is my hope that this textbook will be useful to all the young future school health teachers in gaining thorough knowledge of correct health and hygiene and that they will, in turn, pass on that knowledge to the younger generation.

The Nippon Foundation has implemented a number of teacher training programs since 2004 to rebuild the Cambodian education infrastructure, which was devastated by the catastrophic civil war that continued for about 20 years. We have great expectations that this school health project will also contribute to produce excellent school health teachers. I would like to express my gratitude to the Cambodian Ministry of Education, Youth and Sports, Phnom Penh Teachers' Training College, Battambang Teachers' Training College, Tokyo Gakugei University and members of Social Compass, and the NGO Education Support Center Kizuna.

Yohei Sasakawa

Chairman, The Nippon Foundation



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Characteristics of school health: How are they learned and taught?

Learning objectives

You will be able to gain proper understanding and explain:

- What it means for people to live healthy lives, in terms of their life cycle.
- The characteristics and importance of school health as a school subject.
- Health as a personal matter.
- The link between the 17 Sustainable Development Goals (SDGs) and school health.
- Why it is significant for students aspiring to be teachers to study school health and teach it to children, and increase students' interest in the contents of this textbook including 16 chapters.

Targeting students in the teacher training course who use this textbook to study school health and will teach it to children in the future, this book discusses the characteristics of the subject of school health, how to study and teach it, and the points that should be understood.

1. What does it mean for people to live a lifetime in good health?

What does it mean for a person to live a lifetime in good health? A healthy human life begins when a healthy sperm meets a healthy egg, resulting in healthy fertilization (Figure 0.1). The healthy fertilized egg divides and eventually forms a fetus, which grows and develops healthily in the healthy womb of the healthy mother and is born healthy through a healthy delivery upon reaching full term. The healthy baby grows and develops healthily and eventually matures sexually. A healthy adult will work, enjoy

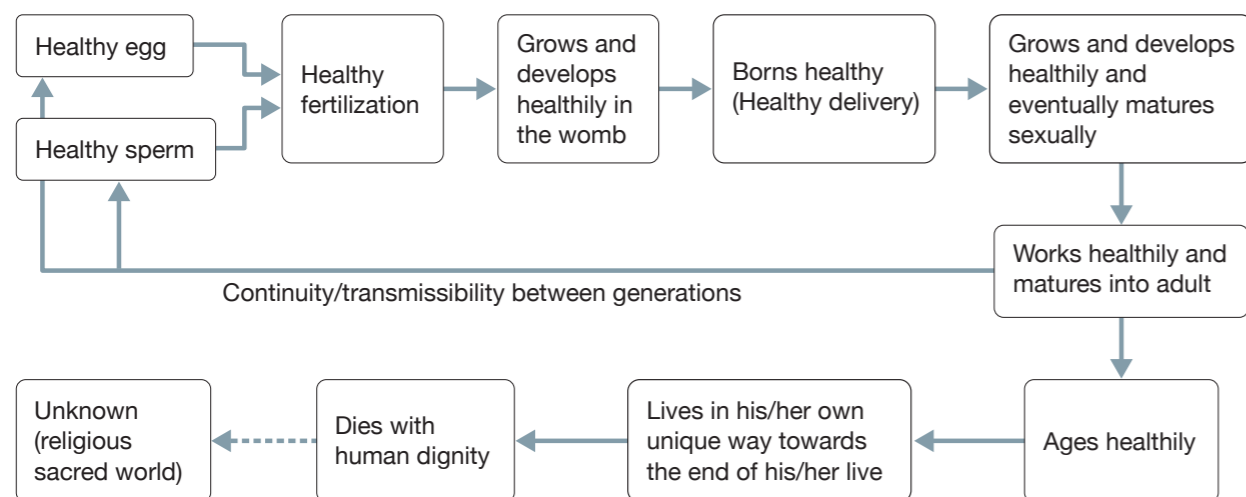


Figure 0.1 Human life cycle and health

life, and eventually have a family. A healthy man and healthy woman produce healthy sperm and healthy eggs in their respective reproductive organs, and pass on the life information in their DNA to the next generation. Life repeats this cycle.

When people reach maturity and healthy adulthood, they undergo the aging process according to the laws of human life. They age healthily towards the end of their lives. They live healthily in their own unique way in their last days, and finally die with human dignity. The afterlife is an unknown world. There is a sacred world that differs with each religion. Some may not believe in the existence of such a world.

2. Significance of learning and teaching school health

If people could live in perfect “health,” as shown in this diagram, it would be a miracle and this is practically impossible. The pursuit of perfect health without considering the limitations of human beings and society leads to the concept of eugenics, which may result in the social exclusion of all but those who can be considered “healthy.” Since there is no such thing as a perfect human being, we must not fall into the trap of healthism (the pursuit of health as the most valuable attribute).

At some point in the life cycle, everybody experiences situations, environments, and conditions that adversely affect their health, as well as suffers health challenges such as illness, injury, disability, and ill-health to some extent. No matter how early or late, there is no escaping the fate of being human, or death. In other words, while the timing of death may be unequal, we are all equal in the sense that none of us can escape death.

However, most people want to live as long as possible in good health, and lead as abundant and happy a life as possible. What can education and schools do to achieve this? School health is an initiative that brings together teachers and staff, families and relatives, and community members to work together to realize the wish to live a healthy life, by focusing on the health of school-aged children. The role of “perfect health” as defined by WHO (see Chapter 1) can be seen as a guide to how we should survive and lead our daily lives, just as the ancients sailed across the sea at night toward their destination by following the North Star and the Southern Cross. The destination may be a feasible “better health” that takes into account the limitations of human beings and society.

Given the **diversities of the physical body, development, sexuality, and socioculture**, it is important to note that “health” is not a single event, but a spectrum that comprises various degrees of health, and a concept with diverse dimensions of value. Depending on the culture, history, religion, ethnicity, gender, etc., of a country, society, and region, various views of health can exist.

In today’s society, it is necessary to teach health based on the knowledge that has accumulated through scientific methods, and simultaneously consider these diversified ways of thinking about health. Accordingly, to live a healthy life means to combine rich wisdom about health rooted in our experiences and daily life (for examples, self-care, self-medication, self-protection, and herbal medicine) with accurate scientific knowledge about health, and to practice and confirm it in our daily lives, and to improve our lives and ways of life by ourselves. At times, it is necessary to seek assistance from the community and others in order to live a healthy life.

Nevertheless, the scope of what humans know about the **mysteries surrounding health** is limited. Therefore, the attitude of being conscious of our ignorance and modestly putting into practice the wisdom and knowledge of health in our daily lives is the mindset that allows us to think of health as our own, and is the stance required of those who study and teach school health.

This textbook discusses the contents of the newly introduced elementary school health course. Specifically, it comprises 16 chapters that university students should study to become teachers qualified to learn and teach school health. These 16 chapters contain the essence of school health, which will not only be useful for you when you become a teacher, but will also help you to understand your own health, the health of your family and friends, and the health of the people of Cambodia. It is important that you approach the contents of each chapter as your own experience and something to reflect on, and study them as a personal matter, not that of others. You can work on the EXERCISE at the end of each chapter and discuss it in class to deepen your learning.

Column: Diseases, disabilities, and the concept of eugenics

Eugenics is a field of academic study that believes that there are two types of human beings: those with good biological characteristics and those without. It seeks to improve the quality of human beings by retaining those with superior genetic characteristics and eliminating those with inferior genetic factors. Against the background of this discipline, the concept of eugenics is the belief that there are people with qualities worthy of living and those without. It assigns superiority and inferiority to human lives. The most significant criteria used to determine superiority and inferiority, in the past and present, are disabilities, diseases, race/ethnicity, and age.

3. Characteristics of health as a school subject

To teach and learn health in schools, one should comprehensively understand human health in relation to the body, psychology, behavior, social environment, and natural environment, and apply what has been learned to daily lives. In particular, teaching and learning about health in schools means conveying scientific knowledge about health and right living skills to students to help them practice healthy living.

The key to achieving this is communication between those who teach and those who learn (including teaching methods, i.e., how to teach health). In fact, there are two worlds: the one where teachers belong and the other where students, children, and the general public live. The knowledge and common sense about health differ between these two worlds. The languages being used are also different.

The two worlds of life, of course, overlap. Teachers are familiar with both worlds: the one using professional and scientific knowledge and the other one depending on everyday common and traditional wisdom. They play a vital role in bridging the two (**Figure 0.2**). This role, in other words, is that of a **health education-communicator**.

In health education, it is essential to convey specialized knowledge to students, children, and the general public in an easy-to-understand manner that can help them change their behavior and thinking. However, this by itself will only result in teachers unilaterally imposing their knowledge on students and

pupils. Since scientific health knowledge is universal, it may not necessarily correspond to each person's individual health, lifestyle, or environment (for example, consider traditional food cultures and how ingredients are procured in a region). This is why the wisdom of health that exists in our daily lives is so valuable. It may actually serve practical purposes because it is an accumulation of experiences that are appropriate to each person's physical and personality characteristics, local lifestyle, and living environment. Of course, there are some practices that need to be changed from the SDGs perspective, including Cambodia's traditional sexual norms and childbirth culture, as well as child marriage and female genital mutilation seen around the world ([see Chapter 11](#)).

Therefore, health education requires you to well understand and respect the traditions, customs, wisdom, and ideas of the local communities, as well as to communicate by translating scientific knowledge in a way that is easy to understand and practice in daily lives. This may involve using scientific, technical terms, or translating technical terms into the language used in daily life, requiring flexibility to accommodate the circumstances.

The health education in Cambodia should be aimed at exploring a healthy way of life that benefits from the health and welfare systems and services that will be domestically developed in the future, and from a body of scientific knowledge of health and medicine emerging around the world, while preserving as much as possible the culture and ecology of living in the regions where economic development will take place.

In this way, health education in school seeks to cultivate the ability of students and children to live healthily, as well as to create a society and environment in which everyone in the community can live healthier life.

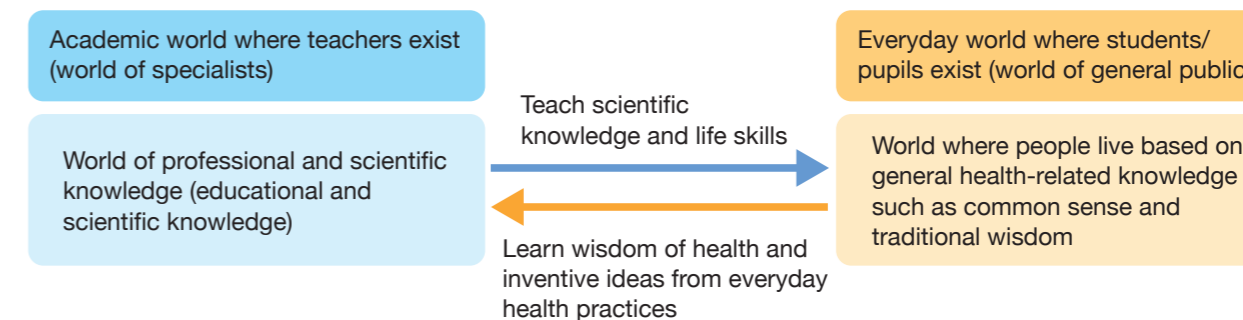


Figure 0.2 Two-way health education communication in school health

4. Sustainable Development Goals (SDGs) and school health

The final topic is the connection between **SDGs** and school health. SDGs are the successor to the Millennium Development Goals (MDGs), set out at the United Nation (UN) Summit in 2015, as goals or challenges to achieve a sustainable and better world by 2030. In essence, the SDGs are a set of goals that the entire world should work towards, regardless of economic or development level, in order for humanity to survive and prosper sustainably on this planet. Of course, Cambodia is also trying to address

Health

the SDGs.¹

The SDGs consist of 17 goals and 169 targets under these goals. The 17 goals are as follows:

- Goal 1: End **poverty** in all its forms everywhere
- Goal 2: End **hunger**, achieve **food security** and improved **nutrition** and promote **sustainable agriculture**
- Goal 3: Ensure **healthy lives** and promote **well-being** for all at all ages
- Goal 4: Ensure inclusive and equitable **quality education** and promote **lifelong learning** opportunities for all
- Goal 5: Achieve **gender equality** and empower all women and girls
- Goal 6: Ensure availability and sustainable management of **water and sanitation** for all
- Goal 7: Ensure access to affordable, reliable, sustainable, and modern **energy** for all
- Goal 8: Promote sustained, inclusive, and sustainable **economic growth**, full and productive employment, and **decent work** for all
- Goal 9: Build resilient **infrastructure**, promote inclusive and sustainable **industrialization**, and foster innovation
- Goal 10: Reduce **inequality** within and among countries
- Goal 11: Make **cities and human settlements inclusive, safe**, resilient, and sustainable
- Goal 12: Ensure sustainable **consumption and production** patterns
- Goal 13: Take urgent action to combat **climate change** and its impacts
- Goal 14: Conserve and sustainably use the **oceans, seas, and marine resources** for sustainable development
- Goal 15: Protect, restore and promote sustainable use of **terrestrial ecosystems**, sustainably manage **forests**, combat **desertification**, and halt and reverse **land degradation** and halt **biodiversity loss**
- Goal 16: Promote **peaceful and inclusive societies** for sustainable development, provide access to justice for all, and build effective, accountable and inclusive institutions at all levels
- Goal 17: Strengthen the means of implementation and revitalize the **global partnership for sustainable development**

The terms in bold in the list of 17 goals are those that are discussed in this textbook in relation to health and well-being, safety, and hygiene. They show that school health is not just about health education in schools, but that it plays a vital role in working towards the SDGs and can make a significant contribution to Cambodian society. Furthermore, as stated in the Cambodian School Health Policy (2016, 2019)^{2,3}, university students, pupils, and teachers who have studied school health are expected to become human resources who can contribute to a Cambodian society that grows sustainably and is peaceful and healthy.

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- 3 Royal Government of Cambodia. National Policy on School Health. 2019.

Learning objectives

You will be able to gain proper understanding and explain:

- The definition and aspects of health.
- The importance and benefits of health education programs in schools.
- The significance of implementing school health activities.
- School health policies and initiatives adopted in Cambodia.

This chapter provides basic knowledge necessary to understand human health and school health initiatives. First, we introduce basic health concepts and a few new ideas, and underscore that health is a basic human right. Next, we explain the concept of child health based on the characteristics of child development. We also outline the global trend towards health promotion and building healthy societies, and describe the importance of school health initiatives, their four pillars, and school health policy in Cambodia.

1. Aspects of health

“Health” is a term that encompasses the physical, mental, psychological, and social state of human beings in a single word.

The constitution of the **World Health Organization** (WHO), signed by representatives of 61 nations in 1946, describes the most desirable and ideal conditions for health with the following statement: **“Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”**¹ The WHO Constitution also declares that “enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being.”¹ This right must be guaranteed regardless of race, ethnicity, religion, political belief, or socioeconomic status.¹

The WHO Constitution warns that inequalities exist in the areas of health promotion and infectious disease control, depending on respective levels of socioeconomic development among nations. Such conditions are described as a threat shared worldwide, not just among developing nations.¹

More recently, global climate change as well as the spread of lifestyle-related diseases accompanying changes in people’s ways of life and the rise in average human life expectancy have had a conspicuous impact, prompting new ideas about health. One such example is to seek lifestyles that are in harmony with the environment and ecosystem. For instance, the **Ecohealth** concept is rooted in awareness that human beings are also part of the ecosystem (**Figure 1.1**). This approach to human health stresses the importance of maintaining a balance among the environment, the ecosystem, socioeconomic development, peoples’ livelihoods, production activities, and lifestyles.²

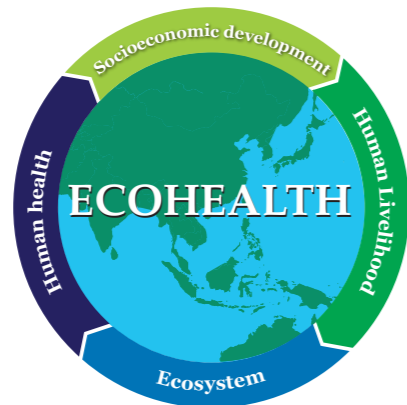


Figure 1.1 Ecohealth is a health concept that says socioeconomic development influences the ecosystem and human livelihood, and thus human health

With the advancing age of populations in many nations, the world is moving into an era in which most people will have to deal with lifestyle-related diseases and physical, cognitive, psychological, and social dysfunction. Such trends have encouraged people to accept and deal with health challenges. Rather than eliminating disease and impairment, for example, greater emphasis is being placed on the ability to achieve decent living conditions despite illness or impairment, which involves controlling the lifestyle impact of such negative conditions while receiving the social support necessary to cope with such circumstances.³

In 1998, the WHO Executive Board approved a proposal to add “**spiritual health**” to the categories of **physical health** (e.g., physiology, morphology, and body structure and function), **mental health** (e.g., intellectual and cognitive function), **psychological health** (e.g., emotional, behavioral, and psychological development), and **social health** (e.g., participation, engagement in activities, and social role).⁴ While that proposition has yet to be officially adopted, spirituality is a vital dimension in the health and happiness of the people in the Buddhist nation of Cambodia. Spirituality has no ties to specific religions. Rather, it describes the universal spiritual nature surrounding our origins as human beings. It is the state of mind in which we experience sensations, such as harmony, goodness, beauty, sacred tranquility, and eternity beyond life and death. That inner state is brought about by feeling a connection with entities that transcend human beings through our mental activity, such as praying or expanding our minds to connect with nature and the universe.

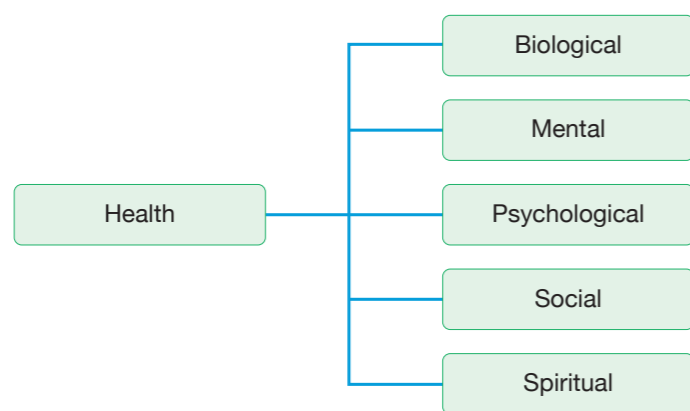


Figure 1.2 Multidimensionality of health

Therefore, **health is a multidimensional concept** including at least five aspects (Figure 1.2), which are often interdependent.

Column: What is the WHO?

The WHO was established as the directing and coordinating authority on international health within the United Nations system in 1948. The WHO mission is to promote health, keep the world safe, and serve the vulnerable. Now more than 7,000 people from over 150 countries work in 150 national offices, 6 regional offices, and at our headquarters in Geneva.

(Cited from: <https://www.who.int/about/who-we-are/our-values>, and <https://www.who.int/about/who-we-are>)

2. Health is a human right

Health is considered a basic right for all people, regardless of their race, ethnicity, religion, political beliefs, or socioeconomic status.¹ True to this principle, it is vital for the nation of Cambodia to ensure that all of its citizens enjoy access to the highest attainable standard of health.

Healthy development, particularly for children, is a fundamental right in all nations. With that goal in mind, the WHO Constitution emphasizes the importance of nurturing children who can live harmoniously in a changing total environment.¹ In this regard, **school health initiatives** play a vital role in efforts to ensure that children attain sound development within the changing environment.

3. Health during the developmental period

Human growth and development commence from encounters between sperm from a male and an ovum (egg) in the female, with the fertilized egg(s) growing in the woman’s womb. The growth and development cycle follow a process of maturation that continues after a child is born, with various capacities and characteristics peaking during adulthood. After attaining this peak, human beings experience the natural phenomenon of aging. This phase is characterized by gradual decline and loss of capacities, eventually resulting in death.

Within the course of human life, kindergarten, elementary, junior high, and high school students—the targets of school health education—are in an age bracket defined by steady growth and development. As they mature into adults, their minds, bodies, and social relationships evolve and change daily. The term “**developmental health**” is used to express the changing reactions of such children during this period to various experiences, the surrounding environment, and other factors.⁵

“Developmental health” is thus a term used to express the process leading toward maturity that schoolchildren follow. They experience various things (e.g., friendship, commitment to learning, leisure activities, support from others, and mutual help) within social environments (e.g., school, family, and community) and acquire numerous qualities (e.g., indulgence, honesty, trust, collaboration, curiosity,

sense of justice, and aspiration) through interactions with their environment that steadily increase their intellectual, physical, and emotional capacities to their full potential.

4. Health promotion

1) Background to the concept of health promotion

Research in the 1970s and 1980s made it increasingly clear that certain aspects of personal lifestyles and daily habits—including diet, exercise, rest, sleep, smoking, alcohol consumption, and work styles—are primary factors in causing disease. The first work to bring about this change was *A New Perspective on the Health of Canadians* by Marc Lalonde, published in 1974 and often referred to as the “Lalonde report”.^{6,7} Lalonde also emphasized the role of physical and social environments as determinants of health that are out of individuals’ control. However, this evidence strengthened the trend towards viewing disease as a matter of personal responsibility, and efforts to both prevent disease and improve health have focused on individuals, with little attention paid to social elements or social environments that influence people’s daily habits.

Naturally, not everyone can freely determine their own daily habits, lifestyle choices, and other aspects of life. Key factors in this context include the quality of education received, work performed and level of income earned, quality of housing and co-habitants, foods consumed, and how leisure time is spent. Such factors are heavily affected by circumstances such as the communities in which people live, their workplaces, cultural and economic conditions at provincial, district, and national levels, and social stability and policies. Thus it is essential for communities and nations to collectively support the health of their citizens.⁸ The concept of health promotion evolves from this background.

2) The Ottawa Charter for Health Promotion

The First International Conference on Health Promotion took place in Ottawa, Canada, on November 21, 1986. The conference featured the declaration of **the Ottawa Charter for Health Promotion**. This charter contained the following definition: “Health promotion is the process of enabling people to increase control over, and to improve, their health.”⁸ Health, meanwhile, was defined as follows: “Health is a positive concept emphasizing social and personal resources, as well as physical capacities.”⁸ As stated, health was clearly perceived as a resource and capacity for pursuing everyday life, rather than being defined as an objective.

The charter also mentions the following eight areas as prerequisites serving as a foundation for realizing good health.⁸

1. peace
2. shelter
3. education

4. food
5. income
6. a stable eco-system
7. sustainable resources
8. social justice and equity

To inspire good health, it is vital for society to fulfill each of these conditions.

Six areas are identified as pillars of the health promotion movement.⁸ The key points of these pillars are summarized below.

1. **Build Health-focused Public Policy**

Health promotion puts health on the agenda of policymakers in all sectors and at all levels, directing them to be aware of the health consequences of their decisions and to accept their responsibilities for the people’s health.

2. **Create Supportive Environments**

Health promotion creates living and working conditions that are safe, stimulating, satisfying, and enjoyable.

3. **Strengthen Community Actions**

Health promotion works through concrete and effective community action in setting priorities, making decisions, planning strategies, and implementing them to achieve better health.

4. **Develop Personal Skills**

Health promotion supports personal and social development through providing information, health education, and enhancing life skills.

5. **Reorient Health Services**

The role of the health sector must move in a health promotion direction, beyond its responsibility for providing clinical and curative services.

6. **Moving into the Future**

Caring, holism, and ecology are essential issues in developing strategies for health promotion. Holism is the idea that every part of a whole is intimately intercorrelated.

3) The Bangkok Charter for Health Promotion in a globalized world

The Bangkok Charter for Health Promotion emerged from a meeting of WHO member states convened in Bangkok, Thailand, in August 2005. The meeting was held as globalization advanced around the world, and reflected the growing impact of that trend on human health.⁹ The following declaration was issued at that time: “Health promotion is based on this critical human right and offers a positive and inclusive concept of health as a determinant of the quality of life and encompassing mental and spiritual well-being.”⁹ This charter emphasizes that health promotion must be the focus of development planning worldwide, with health also to incorporate spiritual aspects.

5. School health initiative

According to the WHO, approximately 2.3 billion school-age children worldwide spend about a third of their time each day at school. **Schools are environments unique in their ability to foster a positive outlook on life and establish healthy lifestyles.**¹⁰ To achieve these objectives, schools work to independently formulate various types of health services (e.g., health education, health check-ups, first aid, mental health counseling, and school lunches). It is also their mission to collaborate with social resources available in their communities to contribute to the health not only of children, but also of school personnel, children’s guardians, and local residents. The types of health services that schools furnish and the approaches they use to supply those services—as well as the laws, policies, and ideas regulating them—differ from country to country.

1) School health objectives and initiatives

Let us look at the examples of the United States and Japan. Below is a summary of the seven school health approaches and services supplied in the US, as presented by the American School Health Association.¹¹ School health support in the United States consists of three pillars: the environment, services, and teacher training.

- **Environment:**
A healthy and safe environment, including the physical, psychosocial, and learning environments
- **Services:**
Services and opportunities, including meals, physical activities, and health education as well as counseling, social work, and nursing
- **Teacher training:**
Knowledgeable teachers and competent staff for health education and health services

In Japan, the Ministry of Education, Culture, Sports, Science and Technology defines the objectives of school health activities as follows: ensuring that schools strive to maintain and improve the health of students and other parties (e.g., teachers and school office staff); giving careful consideration to the health and safety requirements for school education activities as a form of group learning; and cultivating abilities needed to maintain and improve the health of oneself and others.¹² To achieve these goals, schools provide on-site **health administration** and **health education**.

Health administration comprises health initiatives such as conducting health checkups and improving school environments based on the School Health and Safety Act. Health education aims to instill knowledge and capabilities necessary for healthy living through all school education activities, including subjects such as physical education and special activities.

2) Significance and importance of health education in schools

There are various interpretations of the significance of school health education. Dr. Didier Jourdan (Professor, Dean of the Faculty of Education at the University Blaise Pascal of Clermont-Ferrand, France) offers two distinctive perspectives.¹³ The first has to do with security, and the second with the well-being of the individual and society.

In the first perspective, “security” signifies concern when increasing numbers of young people engage in unhealthy lifestyles and risky behavior due to inadequate knowledge about health. Such a trend could result in damage to one’s own health, injuries to others, and behaviors that raise the economic burden on society. Public order could also deteriorate, leading to societal instability. In the interest of maintaining the security of society and avoiding such risks, providing young people with health education at their schools is therefore believed essential.

Dr. Jourdan’s second perspective on the significance of school health education, “well-being,” reflects the moral and ethical obligations of modern nation-states.¹³ This refers to expectations and demands for a heightened sense of well-being by the individual and society. In other words, because the health of individuals and society in general amounts to well-being, it is vital to make concerted efforts to maintain and improve the health of both individuals and society through school-based health education and health promotion.

3) The link between education and health

According to Dr. Fiona Brooks (Professor, the Faculty of Health, University of Technology Sydney, Australia), “research evidence shows that education and health are closely linked. So promoting the health and wellbeing of pupils and students within schools and colleges has the potential to improve their educational outcomes *and* their health and wellbeing outcomes.”¹⁴

In the “Annual Report of the Chief Medical Officer 2012” issued by the Department of Health, UK, Dr. Brooks also mentioned that promoting physical and mental health in schools creates a virtuous circle, reinforcing children’s attainment and achievement, which in turn improves their wellbeing, enabling children to thrive and achieve their full potential.¹⁵

6. Cambodian initiatives Focusing Resources on Effective School Health

The Cambodian government has set four goals in its quest for school health: 1) improve the health of all people; 2) improve the capacities and skills needed to prevent sickness and avoid the dangers of accidents in everyday life; 3) supply and encourage opportunities for school health promotion; and 4) ensure equal access to health education services. These goals cannot be achieved through the efforts of the health and education sectors alone; they also require the cooperation of numerous related organizations (e.g., the private sector, community organizations and women’s groups, and non-government organizations).

Based on that understanding, the program has been advanced through the **Focusing Resources on Effective School Health (FRESH) framework**.¹⁶

FRESH was first proposed in 2000 as a framework for addressing comprehensive school health. The program was based on the results of deliberations by the **WHO**; the **United Nations Educational, Scientific and Cultural Organization (UNESCO)**; the **United Nations International Children's Emergency Fund (UNICEF)**; and the **World Bank**. Those discussions addressed how best to integrate the effects of human, financial, and other resources in activities that would have positive effects on school health.¹⁷

Under FRESH, the following four areas are considered core components for integrating such activities:

1. **Health-related school policies**
Strategic positioning of health in school administrative policies
2. **Safe water and sanitation—the essential first steps toward a healthy physical and learning environment**
The true foundation of safe and healthy school environments lies in safe water and sanitation
3. **Skills-based health education**
Health education positioned to cultivate the attainment of specific skills
4. **Access to health and nutrition services**
Supply of outstanding health and nutrition services

As described above, FRESH serves as a framework for effectively achieving Cambodia's drive to realize better, more child-friendly schools by prioritizing the aspects of school health expected to produce positive effects.

7. The future of school health in Cambodia

Since 2006, the School Health Policy has enabled fundamental understanding of Cambodia's pillars of school health.¹⁷ It consists of the **four pillars** listed below, which are shared with school health schemes adopted in the US and Japan. Pursuing better school health initiatives in keeping with these schemes is therefore likely to lead to a brighter future for school health in Cambodia.

- **Basic healthcare services**

Supplying basic healthcare services that children need to equitably attain physical, mental, spiritual, and social development

- **Health education**

Promoting behavioral changes in children to achieve well-being and safety (via information supply, knowledge, skills, and changes in attitude to this end)

- **Environment**

Pursuing initiatives to improve facilities and equipment that support learning environments and

physical health, while promoting sanitation, cleanliness, and comfort in the interests of greater safety and peace of mind in schools, communities, and public spaces

- **Participation, collaboration, and coordination** of wide-ranging groups, organizations, and agencies

Participation and collaboration by all concerned parties (e.g., schools, local governments, health workers, community groups, religious groups, and NGOs) to advance school health promotion programs

In 2019, the Cambodian government introduced a new policy setting out future vision based on the School Health Policy 2006.¹⁸ Achieving effective school health in Cambodia based on the new policy requires all students, teachers, guardians, and other concerned parties to actively participate and collaborate in healthcare services, health education, and environmental enhancement, and to join in efforts to help schools serve as health promotion hubs.

Column: National School Health Policy 2019 is promulgated

Under School Health Policy 2019, by improving the quality of education, the government will engage in the following challenges; providing health knowledge based on scientific knowledge of mental and physical development, providing basic health services, encouraging the learning of skills for preventing infectious and non-infectious diseases, fostering values and behaviors for attaining full health (mind, body, and spirituality), and enhancing a sense of responsibility for behaviors. Furthermore, the new school health policy has the goal of creating an inclusive learning environment and fostering a culture of care in school personnel, family, and community.

The new policy has the following eight pillars, of which we list some examples.

① **Improve fundamental health of learners and educational personnel**

- equipping health rooms
- providing health examinations and physical measurements, first aid, and vaccination
--preventing infectious diseases, food poisoning, and mental health insufficiency

② **Promote nutrition provision**

- implementing a school vegetable garden
- setting environmental hygiene standards
- monitoring food sales in educational facilities
- setting food safety and hygiene standards
- providing nutrition education for parents

③ **Improve supply of clean water, sanitation, and hygiene**

- setting the guidelines of the minimum requirements for water, hygiene, and cleanliness
- enhancing facility cleanliness and hygiene, and sanitary behavior
- strengthening the concept of cleanliness, safety, and hygiene behavior

④ **Improve safe, inclusive, comfortable and friendly learning environment**

- creating an environment to support health, happiness, and comfort of children and personnel,

including exhibiting educational materials and works

- equipping garbage disposal
- holding school events
- providing education to prevent tobacco, alcohol, and illegal drug use
- as accident prevention, setting up signs to inform of danger, traffic signs, and teaching traffic safety rules

⑤ **Promote security and order in educational institutions**

- setting “One School, One Harmonious zone” principle
- prohibited bring in dangerous materials and weapons
- strengthening traffic safety education
- installing school fence to ensure safety
- teaching accident prevention (drowning accident)
- appointing a vice-principal in charge of school health
- implementing extracurricular activities for children and teachers in collaboration with health organizations and communities

⑥ **Promote health education**

- making a health education curriculum to introduce health education into teacher training and ordinary education
- training health education specialists at teacher training institutions
- providing in-service training to school teachers and training to teacher training institutions
- disseminating information on disease/risk prevention
- appointing health education managers
- fostering a health education role model

⑦ **Promote the implementation of health skills**

- changing behavior for health, environmental health, and social well-being
- learning first aid skills
- building a gymnasium
- implementing systematic hygiene and cleanliness measures

⑧ **Promote the participation of all stakeholders in improving school health**

- promoting engagement of relevant agencies, parents, communities, aid partners, monks, and community leaders in school health

(Source: Royal Government of Cambodia. National Policy on School Health. 2019)

Exercises for further thought and research

- [1-1] Think about what health and the conditions for being healthy mean to you.
- [1-2] Consider why school programs need to teach children about health and diseases.
- [1-3] Examine how Cambodian society views diseases.
- [1-4] Conduct group discussions on what Cambodian schools can do to promote children’s health, reflecting on your own experiences.

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How your bodies function (Mechanisms and functions of your body)

Learning objectives

You will be able to gain proper understanding and explain:

- The mechanisms and functions of a body that supports life.
- The regulatory mechanisms of the human body in supporting daily activities, in relation to your own daily activities.

In this chapter, you will learn about the basic structure (structure and morphology of organs) and functions (roles and functions of organs) of the human body; organs and tissues functioning while interacting with each other; and functions of the body that maintain a stable internal environment.

1. Structure and functions of the human body

The human body carries out various functions. These functions are broadly grouped into those that sustain life and those that actively use life for motion and regulation. Examples of functions that sustain life include eating food to obtain nutrition, breathing to take in air, and circulating blood throughout the

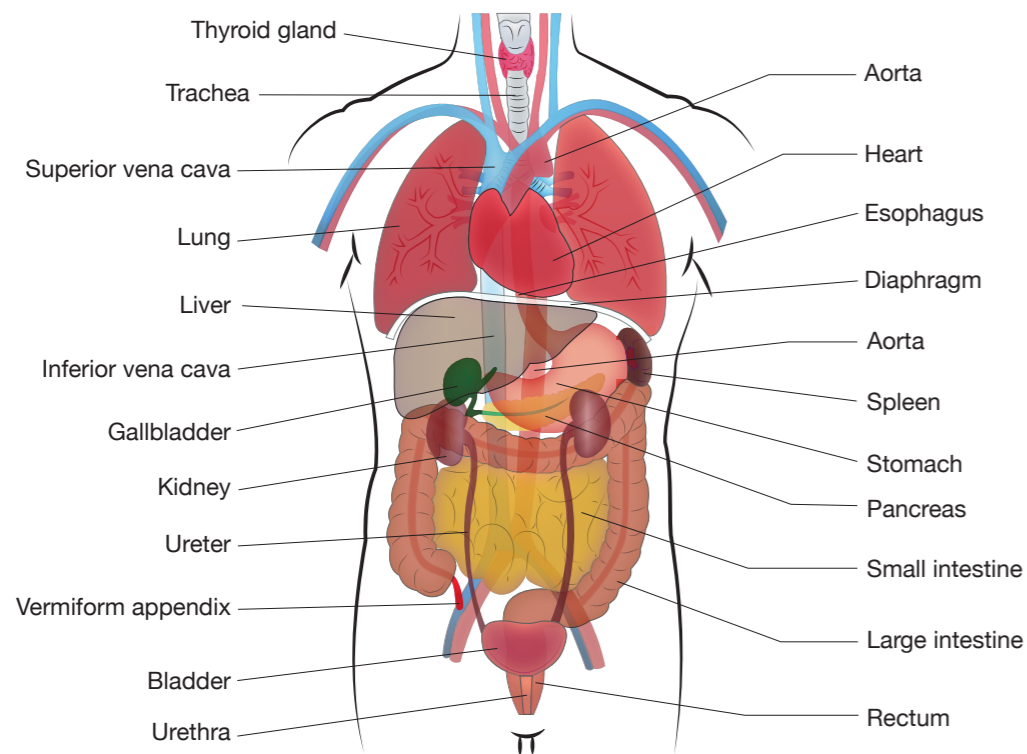


Figure 2.1 Anatomy of the human body (Organs)

body (Figure 2.1). Functions for motion and regulation include seeing, hearing, and moving joints. Organs inside and outside the body are involved in these functions.

1) Basic structure of the human body (cells, genes, tissues, and organs)

The human body is made up of **cells** as minimum units. A cell is composed of a **cell nucleus** and the **cytoplasm** surrounding it. The cell's basic function is to produce proteins based on the information possessed by the cell nucleus. Each cell nucleus contains 23 pairs of **chromosomes** (46 in total), and one chromosome contains hundreds to thousands of **genes**. Genes correspond to the blueprint of the human body and form a part (region) of **deoxyribonucleic acids** (DNAs), which holds specific genetic information such as "what kind of protein to make. DNA is a chain of small units called nucleotides composed of sugar, a nitrogenous base, and a phosphate group. It usually has a double-helix structure in which two strands of nucleotides running in opposite directions are bound to each other. Long-pitch filamentous double-helix DNA is connected to histones (protein) to form chromosomes, and is located in the nucleus of a cell. There are four types of DNA bases, namely adenine (A), guanine (G), thymine (T), and cytosine (C), where A binds to T and G binds to C (Figure 2.2). Sequences in which the four types of bases are arranged (base sequence) provide encoded (symbolized) genetic information. There are many areas in DNA whose functions have yet to be understood.

There are many types of cells in the body, such as heart, liver, and muscle cells. They vary in size and shape by their functions. For example, red blood cells (erythrocytes) are disc-shaped and are able to change shape easily. This allows them to squeeze through narrow blood vessels and transport oxygen throughout the body. Derived from a single fertilized egg, all cells essentially have the same DNA. However, different genes are expressed in different cells (or at different times in the same cell), which is why cells are able to acquire diverse appearances and functions.

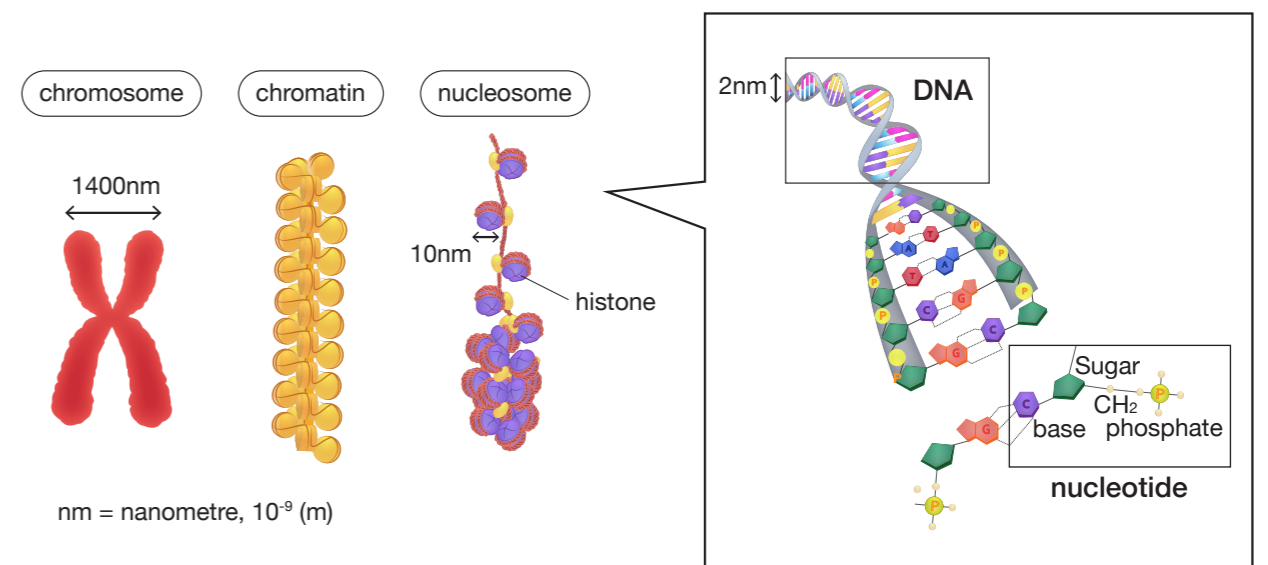


Figure 2.2 DNA structure

A collection of specifically differentiated cells is called a **tissue**. Tissues work together to create an **organ** that performs a specific function. A group of organs with similar functions is called an **organ system**, which can be classified as shown in **Table 2.1**:

Table 2.1 Main functions and types of organ systems

| Organ system | Main functions | Main organs |
|------------------------------------|--|--|
| Motor system (Bone, and muscle) | Bones form the skeleton (strut) that supports the body. The body is able to move simply by moving bones with joints. Bones also protect internal organs and the hematopoietic function. | Bones, cartilage, joints, muscles |
| | Skeletal muscles are able to contract and change their length to move each part of the body. | |
| Cardiovascular system | The cardiovascular system consists of the heart (acting as a pump to circulate blood) and blood vessels (acting as pipes for supplying blood), and functions to deliver the required nutrients and oxygen to cells throughout the body, as well as carry carbon dioxide and other waste products away for disposal. | Heart, blood vessels (arteries, veins), blood, lymph vessels |
| Respiratory system | The respiratory system takes in oxygen necessary for activities into the body and discharges carbon dioxide. It also functions to produce sound waves (pharynx) and resonate in the oral cavity to produce voice. | Nose, pharynx, trachea, lungs |
| Nervous system | The nervous system can be divided into the central nervous system (which processes collected information and sends out instructions) and the peripheral nervous system (which conveys instructions from the central nervous system to various parts of the body and conveys systemic information to the central nervous system). | Brain, spinal cord (central nervous system) |
| | | Autonomic nerve, somatic nerve (peripheral nervous system) |
| Digestive system | The digestive system functions to chew, swallow, digest, and absorb the beneficial parts of food into the body. | Oral cavity, esophagus, stomach, small intestine, large intestine, rectum, liver, pancreas |
| Urinary system | The urinary system excretes unnecessary substances in the blood as urine. It adjusts the amount and composition of urine to maintain the constant composition and osmotic pressure of body fluids. | Kidney, urinary tract, bladder, urethra |
| Endocrine system | The endocrine system secretes substances (hormones) that circulate throughout the body along with the blood flow and work on specific organs. It regulates the functions of those organs. | Pituitary gland, thyroid gland, adrenal gland, pancreas, gonads |
| Sensory system | The sensory system mainly collects information outside the body to regulate and control the body's activity. | Eyes, ears, tongue, nose, skin |
| Reproductive system | The reproductive system produces sperms and eggs and functions to preserve species (create future generations), from the binding (fertilization) of sperms and eggs to delivery. | [Male] Testis, seminal duct |
| | | [Female] Ovary, uterus |
| Immune system | The immune system functions to eliminate foreign substances invading the body and abnormal cells in the body. The body is affected if its function deteriorates or reacts excessively. | Lymphatic vessels, bone marrow, spleen, thymus, blood, skin, tonsils |

2. Structures and functions of organs

1) Motor system

The motor system consists of the bones (making up the skeleton), muscles, joints, ligaments, cartilage, and other connective tissues. It functions to move and support the body.

(1) Skeleton

The skeleton is the base tissue shaping the human body. It includes a total of about 200 bones (cranial 23, spinal column 26, thorax 25, upper limbs 64, lower limbs 62), with five types of bone shapes (long, short, flat, irregular, and pneumatized bones). Pneumatized bones (hollow bones) are filled with space for air.

The roles of bones are as follows: (1) supporting the head, internal organs, and trunk, (2) supporting movement, (3) protecting key organs, (4) storing minerals (calcium, phosphorus), and (4) creating blood in the bone marrow (red blood cells, white blood cells, and platelets).

(2) Muscle

Muscles can be grouped into **skeletal, cardiac, and smooth (visceral) muscles** based on their differences in shape and function. Skeletal muscle can be consciously moved through the somatic nerve (**voluntary muscle**). Its roles include (1) moving the body by contraction and relaxation of skeletal muscle, (2) maintaining posture, and (3) producing body heat. Through muscle contraction, the skeleton moves at joints. The axis and range of joint movement are mainly determined by the shape of the joint. During movement, the muscles that mainly work are called **prime mover (agonist muscles)**, the muscles that work together to move the body are called **synergist muscles**, and the muscles that perform opposite movements are called **antagonist muscles**. For example, both flexors and extensors are **antagonistic muscles (Figure 2.3)**.

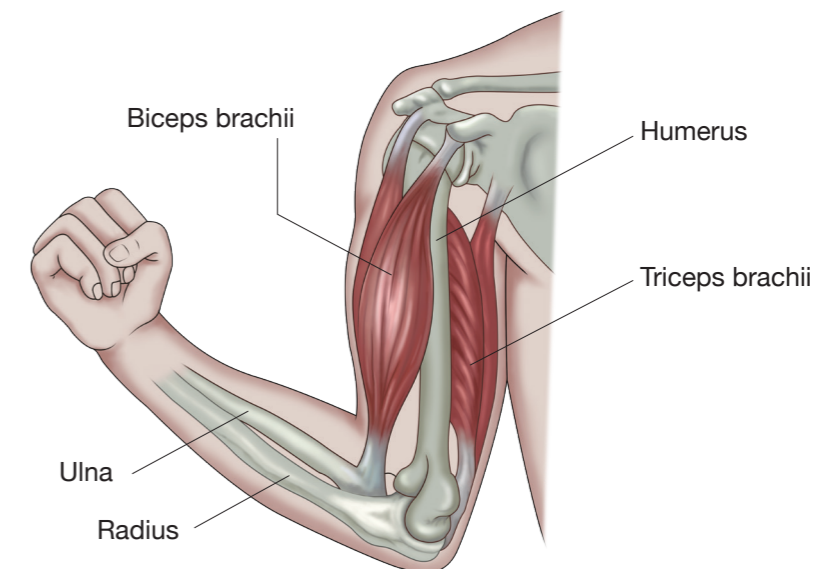


Figure 2.3 Muscle structure (agonist and antagonist muscles)

The myocardium is the muscle forming the heart wall. It is the same striated muscle as the skeletal muscle, but unlike the skeletal muscle, it cannot be moved consciously and is regulated by the autonomic nerves (**involuntary muscle**). It differs from the skeletal muscle in that it does not get fatigued no matter how much it continues moving, and in that myocardial cells do not have the ability to divide, which means that these cells will not be regenerated once they are damaged or undergo necrosis, for example, due to events such as myocardial infarction.

Smooth muscles are also involuntary muscles, which are controlled by the autonomic nerves in the same way as myocardium. They serve as the internal organ walls and blood vessel walls of the digestive tract, airways, etc. Their ability to contract is not as strong as skeletal or heart muscles, but they can continue to move without getting tired.

Column: Why do elderly people fall easily? (Aging of bones and muscles)¹

With aging come many changes in the skeleton and muscles. For example, sarcopenia, a phenomenon in which muscle mass decreases with age, begins around 30 years of age and progresses throughout life. During this process, the amount of muscle tissue and the number and size of muscle fibers gradually decrease. As a result, muscle mass and strength gradually decrease. This mild weakness increases the load on some joints (e.g., knee joints), thereby increasing susceptibility to arthritis and falls. Although physical inactivity (lack of exercise) is assumed to be the main cause, its mechanism has yet to be fully understood.

2) Circulatory system

The **circulatory system** consists of the heart, blood vessels, blood, and lymphatic vessels. It sends oxygen and nutrients to cells throughout the body and takes back carbon dioxide and waste products that are no longer needed by the cells.

(1) Circulation

The **heart** acts like a pump and is slightly larger than the fist (weighs about 250–300 g in adults). It is located slightly to the left of the center of the chest in the mediastinum space in the thoracic cavity, surrounded on its right and left sides by the lungs, and connected to the diaphragm at the bottom.

The heart is composed of four chambers (**left ventricle**, **left atrium**, **right ventricle**, and **right atrium**). The **atria** receive blood to the heart, and the **ventricles** pump out blood from the heart (**Figure 2.4**). Blood from the left ventricle flows throughout the body to supply oxygen and nutrients to somatic cells, receives waste from those cells, and returns to the right atrium. This circulation is called **systemic circulation**. On the other hand, blood from the right ventricle passes through the lungs, where it undergoes **gas exchange** (exchange of oxygen and carbon dioxide), and then returns to the left atrium. This is called **pulmonary circulation**.

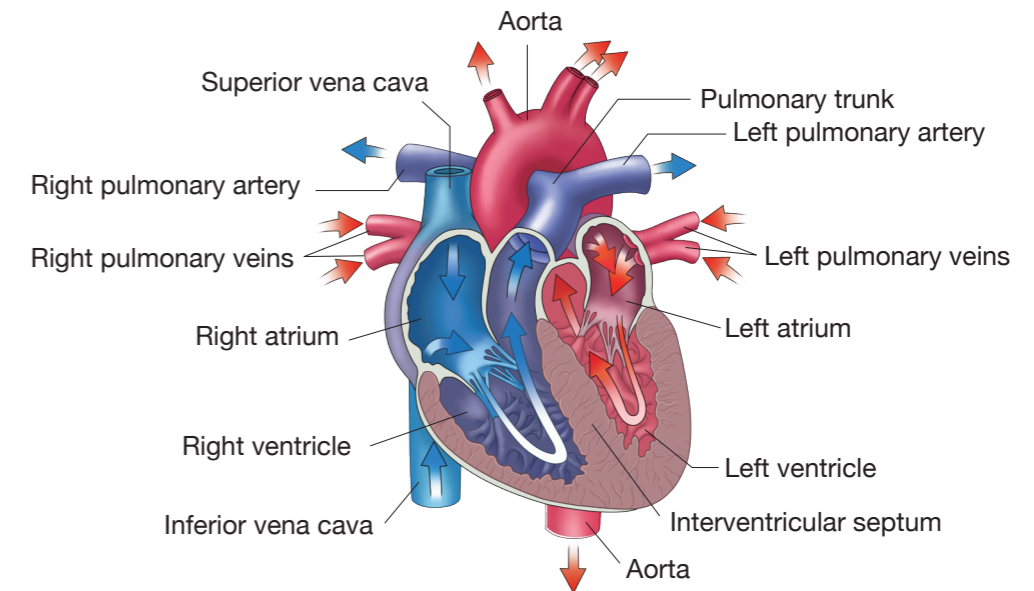


Figure 2.4 Heart structure and blood flow

(2) Blood pressure regulation

The pressure of blood on the walls of blood vessels is called **blood pressure**. The blood pumped by contraction of the ventricles generates blood pressure. Blood pressure decreases as distance from the left ventricle increases or elasticity of the vascular wall (vascular resistance) changes while blood moves in the vasculature from arteries through arterioles, capillaries, and venules to veins (**Figure 2.5**).

Vascular resistance is defined by: (1) inner diameter of the blood vessels, (2) viscosity of blood, and (3) total length of the vessels. The smaller the inner diameter of the blood vessel, the greater the resistance to blood flow. Generally, physiological changes in the vessel diameter of the arterioles affect blood pressure. Blood pressure lowers during vasodilation and rises during vasoconstriction. Blood pressure rises when the viscosity of blood, which is regulated by the amount of red blood cells and plasma, increases, and falls when it falls. Blood pressure is maintained relatively constant at rest. In adults, normal values are approximately 120 mmHg for systolic blood pressure and 80 mmHg for diastolic blood pressure.

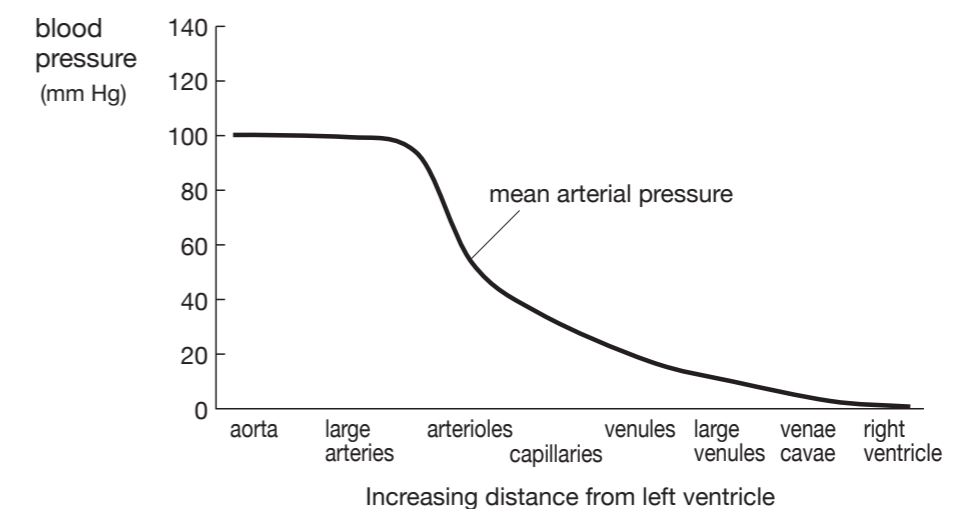


Figure 2.5 Changes in blood pressure along systemic circulation²

3) Respiratory system

The **respiratory system** consists of the **upper respiratory tract** (nasal cavity, pharyngeal pharynx, larynx), **lower respiratory tract** (trachea and bronchus), and **lungs**. It works to take into the body necessary oxygen and excrete carbon dioxide outside of the body (Figure 2.6).

The function of taking oxygen (O₂) from the air (outside air) into the blood and excreting the carbon dioxide (CO₂) generated in the body from the blood to outside the body is called **external respiration**. The O₂ and CO₂ that enter and leave the body through breathing are collectively called **respiratory gases**, and O₂ and CO₂ gas exchange is performed in the **alveolis**.

After emitting CO₂ and taking in O₂ by external respiration, the blood returns to the heart as **arterial blood**, and is pumped out from the left ventricle to the entire body. This blood reaches the periphery, enters the capillaries, and exchanges gas with body tissues. The direction of inflow and outflow of respiratory gas at this stage is opposite to those in external respiration in the lungs, i.e. O₂ is released from the blood and taken in by tissue cells, while CO₂ generated by cell metabolism is released from cells and moves into blood. Such gas exchange at peripheral tissues is called **internal respiration**.

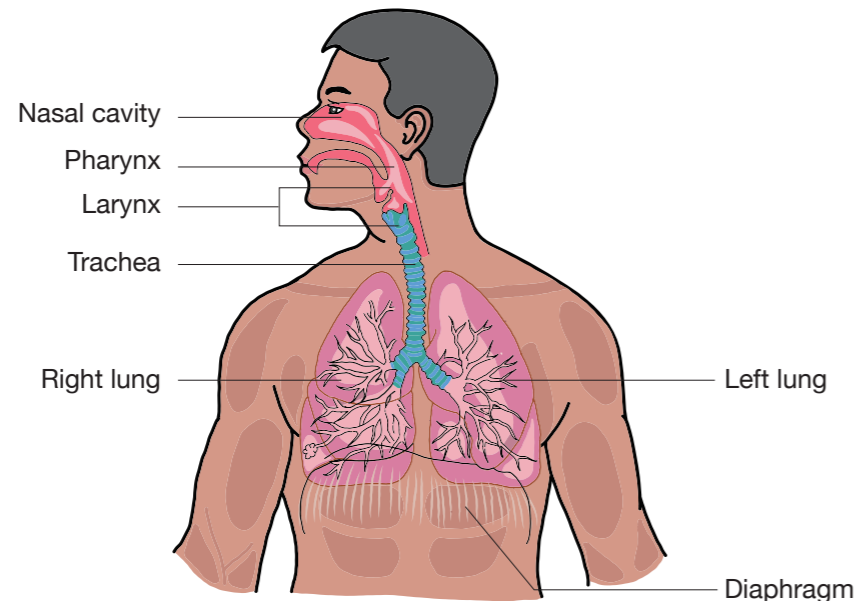


Figure 2.6 Respiratory organs

4) Nervous system

Neurons are the basic developmental, morphological, and functional units of the nervous system. They are excited by stimuli, and the excitement is transmitted to other neurons by synapses. Neuronal excitement generated by the stimulation of receptors in various parts of the body is transmitted to the central nervous system by ascending neurons, while excitement of the central nervous system is transmitted to peripheral effectors by descending neurons. The nervous system covers the entire body like a mesh and controls the functions of organs and tissues through the conduction of excitement generated by impulses of nerve fibers and conduction of excitement to effectors and other neurons.

The nervous system can be divided into the **central nervous system** (brain and spinal cord, the center of functions of the nervous system) and the **peripheral nervous system** (**somatic** and **autonomic nervous systems**). Peripheral nerves cover every corner of the body and play a key role in connecting each part of the body to the central nervous system (Figure 2.7).

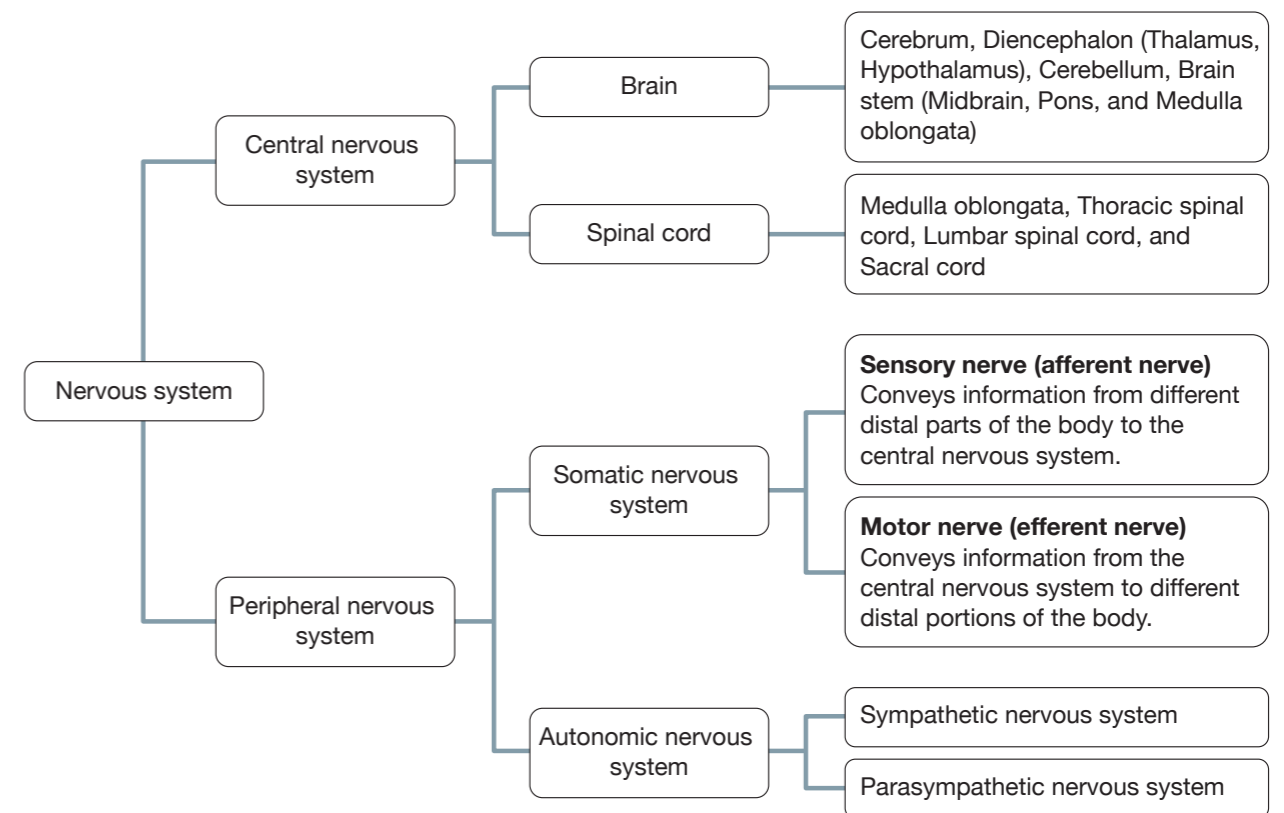


Figure 2.7 Structure of nervous system classification

(1) Central nervous system^{3, 4}

The central nervous system comprises the brain and spinal cord. Located in the cranial cavity, the brain weighs approximately 1,300–1,400 g in adults. It can be divided into four main parts (cerebrum, diencephalon, cerebellum, and brain stem). The **cerebrum** is the most developed part of the brain and occupies 80% of the whole brain volume. Its functions include identifying information and instructing movements accordingly (primary functions), as well as advanced mental functions such as memory, emotion, motivation, and cognition (higher functions). Under the cerebrum lies the **cerebellum** (motor regulation). Between the left and right sides of the brain is the **diencephalon** (sensory information processing, and integration of the autonomic nervous system). The **brain stem** is the center of the functions supporting life, namely respiration, circulation, digestion, and thermoregulation. The **medulla oblongata** at its lower rear is connected to the **spinal cord**. The spinal cord is located in the spinal canal and is approximately 40–45 cm long in adults. Each nerve of the peripheral nervous system runs from the central system and branches repeatedly toward the target organs under its control. If the spinal cord loses its function, all sensations will be lost, and you will become numb. Furthermore, motor functions are also lost, and you will not be able to move.

(2) Peripheral nervous system (somatic nervous system and autonomic nervous system)

Somatic nerves control the skin and muscles. The sensory information can reach consciousness easily, and often motor commands are consciously sent from the cerebrum.

The **autonomic nervous system** controls most of the complex communication networks that regulate body functions. It works without human consciousness, and you almost never notice that it is functioning. Substances called **neurotransmitters** transport messages in different parts of the nervous system, or between the nervous system and other organs. There are two types of autonomic nervous systems: **sympathetic nervous system** and **parasympathetic nervous system**. They control processes such as **blood pressure, heart rate, body temperature, digestion, metabolism, sweating, excretion, and sexual response**. Many organs are regulated by both sympathetic and parasympathetic nerves. These two types of nerves work antagonistically. For example, signal input to the sympathetic nerve increases the heart rate, while signal input to the parasympathetic nerve decreases it (Figure 2.8). They also play a major role in regulating blood pressure via hormones.

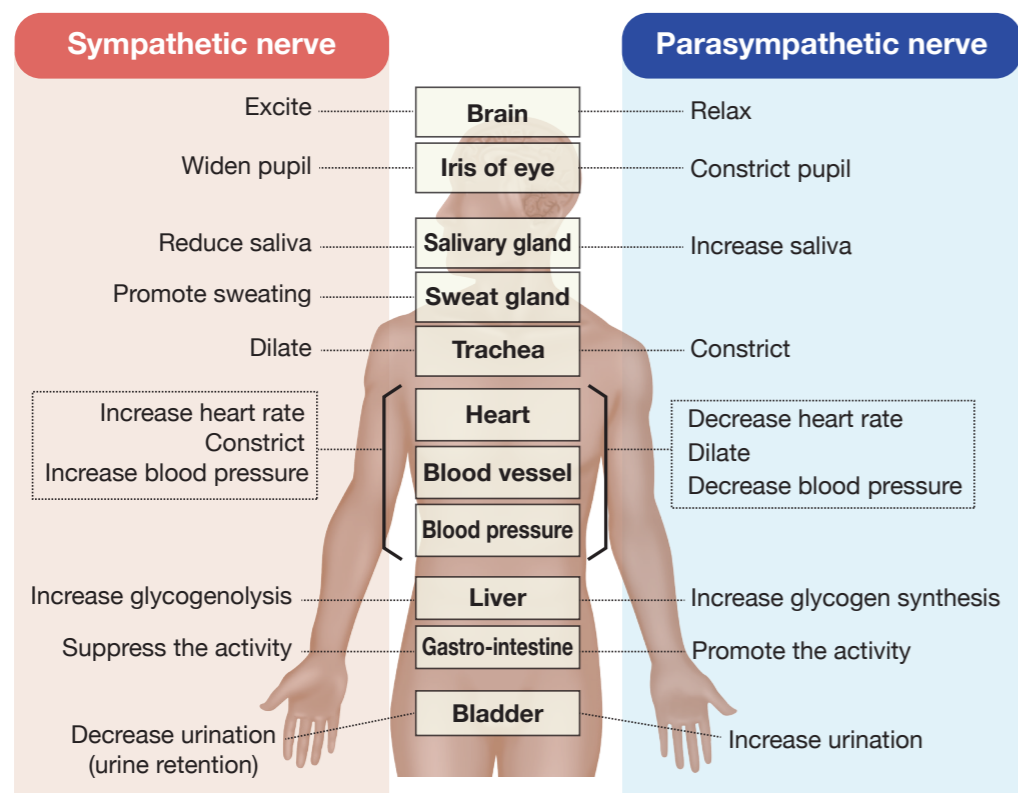


Figure 2.8 Actions of sympathetic and parasympathetic nervous systems

Column: Autonomic nerves referred to as “fight or flight” and “rest and digest”⁴

Generally, the sympathetic nervous system works when you are stressed or taken by surprise. For this reason, it is referred to as “fight or flight,” as sympathetic nerves work to either counteract (fight) against or escape (flight) from the situation in order to adapt to the circumstances. This explains, for example, why when you are taken by surprise, your heart beats intensely, your pupils dilate, your

breathing becomes fast and deep, your palms get sweaty, and you get thirsty. These are due to hyperactivity of the sympathetic nervous system. On the other hand, the parasympathetic nervous system works when relaxed to encourage you to rest for storing energy. The parasympathetic nervous system also plays an important role in regulating the function of the digestive system, which together makes its function referred to as “rest and digest.”

5) Digestive system

The **digestive system** has four roles: food intake and digestion, nutrient absorption, and excretion of unwanted substances. It is composed of a single gastrointestinal tract, which extends 9 m from the mouth to the anus, and several organs attached to it (Figure 2.9). Specifically, these organs include the **mouth (oral cavity) , pharynx, esophagus, stomach, small intestine, large intestine, and anus** for moving and absorbing food, as well as the **pancreas, liver, and gallbladder**, which are responsible for making digestive enzymes, removing toxins, and storing substances needed for digestion.

Food taken from the mouth is digested by the actions of **digestive enzymes** in the digestive juice secreted into the digestive tract while the food is transferred to the stomach and small intestine. The digestive juice is secreted not only from the cells in the digestive tract such as the stomach and small intestine, but also by the salivary glands, pancreas, and liver.

Digested nutrients, water, and various electrolytes are mainly absorbed from the wall of the small intestine into the cell, then into the blood. Most of the absorbed nutrients are sent to the liver. There, they are synthesized, decomposed and detoxified, and converted into a form that can be used by cells throughout the body. What is not absorbed is subjected to water absorption in the large intestine and then is excreted as stool. Gastrointestinal motility and secretory functions are regulated by autonomic nerves, intestinal plexus, and gastrointestinal hormones secreted into the blood from the gastrointestinal wall.

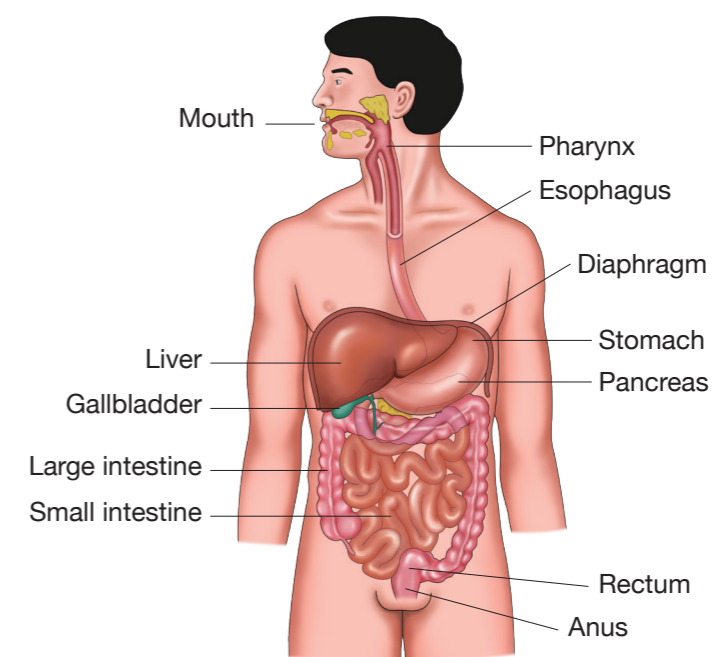


Figure 2.9 Digestive organs

6) Urinary system

As you live, many waste products, excess salts, and non-volatile acids are produced in your bodies as a result of metabolism. The **urinary system** functions to produce urine in the kidneys so as to efficiently remove these substances from the blood and excrete them from the body through the urine. By adjusting the amount and concentration of urine produced, it maintains the amount of circulating blood and its chemical composition.

The urinary system is comprised of the **kidneys** and **urinary tracts (ureters, bladder, urethra)** (Figure 2.10). The kidneys filter and concentrate blood to make urine. The kidneys are located on the left and right sides of the spinal column. Each is about 10 cm in length, 6 cm in width, and 3 cm in thickness. They are slightly larger than the fist, protrudes like a bow on the outside and indents on inside, giving them their bean-shape. By regulating urine production, the kidneys keep fluid volume, osmotic pressure, and pH (acid-base balance) constant, excrete unnecessary metabolites and drugs, and maintain the homeostasis of the fluid environment. The kidneys also have the endocrine function of secreting renin, which is involved in blood pressure regulation, and erythropoietin, which has a hematopoietic effect, as well as activating vitamin D for calcium metabolism.

The bladder is a stretchable sac-like organ that temporarily collects urine. The amount of urine produced per day is about 1.5 L, but the capacity of an adult bladder is 250– 600 mL. You feel a light urinary urge when about 150 mL is collected and a strong one with about 250 mL.

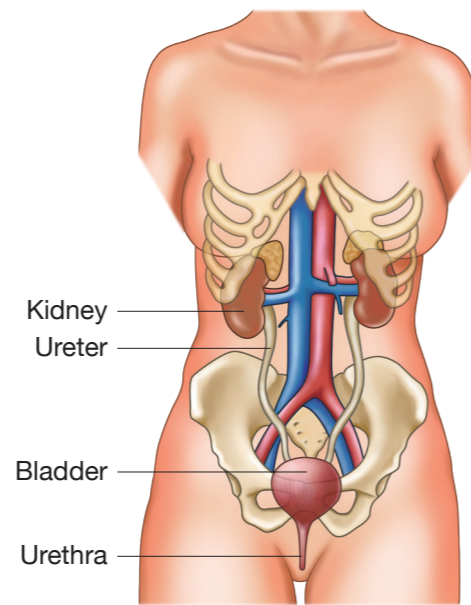


Figure 2.10 Urinary organs

7) Endocrine system

The **endocrine system** consists of **endocrine glands** that are found widely throughout the body (Figure 2.11). It produces chemical substances (transmitters) according to purpose. These substances are collectively called **hormones**. The endocrine system regulates various functions of the body by secreting (releasing) hormones directly into the blood. Hormones work as messengers responding to instructions from the brain, and act on specific organs (**target organs**) in cooperation with the nervous system to control the activities of each part of the body such as metabolism, growth/development, and reproduction. Excessive secretion or deficiency of hormones leads to serious health consequences, with excessive secretion possibly causing hyperfunction, and reduced secretion causing hypofunction.

Major endocrine glands include the **pituitary gland, thyroid gland, pancreas, adrenal glands, and gonads**. For example, **growth hormone**, one of the representative hormones from the pituitary gland,

mainly affects the growth of bones and skeletal muscles, determining the size and height of the body. Growth hormone is secreted during exercise and sleep, that's why they say "children who sleep (and exercise) adequately grow well." Reduced secretion from the pituitary gland during childhood causes short stature. The pancreas secretes **insulin** and **glucagon** into the blood, hormones involved in the regulation of blood sugar levels (glucose levels in the blood). Insulin is the only hormone produced in the body that can lower blood sugar levels. When insulin does not function properly, blood sugar levels spike, leading to the possible onset of diabetes.

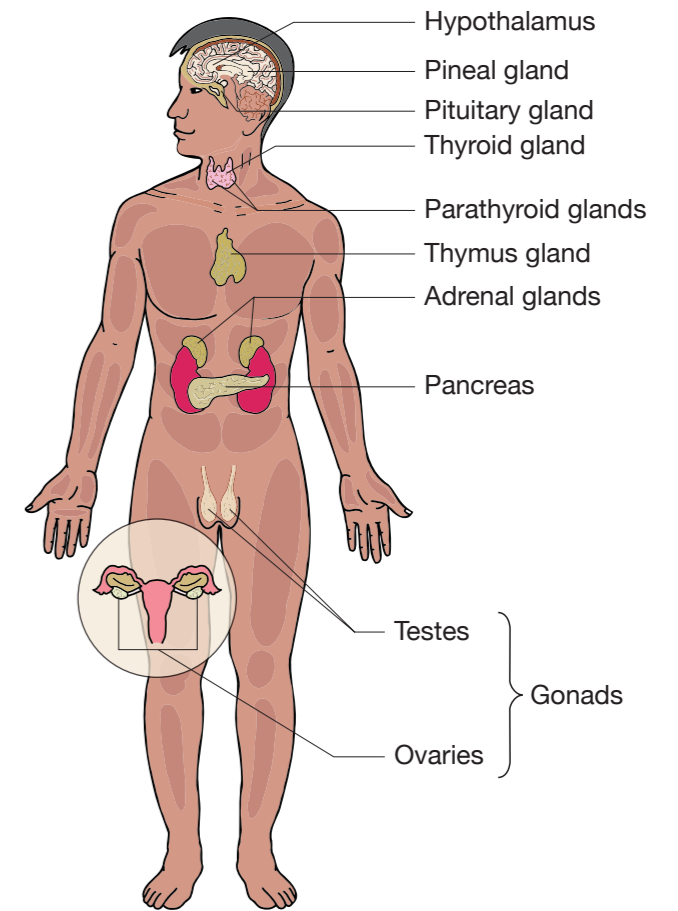


Figure 2.11 Endocrine organs

8) Sensory system⁴

Sensation is awareness and consciousness of sensory information input from the outside or inside of the body. For example, when you say "Ouch!" it means that you have become aware of pain stimulus. For humans to carry out actions and follow their will, they need to carry out a series of actions by swiftly grasping various information from the outside, making judgments based on the information, and working on the surroundings. The sensory system detects internal and external information and conveys that information to the central nervous system.

Receptors are parts of the body that are sensitive to physical and chemical stimuli such as light, sound, body posture and movement direction, temperature, taste, and smell of things. On the other hand, **sensory organs** have a series of structures that transmit these stimuli to the **afferent nerves** (Figure 2.12).

There are **general senses and special senses**. Receptors for the general sense, also called **somatic sense**, can be found all over the body, specifically in the skin, muscles, joints, and internal organs. The general senses include the senses of pain, touch, pressure, temperature, and proprioception (sensory function to feel the relative positional relationship of each part of the body, which forms the body-image). Special senses include vision, hearing, taste, smell, and parallelism. Receptors for these senses are located in specific organs such as eyes, ears and semicircular canals, tongue, nose, and skin.

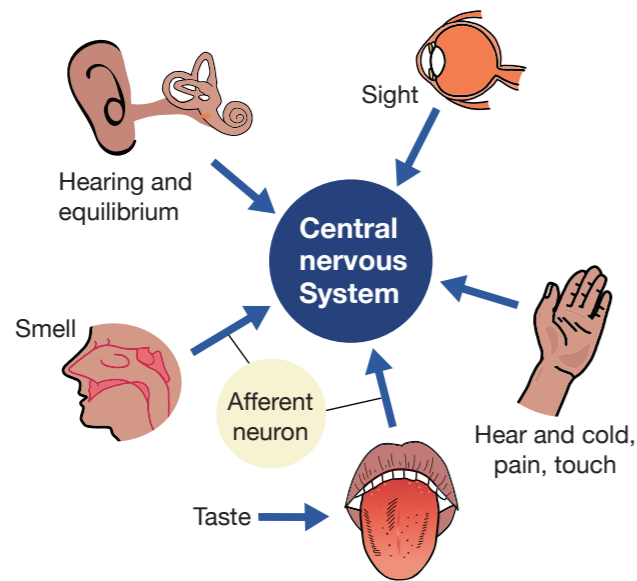


Figure 2.12 Sensory organ system (exchange of signal information)

Column: Why can we see in the dark? (Mechanism allowing to see in the dark)²

In “vision,” which is the mechanism by which you can see things, sensitivity to light constantly changes according to the intensity (brightness) of light so that you can obtain appropriate light and color information. When you suddenly go to a bright place after being in a dark place for some time, you feel it is very bright, but that glare disappears in a relatively short time (**light adaptation**). This is because photoreceptor cells rapidly reduce their photosensitivity, and miosis occurs due to the contraction of the iris sphincter muscle (pupillary light reflex), which also reduces the inflow of light.

On the other hand, if you move from a bright place to a dark place suddenly, at first you will not be able to see anything, after which you will gradually be able to see things (**dark adaptation**). In dark adaptation, mydriasis is caused by the dilator muscle of the pupil. Vitamin A deficiency causes failure to adapt to darkness and this is called “night blindness.” Vision is discussed in detail in Chapter 8.

9) Reproductive system

Reproduction is the act or process by which male and female germ cells, namely **eggs** and **sperms** are fertilized, to create new beings with the genetic information of each cell. The reproductive system has two functions. The first is production, development, and transport of eggs and sperms, and the second is the secretion of hormones. There are two types of reproductive organs, **primary reproductive organs** and **secondary reproductive organs**. The primary reproductive organ, which is the gonad (**ovary** in females and **testes** in males), has two functions: secretion of hormones and production of egg and sperm. During growth, the functions of the reproduction system change significantly, the details of which are discussed in Chapter 11.

(1) Male reproductive system (structure and functions)

The male reproductive organs consist of (1) testes; (2) epididymises, sperm ducts, and ejaculatory ducts (for maturation of sperms, transport path, and ejection); (3) seminal vesicles and prostate (attached gland); and (4) penis and scrotum (extrinsic region) (Figure 2.13). Reproductive functions include (1) sperm formation in the testes, (2) sexual response (various physical and mental changes that occur when sexually stimulated), and (3) regulation of reproductive functions by hormones.

(2) Female reproductive system (structure and functions)

The female reproductive organs consist of (1) ovaries; (2) fallopian tubes, uterus, and vagina (for transportation route); and (3) mons pubis, clitoris, labia majora, labia minora (Figure 2.13). Reproductive functions are (1) conception and preparation for pregnancy, (2) pregnancy, and, similar to male, (3) sexual response, and (4) regulation of reproductive functions by hormones.

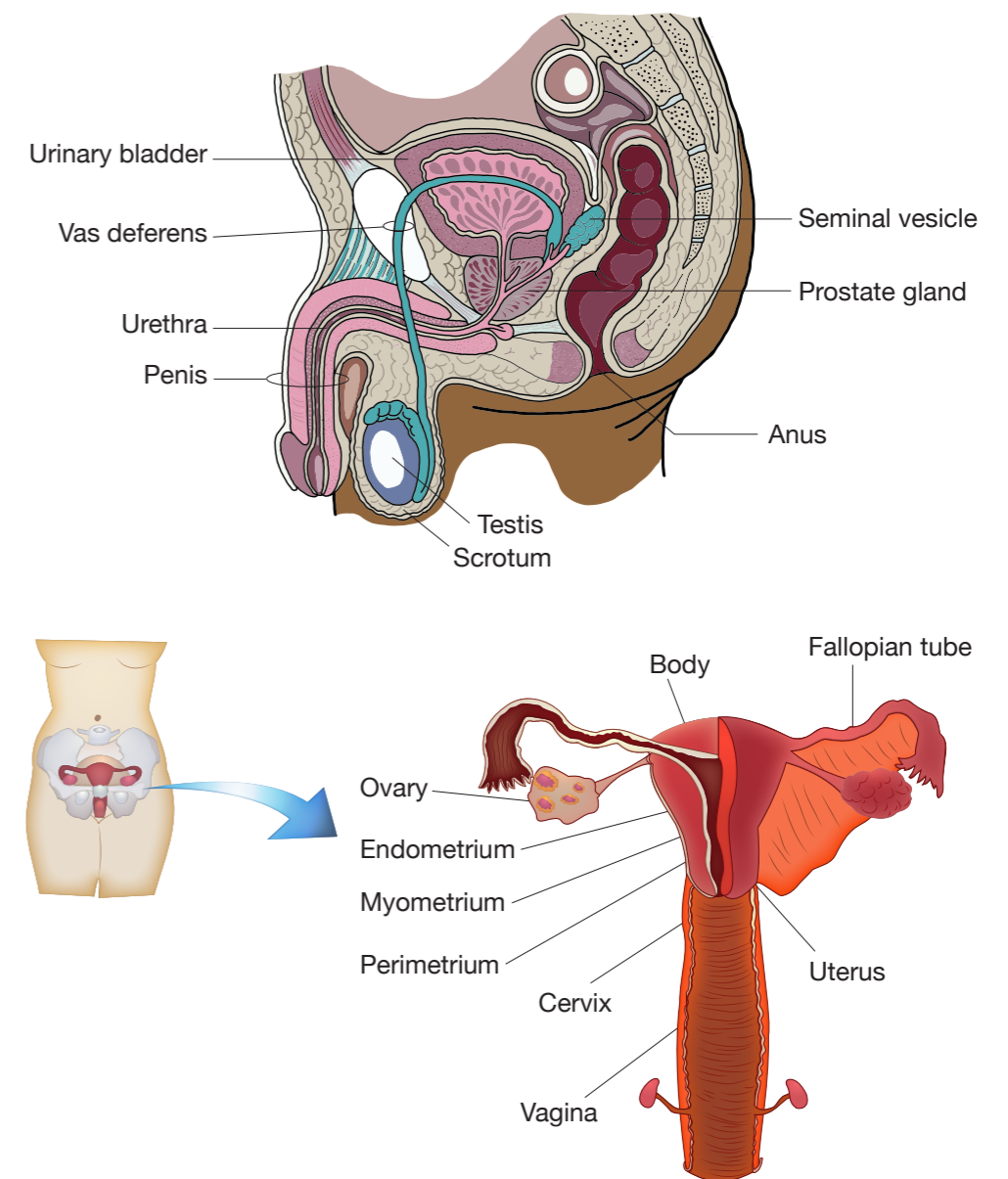


Figure 2.13 Reproductive system (top: male reproductive organs, bottom: female)

10) Immune system⁵

Immunity is a self-defense mechanism in which immune cells in the body prevent the entry of foreign invaders or pathogens, such as bacteria and viruses, and eliminate harmful substances produced in the body. Many types of **immune cells** work together to play the roles of discovering, transmitting information about, and attacking foreign invaders. There are two main types of immune functions that eliminate foreign substances entering the body: **innate (natural) immunity** and **adaptive (acquired) immunity**.

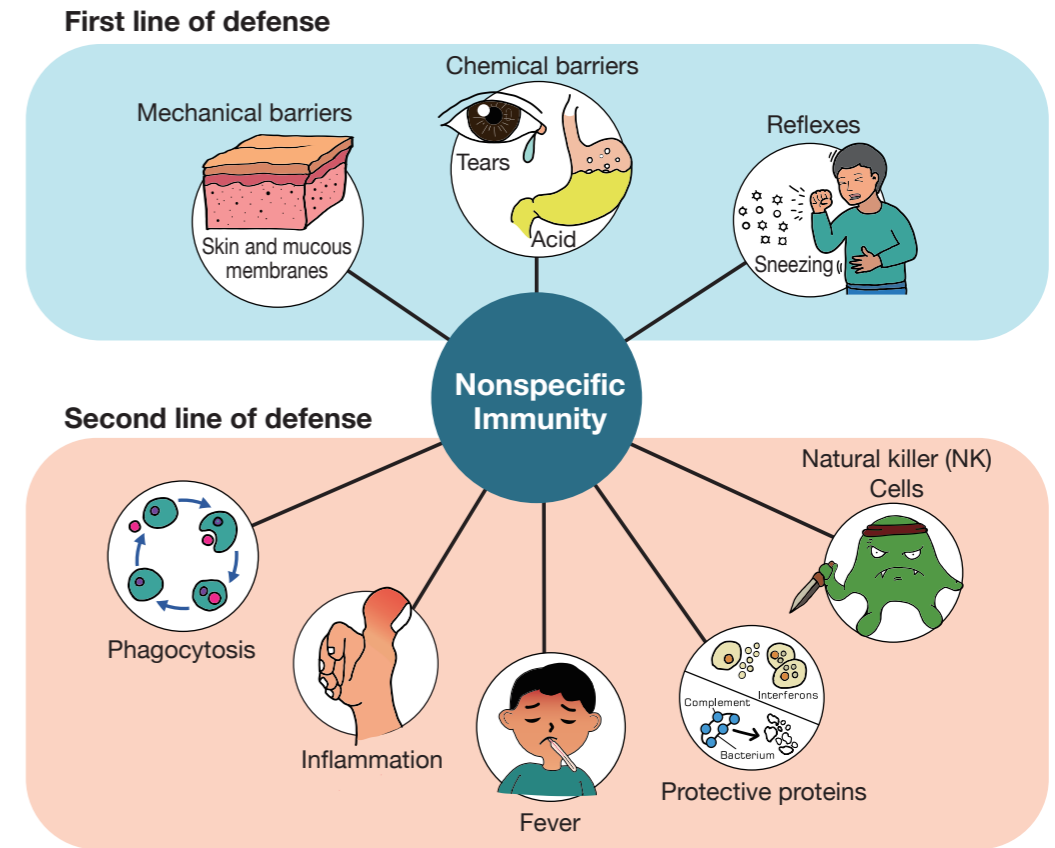
Innate immunity is a mechanism that identifies a wide range of characteristics common to pathogens and acts swiftly. It includes **phagocytosis** (action of taking foreign substances into cells and digesting them) by neutrophils, monocytes, dendritic cells, and macrophages to eliminate foreign substances, inflammatory reactions, and attack by natural killer (NK) cells. On the other hand, adaptive (acquired) immunity works against foreign substances that cannot be eliminated by innate immunity. In this case, lymphocytes act specifically on foreign substances. It can be divided into **humoral immunity**, in which B cells **produce antibodies** from the actions of lymphocytes, and **cellular immunity**, in which killer T cells **directly attack** cancer cells and infected cells (Table 2.2).

The immune system works to identify what is in the body as its “self” or “nonself,” and to eliminate the latter. To do this, the immune system coordinates innate immunity and adaptive (acquired) immunity to deal with disease-causing microorganisms (pathogens). On the other hand, because the immune system may overreact to your “self” and cause diseases (**autoimmune diseases**), there is a system that adjusts the immune system to maintain the immune homeostasis of the living body in a balanced way.

There are many types of organs that contribute to immune cells and immunity (Figure 2.14). For example, almost all immune cells are produced in the bone marrow. Immature T cells produced in the bone marrow gather and mature in the thymus. The thymus, consisting of left and right parts, is located in such a way that it covers the heart. During puberty, the thymus reaches a maximum weight of 30–40 g. After puberty, the thymus begins to atrophy. The details of immunity are discussed in Chapter 7.

Table 2.2 Types and functions of human immunity and defense

| Type | Main functions | Target | |
|---|--|---|------------------------------------|
| (1) Physical/chemical defense | Skin, mucous membranes, saliva, sweat, tears, runny nose, gastric acid | Various foreign substances (Nonspecific) | |
| (2) Innate immunity | Phagocytotic elimination, inflammatory reactions, NK cell attack | | |
| (3) Adaptive immunity (Acquired immunity) | Humoral Immunity | Antibodies produced by B cells react specifically with the antigens to eliminate them | Specific foreign matter (Specific) |
| | Cellular Immunity | Killer T cells and B cells eliminate cancer and infected cells | |



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Figure 2.14 Immunity functions (innate immunity)⁴

3. Mechanisms that support human activities in daily life

Mechanisms maintaining defense functions and regulatory mechanisms for sustaining life and the homeostasis of the human body

1) Homeostasis of internal environment and its regulatory mechanism

What happens to your bodies in your daily lives? Living things have functions that help them stay balanced and maintain a similar state with their surrounding environment. This is called **homeostasis** (see also Chapter 6). To maintain homeostasis, the mechanism of information transmission in the living body is crucial, and two systems serve this purpose: the **nervous system that transmits information by electrical signals** and the **endocrine system that transmits information via chemical substances**.

2) Thermoregulation

The system that keeps the body temperature constant is very important for the brain and for sustaining life. For example, hyperthermia such as **heat stroke** causes brain dysfunction, and can be life-threatening.

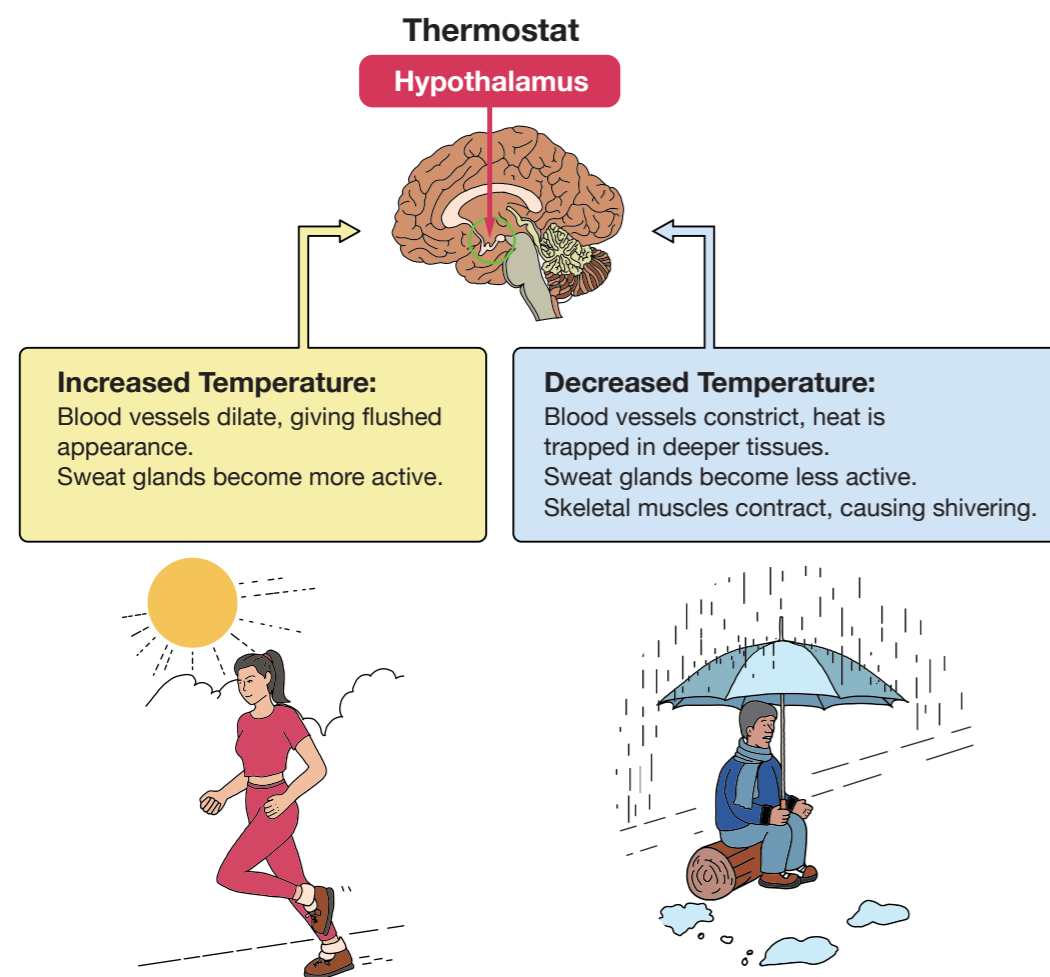
(1) Body heat production and dissipation

Your body temperature differs by location. The temperature at the core of the body is called **core temperature** and cannot be measured directly. For this reason, rectal temperature, oral temperature, and axillary temperature are used. The rectal temperature is the closest to the core temperature. Even if the environmental temperature fluctuates, it remains more or less constant at about 37°C, which is 0.4–0.7°C higher than axillary temperature. The temperature of the skin and muscles is called **outer shell temperature**, and it differs according to the body part and outside temperature.

(2) Thermoregulation mechanism

The **temperature regulatory center** in the hypothalamus (diencephalon) works on cutaneous blood vessels, sweat glands, and arrector pili muscle to regulate temperature. Thermoregulation in humans is controlled by the sensitivity of skin temperature receptors and temperature receptors in the hypothalamus. (Figure 2.15).

When the body temperature rises, the sympathetic nerves work less, the blood vessels passively dilate, and sweating dissipates heat from the skin to regulate the body temperature within the normal range. Meanwhile, when the body temperature decreases, the sympathetic nerves constrict blood vessels.



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Figure 2.15 Mechanism of body temperature regulation ⁴

This reduces the amount of blood flowing to prevent heat dissipation, and inadvertent muscle contraction causes heat production. Exceeding the limit of the thermoregulation range may lead to consciousness disturbance or death.

(3) Diurnal fluctuation (see also Chapter 6)

Body temperature drops to the lowest level during sleep in the early morning, starts rising as you wake up, and sharply rises after breakfast. After that, it continues to rise gradually and peaks in the evening, after which it starts dropping. This change in body temperature in the cycle of one day is called **diurnal fluctuation (circadian rhythm)**. Circadian rhythm is present in many vital activities such as body temperature and blood pressure and affects sleep and dietary patterns. If disturbed, sleep rhythm will be disrupted, for example, resulting in sleep disorders. It is said that a good way to regulate this rhythm normally is to receive sunlight in the morning.

Column: Body temperature rhythm of women during and after puberty ⁶

In women during and after puberty, the body temperature fluctuates due to the effects of hormone secretion according to the menstrual cycle. From menstruation to preovulation, body temperature is low (normal body temperature). After ovulation, the body temperature rises. The difference between the low and high temperature periods is about 0.5°C. This fluctuation is due to the progesterone (secreted from the corpus luteum formed in the ovaries during the secretory period) acting on the hypothalamus in the temperature regulatory center.

Exercises for further thought and research

[2-1] Use information about the body: Challenge the quiz!

- (1) Does the number of times you blink change when using a smartphone?
(i) Increases (ii) Same (iii) Decreases
- (2) How much do you breathe in one day? (In terms of 500 mL plastic bottles)
- (3) How much blood is sent from the heart to the entire body in one minute? Measure your pulse for one minute and make a prediction based on it (see Chapter 15 for how to measure your pulse).

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Answers

[2-1] Use information about the body: Challenge the quiz!

(1) Does the number of times you blink change when using a smartphone?

A. (iii). You blink less when concentrating on something such as when looking at the screen of your smartphone. When you blink less, tears do not spread on the surface of the eyes, causing the eyes to dry. It can also cause “dry eye which leads to subjective symptoms such as dryness and uncomfortable sensation and damage (scratches) on the surface of the eyes.

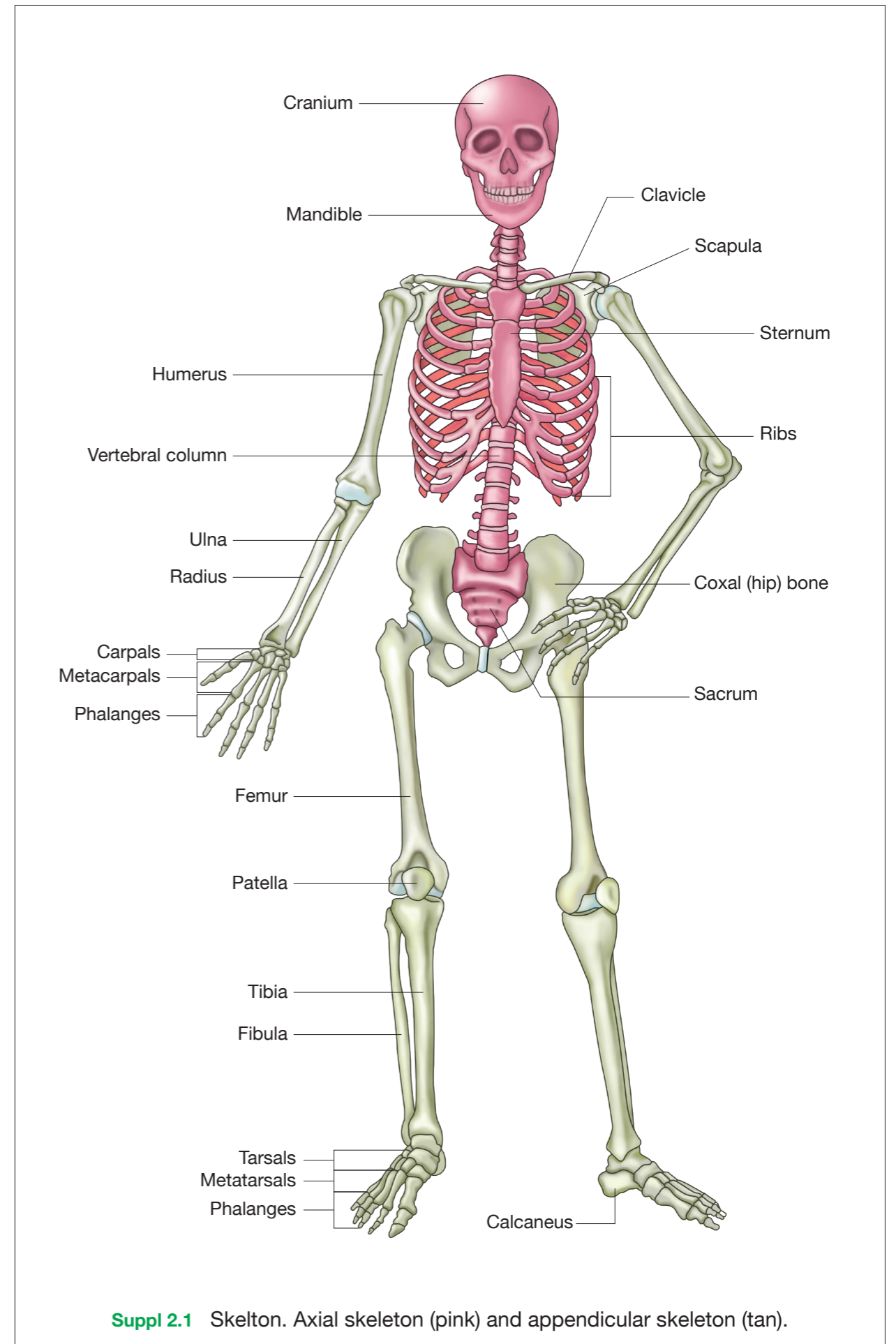
(2) How much do you breathe in one day? (In terms of 500 mL plastic bottles)

A. **About 11,520 L** (taking the amount you breathe each time to be about 0.5 L)

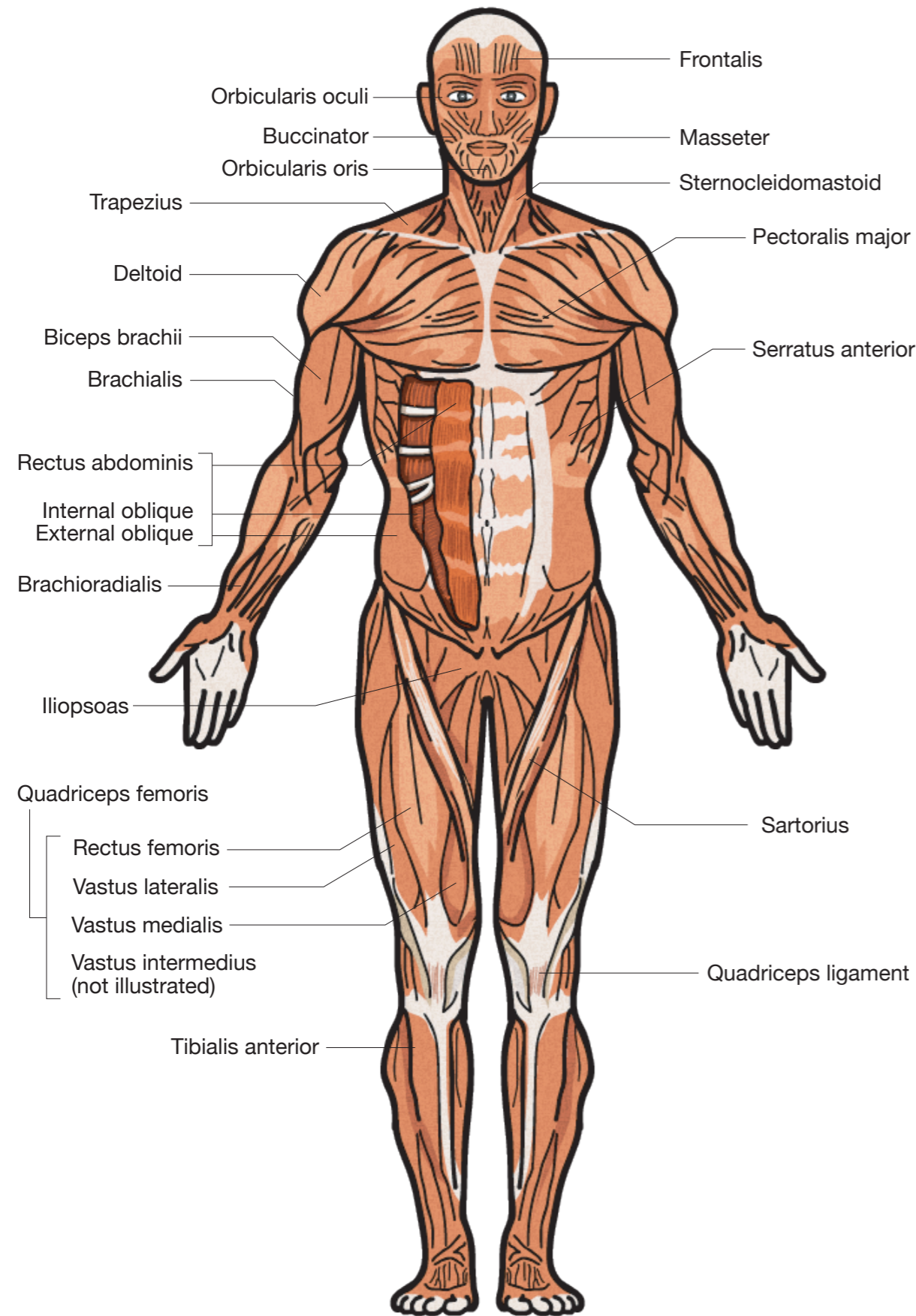
(3) How much blood is sent from the heart to the entire body in one minute?

A. **Approximately 5 L.** For adult, approximately 60–70 mL of blood is pumped out by one contraction of the heart. The heart beats 60–80 times per min. Normally, your heart rate is equal to your pulse rate. For example, $60 \text{ mL} \times 80 \text{ times} = \text{approx. } 5 \text{ L}$ volume of blood is sent to the entire body in 1 min. The volume of blood pumped out per minute varies depending on the individual’s age, body size, gender, health condition, and exercise experience.

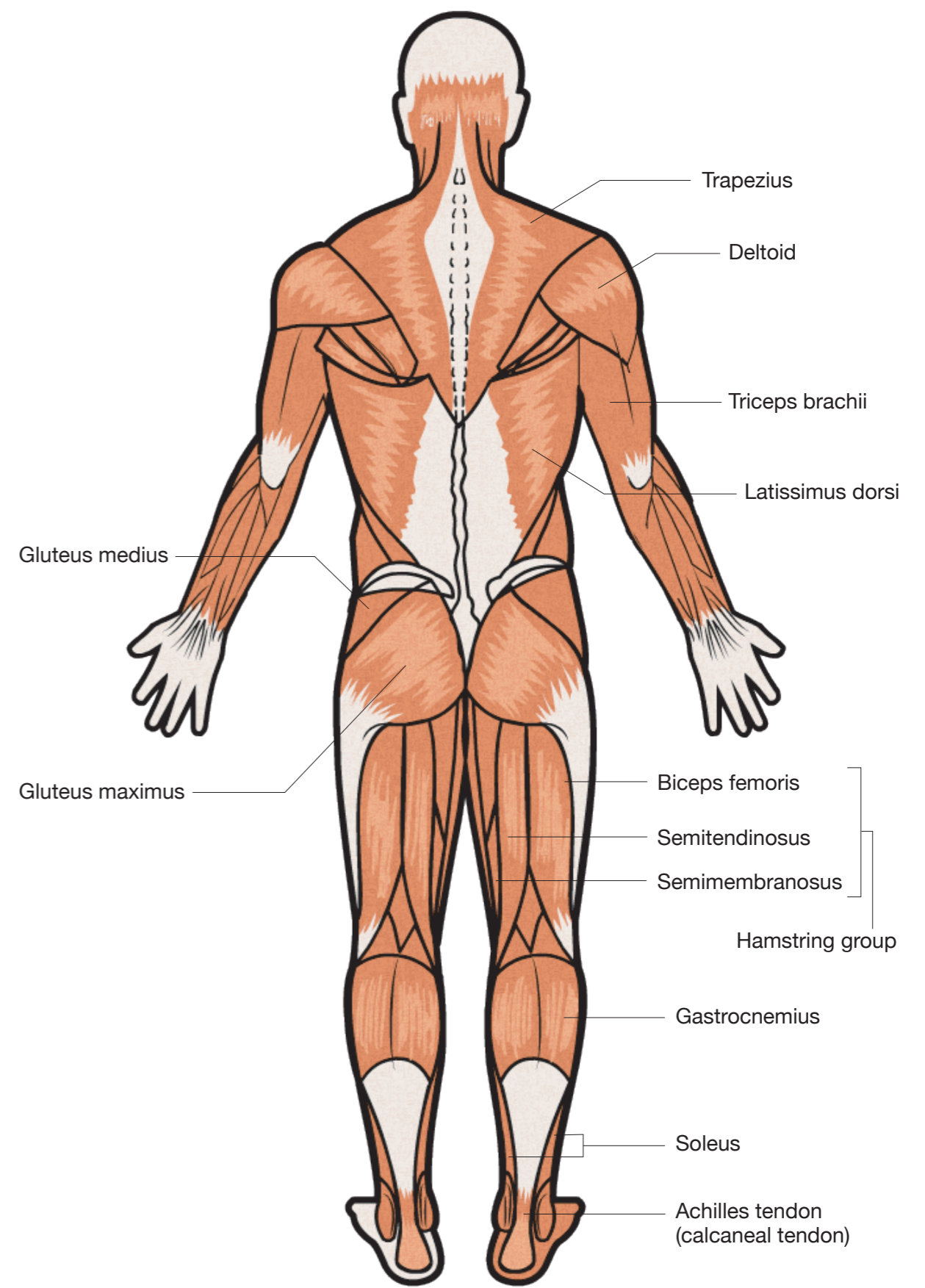
Supplemental materials (Suppl.)



Suppl 2.1 Skelton. Axial skeleton (pink) and appendicular skeleton (tan).



Suppl 2.2 Major muscles of the body. Anterior view.



Suppl 2.3 Major muscles of the body. Posterior view.

Children's growth and development

Learning objectives

You will be able to gain proper understanding and explain:

- The principles of growth and development.
- The characteristics of physical and physiological growth and development from infancy to early adolescence.
- What is necessary for the healthy growth and development of children in light of circumstances in Cambodia.

This chapter defines the concepts of growth and development, then provides an exposition of the common principles of children's growth and development and explains the characteristics of physical and mental growth and development from infancy to early adolescence. Lastly, we describe factors that affect growth and development.

1. Human development

The process of humans maturing from birth to adulthood is expressed in various words including “**growth**,” “**development**,” and “**maturity**.” Growth refers to the maturation process of a living organism increasing in quantity through cell division, in other words **quantitative change in morphology** or body growth. Body height and weight are representative indicators of growth. Development, on the other hand, is a process through which biological structures and functions undergo division and diversification to become more complex. Through this process, latent functions emerge over time. It is a phenomenon of **qualitative change** also influenced by the additional effects of experience, practice, training, education, and environment. In other words, development refers to structural and functional growth centered on mental aspects.¹

Children are still in the process of growth and development. Their minds, bodies, and social relations change daily toward maturity. It is critical for children to have healthy childhoods in order to develop their intellectual, physical, and emotional capacities to their full potential. Children's healthy growth and development not only enrich the child's own personal life but also lead to enrichment of society as a whole. Since children spend much of their time at school, teachers who engage with children have a duty to support children's healthy growth and development. To this end, it is important for teachers to bear the following four points in mind and take **an integrated view of the holistic health of each child**, rather than a fragmented view of children's growth and development.²

- (i) View the child as a whole person. Understand the unique characteristics of each child and take a holistic approach to assessing his or her health.

- (ii) Believe in the innate power to grow that every child is born with. Treat each child as having strong vitality.
- (iii) Understand, believe, and help develop the child's innate abilities. Newborn babies already have various abilities at birth. We need to believe in such abilities and support the fulfillment of their potential.
- (iv) View the child from a life-course perspective to support his or her future. A life-course perspective involves understanding the child's health based on his or her past, present, and future. We also need to bear in mind that the health impacts of childhood conditions may not become apparent until adulthood.

Teachers can instruct children according to their growth and developmental stages by learning about children's growth and development. Teachers can also help to build environments that promote healthy growth and development by removing factors that have adverse effects on growth and development and by instructing children and their families to avoid such factors. Furthermore, by learning the normal patterns of growth and development, teachers can assess whether a child is developing appropriately within normal ranges and help to start addressing problems at an early stage if any abnormalities or problems are suspected.

2. Principles of growth and development

Human growth and development are considered to result from synergy between a biological maturation process regulated by genes and a developmental process influenced by the environment and learning experiences of the individual. **Individual variability** in human growth and development results from differences in the biological maturation process and developmental process influenced by the environment. However, there are common principles of growth and development that apply to most individuals.

1) Most children follow a certain developmental order

Body growth and development of motor functions progress in a certain order.

For example, most children become able to hold their heads up steadily when they are 3-4 months old, roll over from tummy to back when 5-6 months old, sit unsupported when 7-8 months old, start crawling and stand holding furniture when 9-10 months old, and by the time they reach 12 months, some start to walk alone. Although there is a wide variation as to when a child reaches a certain stage of motor function development, they mostly follow a certain order of development (**Figure 3.1**).

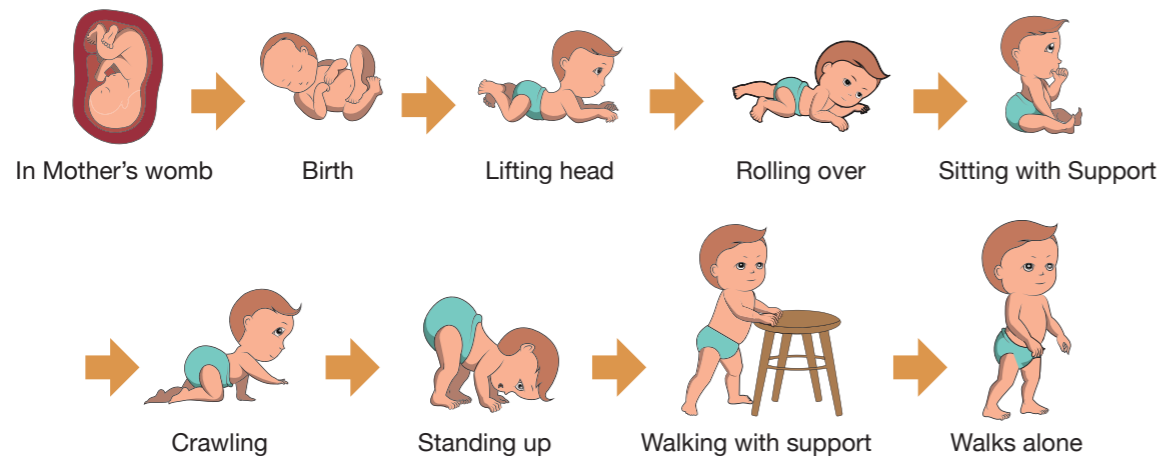


Figure 3.1 Stages of growth and development in babies

2) A certain direction is observed in growth and development^{3,4}

Body growth and development of motor functions progress in a certain direction. For example, motor skills develop from holding the head erect, rolling over, sitting up without support, then standing up alone. As seen in this order, body functions develop in the direction from head to tail (**cephalocaudal direction**), and from the center or middle to peripheral portions of the body (**proximodistal direction**). When we look at the process of how children become able to grasp an object, they first touch things, then start grasping things using their fingers and palms (palmar grasp), and finally become able to grasp or pick things up with their fingers (pincer grasp) (**simple to complex, general to specific**). As seen here, body functions develop in the direction from gross to fine motor functions (Figure 3.2).

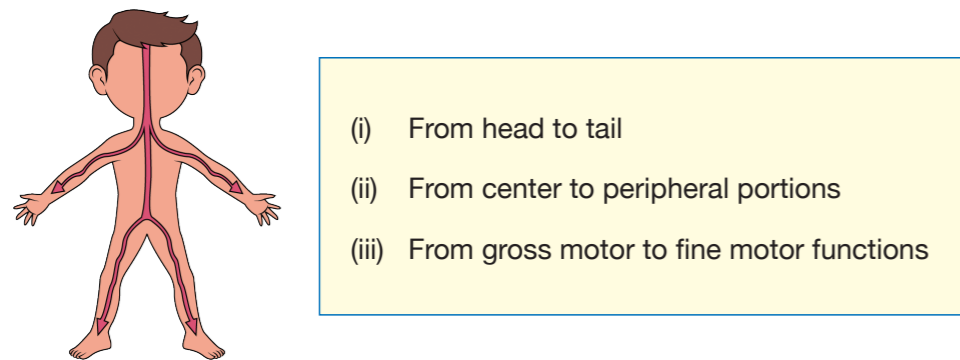


Figure 3.2 Directions of body growth and development

3) Continuity of growth and development and difference in growth velocity by organ and tissue

As seen in **Scammon's growth curves** (Scammon, 1930), which show the growth of various tissue types over time, while there are ups and downs in the curves, growth and development of organs and tissues continue uninterruptedly until they reach the size of the adult level represented by 100% (**continuous**

process). The growth velocity, however, differs by age, sex, and function of the tissue (**genetic factors**). For example, body height increases from infancy to adolescence. Furthermore, the period when body height increases rapidly differs between boy and girls. Neural tissue develops rapidly during infancy and early childhood, while lymphoid tissue develops throughout middle and late childhood. Note, however, that Scammon's growth curve only gives an image of growth and development after birth and that the size and functions of each organ and tissue are not zero at the time of birth. Let's work on "Exercise [3-3]" here.

4) There are critical periods and sensitive periods in a child's growth and development⁵

In the biological process of growth and development, there are critically important periods for the development of certain physical and mental skills and acquisition of new patterns of behavior. If a child does not receive the appropriate environmental stimulus or experience to acquire a given skill during that period, it becomes difficult for the child to develop the associated functions or behavior later in life. This period is called **the critical period**. In the case of sensory and motor development, for example, the environment and experiences during infancy have a large impact on the development of binocular vision (the ability to see things using both eyes) and hearing acuity. The critical period for the ability to acquire language is said to be up to 12 or 13 years of age, meaning that if a child grows up in an environment where he or she cannot receive proper language input during early childhood, it becomes very difficult for the child to acquire language proficiency after reaching adolescence.

A sensitive period is when the child is most sensitive to certain environmental stimuli effective for acquiring a new pattern of behavior, which means that the period is most suitable for acquiring that behavior or skill. For example, Dr. Maria Montessori (described by the American Montessori Association as "an Italian physician, educator, and innovator, acclaimed for her educational method that builds on the way children learn naturally") advocated that the sensitive period for acquiring cognitive skills and social aspects of life is from infancy to early childhood.^{6,7}

Although the path of individual growth and development is not completely determined biologically, we are not endowed with unlimited plasticity while we grow up. In fact, human growth and development is an intermediate of both, determined through the influence of both biological characteristics and growth environment.

5) Individual variability of growth becomes significant with age

The biological variability of newborn babies is rather small, but as babies grow older, individual variability becomes larger through the influence of genetic factors and the growth environment (**individual difference**).

3. Growth and developmental periods by age

Human growth and development periods can be roughly divided according to age groups: newborn (up to 4 weeks from birth); infant (until the age of 1); early childhood (until entering primary school) divided into toddler (1-3 years) and preschool (3-6 years); middle childhood (during enrollment in primary school; school age, 6-12 years); and adolescent or late childhood (from secondary school to adulthood, or until height growth ceases; approximately 12-18 years) (Figure 3.3). Here, we will investigate the details of physical growth, motor and cognitive development, and emotional and social development during the early and middle childhood periods (Table 3.1).

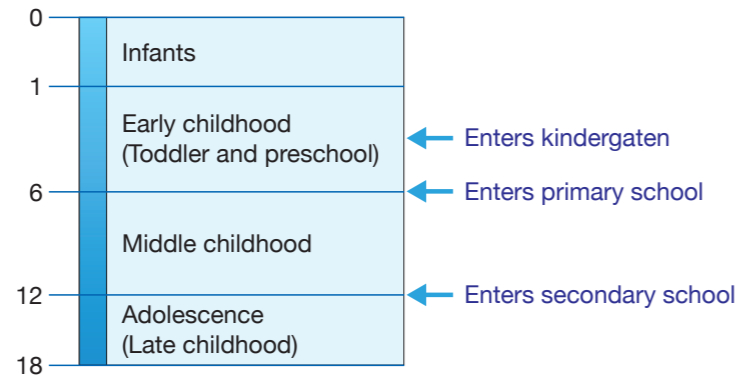


Figure 3.3 Children's growth and development periods by age

1) Growth and development during early childhood

(1) Physical growth

Body height and weight steadily increase during these periods. By the time a child reaches the age of five, body height and weight will increase 2.2-fold and 6-fold respectively from the time of birth. Body shape becomes more slender, approaching the shape of an adult, and the head-to-body ratio reaches around 1:6 at the age of six. A child's permanent teeth start to grow from around this time, with some individual variability.

(2) Motor development

Gross motor skills development: a child typically starts walking around 12 months after birth, becomes able to walk steadily by 18 months, and by the age of three, can jump and kick a ball. At ages five to six, most children become able to make complex and coordinated movements using hands and feet like standing on one foot, skipping on both feet, and jumping rope.

Fine motor skills development: a child from 12 to 18 months old has typically mastered basic skills like reaching out for an object, grabbing, and letting go. As children grow older, they become capable of coordinated motions using tools with both hands. At ages three to four, they become able to use scissors or button and unbutton clothes, which require different movements between the two hands, but still in an awkward manner. From around age four, children start showing a tendency to consistently use their dominant hands. By the ages of five to six, they become capable of skillfully moving finger joints,

meaning that they can learn to write letters by moving a pen with the tip of their thumb, index finger, and middle finger. They will also become able to hold a paper cup without crushing it by applying the right amount of force as appropriate to the object.

(3) Cognitive development

Children at the ages of two to three start developing abstract thinking skills, the ability to form an image of something through perceptual experiences, and imagine things that are not being directly experienced. When they reach the ages of four to six, they become capable of sorting and associating objects. They also understand left and right with reference to their own body. When drawing a picture of a person, they start drawing hands and feet, though not in sufficient detail.

Dramatic language development can be seen during the toddler period. After 18 months to two years from birth, children start joining two words in a sentence and their vocabulary rapidly expands. It is said that by the age of two children typically have a vocabulary of more than 300 words. At the ages of four to six (i.e., preschool age), they understand that a "cat" is an "animal" and "banana" is "food." This means that they understand the definition of those words and can categorize words that represent a concrete object into a category of abstract meaning.

(4) Emotional and social development

Emotional and social development during the early childhood period is closely associated with human relations, basic lifestyle habits, and play that the child experiences. Children start developing self-consciousness and show their desires. For example, children two to three years old play individually, doing their own things, even when there are other people around, but as they grow older, they gradually learn to engage in the same play and interact with others. By the time they reach five to six years of age, they can share common goals and rules while playing. They develop the ability to understand other people's feelings from around age four and become capable of thinking from another person's point of view.

2) Growth and development during the middle childhood period

(1) Physical growth and development

Physical growth and development are steady and gradual during the earlier half of the middle childhood period. Once children enter the latter half, however, genital functions develop rapidly with some individual variability. Development of genitalia begins earlier in girls than in boys. Girls start to develop breasts and pubic hair.

(2) Motor development

Children develop muscles and acquire basic motor skills over the middle childhood period. They become able to jump, throw, and perform other motions much more skillfully than during the early childhood period. They learn how to combine basic motions using hands and feet, and attain temporal and spatial movement skills.

(3) Cognitive development

In the cognitive aspect, children start thinking logically about specific things. By ages nine to ten, they become able to recognize equal amounts of a substance even if it is placed in different containers. This indicates that they have acquired the concept of “preservation” and are ready to understand such concepts as numbers, weight, volume, and time. From ages eleven to twelve, children start to think systematically and infer a conclusion based on a hypothesis.

The main form of communication for children is speech during the early childhood period, but as they grow up and attend school, they acquire other forms of communication: writing and reading. During the earlier half of the middle childhood period, children tend to write only short sentences, but will eventually learn to write longer sentences using conjunctions in the latter half of this period.

(4) Emotional and social development

The middle childhood period is a time when children develop social emotions such as sense of self and empathy within the social framework of school. Self-consciousness can be observed from the early childhood period, but children start to recognize and sense themselves as beings (i.e., experience their own existence) through social interrelations with their peers when they enter the middle childhood period. They develop feelings of capability as well as inferiority through comparison with others, and gradually establish their feelings of self-esteem. Peer-to-peer relationships also undergo change in the later part of the middle childhood period. The peer group with which a child engages grows larger.

Children form groups based on a sense of unity fostered by playing together and sharing the same experience. This period is called the “gang age” and peer groups take on a social significance. These gangs or peer groups are prominently characteristic of boys.

4. Factors that influence children’s growth and development

Historically, children’s health was defined in the same way as adult health and was hardly given special consideration. However, it has recently been recognized that a developmental perspective needs to be incorporated into the concept of children’s health. It is becoming increasingly clear that children’s health is determined through the interaction of many factors different from those of adults. Against this background, the Committee on Evaluation of Children’s Health (National Research Council and Institute of Medicine, US) issued a report that proposes to define the concept of children’s health as follows to include growth and development and sheds light on the factors that influence developmental health.⁸

“Children’s health is the extent to which individual children or groups of children are able or enabled to (a) develop and realize their potential, (b) satisfy their needs, and (c) develop the capacities that allow them to interact successfully with their biological, physical, and social environments.”⁸

Table 3.1 Summary of development indicators during the early and middle childhood periods

| Dimension of Development | Infancy and early childhood period | | | | | Middle childhood period | |
|-----------------------------|--|--------------------------------|-------------------------------------|----------------------------------|--------------------|---|---|
| | 0 - 1 | 1 - 2 | 2 - 3 | 3 - 4 | 4 - 5 | 5 - 6 | 6 - 7 |
| Age | 0 - 1 | 1 - 2 | 2 - 3 | 3 - 4 | 4 - 5 | 5 - 6 | 6 - 7 |
| Body height | 1.5 times birth height | | | Twice birth height | | | |
| Body weight | 3 times birth weight | 4 times birth weight | | 5 times birth weight | | | |
| Gross motor skills | Stands holding furniture | Walks | Runs | | | | |
| | Drops a ball and follows it with eyes | Throws a ball toward a target | Kicks a ball | Skips on one foot | Skips on both feet | Catches a ball with hands | |
| Fine motor skills | | Draws and copies lines | Draws a circle | Draws a square | Draws a triangle | | |
| | | Builds a tower with blocks | | Uses scissors | | | |
| Language skills | Produces first intelligible words | Expands vocabulary | Asks questions using interrogatives | | | Capable of holding a conversation | Reads, writes, and acquires basic academic skills |
| Emotional and social skills | Understands and obeys prohibition | Plays alone apart from parents | Plays with friends | Plays in groups of three or more | | Rational and theoretical thinking | Can make inferences in the mind |
| | Repeats the same behavior when praised | Imitates phone conversation | Likes to care for younger children | Asks for permission | | Can move from concrete to abstract thinking | |

Table 3.2 Organization of Influences on Children’s Health

| |
|---|
| Children’s biology |
| Children’s behavior |
| Physical environment |
| Prenatal exposures |
| Childhood exposures |
| Home, school, and work settings |
| Child injury and the provision of safe environments |
| The built environment |
| Social environment |
| Family |
| Community |
| Culture |
| Discrimination |
| Services |
| Policy |

Cited from “Committee on Evaluation of Children’s Health. Children’s health, the nation’s wealth: Assessing and improving child health.”⁹

According to the report, there are biological, behavioral and (physical and social) environmental factors that affect a child’s developmental health (Table 3.2). From this report, we can understand a comprehensive list of factors that affect children’s health. **Biological influences** include genetic expressions, prenatal influences, and perinatal and postnatal events. **Behavioral influences** include the child’s emotions, beliefs, attitudes, behaviors, and cognitive abilities. **Environmental influences** are wide-ranging and include influences from the biological environment (e.g., infectious agents such as malaria and intestinal helminths in Cambodia) and physical environment (e.g., water pollution and exposure to metals and pesticides in Cambodia) and social factors such as loving interactions with caregivers (e.g., domestic violence, abuse, and maternal mental health in Cambodia), socioeconomic resources in the family and community (e.g., income and job opportunities in Cambodia), and peer relationships and the availability and quality of services (e.g., health services in Cambodia).⁹

In a survey of factors affecting early childhood growth and development based on the current situation in Bhutan, the following five main factors have been identified as contributing to growth and development in early childhood: nutrition, environment, parent’s behaviors, parenting, and social and cultural practices.¹⁰ Table 3.3 shows risk factors for growth and developmental delay in developing countries, listing influence of both community or ecological factors and individual factors on preschool children.¹¹

The issue of healthy growth and development in children is a focus of interest in Cambodia, too. The health status of children in Cambodia largely improved in the period from 2000 to 2010: infant mortality (deaths per 1,000 live births) dropped from 95 to 45 and under-five mortality (deaths per 1,000 live births) from 124 to 54.¹² On the other hand, consistent with the risk factors noted in Table 3.3 and the Bhutan study, there are still challenges to be resolved, such as improvement of nutritional status, hygiene

conditions such as water sources and toilet facilities, violence against children and child labor, and socio-economic disparity between urban and rural households. Therefore, in order to promote the healthy development and growth of Cambodian children, it is necessary to clarify the risk factors and factors promoting development and growth by targeting a wider age range of children and to address such challenges as school health initiatives under the national policy.

Table 3.3 Examples of community or ecological risk factors and individual risk factors among preschool children in developing countries

| Community or ecological risk | Individual |
|--|---|
| Poor sanitation | Repeated infections |
| Famine | Under-nutrition |
| Endemic violence | Abuse and neglect |
| Lack of accessible services: preschools, schools, libraries, health services | Very low family income |
| Lack of commitment to child development | Low birthweight |
| | Low maternal education |
| | Large family size |
| | Short intervals between births |
| | Low levels of developmentally enhancing parenting practices |

Cited from “A brief review of risk-factors for growth and developmental delay among preschool children in developing countries”¹¹

In light of this situation, the Cambodian Government developed the five-year National Action Plan on Early Childhood Care and Development, 2014-2018, which aims, as a priority, to increase school enrollment rates and enhance protection of all young children under six years of age, especially children from poor families and indigenous minority groups and children with disabilities, who were most marginalized from early learning opportunities. Through this action plan, the Cambodian Government commits to extending support and improving the quality of early childhood care and development throughout the nation.¹³

Exercises for further thought and research

- [3-1] Think of a child you are familiar with (a younger brother or sister, a child in the neighborhood, etc.) and check the child’s growth and development status according to the dimensions of development in Table 3.1.
- [3-2] Consider the potential benefits and significance for a school teacher of learning about children’s growth and development processes.
- [3-3] Check the patterns of Scammon’s growth curves on the Internet and their characteristics. Next, think about why these pattern differences occur.

Cleanliness, hygiene and health

[3-4] Consider events and phenomena that are, or are likely to be, a threat to the growth and development of children in Cambodia.

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Learning objectives

You will be able to gain proper understanding and explain:

- The principles of cleanliness and hygiene.
- With examples, diseases and conditions that arise from unsanitary and unhygienic behavior.
- With examples, good hygiene behavior and behavior to keep our bodies clean.
- With concrete examples, unhygienic environments (home, school, town/community).
- With multiple examples, diseases and conditions that arise from unhygienic environments.
- With examples, what can be done to improve unhygienic environments.
- Ideas on how unhygienic and unclean behaviors can be changed.

In this chapter, we learn about cleanliness and hygiene in relation to children, homes, schools, and communities. The specific learning topics are hand washing, bathing, clean water, hygienic food preparation, cleaning, waste separation, and water and sewage systems.

1. Personal and environmental cleanliness and hygiene (home, school, town/community)

1) Personal cleanliness and hygiene

To lead healthy lives, we need to keep our own bodies **clean and hygienic**. “Cleanliness” refers to the state or habit of keeping yourself and your surroundings free from dirt. “Hygiene” means the practice of preventing illness or the spread of disease by keeping yourself and your home, workplace, and community environments clean. Key behaviors in maintaining cleanliness and hygiene are washing your hands, brushing your teeth, and bathing.

First, to prevent infectious diseases, it is important that your hands are clean (not dirty) and hygienic (no cause for disease to take effect). Hands need to be washed with water and well-lathered soap to remove dirt attached to the surface of the hands (cleanliness), while also removing the viruses and bacteria that are the cause of disease (**hygiene**), blocking this infection route. As explained in detail in Chapter 7, the three main factors in the transmission of infectious diseases are **pathogens** (for example, bacteria and viruses that cause disease), **transmission routes** (the routes whereby bacteria and viruses are communicated), and **hosts** (people’s resistance and immunity to bacteria and viruses). Transmission routes include **direct contact, droplets, and airborne transmission**. To prevent direct contact transmission in particular, it is important to maintain cleanliness and hygiene by washing your hands, sterilizing your fingers, and sterilizing surfaces that are touched by multiple people.

Next, cleanliness and hygiene are also the foundation for preventing tooth disease and keeping teeth healthy. If teeth are not brushed correctly, food particles are not completely removed, and the particles attach to the tooth surface. Bacteria then flourish, forming a sticky white substance called **plaque**. Plaque can grow within approximately eight hours of your last meal. Many bacteria live in the plaque adhering to your teeth, with *mutans streptococci* ('cavity bacteria') and lactobacilli converting the sugar from food particles into acid that begins to dissolve the teeth. To prevent tooth disease and keep teeth healthy, it is therefore vital to keep teeth clean so that food particles don't remain on the teeth, and to **maintain oral hygiene** by removing the clumps of bacteria and bacterial metabolites that make up plaque. This means, firstly, brushing your teeth correctly every day. Brushing using a fluoride toothpaste and using dental floss or an interdental brush for interdental care are also effective methods. Fluorides encourage tooth recalcification, repairing the tooth damage caused by decalcification and restoring the teeth to health. Fluorides also inhibit the production of acid by plaque (see Chapter 8 for details).

Cleanliness and hygiene are also fundamental in preventing infectious diseases and dermatitis (skin disease) (Figure 4.1, Figure 4.2). After you have washed dirt from your body in a shower or tub using cold or hot water and soap and then dried yourself, your skin needs to be moisturized. Brushing and washing your hair and trimming your nails so that your skin is not scratched also help to maintain personal **cleanliness**. Washing dirty clothing and towels prevents diseases and the bad odors caused by the reproduction of the bacteria and mold feeding off sebum and protein in the stratum corneum (**hygiene**).

A survey¹ on the cleaning practices and hygiene behaviors of Cambodian children aged 13–17 found that most brush their teeth at least once a day and are in the habit of washing their hands before meals



Figure 4.1 Practicing personal cleanliness and hygiene

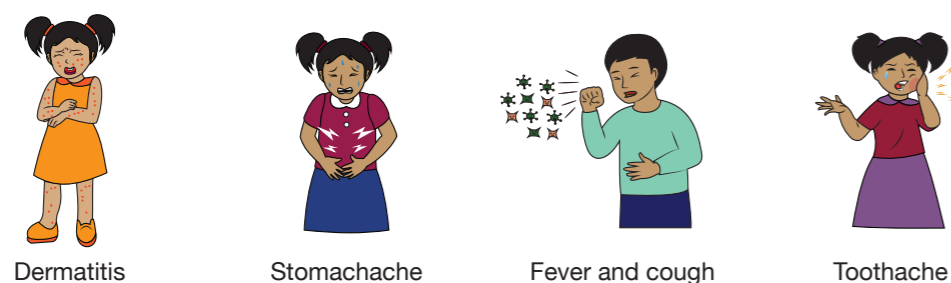


Figure 4.2 Disease caused by unhygienic behaviors

and after using the toilet. On the other hand, around 20 percent of children had taken time off school in the last 12 months because of toothache, which shows that cavities and periodontal disease prevention through correct brushing is clearly an issue in school health care.

2) Home cleanliness and hygiene

A clean and hygienic home environment is closely related to your health. For example, **cleaning** your house and separating your household waste properly prevents **vector insects** and environmental pollution. Make sure that you use the right disposal methods for waste and recycling resources. Organic waste (food scraps) should be placed in a polythene bag for disposal, or, if you are burying it, covered with a good layer of soil. Glass bottles, cans, and plastic bottles should be put out for recycling.

Column: Vector insects — Insects causing direct harm to people, including lice, mites, cockroaches, and flies

Ensuring clean water with no pathogens helps to prevent food poisoning and the intestinal infectious diseases which are so common in Cambodia. Dirty water contains pathogenic microbes such as pathogenic *Escherichia coli* (*E. coli*), *Salmonella enterica*, *Staphylococcus aureus*, viruses, and *Entamoeba histolytica* that cause infectious gastroenteritis. For drinking water, buy mineral water or, if none is available, drink boiled tap water. In the countryside, when using water from wells, rivers, lakes, and springs, remove any dust and dirt first by straining the water through clothing, a handkerchief, or a towel and then boil the water to kill bacteria and viruses, which cannot be simply strained out. The boiling time must be at least five minutes.

You can prevent food poisoning by acquiring fresh food ingredients, storing them appropriately, preparing them hygienically, and storing food appropriately after cooking. In particular, raw fish and meat that have been purchased at the market should be cooked immediately or, if you have a refrigerator, stored in the refrigerator. If you don't have a refrigerator, use all the fish or meat at once. If there are **best-before** or **use-by dates** on food packaging, make sure you consume that food completely before the given date.

Column: Drinking water in Cambodia

The World Health Organization (WHO) defines drinking water as including all water used in daily life, breaking this up into three levels. '**Improved drinking water sources**' comprise 'pipied water on the premises' (from a household well, for example), while '**other improved drinking water sources**' comprise public wells and rainwater tanks, etc. All of these have lids to prevent contamination by fecal matter and are relatively hygienic, but they can still be contaminated with bacteria, so care is needed. '**Unimproved drinking water sources**' comprise sources that are not protected from the external environment and could be contaminated by fecal matter, etc. (https://www.who.int/water_sanitation_health/monitoring/water.pdf).

According to a study on the drinking water used by Cambodian children aged six to 36 months, more than 90 percent of city children use relatively hygienic water, including 34.8 percent who use bottled water and 58.1 percent who use piped water on the premises. In rural areas, however, the total was only around 30 percent, including 23.6 percent who use bottled water and 7.9 percent who use piped water on the premises. Around 40 percent of rural drinking water comes from unimproved drinking water sources, making securing safe and hygienic drinking water a key challenge in health protection (Poirot et al, "Water quality for young children in Cambodia: High contamination at collection and consumption level," *Maternal and Child Nutrition*, 2019; e12744. doi.org/10.1111/mcn.12744).

Column: Best-before and use-by dates

The food that you buy in stores only tastes good and can be consumed safely for a certain length of time. Food packaging and containers are usually marked with a best-before or use-by date. The **best-before date** is the date up to which, if the packaging or container around the food remains unopened, the food will taste good and have lost none of its quality. The **use-by date** is the date up to which, if the packaging or container around the food remains unopened, the food may have lost some of its quality and not taste as good but is still safe to eat. Food stored at high temperatures and humid conditions tends to spoil more quickly than the indicated date. Once the packaging or container has been opened, the product should be consumed as quickly as possible regardless of the date.

3) School hygiene

Because many people gather at schools, they can become places for disease transmission. Schools also need to provide a good learning environment to promote children's growth and development. Care therefore needs to be taken to ensure a clean and hygienic school environment. First, toilets must be used for all urination and defecation, and children must be taught to wash their hands with well-lathered soap after using the toilet (Figure 4.3). Classrooms must be kept clean and food debris and waste placed in waste bins, not left lying around.

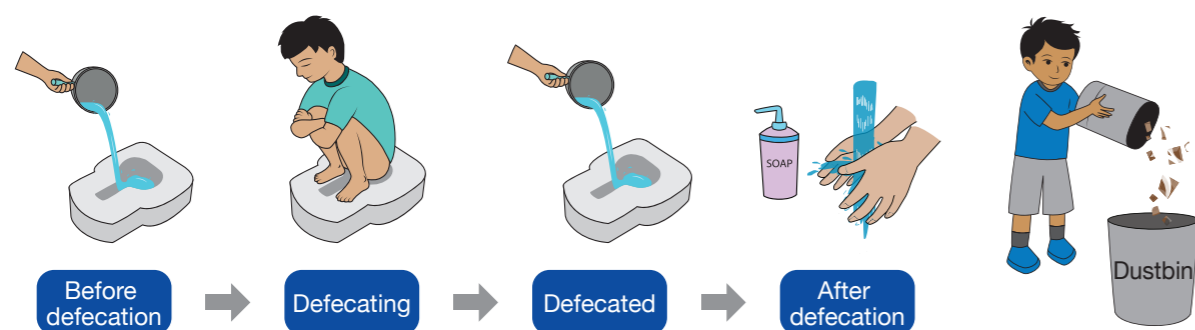


Figure 4.3 Hygienic behavior at school (left: how to use the toilet, right: placing waste in waste bins)

It is also important to make the classroom a good learning environment. Not only do classrooms need to be clean and free of waste but care also needs to be taken with the air quality (temperature, humidity, dust), brightness (natural light and artificial light), and noise levels (Figure 4.4). Natural and artificial light should be used to ensure that classroom brightness is right for learning, and the air in the classroom should be kept at a normal level by bringing in fresh air from outside and expelling stale air.



Figure 4.4 How to keep classrooms healthy and hygienic

Table 4.1 Examples of necessary conditions for the school environment in Cambodia

| Category | Requirement | Example |
|-------------------------|---|--|
| Drinking Water | • All students have safe drinking water in schools. | All students have safe drinking water at least 500 ml per shift by bringing from home or from other sources. |
| Latrines and Urinals | • All students can use functional and clean latrines in both shifts. | The school has 1 latrine for boys and 1 latrine for girls. |
| Hand Washing Facilities | • All students can use hand-washing facilities with water and soap. | A basic hand washing facility is next to each latrine or/and classroom. |
| Environment and Safety | • All students participate in daily cleaning of school premises, classrooms, latrines and hand-washing facilities. • No waste in school premises and classrooms. | School has at least one waste bin per classroom and latrine, and they are used. |

Created from *Minimum Requirement Guidelines on Water, Sanitation and Hygiene in Schools* (2016)⁴

Cambodia has set the target of having hygiene facilities installed in all schools to create a healthy and safe learning environment and enable children to practice desirable health behavior.^{2,3} In 2016, the School Health Department created the **Minimum Requirement Guidelines on Water, Sanitation and Hygiene in Schools** (WinS) that stipulate necessary school conditions in relation to (a) drinking water, (b) toilets, (c) hand washing facilities, and (d) environment and safety (Table 4.1), as well as mechanisms for the improvement of hygiene facilities and for health and hygiene activities.⁴

In 2019, the School Health Policy was upgraded into a **National Policy on School Health**,⁵ of which one of the strategies is to “strengthen the concepts of cleanliness, safety and good hygiene practice regularly in the workplace and in educational institutions.” In other words, in addition to creating mechanisms for health and hygiene activities and improving hygiene facilities, Cambodia has now reached a stage whose aim is to introduce clear standards for cleanliness, safety, and hygiene.

Column: School environmental hygiene in Japan

In Japan, the School Health and Safety Act requires **regular school environment hygiene inspections** based on the school environmental hygiene standards.⁶ These regular inspections check whether schools are maintaining appropriate learning environments. For example, they measure carbon dioxide, temperature, relative humidity, floating dust, air flow, carbon monoxide, nitrogen dioxide, volatile organic compounds, mite allergens, illumination, glare, and noise levels. The inspections are conducted by experts or by teachers under the guidance of experts.

In addition to the inspections, there are also several items that must be checked daily (Table 4.2). Teachers can conduct these checks every day either visually or using simple instruments.

Table 4.2 Examples of school environmental hygiene items subject to daily checks in Japan

| | Item | Standard |
|---|--|---|
| Classroom environment | (1) Ventilation | (1) No irritants or foul odors are detected on entering the classroom from outside |
| | | (2) Appropriate ventilation |
| | (2) Temperature | The classroom is at a temperature conducive to learning (in Japan, stipulated at 17°–28°C). |
| | (3) Brightness and glare | (1) Sufficient light to be able to clearly see letters and diagrams on blackboards and desktops |
| (2) No glare interfering with the visibility of blackboards, desktops, and surroundings | | |
| (3) No light reflections on the blackboard | | |
| (4) Noise | Students can easily hear what the teacher is teaching. | |
| School cleanliness, vermin, and insect pests | (5) School cleanliness | (1) School facilities and classroom equipment are clean and undamaged. |
| | | (2) Sports grounds and sandpits are clean and free from waste and animal fecal matter. |
| | | (3) Toilets and toilet facilities are clean, functional, and undamaged. |
| | | (4) No mud or sand has built up in drainage ditches and their surrounds, and there are no foul odors. |
| | | (5) Rubbish collection points, waste bins, and their surroundings are clean. |
| | (6) Vermin and insect pests | There are no mice, wild dogs or cockroaches inhabiting school buildings or school grounds. |

Created from Ministry of Education, Culture, Sports, *Science and Technology*, *School Environmental Hygiene Management Manual*, 2018 revision⁶

4) Town and community hygiene

(1) Waste disposal

In Cambodia, rapid socioeconomic development and the advance of the tourism industry have made waste disposal a huge social problem. Throwing waste on roads and into empty lots makes your town look ugly, and people are offended by the putrid smell. Not only that, discarded waste makes the living environment unhygienic. Piles of waste provide breeding grounds for mosquitoes, flies, and other insects harmful to human health, for example, as well as generating toxic gases, and when it rains, waste-clogged drainage ditches flood the town with dirty water. In rural areas, rain falling on piles of waste creates polluted water that then flows into farmland and pollutes the crops. Waste is not a problem created solely by Cambodians, but also by tourists visiting the country. At the same time, mountains of waste can also be a source of revenue supporting people’s lives in some poor regions and regions with little industry. We need to recognize that waste is a complex issue in which social development, environmental and ecosystem pollution, and people’s livelihoods and health are all interwoven.

To address the waste issue in daily life, it is important to start by learning about the necessity of waste separation and recycling, including setting up boxes and containers so that waste can be divided into recyclables, non-recyclables, and organic waste when it is thrown out. Ideally, social mechanisms will be developed for collecting and processing the separated waste.

If not dealt with, organic waste in particular becomes a breeding ground for flies, cockroaches, and other vector insects, so the waste must be disposed of hygienically. The elimination of cockroaches, mosquitoes, and other disease vectors carrying the pathogenic microbes that cause infectious diseases is just as important. For example, because dengue fever and malaria are transmitted by mosquitoes, the number of people affected increases during the rainy season. Certainly, people should take personal care of themselves to avoid mosquito bites, such as using insect repellent and mosquito nets. However, it is also important to create an environment that prevents mosquitoes from breeding, such as removing old tires, empty cans, and plastic bottles where water could collect and provide a home for mosquito larvae (see Chapter 7).

In addition to developing social mechanisms for waste disposal, reducing the amount of waste created in the first place will be critical for Cambodian society in addressing the waste problem.

(2) Drinking water and wastewater treatment

The public facilities that supply potable water are called **waterworks**, while the facilities that purify rainwater and sewage (the generic term for human waste) and then release it into rivers and seas are called **sewers**. Waterworks send water to households and factories via (a) water tanks in which waste and sand is precipitated from water taken from rivers; (b) mixing tanks where microorganisms and air are mixed in thoroughly to have the water purified; (c) flocculation tanks which use chemicals to flocculate impurities; (d) sedimentation tanks that settle the suspended particles of impurities; (e) filter tanks that filter the impurities; and (f) reservoirs for adding chlorine and storing clean water). The water purification system at the Phnom Penh waterworks is shown in Figure 4.5.⁷

Ensuring safe drinking water and preventing infectious diseases require installing combined septic tanks and sewage systems to process town and community sewage. **Sewage** is the generic term for the

human waste from toilets as well as domestic wastewater from cooking and laundry, along with the industrial wastewater from business operations (stores, hotels, and workshops through to large factories). Waterworks are gradually being installed in Cambodia, starting with Phnom Penh and other cities. However, there are still few sewage systems, with sewage passing from septic tanks through drainage canals out into lakes and wetlands where it is purified by natural processes. Given the issues related to sewage treatment as shown in **Table 4.3**, Cambodia clearly needs to install combined septic tanks and sewers.⁸

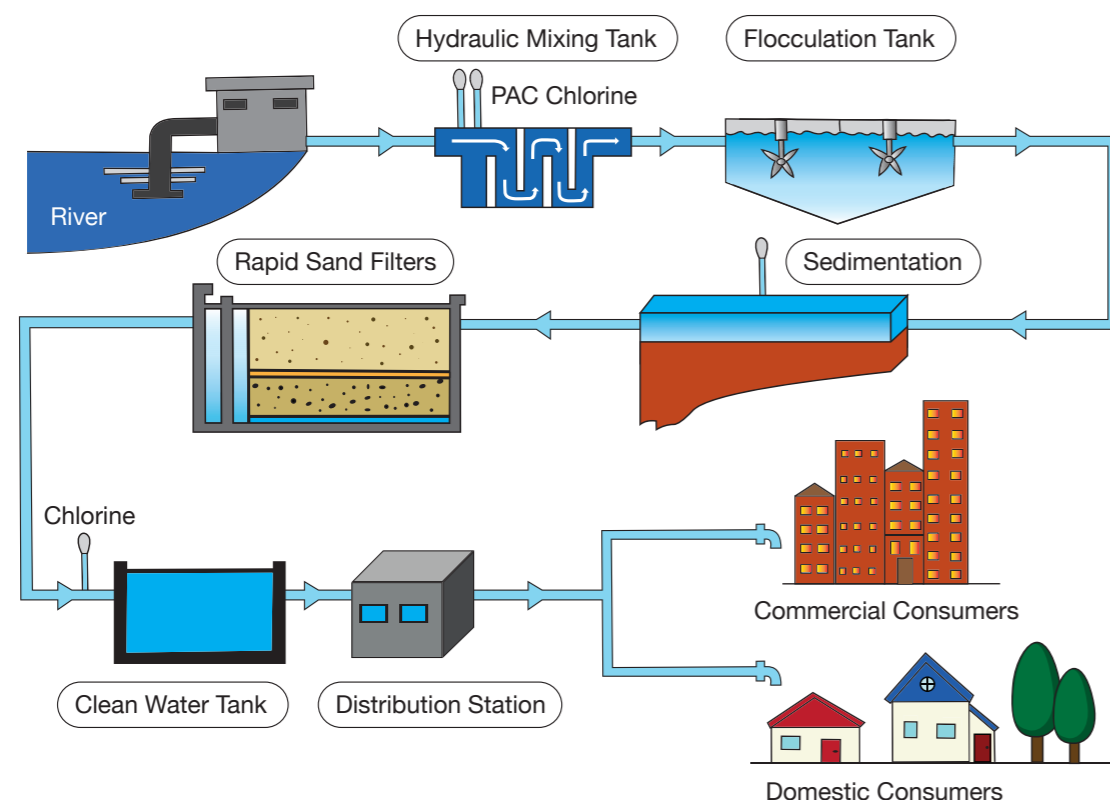


Figure 4.5 Water treatment process⁷

Table 4.3 Sewage treatment issues in Cambodia⁸

- 1 Because septic tanks have not been installed, untreated sewage percolates underground or is released directly into drainage canals and rivers.
- 2 Even when septic tanks are installed, they have insufficient capacity.
- 3 Only human waste is treated in septic tanks, with domestic wastewater directly released to the environment.
- 4 Septic tank sludge is not properly scooped up, so septic tank treatment efficiency is low.
- 5 Households along rivers and waterways release their sewage directly into the water.

2. Tips for creating a clean and hygienic personal environment

1) Preventing food poisoning

To prevent food poisoning, hygiene needs to be maintained at each stage of consumption, from buying and storing food to preparing and cooking it, eating it, and storing the leftovers. Key points in relation to each of these are shown in **Figure 4.6**. First, when buying food (**point 1**), choose fresh ingredients, check the use-before dates (see **Column: Best-before and use-by dates**), and get your groceries home as quickly as possible. Store raw fish and meat and perishable ingredients in the refrigerator (**point 2**), if one is available, to protect the food from perishing or being contaminated by flies. At the preparation stage (**point 3**), don't use the same chopping board and knife that you used for raw fish and meat for your vegetables, wash your cooking implements thoroughly afterwards, and wash your hands after handling raw fish and meat. Avoid undercooking by heating food to the point that it reaches a sufficient temperature even right in the middle (**point 4**). Wash your hands before eating and use clean tableware (**point 5**). Store remaining food and ingredients in the refrigerator and throw out old food (**point 6**).



Figure 4.6 Actions to prevent food poisoning

2) Cleaning

Tidying and cleaning your environment contributes to safe and healthy living by helping to prevent infectious diseases and allergies as well as injuries from falling. Engage in cleaning activities, including using a dustpan, broom, or vacuum cleaner to remove dust from floors, wiping desks with a cloth, and putting the accumulated waste in waste bins (**Figure 4.7**). Particularly when infectious diseases are going around, use **disinfectants** to sterilize surfaces that many people touch (**Figure 4.8**) and engage in cleaning activities to **block infection routes** (for more on infection routes, see **Chapter 7**).



Figure 4.7 Classroom cleaning



Figure 4.8 Examples of disinfectants

Column: Disinfectants by efficacy

There are many types of disinfectant with varying efficacies, so the right disinfectant needs to be used for the right job. **Ethanol** is used to sterilize fingers and objects such as doorknobs and tables. However, there are some viruses on which ethanol has little effect unless it is very concentrated. It also has no sterilizing effect on spores, which are the special cellular structures that form when some microbes are placed in an environment in which they cannot reproduce. Spores are highly resistant to heat, desiccation, and drugs, and cannot be sterilized using ethanol.

Sodium hypochlorite is usually found in bleach and has powerful disinfecting properties. Unlike ethanol, it should not be used on the skin, but it can be used to soak clothes and dishes or applied directly to vomit for sterilization (see also Chapter 15). Check the product label for the appropriate concentration. For skin applications, people who are allergic to alcohol can use povidone iodine (isodine) instead. **Povidone iodine** is sometimes used to sterilize wounds and injection sites. It can also work on spores given a long disinfection period. The area of skin to which it is applied will turn brown, but this will wash off with water.

3. Good hygiene practices

1) Effective handwashing technique

Influenza and many other infectious diseases can be spread by human fingers, so making it a habit to wash your hands effectively using water and well-lathered soap increases the chances of preventing infectious disease. The specific method (Figure 4.9) is to wash hands with running water, pick up the soap and lather it well, and then wash your hands for around 30 seconds in the following order: palms, palm side of fingers, back of hands, back of fingers, between fingers right down to the base, thumbs and cushion at the base of thumbs, fingertips, and wrists. Then rinse thoroughly with running water to wash off the soap. After washing your hands, wipe and dry your hands using a clean towel or paper towel. Please do not use a shared or dirty towel, as the effect of hand washing can be lost as a result. Disinfecting your hands with alcohol once you have wiped away the water is also effective. Washing your hands with soap using the correct method increases the chance of eliminating bacteria and viruses (Table 4.4).⁹

The **coronavirus** (SARS-CoV-2), and infectious disease caused by them (**COVID-19**) has been sweeping the world since January 2020, and effective treatments and vaccines to increase immunity against the virus are still in development. The virus is transmitted via droplets and fingers, so it is vital to follow **cough etiquette** when coughing, and to wash your hands carefully and thoroughly for at least 30 seconds. Cough etiquette means using your sleeve, a tissue, a handkerchief, or a mask to cover your nose and mouth when coughing or sneezing to avoid spreading the virus to others (Figure 4.10).

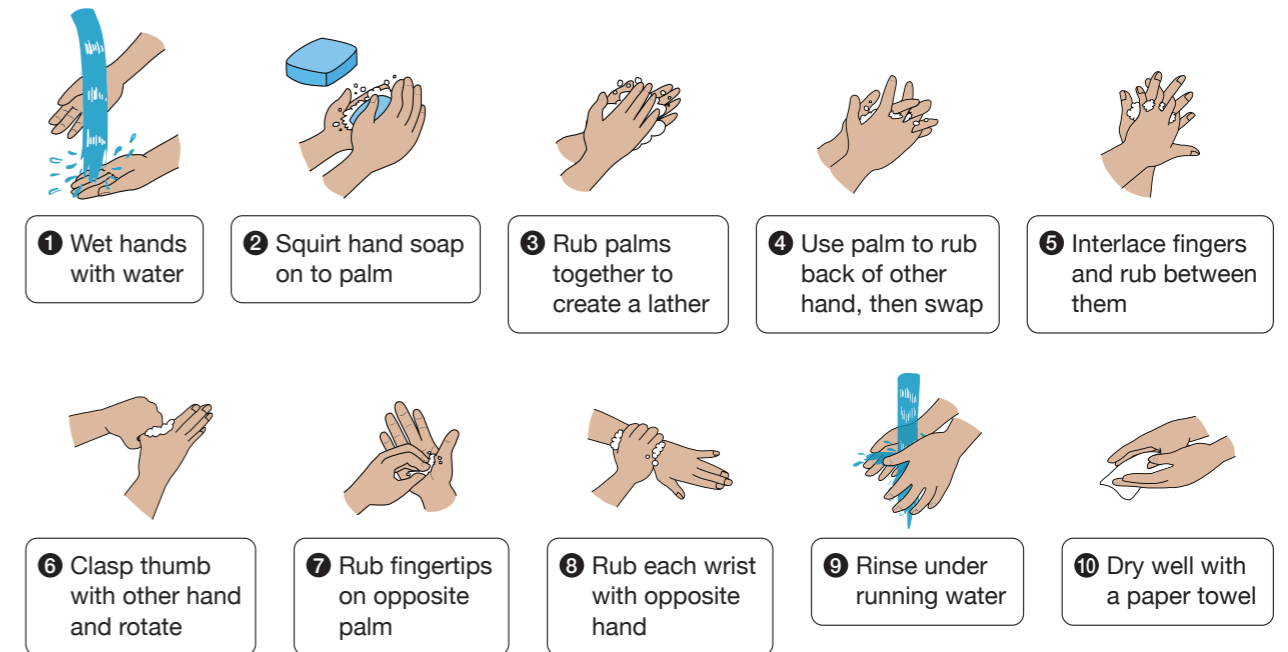


Figure 4.9 Washing hands with soap

Table 4.4 Effect of handwashing by duration and no. of times

| Handwashing method | No. of viral flora remaining (survival rate) |
|--|--|
| No handwashing | Approx. 1,000,000 |
| Wash 15 seconds under running water | Approx. 10,000 (approx. 1%) |
| Rub with hand soap for 10 seconds, then rinse under running water for 15 seconds | Several hundreds (approx. 0.01%) |
| Rub with hand soap for 30 seconds, then rinse under running water for 15 seconds | Several hundreds (approx. 0.01%) |
| Rub with hand soap for 60 seconds, then rinse under running water for 15 seconds | Several dozen (approx. 0.001%) |
| Rub with hand soap for 10 seconds, rinse under running water for 15 seconds, then repeat | Several (approx. 0.0001%) |



Figure 4.10 Cough etiquette

Exercises for further thought and research

[4-1] Try an experiment on effective handwashing.

You will need: Starch, iodine solution (or another disinfectant containing iodine), basin.

Method (Figure 4.11):

- (1) Rub the starch over your hands and wrists like hand cream.
- (2) Let it dry.
- (3) Wash and dry your hands using your usual method.
- (4) Place the iodine solution in the basin and soak your hands into it.
- (5) The iodine solution will react with any remaining starch by turning purple.
- (6) Discuss those areas easily missed when washing your hands.



Figure 4.11 Experiment on effective handwashing

- [4-2] Identify an unhygienic environment close at hand and discuss in groups how it could be improved.
- [4-3] Identify unclean or unhygienic actions by people around you and discuss in groups how those actions could be changed.
- [4-4] Discuss in groups problems related to using and cleaning school toilets and cleaning classrooms and school grounds, as well as possible solutions to these problems.
- [4-5] Research waste treatment problems in developing countries and discuss why these problems are occurring and what impact they are having on the environment and on people's lives and health from the perspectives of social development, the environment and ecosystems, and people's lives

and health. Draw a diagram of how these elements are related.

- [4-6] Discuss your experiences of food poisoning and think about how they could have been prevented.
- [4-7] Discuss how to ensure that there is always soap in school bathrooms when schools have such tight budgets.

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Lifestyle habits and health

Learning objectives

You will be able to gain proper understanding and explain:

- What makes healthy lifestyle habits.
- Healthy lifestyle habits at different stages of children's development.
- How malnutrition and overnutrition affect the human body.
- How lack of sleep and physical inactivity affect the human body.
- What relationship diet, exercise, and rest/sleep have with health, and then think about healthy lifestyle behaviors.
- What should be improved in terms of healthy lifestyle behaviors by reviewing your life on a specific day (from the previous week).
- What should be improved in terms of healthy diet and balanced nutrition by reviewing your diet on a specific day (from the previous week).

In this chapter, you will learn about the relationships between one's health and lifestyle habits (lifestyle behaviors), with a focus on diet, exercise, and rest and sleep. Specifically, we will cover topics that include children's growth/development and lifestyle habits, lifestyle habits and health, basic lifestyle habits, diet/nutrition and health, exercise and health, rest/sleep and health.

1. Children's lifestyle habits and health

1) Growth/development and lifestyle habits

Mental and physical changes in children are known to include **growth** and **development**. The former includes quantitative changes in factors such as height and weight, and the latter refers to functional (qualitative) changes. While children's growth and development vary among individuals, they may be divided into the following stages according to their nature: **neonatal** (first four weeks after birth); **infancy** (birth to 1 year); **early childhood** (preschool years); **middle childhood** (primary school years); and **adolescence** (junior high school years to young adulthood, or until one stops gaining height) (see Chapter 3 for details on the topic of children's growth and development). Here we discuss the relationship between lifestyle habits and health in the following phases: infancy and early childhood; school-age years; and adolescence.

Infancy and early childhood: This is a phase when a child will become able to do things on their own, such as eating, using the toilet, and dressing and undressing themselves, as well as learn patterns of everyday life. It is therefore important that a child should acquire habits of healthy diet, exercise, and

rest/sleep. Where exercising is concerned, this is a phase when development of the nerve system occurs, which prompts a child to try a variety of different body movements, such as those that require control of body balance (i.e. standing, sitting, or spinning), those that move the body from one place to another (i.e. walking, running, or climbing), and those that involve the maneuvering of tools (i.e. throwing, kicking, or pedaling)¹.

School-age years: The first half of this phase is when a child undergoes relatively stable growth, and it is important that a child should not only establish habits of healthy diet, exercise, and rest/sleep, but also learn and gain an understanding and sense of right and wrong, language and cognitive abilities, and self-affirmation, as well as developing social skills². Following infancy and early childhood, school-age years will continue to see development of the nerve system; in addition to body movements that require control of body balance, moving the body from one place to another, or which involve the maneuvering of tools, a child during this period will try body movements that test their body strength (for example, two children carrying another child, tug-of-war) or those that combine more than one basic body movement³. In the latter half of the school-age years, meanwhile, a child will experience significant growth of their body, and it is essential that they lead a healthy life to promote body growth. This is a period when a child's body will come to change to that of an adult's, although growth varies significantly among individual children. In terms of exercising, it is important that a child practice sustained, low-intensity exercise that helps them become better at keeping skilled movements, such as jumping rope and standing on one foot.

Adolescence: A child will undergo dramatic changes to their body such as menarche or spermarche. These are called **secondary sex characteristics**. During this phase, a child will experience certain physical issues associated with body growth and development, including **anemia** due to deficiencies of nutrients, especially iron, as a result of muscle growth and menstruation, or **dizziness** and **fatigue** due to unstable autonomic function.

In psychological and behavioral development, a child may develop sexual interest and rebel against adults. It is therefore necessary to pay attention to any sign of risky sexual activities, smoking, drinking,

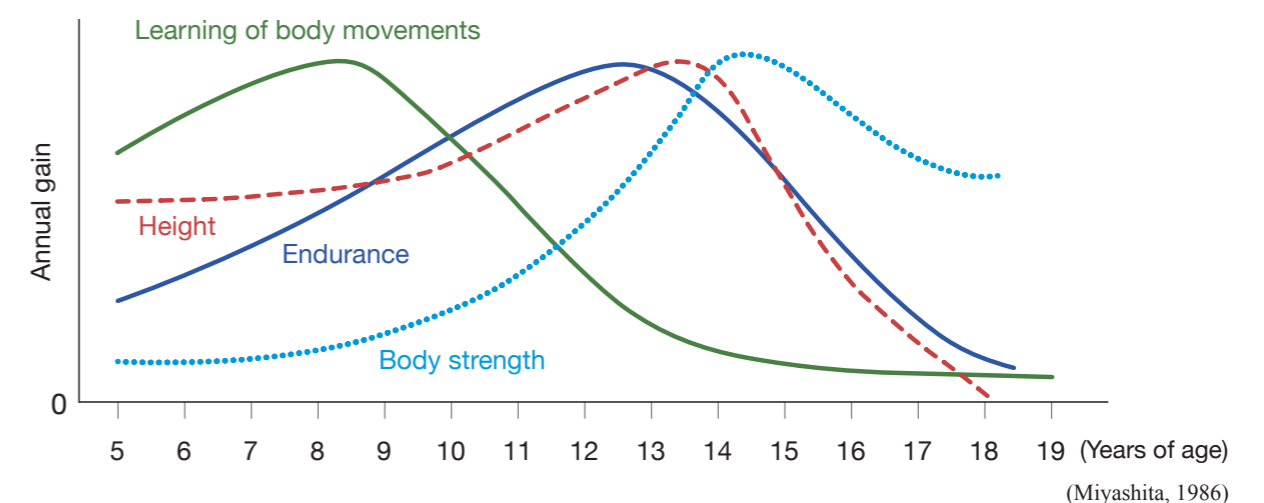
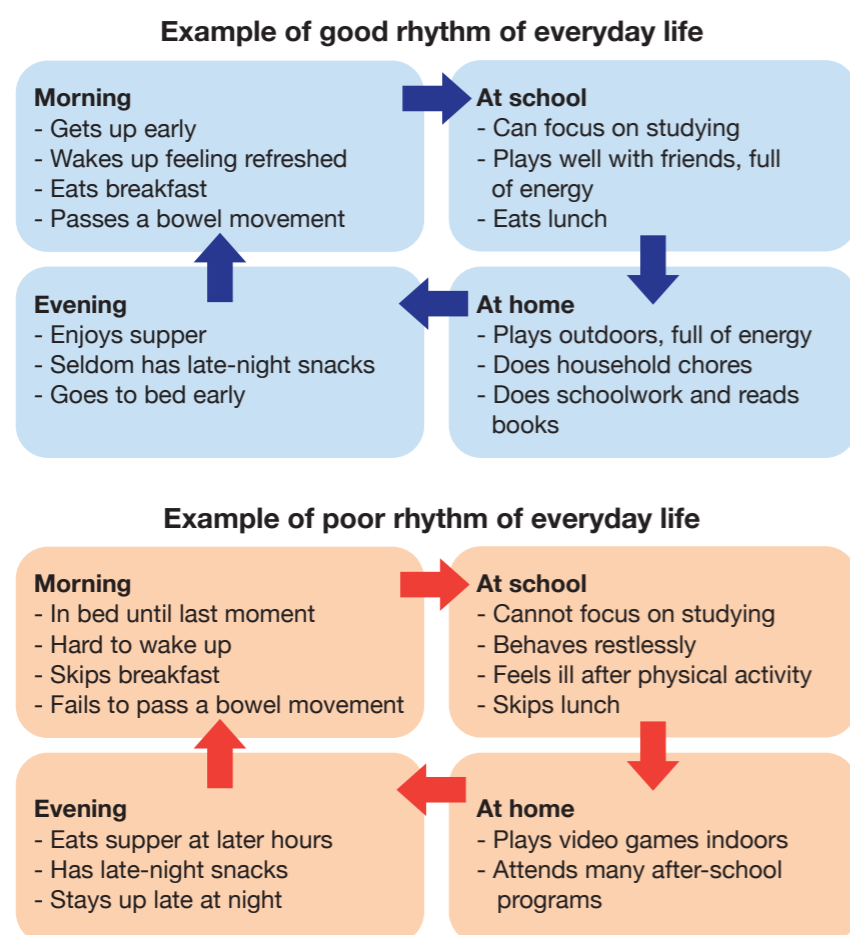


Figure 5.1 Child growth/development patterns⁴

or drug abuse. Socially, a child will need to acquire control of their social life so that they remain true to themselves and live their own way while fulfilling their social responsibilities in interactions with friends and adults in school, the local community, and at home. In terms of exercising, this is a period when the load on children increases so that they acquire abilities (endurance) and body strength to perform sustained exercise that helps them become better at skilled movements⁴ (Figure 5.1).

2) Establishment of basic lifestyle habits

Basic lifestyle habits refer to a set of lifestyle habits with **well-balanced nutrition, exercise, and rest/sleep** that are important for the promotion of a child's growth. Sections 3, 4, and 5 below discuss diet/nutrition, exercise, and rest/sleep, respectively. They are not independent of one another, however, but are mutually interrelated. As Figure 5.2 shows, for instance, reduced quality of sleep affects breakfast habits, skipping breakfast affects daytime activities, and physical inactivity during the day reduces quality of sleep, thus creating a vicious cycle.⁵ Rather than focusing on one element only, it is critical to establish healthy and regular lifestyle habits in which all of the elements are well-balanced, and thus aim for a **virtuous cycle** based on good rhythm of everyday life.⁵



Adapted from Ministry of Education, Culture, Sports, Science and Technology, Learning materials on eating habits (for 5th and 6th graders)

Figure 5.2 Examples of good and poor rhythms of everyday life⁵

2. Diet/nutrition and health⁶⁻⁸

1) What it means to human health to eat⁹

Humans need to take in **nutrients** from the external world in order to maintain life activities. Humans fulfill this need by eating. Eating has the following three primary functions:

- Supplying nutrients to sustain life and support living activities
- Providing a sense of security and satisfaction, bringing about psychological fulfillment
- Building a basic unit of social community

The function of “supplying nutrients to sustain life and support living activities” is an important one for the purpose of maintaining **homeostasis** in the body of a living person. The body of a living person has **biological clocks** that regulate the cycle of **circadian rhythms**. Maintaining one’s circadian rhythm is strongly associated with maintaining their health in a favorable condition. When the body of a living person develops a memory of the timing when nutrients are supplied, regulatory functions such as hormone secretion and enzyme reaction are synchronized properly. While nutrients may be pooled within the body of a living person to a certain degree, they are basically supplied with each meal. Regular supplies of nutrients are essential for sustaining life and supporting living activities. Eating regularly everyday therefore forms a foundation of desirable lifestyle habits, which in turn helps prevent lifestyle-related diseases.

The function of “providing a **sense of security and satisfaction**, bringing about psychological fulfillment” helps one avoid a sense of danger to life and remain emotionally stable. If the body of a living person senses a state of starvation, it will trigger a variety of chemical reactions, including preferential activation of the system that supplies glucose to the brain and nerve cells. During infancy and early childhood, in particular, meals have the significance of giving children a sense of security in that they will always obtain food at regular times or when they feel hungry. Eating food that is delicious or which is something they like can also give them a sense of satisfaction or a zest for life.

The function of “forming a basic unit of a social community” is, in other words, a tool for communication to form connections between people. This is because people form human relationships that will become basic units of a community through interactions among themselves as they share a meal, giving children an opportunity to acquire social-mindedness from adults such as their food culture, table manners, and ceremonial rituals. Furthermore, the same group of people sharing the same time and place regularly will be able to check in on the safety and health of one another. It has been reported that those in middle childhood and adolescence who share family meals three or more times per week are more likely to stay in a normal weight range and have healthy dietary and eating patterns compared to those who do so less than three times per week¹⁰.

2) Characteristics of dietary effect

The body of a living person will not fall out of form immediately after the external supply of food ceases. This is because various mechanisms come into play to maintain the homeostasis of the body. For

instance, mineral or vitamin deficiencies will not immediately cause pain or other problems; in many cases, by the time a mental or physical symptom does manifest itself, the problem will already have fairly progressed. Dietary effects have the following three characteristics:

- i. Diet has gradual effects on the body of a living person
- ii. Adequacy of content of meals does not become clear to them immediately in general
- iii. One must take in nutrients repeatedly and indefinitely

The effects a diet has are characterized by their slow and gradual nature. While pharmaceutical products in general produce effects rapidly, food produces effects little by little, which often makes it impossible to evaluate its effects promptly. Imbalance in diet results in inadequate nutrient intake, leading to **malnutrition**. In many cases, people recognize the fact that they have an inappropriate diet only after a state of malnutrition persists for a while and they themselves or others around them notice their mental or physical changes. **Figure 5.3** illustrates what characterizes dietary effects and how they may be evaluated. In order to detect any imbalance in nutrient intakes and a poor nutrition due to improper diet at an early stage, it is important to conduct a diet survey and physical examination. If malnutrition is manifested as mental or physical symptoms, testing must be performed, including biochemical and physiological tests such as blood tests (e.g. white blood cell count and hemoglobin levels) and urine tests (e.g. urine protein, occult blood, and urine glucose level), and functional and morphological tests (e.g. height/weight measurements, athletic performance, pulmonary function test, hearing, and eyesight).

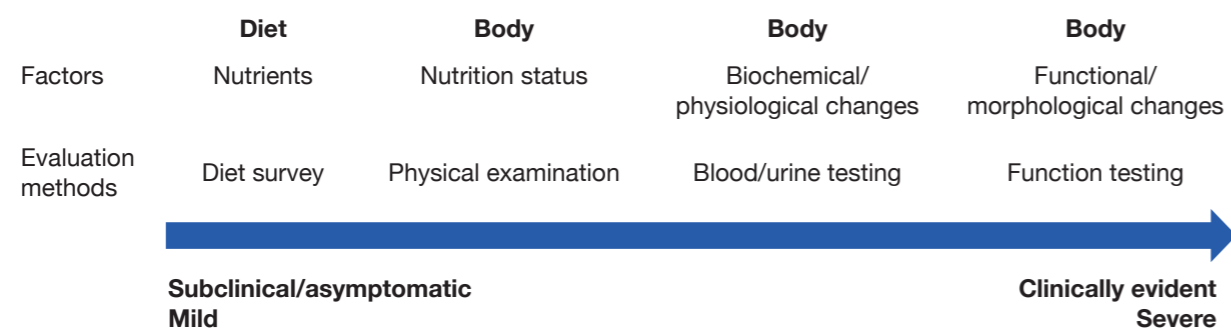


Figure 5.3 Dietary effects and methods for their evaluation

3) Healthy diet

In order to stay healthy both mentally and physically, one needs to take in energy and nutrients in a manner that is appropriate for their individual physical build, behavioral patterns, state of health, and living environment. When one “**keeps a well-balanced diet**,” it means that their dietary intake of energy and nutrients closely match those they need, with very little excess or shortage.

Figure 5.4 shows major nutrients and their roles, as well as their respective primary dietary sources. Nutrients may be divided roughly into the following: **carbohydrates**, **lipids**, **proteins**, **minerals**, and **vitamins**. They are called **the five essential nutrients**. In recent years, it is recommended that **dietary fibers** (nondigestible saccharides) should also be taken in addition to these five. There are **three major roles of nutrients**: to provide energy required for physical activity; to become building components of

the body; and to coordinate the chemical reactions that occur in the body. Carbohydrates, lipids, and proteins serve as the sources of energy, and proteins and minerals (i.e. **the 16 essential minerals** including calcium, iron, and sodium) form components of the body, while minerals, vitamins, and dietary fibers are required to coordinate the chemical reactions in the body.

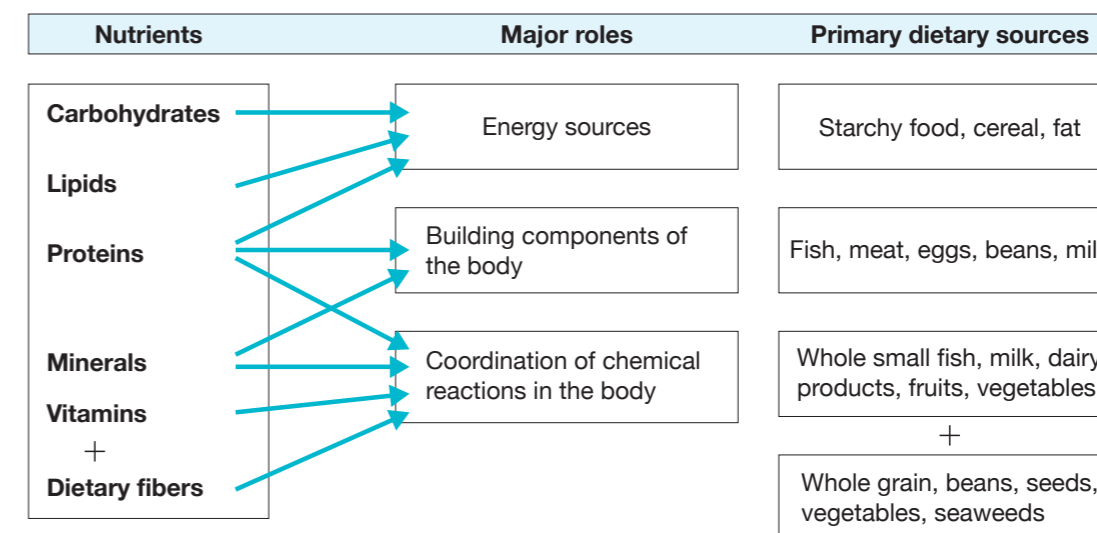


Figure 5.4. Nutrients, and their major roles and primary dietary sources

With the exception of granulated sugar and refined oils, very few food items contain a single nutrient; food contains a variety of nutrients. In order to minimize imbalance in nutrient intake, it is important to take in as many types of food as possible. In reality, however, it is difficult to have every type of food in one meal and such an attempt can even result in excessive intake. It is therefore important to focus on daily total or weekly average intake to keep a well-balanced diet. In the following, we will briefly discuss the nutritional significance of the nutrients shown in **Figure 5.4**. It is important that you gain understanding of where these nutrients exist and what roles they serve in the body of a living person.

Column: Things to consider when using dietary supplements

A large variety of dietary supplements are marketed for use to supplement inadequate intake of minerals, vitamins, and amino acids. It is important that you should review your diet rather than taking such dietary supplements without careful consideration. Some dietary supplements may contain ingredients that are different from those found in plant- or animal-based food products. It is important that you acquire correct knowledge about dietary supplements in order to stay in good health.

(1) Nutritional significance of carbohydrates

Saccharinity is also called “**available carbohydrates**,” which are high in polysaccharide starch. Starch is the main source of carbohydrates in our diet and is composed of hundreds to thousands of basic carbohydrate molecules. This basic molecule is a monosaccharide, of which **glucose**, **fructose**, and

galactose are important for our body. Our body uses digestive enzymes to decompose many of the “available carbohydrates” in our diet into monosaccharides, absorbs, and then uses them as an energy source. The cells in the brain and nerve tissues, red blood cells, as well as skeletal muscles during depletion of energy, can only use glucose. Because depletion of glucose can result in a collapse of homeostasis and even death, the level in the blood (blood glucose levels) is maintained even during a fasting state. The liver and muscles store glucose temporarily in the form of glycogen, which is a polysaccharide of glucose. Glycogen in the liver is readily used as an energy source to maintain the level of blood glucose concentration. Excessive amounts of glucose are stored as triglycerides, which may be used as another source of energy in the future. When energy taken in from food is not entirely consumed and leaves an excess, triglycerides are carried in the bloodstream to become subcutaneous or visceral fats, which promote the development of arteriosclerosis.

(2) Nutritional significance of lipids

As a source of energy that is readily stored in the body of a living person, **lipids** are stored primarily in the form of **triglyceride**. They are constituents of hormones, cell membranes, and nuclear membranes. In the form of subcutaneous fats, they serve to protect internal organs and tissues against injury and cold. They also promote absorption of fat-soluble vitamins.

(3) Nutritional significance of proteins

Proteins are an important nutrient that supports cells’ life activities. The muscles, organs, skin, hair, nail, hormones, enzymes, and antibodies are built with proteins. While proteins are broken down into **amino acids** before being absorbed, proteins that are absorbed without having been broken down into amino acids can become allergens (which trigger **allergic reactions**.)

Column: Food allergy

The immune system is a biological defense mechanism that protects our body by ridding the body of invading pathogens or other substances that are harmful to the body (See Chapter 7). A food allergy occurs when the immune system mistakenly treats a certain protein in food that entered the body as an antigen and overreacts to it. Many food allergies produce immediate allergic reactions, in which the reaction occurs shortly after the intake of the offending food. They are mediated by a protein found in the living body called immunoglobulin E (IgE antibody). Typical symptoms of food allergies include hives, eczema, vomiting/stomachache/diarrhea, coughing/sneezing, and breathing difficulties. Intense allergic reactions that cause a drop in blood pressure, lowering of consciousness, or fainting are called anaphylactic shock, which can be life-threatening. It is necessary that school teachers and staff are aware of whether or not their pupils have any food allergies, and they have a form to keep tabs on them (<https://schoolsequella.det.nsw.edu.au/file/d6b6621f-7036-4d2a-a84c-0cc740cbe946/1/anaphylaxis-appendix-1-khmer.pdf>). This form provides a space to check as to whether a child has an EpiPen prescribed. It is preferable that teachers familiarize themselves with first aid and use of an EpiPen in the event of anaphylactic shock (https://allergy.org.au/images/stories/anaphylaxis/2018/Khmer_ASCIA_PCC_Anaphylaxis_First_Aid_2018.pdf).

(4) Nutritional significance of minerals

Minerals are divided into macrominerals and microminerals, depending on the amount needed; the former are needed in relatively large amounts, while the latter are needed in trace amounts. There are **six macrominerals**: calcium, phosphorus, sodium, potassium, chloride, and magnesium. They are required for the control of pH and osmotic pressure of body fluids as well as for nerve impulse transmission and muscle contraction. Of the six macrominerals, calcium, potassium, and magnesium are essential for the development of bones and teeth. **Microminerals**, meanwhile, include 16 types of minerals, such as iron, zinc, and iodine. They are involved primarily in metabolism. Some microminerals, including arsenic and lead, can cause harm to health and trigger poisoning symptoms when taken in large amounts, so caution is required against excessive intake.

(5) Nutritional significance of vitamins

Although not a source of energy for the living body, **vitamins** are an essential nutrient that serves significant physiological roles even with a trace amount of intake. They can be either **water-soluble** (such as vitamin C and B vitamins) or **fat-soluble** (such as vitamin A and vitamin D) (Table 5.1). Water-soluble vitamins are excreted in urine and not readily stored in the body, making them prone to deficiency. Fat-soluble vitamins, meanwhile, are stored in the liver, and may cause poisoning symptoms in case of continuous excessive intake.

Table 5.1 Types of vitamin and symptoms of their deficiencies

| Types of vitamin | | Deficiency symptoms |
|------------------------|-------------------------------------|---|
| Water-soluble vitamins | Vitamin B ₁ (thiamin) | Beriberi, anorexia, edema |
| | Vitamin B ₂ (riboflavin) | Impaired growth, oral ulcer |
| | Vitamin B ₃ (niacin) | Dermatitis, diarrhea, brain damage |
| | Vitamin B ₆ (pyridoxine) | Impaired growth, arteriosclerosis, dementia |
| | Vitamin B ₇ (biotin) | Hair loss, dermatitis, impaired growth |
| | Vitamin B ₉ (folic acid) | Anemia, arteriosclerosis, dementia, fetal neural tube closure |
| | Vitamin B ₁₂ (cobalamin) | Anemia, neuropathy |
| Fat-soluble vitamins | Vitamin C | Gum or skin bleeding |
| | Vitamin A | Night blindness, impaired immunity |
| | Vitamin D | Impaired bone formation, osteomalacia |
| | Vitamin E | Infertility, miscarriage |
| | Vitamin K | Excessive bleeding (intracranial hemorrhage in newborns and infants), impaired bone formation |

(6) Nutritional significance of dietary fibers (nondigestible saccharides)

Dietary fibers are a type of carbohydrate. They are also called nondigestible saccharides because they are not broken down by digestive enzymes. They are fermented by intestinal bacteria, and work to regulate the functions of the intestines and maintain gastrointestinal function. One needs to take in dietary fibers to maintain and improve health.

(7) Recommended dietary allowances of nutrients

In Cambodia, the Government discussed the recommended dietary allowances (RDA) for children aged between 6 and 17 years in collaboration with FIDR, and established the RDA for different nutrients using a reference body weight for each age group of school-aged children¹¹. In addition, the Food-Based Dietary Guidelines (FBDG) were proposed; the recommended food intakes are visually illustrated for six food types in the **Cambodian Food Pyramid (Figure 5.5)**. The definition of 6 food types and standard of serving (Table 5.2) provides the standard of serving and the portion size of serving for each of the six food types, while the following seven key messages are proposed for the healthy growth of children (Figure 5.6)¹¹. In school health education, it is necessary to actively teach and disseminate these messages by using a handbook based on these guidelines.



Figure 5.5 Cambodian food pyramid¹¹

Table 5.2 Definition of 6 food types and standard of serving

| Food type | Standard of serving | Portion size of serving |
|---------------------------|--|--|
| Cereals and Starchy foods | 1 serving is 40 g of carbohydrate | 1 small bowl or 10 spoons of cooked rice (140 g) 2 changvay (set) of Khmer noodle (165 g) 1/2 of corn (65 g) 1 loaf of baguette (70 g) 2 1/2 pieces of sandwich bread (80 g) |
| Vegetables | 1 serving is 30 g | 2 spoons of green vegetable (30 g) 3 pieces of pumpkin (30 g) 1/2 or 4 pieces of cucumber (30 g) |
| Fruits | 1 serving is 100 g | 4 pieces of water melon (100 g) 3 pieces of guava (100 g) 4 pieces of papaya (100 g) 1 1/2 of banana (100 g) 4 pieces of ripe mango (100 g) |
| Protein-rich foods | 1 serving is 6 g of protein | 2 spoons of chopped or slice meat (20 g) 4 pieces of fish meat (30 g) 1 chicken egg (50 g) 3 spoons of mungbean (60 g) |
| Calcium-rich foods | 1 serving is 100 mg of calcium | 2 spoons of small fish (40 g) 7 small dried fish (10 g) 1 cup of yoghurt (100 g) 1/2 glass of milk (100 ml) 5/9 pieces of tofu (60 g) |
| Fat and oils | 1 teaspoon of butter (5 g) 1 teaspoon of oil/fat (5 g) Try to choose vegetable oil rather than animal fat. Fat is also contained in other food types. Limit your fat intake by 2-3 teaspoons (10-15 g) per day only. | |

- i. Eat food from all food types with a well-balanced diet* everyday
 - ii. Consume calcium rich-food such as whole small fish, milk, and milk products.
 - iii. Eat protein-rich food such as fish, meat, eggs, or beans at least 2 or 3 times a day.
 - iv. Eat plenty of fruits and vegetables regularly.
 - v. Eat cereal and starchy food such as rice, noodles, breads, and its alternatives in an adequate amount.
 - vi. Reduce food high in salt, sugar, and fat.
 - vii. Measure your body weight and height regularly and track your growth.
- *Balanced diet is to eat from all types in proper amounts and in line with physical activity.

Figure 5.6 Seven key messages¹¹

4) Habit of choosing foods with safety and security assured

We take in nutrients required for the maintenance of homeostasis in the living body in the form of food. For this reason, we need to take in a wide variety of food. The intake of contaminated or spoiled food may modify the homeostasis of the body and lead to diseases. It is therefore important that we gain knowledge of **food safety and sanitation**, and acquire **the habit of choosing safe food**. Such a habit not only maintains and improves our health but also promotes environmental health and safety (see Chapter 4).

Food safety and sanitation must be evaluated in a careful and wide-reaching manner, from each process of food production/harvesting, processing, distribution, preparation, and sales, to the stages where consumers purchase, cook, and eat the food. In the agriculture, dairy, forestry, and fishery industries, the safety of soil, sea water, and air is important. Using safe seeds and seedlings, fertilizers, and feedstuff helps ensure environmental safety. It is also desirable that consistent views on food safety are introduced to the processes of food processing, distribution, and sales, as well. It is also important to establish regulations and standards concerning the genetic engineering, irradiation, and preservatives, and for consumers to gain correct knowledge of these.

It is important for consumers to acquire knowledge of food safety and sanitation, and choose safe and sanitarily prepared food on an everyday basis. It is therefore necessary for pupils/students to learn in school health education about contamination and other risks that may occur anywhere between the production and consumption of food. It is also important to provide opportunities for them to learn through first-hand experience, which may include, for instance, growing edible plants from seeds or seedlings, raising animals, observing parasites in fish, and visiting a market or a shop in person. Keeping **school vegetable gardens** may also offer an opportunity for pupils/students to learn about and improve nutrition.

Column: Prevalence of underweight, overweight and obesity in Cambodian children and adolescents aged 5–19 years

When you look at the nutrition status of boys and girls in Cambodia in their middle childhood and adolescence, aged between 5 and 19 years, based on the Global Nutrition Report (<https://globalnutritionreport.org/resources/nutrition-profiles/asia/south-eastern-asia/cambodia/>) and its data (<https://ncdrisc.org/data-downloads/adiposity-ado.html>), percentages of boys who are underweight are high for all ages, with approximately 40% being underweight between 11 and 17 years of age (Figure 5.7). This shows that many in this age group have problems in their nutrition status. While the percentages of boys who are overweight are relatively large between 5 and 11 years of age, they decrease with age.

Compared to boys, girls overall show lower percentages of being underweight, although about 40% are underweight at around the age of 10 years, which is comparable to boys (Figure 5.8). Percentages of girls who are obese are also small, at about one-third of those of boys. Based on these findings on excessively low or high body weight, the nutrition status seems to present larger problems with boys than with girls.

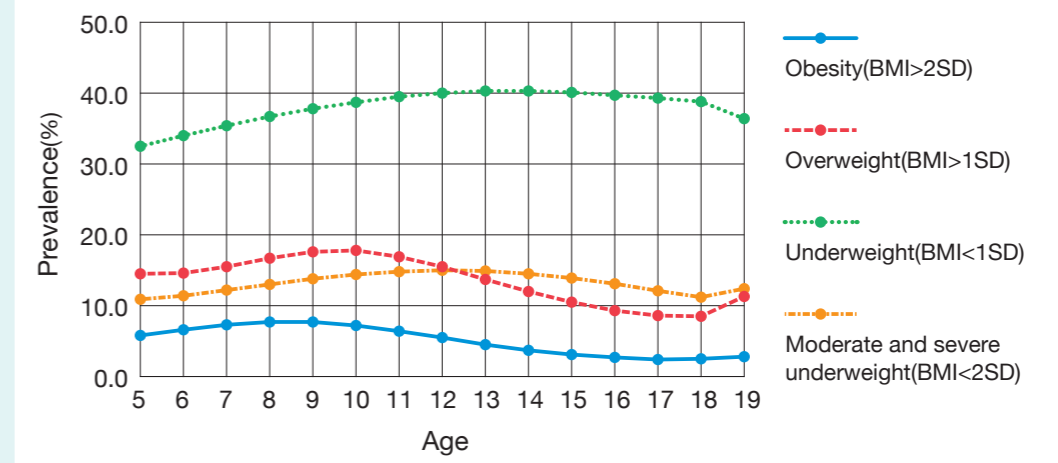


Figure 5.7 Nutrition status by age (Boys, 2016)

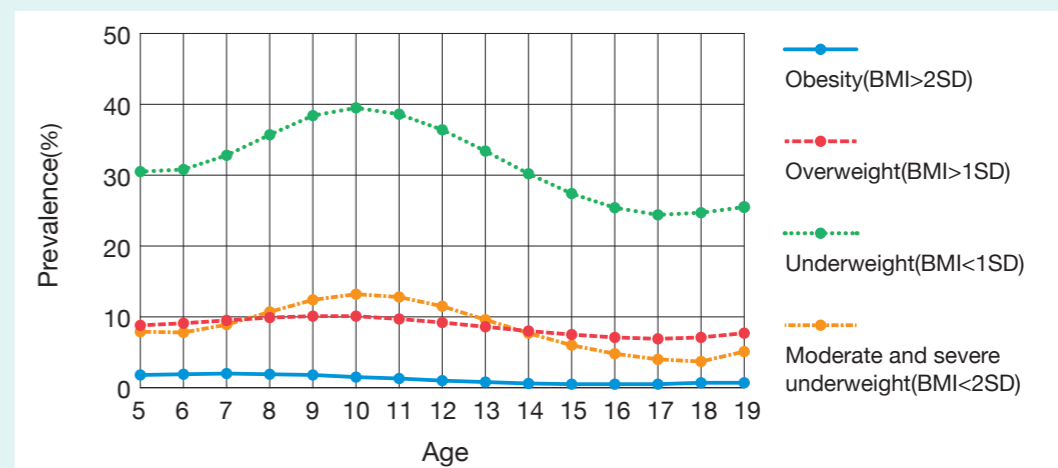


Figure 5.8 Nutrition status by age (Girls, 2016)

Column: UN WFP (United Nations World Food Programme)

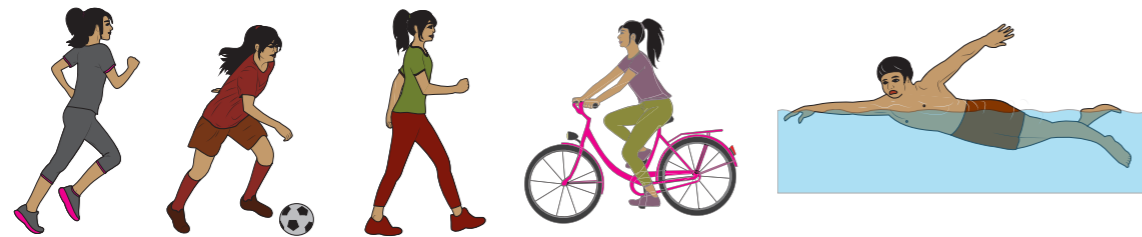
UN WFP (United Nations World Food Programme) won the Nobel Prize for Peace in 2020. This was in recognition of WFP members' fighting hunger in all corners of the world and helping to improve conditions to bring peace to the people, as they go anywhere on the planet if needed, even war zones (<https://insight.wfp.org/world-food-programme-chief-pays-tribute-to-front-line-staff-and-partners-after-nobel-peace-prize-fc406608d60>).

In Cambodia, the WFP Cambodia Country Strategic Programme - 2019-2023 started in February 2019. At the top of the Executive Summary, the challenges in food security are described as follows: "Cambodia has achieved sustained economic growth over the past two decades, attaining lower middle-income country status in 2016. Despite substantial progress, socio-economic and gender inequalities persist, hampering access to a nutritious diet. Food security and nutrition face challenges caused by shocks, a rapidly changing food environment, and inefficiencies in the food system." (https://docs.wfp.org/api/documents/WFP-0000112436/download/?_ga=2.261728648.484506432.1604280209-264903587.1595213932)

3. Exercise and health

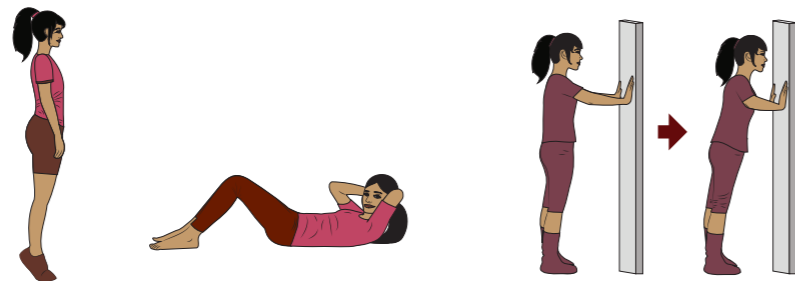
Exercising promotes growth and development of children’s organs, and benefits their health. Stimulation to epiphysis as a result of exercising promotes bone growth. **Moderately loaded exercise** that involves muscle contraction, such as strength training, enlarges muscles and improves muscle strength. **Aerobic exercise** that sends oxygen throughout the body, such as walking and swimming, strengthens the heart and lungs, and helps reduce the risk of lifestyle diseases. Exercise that improves flexibility, such as stretching, increases the range of motion in joints, which helps reduce the risk of injuries (Figure 5.9).

Aerobic exercises



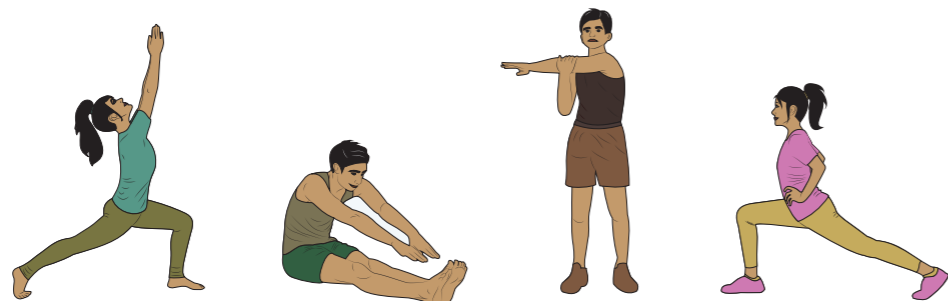
Do exercises that would make you sweat and huff and puff, for a duration of 30 minutes, three times a week.

Exercises to improve muscle strength



Do exercises such as standing on tiptoes, sit-ups, and push-ups to an extent that does not put strain on you.

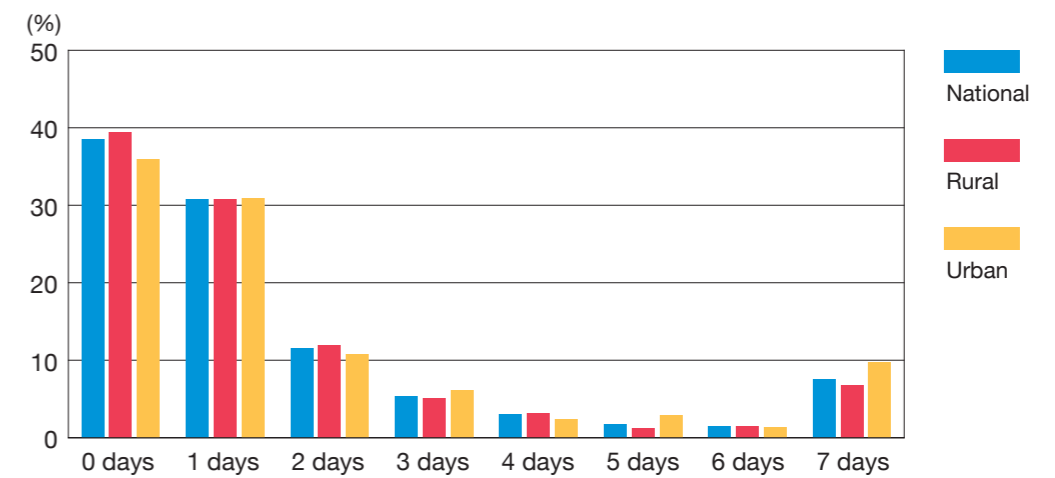
Exercises to improve flexibility



Extend body part(s) without recoil, stop where they feel stretched, and take deep breaths.

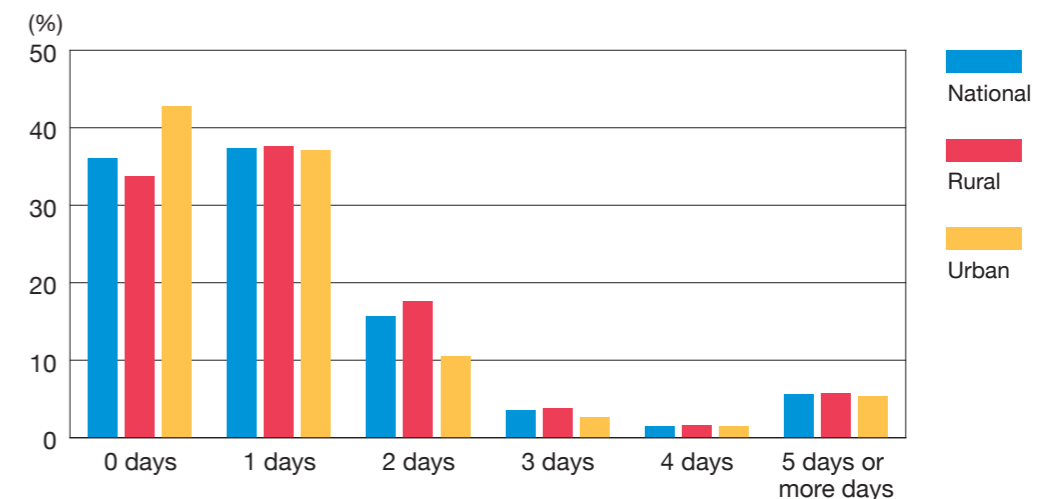
Figure 5.9 Examples of physical activities to build health

Physical inactivity can cause lifestyle diseases such as obesity, arteriosclerosis, and diabetes. In Cambodia, while some children were physically active for a total of at least 60 minutes per day on five or more days, many were not so physically active (Figures 5.10 and 5.11)¹². For instance, nearly 40% of the children said they had not been physically active for a total of at least 60 minutes per day on any of the preceding seven days, while around 35-43% had been attending zero physical education classes per week. The fact that physical education class is not common poses a challenge for ensuring that children acquire exercising habits in Cambodia. Styles of living vary among individual children, and it is important that a child should choose what suits them from among different varieties of exercises, and enjoy doing it. In doing so, they should incorporate activities that improve muscle strength and post-exercise activities that improve flexibility, in order to prevent injury. Care should be taken to avoid excessive exercise, for it can cause injury, which may hinder a child’s growth and development.



Source: 2013 Global School – Based Student Health Survey Results -Cambodia Survey Public Use Codebook (<https://extranet.who.int/ncdsmicrodata/index.php/catalog/220>)

Figure 5.10 No. of days with a daily total of ≥60 minutes of physical activity during the preceding seven days



Source: 2013 Global School – Based Student Health Survey Results -Cambodia Survey Public Use Codebook (<https://extranet.who.int/ncdsmicrodata/index.php/catalog/220>)

Figure 5.11 No. of days with a physical education class per week

4. Rest/sleep and health

Sleep not only helps one recover from fatigue caused by various activities they have performed during the day, but also promotes growth and development in children. The growth hormone produced during sleep, in particular, helps repair damaged tissues and promotes child growth.

Sleep is a part of lifestyle habits, and good sleep is a product of a regular sleeping pattern. Humans have a **body clock**, which not only determines the timing of sleep but also regulates hormone secretion and other physiological activities in advance to prepare one for sleep. Keeping regular hours helps one's body clock work properly and facilitates sleep.

In modern life, however, use of electronic devices such as smartphones and PCs is on the increase. Exposure to **blue light**, or intense light from a smartphone or PC, before bedtime is believed to affect the quality of sleep and sleep rhythm in a negative manner. In order to improve the quality of sleep, one should aim to get the right amount of exercise during the day, keep a well-balanced diet, and do things that relax the body, such as stretching and avoiding the use of electronic devices that stimulate the brain before bedtime.

5. Health habits of adults and life expectancy

We have so far looked at the relationships between lifestyle habits and growth/development and health by focusing on exercise, diet/nutrition, and sleep/rest. We will now take a look back at past studies to see what lifestyle habits or kinds of lifestyles have an influence over our health and life expectancy. The term “health habits” here refers to lifestyle habits that are associated with health. In a study initiated in 1965, Breslow, L., et al.^{13,14} surveyed 7,000 residents of Alameda County, California, United States on a variety of health practices and levels of their physical health, and found that seven health practices were strongly associated with physical health levels. When a 45-year-old man who was practicing 6-7 of the seven health practices was compared with another 45-year-old man who was practicing only 0-3, for instance, the two had a gap of approximately eleven years in their life expectancy. This was the first study that demonstrated that one's habits have an influence on their health.

The seven health habits identified by Breslow, L., et al.^{13,14} are as follows:

1. Getting 7–8 hours of sleep at night regularly
2. Eating breakfast nearly every day
3. Eating between meals once a day or less frequently
4. Not drinking habitually, or having four drinks or less at one time
5. Not smoking habitually
6. Performing moderate to vigorous physical activities^{*1} frequently, and
7. Keeping a proper weight^{*2}

*1 Vigorous sports activities, long-distance walking, hunting, gymnastic exercises, gardening

*2 BMI of around 22 (see Chapter 6)

The relationship between health habits and health has since been explored in a variety of different combinations. In a study¹⁵ that examined five lifestyle factors, for instance, the authors found that those who adhered to more of the following factors: never smoked cigarettes; physical activity of ≥ 3.5 hours/week with moderate to vigorous intensity; high diet quality (e.g. a diet rich in whole grains, nuts, legumes, and vegetables, and low in red and/or processed meats, refined grains, sugar-sweetened beverages, and sodium); moderate alcohol intake of 5–15 g/day for women or 5–30 g/day for men; and normal weight (body mass index < 25) had a longer life expectancy from age 50 free of diabetes, cardiovascular diseases, and cancer.

Past studies such as these have shown that life habits related to **exercise, diet, smoking, alcohol use, and weight control** are important factors of health habits. Health habits are influenced by society and culture, however, and it is important that Cambodia should pursue health habits that are rooted in its own society and culture. To promote school health education, in particular, it is necessary to clarify how lifestyle habits and living activities are associated with health, growth, and development of young people in Cambodia.

Topics for further thought and research

- [5-1] List up as many types of play as you can think of that would involve children being physically active.
- [5-2] Think of what teachers can do to secure playtime for children to be physically active.
Do research on foods in Cambodia that can cause food allergies (see the column on Food Allergy).
- [5-3] Recall and write down what you have eaten in the past few days, and discuss with others as to whether or not you are keeping a well-balanced diet based on a good variety of food, by using the Cambodian food pyramid (**Figure 5.5**) and the Seven key messages (**Figure 5.6**) as references. If your diet lacks certain foods, think of what you should eat to make up for it.
- [5-4] Ask an elderly person (Cambodians have an average life expectancy of approximately 69 years) who is active and healthy without suffering any major illness about what health habits they keep in their everyday life (such as diet, physical activity, smoking, drinking, and stress-relief habits).
- [5-5] Identify unhealthy lifestyle behaviors of people around you, and think of what should be done to help them change such behaviors.
- [5-6] Check on your lifestyle habits using the checklist in **Table 5.3**. Based on the results, review your lifestyle habits by using the examples of good and poor rhythms of everyday life (**Figure 5.2**).

Table 5.3 Lifestyle habit checklist

| Item / Date | 8/23/2021 | / | / | / | / | / | / | / |
|---|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| | (Mon) | () | () | () | () | () | () | () |
| What time did you get up in the morning? (Rest/sleep) | H: 6 | H: | H: | H: | H: | H: | H: | H: |
| | Min: 30 | Min: | Min: | Min: | Min: | Min: | Min: | Min: |
| Did you get up feeling refreshed? (Rest/sleep) | <input checked="" type="radio"/> Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | <input type="radio"/> No | No | No | No | No | No | No | No |
| How many hours of sleep did you have? (Rest/sleep) | 8 hours | hours | hours | hours | hours | hours | hours | hours |
| Did you have breakfast? (Diet) | <input checked="" type="radio"/> Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | <input type="radio"/> No | No | No | No | No | No | No | No |
| Did you pass a bowel movement? (Diet) | <input checked="" type="radio"/> Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | <input type="radio"/> No | No | No | No | No | No | No | No |
| For how long did you do sports or other exercises on the day in question? (Exercise) | 90 min | min | min | min | min | min | min | min |
| For how long did you walk getting to and from school, or do light exercises? (Exercise) | 60 min | min | min | min | min | min | min | min |
| Did you eat at regular hours? (Diet) | <input checked="" type="radio"/> Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | <input type="radio"/> No | No | No | No | No | No | No | No |
| Did you eat between meals? (Diet) | <input checked="" type="radio"/> Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | <input type="radio"/> No | No | No | No | No | No | No | No |
| Did you use a smartphone, etc. before bedtime? (Rest/sleep) | <input checked="" type="radio"/> Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | <input type="radio"/> No | No | No | No | No | No | No | No |
| Did you do things that improve sleep like stretching and taking a bath? (Sleep/rest) | <input checked="" type="radio"/> Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | <input type="radio"/> No | No | No | No | No | No | No | No |
| What time did you go to sleep? (Rest/sleep) | H: 21 | H: | H: | H: | H: | H: | H: | H: |
| | Min: 30 | Min: | Min: | Min: | Min: | Min: | Min: | Min: |

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Prevention of lifestyle diseases

Learning objectives

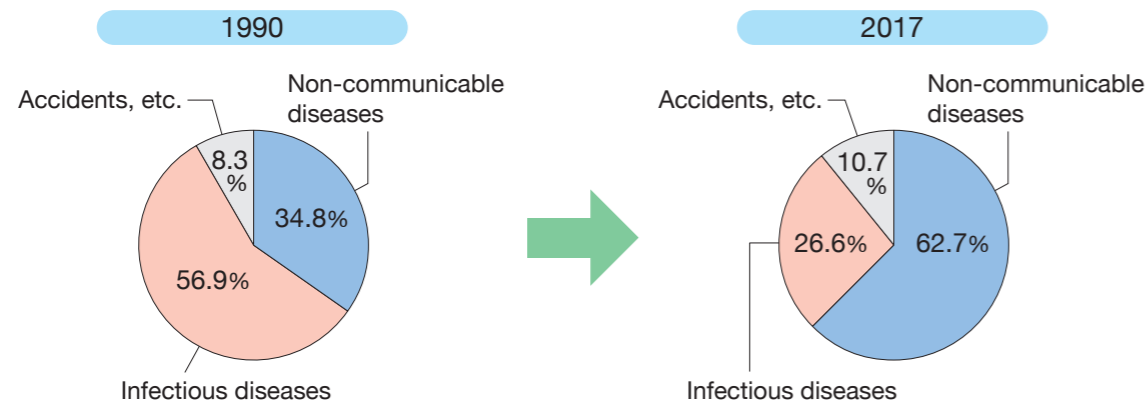
You will be able to gain proper understanding and explain:

- The current situation surrounding lifestyle diseases in Cambodia.
- How obesity affects a person's health.
- The importance of diet/nutrition in the prevention of lifestyle diseases.
- Factors to help one acquire healthy lifestyle habits.
- Health problems that stem from an improper diet.

In this chapter, you will learn about the relationship between lifestyle diseases and lifestyle habits. Specifically, we will cover lifestyle diseases that are common in Cambodia, and basic lifestyle habits and diet/nutrition as contributing factors to the diseases.

1. Common lifestyle diseases among Cambodians

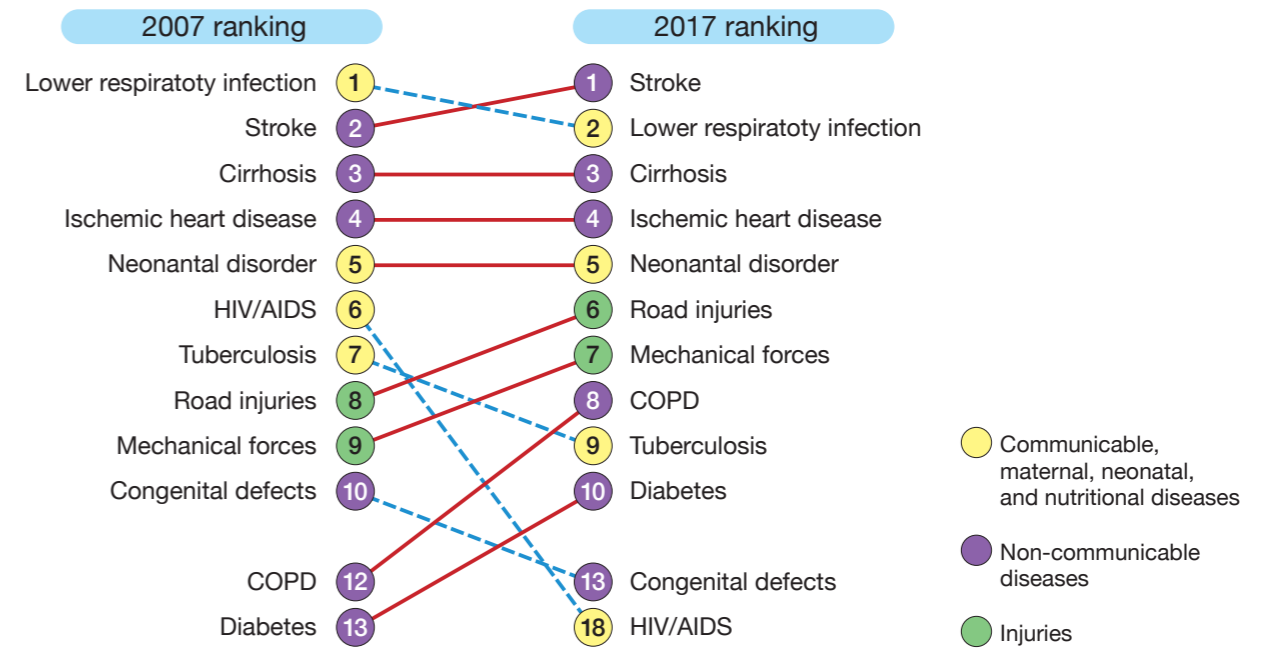
Around 30 years ago, Cambodia had a high mortality rate caused by infectious diseases. While the country has since seen declines in the proportion of infectious diseases-related mortality thanks to improved hygiene and nutrition, the proportion of **non-communicable diseases (NCD)-related mortality** has surpassed 60% (Figure 6.1)¹. In particular, what are known as **lifestyle diseases**, such as stroke, liver disease, heart disease, cerebrovascular disease, malignant neoplasms (i.e. cancer), and diabetes, are now among the leading causes of death (Figure 6.2). Among the **risk factors for death and disability** due to such diseases, factors related to human behaviors and metabolism figure largely;



Source: Ministry of Economy, Trade and Industry. "International Healthcare Development Country Report: Cambodia"¹

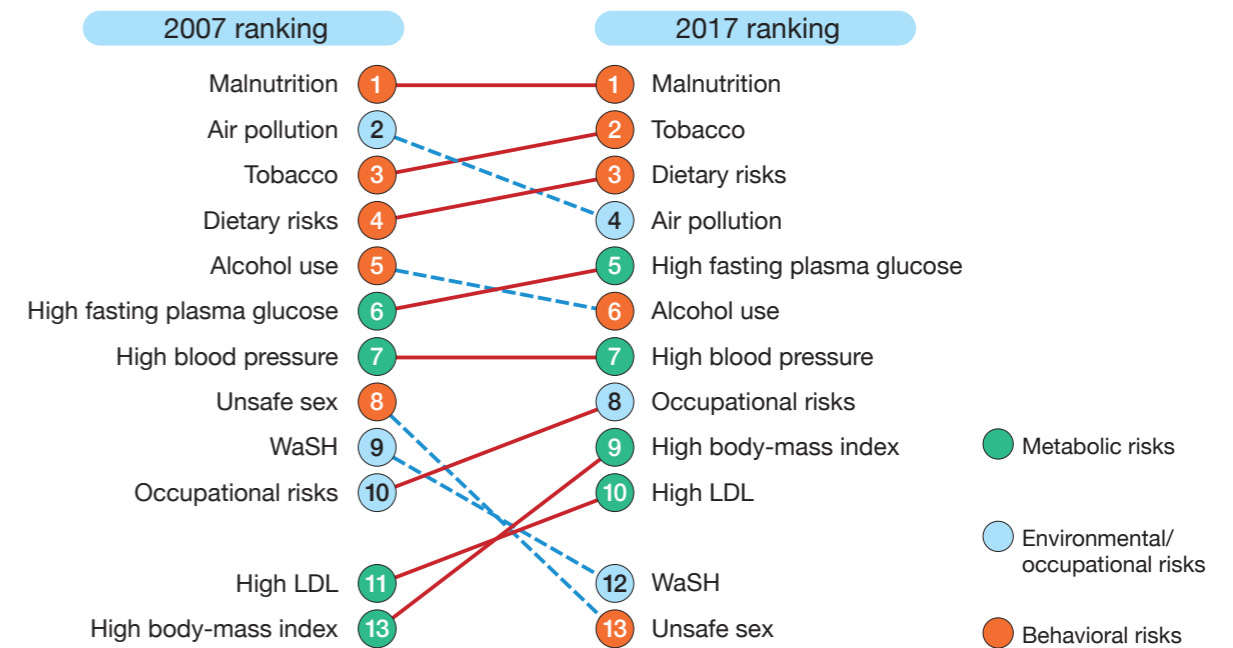
Figure 6.1 Changes in causes of deaths over time in Cambodia (1990–2017)

specifically, factors related to lifestyle habits such as diet and exercise, rest, and labor, and abnormal health conditions (e.g. smoking, diet, alcohol use, obesity, occupational risks, fasting hyperglycemia, hypertension, and high cholesterol) have become problematic (Figure 6.3)².



Source: Institute for Health Metrics and Evaluation. Cambodia - What causes the most deaths? <http://www.healthdata.org/cambodia>

Figure 6.2 Changes in causes of deaths over time in Cambodia (2007–2017)²



Source: Institute for Health Metrics and Evaluation. Cambodia - What risk factors drive the most death and disability combined? <http://www.healthdata.org/cambodia>

Figure 6.3 Changes in risk factors for death and disability over time in Cambodia (2007–2017)²

2. Lifestyle diseases and other conditions related to lifestyle habits

1) Lifestyle diseases

Table 6.1 shows a list of common lifestyle diseases and their symptoms. **Cerebrovascular disease** is a collective term for diseases caused by abnormality of arteries in the brain, with stroke being a commonly known form. **Liver disease (hepatitis)** involves inflammation of the liver, and possible causes include hepatitis virus infection, alcohol use, and obesity. **Heart disease** includes angina and myocardial infarction, which are caused by reduced blood flow or the formation of a blood clot in coronary arteries of the heart. A **malignant neoplasm** is an out-of-control growth of diseased cells (**cancer cells**) within a human body. Cancer cells are a mass of diseased cells, which were originally normal cells that turn into cancerous cells when their genes are damaged. **Diabetes** is a disease in which the bodily function that

Table 6.1 Common types of lifestyle diseases and their symptoms

| Type of lifestyle disease | Symptoms |
|-----------------------------|---|
| Cerebrovascular disease | A collective term for diseases caused by abnormality of arteries of the brain. Stroke is a commonly known form. Stroke has two main types: diseases caused by a blockage or rupture of the brain blood vessels. The former refers to cerebral infarction , in which a blockage of a blood vessel prevents blood from flowing into the brain, depriving the brain of oxygen and nutrients. This leads to the necrosis of neurons in the brain, which may cause a range of damage. The latter form of cerebrovascular disease includes subarachnoid hemorrhage and brain hemorrhage , in which a rupture of an artery in the brain causes bleeding into the brain. The blood that leaks out puts pressure on the neurons in the brain and causes damage. Symptoms include headache, paralysis of limbs, speech difficulty, and decreased level of consciousness. |
| Liver disease (hepatitis) | Liver disease (hepatitis) involves inflammation of the liver. Its possible causes are hepatitis virus infection, alcohol use, and obesity. Symptoms include loss of appetite, malaise, nausea, vomiting, and jaundice. |
| Ischemic heart disease | Ischemic heart disease includes angina and myocardial infarction . Angina is a condition where arteriosclerosis narrows the coronary arteries of the heart and obstructs the blood flow (Figure 6.4), resulting in repeated seizures accompanied by transient pain. Myocardial infarction refers to a condition where formation of clots in a blood vessel of the heart due to arteriosclerosis causes occlusion of the blood vessel, resulting in necrosis of myocardial cells. Delays in treatment can be fatal, and prompt medical attention is required. |
| Malignant neoplasm (cancer) | A malignant neoplasm (cancer) is a disease in which normal cells turn into diseased cells (cancer cells) and grow in an out-of-control manner (Figure 6.5). Cancer cells may form in different organs including the lungs, liver, uterus, and breast, and may grow, expand and spread to other organs, a process called metastasis. Symptoms vary depending on the site of the cancerous organ. |
| Diabetes | Diabetes is a disease in which the insufficiency or impaired action of insulin, which reduces blood sugar, causes a decline of the bodily function that suppresses the elevation of blood sugar levels, leading to chronic high blood sugar. There are type 1 and type 2 diabetes . Type 1 diabetes involves destruction of insulin producing cells due to autoimmune diseases and requires self-injection of insulin. Type 2 diabetes develops due to certain genetic factors combined with certain lifestyle habits such as overeating and physical inactivity. It may worsen without subjective symptoms, and raise risks for the three main complications, namely retinopathy, nephropathy, and neuropathy, as well as for progression of arteriosclerosis in larger vessels which may lead to heart diseases or stroke. |

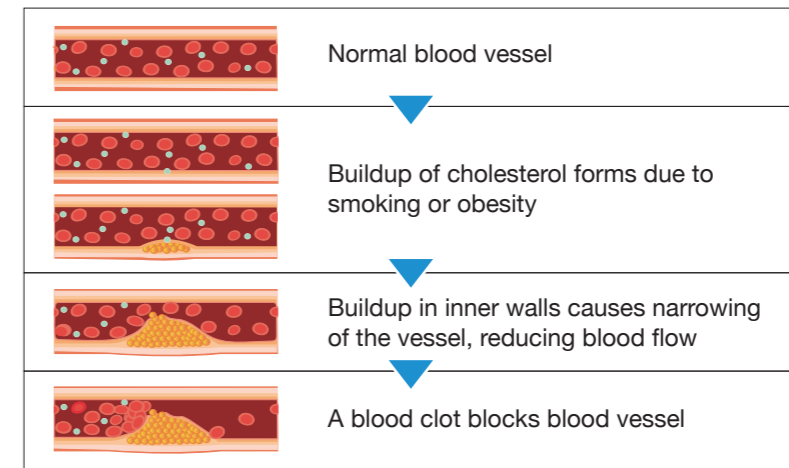


Figure 6.4 Development and progression of arteriosclerosis

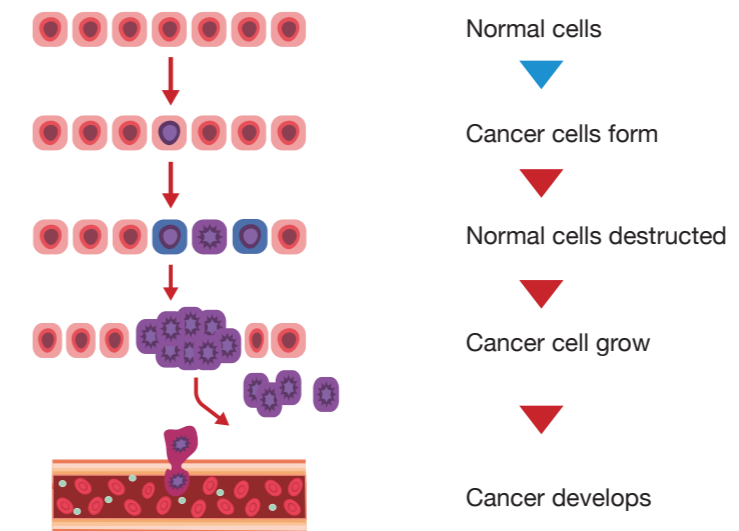


Figure 6.5 Process of carcinogenesis

suppresses the elevation of blood sugar levels is reduced, leading to chronic high blood sugar and causing a number of complications.

Another lifestyle disease is **periodontal disease**. Periodontal disease is an inflammatory disease caused by bacterial infection of the gums (**Figure 6.6**). When the gap between the teeth and gums is cleaned insufficiently, plaque may build up, allowing numerous bacteria to linger. The margins of the gums may be reddened or swollen due to inflammation, although pain is absent in many cases. If it progresses, the gap between the teeth and gums, called a **periodontal pocket**, becomes deeper, and the foundation of the teeth (alveolar bone) breaks down, ultimately requiring tooth extraction. Furthermore, toxic substances that form as a result of inflammation can enter into general circulation via blood vessels of the gums, causing various diseases or worsening pre-existing conditions.

Risk factors for periodontal disease include oral environments such as plaque, tartar, misaligned teeth, and smoking, as well as lifestyle habits that may decrease the body's resistance to diseases such as poor eating habits, stress/fatigue, physical inactivity, and lack of sleep. To prevent periodontal disease,

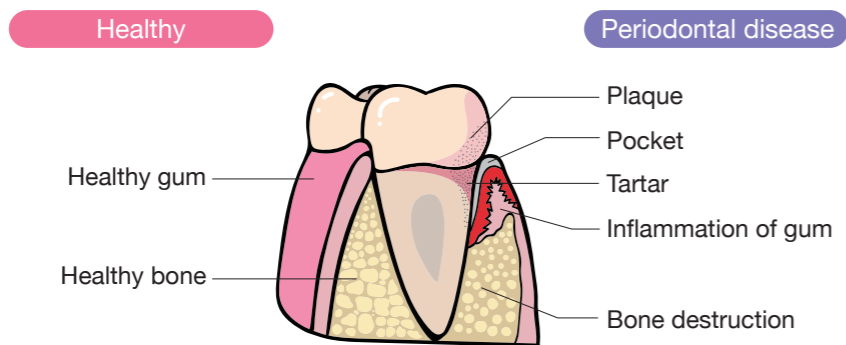


Figure 6.6 Periodontal disease

it is therefore important for one to reduce or refrain from alcohol and tobacco use, keep regular hours, avoid stress, and keep a balanced diet, as well as brushing one’s teeth properly every day to keep the surface of the teeth clean and free of plaque. It is also effective to have one’s teeth cleaned by a dental specialist on a regular basis to maintain the health of one’s teeth, as it will remove tartar completely, even inside the gums, and clean the dental root, making the surface smooth and ridding it of bacteria that cause inflammation. In addition, the treatment of damaged gums and bone will help restore the gums close to a healthy state. For details on dental health, see Chapter 8.

Column: What is inflammation?

Inflammation is a bodily reaction to damage to biological tissues or cells caused by an injury, disease, or noxious stimulation, as a means of removing the damaged parts and helping regeneration. It is a reaction necessary for a human body to restore its health. Major stimuli (causes) of inflammation include: biological stimuli due to the invasion of a pathogen (bacteria, viruses, parasites, etc.; see Chapter 7); physical stimuli such as ultraviolet, light radiation, or high or low temperatures; and chemical stimuli such as acid and alkali. Common symptoms include reddening, swelling, fever, pain, and the inability to move the affected part. Inflammation may be acute, meaning it subsides in a short period of time, or chronic, when the symptoms are prolonged. The acute phase of inflammation is dominated by a type of white blood cell called neutrophils, while lymphocytes and macrophages are at play in the chronic phase (See Chapter 7).

Column: Plaque and tartar

Plaque is a sticky substance, white or yellowish white in color, that is found on the surface of a tooth. It is a mass of numerous bacteria, as many as 100 million per 1 mg. A cavity-causing bacterium called **Streptococcus mutans** is prone to adhere to teeth, forming stiff plaque.

Tartar is a calcified form of plaque. It is a mass that is hard as a stone and tends to form between teeth and the gum ridge. It often contributes to the development of cavities, halitosis, and periodontal disease.

2) Other health issues related to lifestyle habits

(1) BMI-mortality relationship

In all causes of death, the **BMI-mortality relationship** among Japanese men demonstrates a **reverse J-shaped curve** when plotted on a graph (Figure 6.7.1).³ This graph shows that when men whose BMI are between 23 and <25, their mortality risk is assumed to be 1.0 (the reference value), and then shows how many times the mortality risk increases for those who have lower or higher BMI than the reference value. For example, the mortality risk of men with BMI of 30 or higher is 1.42 times higher than those with BMI of 23 and <25. Japanese men whose BMI are between 23 and less than 30 are shown to have low risk of mortality from all causes compared those with other ranges of BMI. That is the optimal range of BMI for Japanese men.

The BMI-mortality relationship among Japanese women demonstrates a U-shaped curve (Figure 6.7.2).³ This graph indicated that, taking into account mortality risk from all causes, the optimal range of BMI for Japanese women is between 21 and less than 27.

It should be noted, however, that BMI, or **body mass index**, is calculated based on a person’s height and weight, and does not tell whether the person is muscular or has excessive fat. “**Latent obesity**,” or normal BMI combined with a high body fat percentage, is found among young women. Although there are body fat scales available for purchase, different models may employ different methods of estimation or criteria, which makes it difficult to take an accurate measurement of body fat percentage. You can use trends in body fat percentage as one indicator for obesity, keeping in mind that it has a margin of error.

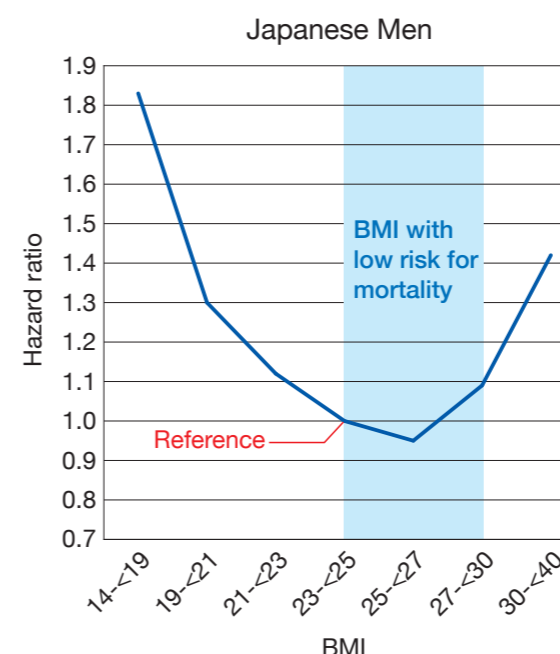


Figure 6.7.1

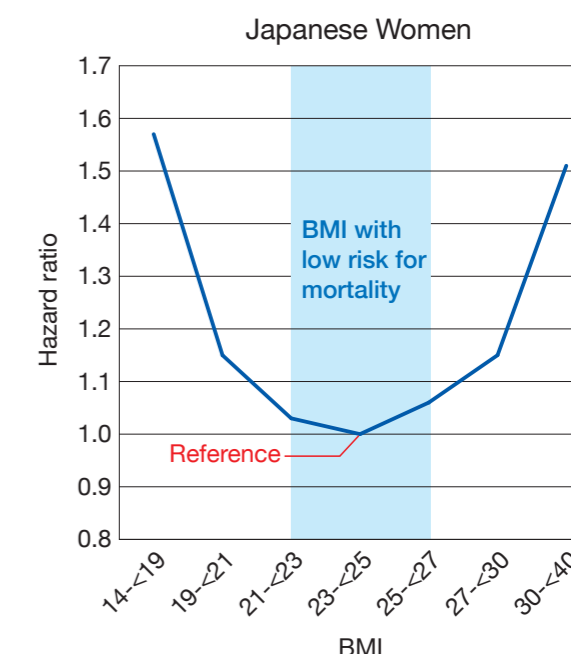


Figure 6.7.2

This figure is created using the data published in Sasazuki S. et al. Body Mass Index and Mortality From All Causes and Major Causes in Japanese: Results of a Pooled Analysis of Large-Scale Cohort Studies. Journal of Epidemiology. 21(6) 417-430. 2011. <http://doi.org/10.2188/jea.JE20100180>

Figure 6.7 Association between Body-Mass Index and Risk of mortality from all causes³

(2) Obesity and underweight

Obesity is a condition in which a person's body has an excessive accumulation of body fat. Because it constitutes a risk factor for respiratory, cerebrovascular, liver, and heart diseases, as well as for diabetes, prevention and control of obesity plays an important role in building health. **Body mass index (BMI)** is used to determine the level of obesity.

Being underweight, meanwhile, is a condition in which a person's body has low body fatness. Many young women may have an unbalanced diet or repeat extreme dieting despite the fact that they do not need to lose weight, and this raises health risks associated with dieting. An unbalanced diet owing to the wrong eating habits, in particular, may cause **iron deficiency anemia** or **osteoporosis**, which are detrimental to one's health. When it becomes serious, it may lead to **anorexia** or **bulimia**. Both anorexia and bulimia are forms of **eating disorders**. The former is estimated to affect in many cases people in their adolescence and early adulthood, when they avoid eating for fear of becoming fat, which causes them to become extremely thin. The latter involves repetitive episodes of overeating a few times a week over a period of months combined with inappropriate compensatory behaviors to avoid gaining weight (i.e., vomiting, use of a laxative). If such eating disorders become chronic, they may cause a number of forms of health disturbance, including **amenorrhea**, hypotension, and arrhythmia.

Column: Health information obtained based on body height and weight

BMI is calculated based on a person's height and weight. According to the WHO standards, a normal BMI is 22.0 for both men and women, and those with a BMI of below 18.5 are classified as being underweight, and 30 and above, obese (Table 6.2). BMI is an indicator meant for adults; the Kaup index and the Rohrer index are used for infant and school children, respectively (See Chapter 9 to learn about the calculation).

$$\text{BMI} = \text{weight (kg)} / \text{height (m)}^2$$

Table 6.2 BMI and Nutritional status

| BMI | Nutritional status |
|------------|--------------------|
| Below 18.5 | Underweight |
| 18.5–24.9 | Normal weight |
| 25.0–29.9 | Pre-obesity |
| 30.0–34.9 | Obesity class I |
| 35.0–39.9 | Obesity class II |
| Above 40 | Obesity class III |

Source: WHO region office for Europe, Body mass index-BMI.⁴
<https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi>

(3) Anemia

Anemia is a condition in which the amount of hemoglobin and the number of red cells in a given volume of blood fall below standard levels. When one has anemia, they may experience symptoms such as **facial pallor**, fatigue, general malaise, headache, palpitation, shortness of breath, loss of appetite, and in the cases of children, the impairment of intellectual development as well as learning or motor problems due to poor concentration. This is because a primary role played by **red blood cells**, which are a component of blood, is to transport oxygen and nutrients throughout the body, and any impairment to this function affects the brain the most out of all organs. A key to the delivery of oxygen is **hemoglobin**, which is a component of red blood cells. Hemoglobin is rich in iron, and it carries oxygen when iron binds to oxygen.

Adolescence in particular is a phase when one's consumption of iron increases as one goes through growth or menstruation, which often causes **iron deficiency anemia** due to a lack of iron as a component of hemoglobin. Poor nutrition also causes iron deficiency anemia. Dietary iron is found in two forms: heme iron, which is present in large amounts in animal-based products such as meat, and fish, and non-heme iron, which is present in vegetables and grains (Figure 6.8). Heme iron is known to be more well-absorbed than non-heme iron. For the prevention of iron deficiency anemia, it is recommended that one takes animal products that are rich in heme iron. Vegetables, legumes, and other common plant-based products that are rich in non-heme iron, meanwhile, can also have better iron absorption when combined with vitamin C-rich vegetables and fruits. One therefore needs to take both heme and non-heme iron in a balanced manner.

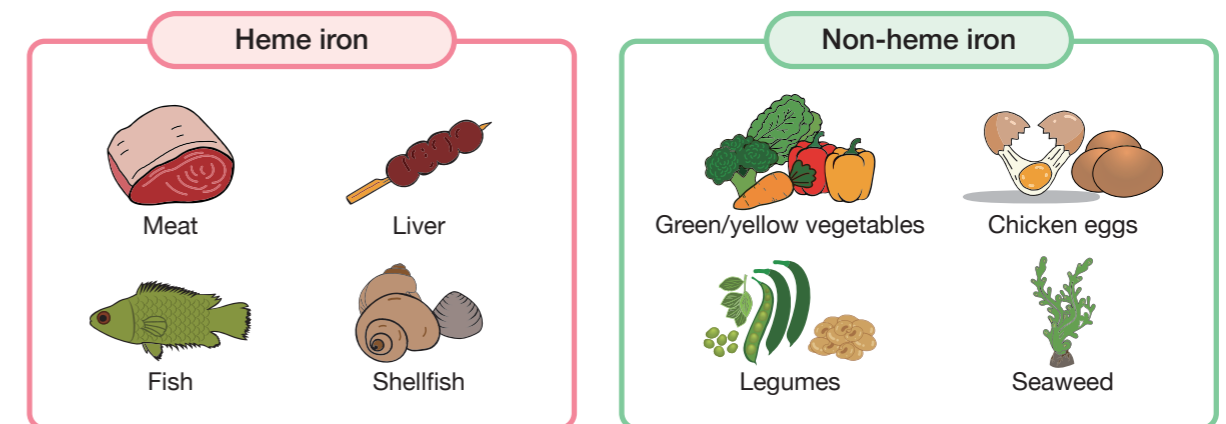


Figure 6.8 Main dietary sources of iron

Column: Cambodians and anemia

Anemia represents a serious health issue in Cambodia. Prevalence of anemia in the country is approximately 56% among children under 5 years of age, and approximately 45% among women 15–49 years of age⁵. Possible causes of anemia in Cambodians, other than simple iron insufficiency, may include deficiencies of zinc or folic acid deficiency, parasite or malaria infection, and pregnancy. Anemia caused by these factors may not be improved by the intake of dietary iron or iron

supplementation alone (Table 6.3)⁶. While use of the **Lucky Iron Fish**⁷ and fish sauce fortified with an iron compound⁸ have been known to improve dietary iron deficiency anemia, the Lucky Iron Fish was reported to have been ineffective in the cases of anemia due to non-dietary causes such as genetic hemoglobin disorder⁹. It is therefore important that one keep a balanced diet. Other possible approaches to alleviate or prevent anemia include parasite control using vermicides, proper malaria prevention and treatment measures, and family planning that suits individuals.

Table 6.3 Non-iron-related causes of anemia in Cambodia

| | |
|-----------------------|---|
| Zinc deficiency | Deficiency of zinc makes the erythrocyte membrane more vulnerable to damage, which causes the red cell count to decline. |
| Folic acid deficiency | Folic acid is essential for hematopoiesis, and its deficiency inhibits production of normal red blood cells. |
| Parasite infection | If hookworms are attached to the intestinal mucosa for a prolonged period of time, it causes chronic blood loss, resulting in anemia. |
| Malaria | Malaria parasites proliferate inside the body and infect and eventually destroy red blood cells. (See Chapter 7 to learn more about malaria) |
| Pregnant women | Expecting mothers require iron and other nutrients in greater amounts than normal. Short inter-pregnancy interval puts greater strain on a mother, raising the risk for anemia. Pregnancy and delivery by a teenager, who is still in a period of growth herself, can also be more susceptible to anemia. |

3. Prevention of lifestyle diseases and diet/nutrition¹⁰⁻¹²

1) Acquiring desirable lifestyle habits

A normal rhythm of everyday life often means that one eats three times a day. It is desirable that one acquires a habit of eating a regular and balanced diet, keeping lifestyle disease prevention in mind as a part of daily life. Being mindful of one's every meal every day helps maintain healthy lifestyle habits.

The human body is inherently equipped with a system that works to maintain **homeostasis**. For instance, if one eats snacks that are high in sugar and fat, levels of sugar and triglyceride or cholesterol in the blood increase. Such increases are a normal bodily response, and they return to the levels before the intake of such snacks. If undesirable lifestyle habits or disturbance to a rhythm of everyday life harms the system that maintains homeostasis, however, it may cause a situation where the blood sugar or triglyceride levels elevated by food intake take much longer to return to normal, with these levels remaining high even when one has not eaten.

A **balanced diet** is a diet that allows one to take in just the right amounts of nutrients they need to maintain their health. To maintain homeostasis, it is important for one to acquire a habit of eating a balanced diet. However, it takes some time for us to see whether or not our diet is right as the latter manifests in the form of abnormal physical conditions. In other words, people are not quick to realize it when their diet is not appropriate. This is what makes dietary habits one of the factors for lifestyle diseases. Continuation of an inappropriate diet exposes a human body to an inadequate supply of nutrients for a prolonged period of time. Many cases of type 2 diabetes, dyslipidemia, and hypertension, for instance, are attributable to inappropriate dietary habits. Development of these diseases constitutes risk factors for ischemic heart diseases and cerebrovascular diseases.

To help one take in the right amounts of necessary nutrients, it is effective to use the **Cambodian Food Pyramid** (see Chapter 5) as a guide to appropriate food intake. The pyramid classifies foods into different groups according to their characteristics. When using the Cambodian Food Pyramid to track one's dietary nutrient intake, it is preferable to do so over the span of one week or similar, rather than judging whether or not the intake is appropriate based on a meal-by-meal or day-by-day basis.

In addition, it is critical to have children acquire good dietary habits in their infancy and early childhood, and children need to learn about the **Cambodian Food Pyramid** and the **Seven Key Messages** during their school-age years (see Chapter 5). Since lifestyle habits of school-age children depend largely on parent education, it is also important to communicate with parents and guardians. In school education, it is desirable to have students/pupils gain understanding of the characteristics of foods that are consumed frequently in each region of Cambodia, and have them acquire knowledge on nutrition, such as what to eat and how much to eat to maintain an appropriate nutrition status. To this end, it is effective to provide opportunities to try actual food and meals by offering experiences such as observing foods being sold at a market or store, eating at a restaurant, growing crops at school or home, and cooking the crops they have grown by themselves, or making use of audiovisual learning materials.

2) Importance of healthy proteins

Proteins are found in nearly all foods, regardless of whether they are plant- or animal-based. They are degraded by multiple digestive enzymes in the digestive tracts into **amino acids** for absorption. Once absorbed, the amino acids are converted into a variety of different substances based on genetic information and biological state, and serve as an energy source or building material for biological structures. In addition, amino acids play important roles to synthesize proteins, which produce enzymes, hormones, neurotransmitters, immune cells and antibodies, various receptors, or transporters. Thereby, the proteins regulate bodily functions and maintain immune function, contributing to preserve bodily resistance (see Chapter 5).

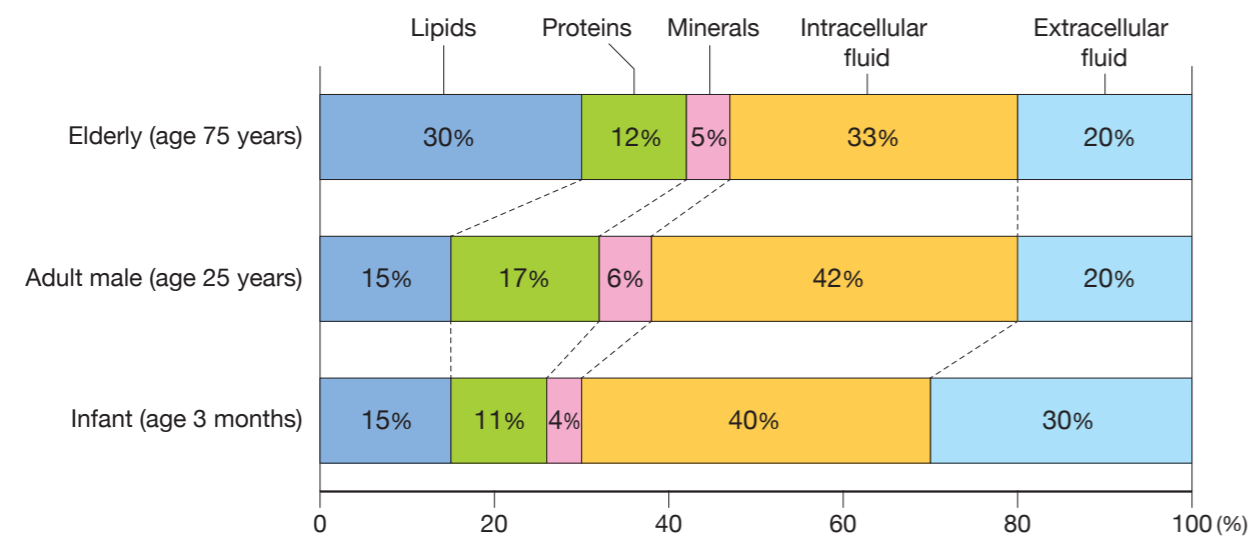
While there are 20 amino acids that are body constituents, nine of them cannot be synthesized in the body. These nine are called **essential amino acids**, and humans must take them in the form of dietary protein. If one's diet consists predominantly of a single type of food, it is difficult for them to cover all essential amino acids. It is therefore necessary for one to maintain a balanced intake of meat, seafood, eggs, and legumes, in addition to grains as a staple food.

4. Acquiring a better rhythm of everyday life

1) Maintenance of biological homeostasis

Homeostasis is a bodily function, or a process of biofeedback, with which a living body maintains a constant internal environment and sustains life activities by responding to environmental changes (see also Chapter 2). A living body has mechanisms that maintain homeostasis, such as regulation of body temperature, body fluid osmolality and pH, the concentration of glucose in blood, and blood pressure. For instance, the body temperature of a healthy human being is maintained at 36–37 degrees Celsius regardless of external temperatures. Likewise, a person's concentration of glucose in blood is maintained within the normal range even right after meals or when they have not eaten. By having these mechanisms work in concert to keep an optimal condition for the individual, a living body is able to sustain life activities.

Figure 6.9 shows the main composition of a human body. Approximately two-thirds of a human body is water, of which two-thirds is the intracellular fluid and the remaining one-third extracellular fluid. Intracellular and extracellular fluids normally have the same fluid density because homeostasis is at work to induce osmotic transport of water. In addition, intracellular and extracellular fluids contain a number of substances required for a living body to sustain life, and they exchange substances via cell membrane to ensure the cells work properly. For instance, key substances found in extracellular and intracellular fluids are electrolytes, including sodium ions (Na^+), chloride ions (Cl^-), and phosphate ions (HPO_4^{2-}) in the former, and potassium ions (K^+), calcium ions (Ca^{2+}), and magnesium ions (Mg^{2+}) in the latter.



This figure is a modification of the original in "Oku T, & Yamada K (Eds.), *Basic biochemistry*, 2nd ed. Nankodo, 2014¹⁰ and its 3rd ed. published in 2019¹¹."

Figure 6.9 Composition of the Human body

2) Biological clocks

The earth rotates once every 24 hours approximately. Living organisms on earth have bodily systems that reflect changes in photoenvironment that repeat in a 24-hour cycle. This is called a **circadian rhythm**, in which their **biological clocks** regulate sleep, hormone release, body temperature, blood pressure, and enzymatic reactions (i.e., chemical reactions such as digestion, degradation, absorption, and metabolism induced by enzyme activity). If a circadian rhythm is out of form or is disrupted, it has mental and physical consequences; if the rhythm is not restored, it may induce sleep disorders, lifestyle diseases, or psychiatric illness (see also Chapter 2).

Humans eat and are active during the light period (i.e., when it is light during daytime) and sleep during the dark period (i.e., when it is dark during nighttime, etc.). The chemical reactions and hormone releases in the body are regulated according to this shift of behaviors. Regular hours and desirable lifestyle habits accord with this innate biological rhythm and play a role in preventing diseases.

3) Lifestyle habits to maintain a normal biological rhythm

To maintain the inner environment of a living body, many organs work in coordination, including the immune autonomic, and endocrine systems. For instance, the concentration of glucose in blood is regulated to be always within the normal range. This is achieved by the pancreas releasing **insulin** in response to elevation of blood sugar, with insulin promoting the cellular uptake of glucose. Diabetes is a condition in which insulin fails to work properly, leaving the blood sugar level out of control and increasing beyond the normal range, which results in an excessive amount of glucose in urine. There are two causes for insulin to fail to work: reduced insulin secretion, and insulin resistance. The former may occur when insulin output by the pancreas is already low to begin with, or it becomes lower as a result of aging or genetic reasons. The latter means that insulin has become less active even when its output is sufficient. If a person becomes obese due to irregular dietary habits and physical inactivity, insulin becomes less active.

To maintain homeostasis, daily lifestyle habits play an important role. Not only does eating at regular hours sate one's hunger and supply the body's need for nutrients, but it is also an activity that is necessary to regulate enzymatic reactions and maintain homeostasis. Besides diet, regular bowel movements and desirable sleep habits are also important. Some hormone release and enzymatic reactions may subside when the body is resting and energy consumption is low, while others may increase. Growth hormones are important during periods of growth, and their secretion is promoted during sleep at night. While sleeping, one's hormone release and enzymatic reactions associated with the digestion and absorption of nutrients are reduced, so that the body stores the nutrients and saves energy. This well-orchestrated regulation allows a living body to sustain life activities without running out of energy. Regular lifestyle habits are important activities in order for a living body to maintain a normal biological rhythm and maintain biological homeostasis.

Column: Environmental stimuli, homeostasis, and autonomic function

Humans are exposed to various environmental stimuli, including physical stimuli such as heat, ultraviolet light, and noise, biological stimuli such as those caused by bacterial infection, chemical stimuli caused by drugs, and psychological distress such as stress from peer relationships, hardships of life due to financial reasons, and violence (see also Chapter 12). When one is exposed to such stimuli for a prolonged period of time, their biological homeostasis may become imbalanced, putting their health at risk. As discussed in Chapter 2, the autonomic nervous system has two divisions, namely the sympathetic and parasympathetic nervous systems, and they control the blood pressure, heart rate, body temperature, digestion, metabolism, perspiration, excretion, sexual arousal processes. When the body is continuously subjected to environmental stimuli, this autonomic regulation may be disturbed, potentially resulting in homeostatic imbalance. This causes certain symptoms to manifest in mental and physical ways, such as tiredness, constipation or diarrhea, headache, dizziness, palpitation, and feeling of depression. It is therefore necessary to pay ample attention to stimuli from the environment in addition to keeping regular lifestyle habits, in order to maintain homeostasis and good health.

5. Improper diets and health problems

In many cases, the health impact of a proper or improper diet may only be noticed when one is aware of subjective symptoms and the illness is advanced. Where infants are concerned, a mother may experience a low milk supply or become unable to breastfeed a child at all due to poor nutrition or health, or child neglect. In their early childhood and school-age years, children may experience an imbalance in energy and nutrition intake that is necessary for them due to picky eating, unbalanced eating, or allergy.

According to an FIDR report¹³, the prevalence of **stunting** in Cambodia was approximately 20% among children of age 6 years, peaked at over 40% in those of age 10–12 years, and was still higher than 30% in 13–15 years. **Wasting** accounted for 10% in age group 7–9 years and approximately 20% in 10–15 years. As for **malnutrition**, the prevalence increased significantly at the age of 10–12 years. In a comparison of children’s nutrition status between urban and rural areas, malnutrition was severe among rural children (Table 6.4). See Chapter 9 to learn about the definitions of stunting, wasting, and underweight as indicators of malnutrition.

For normal growth of children, intake of protein as well as energy is important. In Cambodia, the largest source of students’ protein intake was cereal, followed by fish, meat, eggs, and legumes (Figure 6.10)¹³. The most common meal pattern in Cambodia was “rice with soup or sweetened soup,” followed by “rice with soup and deep-fried/grilled dish.” To ensure normal growth of children, it is important to improve nutrition status through a smart approach to supplying good-quality protein. Meat and eggs, for instance, contain iron on top of quality proteins, which helps prevent anemia. In Cambodia, people consume more soy milk than regular milk, and soy milk serves as their source of protein intake. Proteins, which are an important composition of a human body, are building blocks of the immune system,

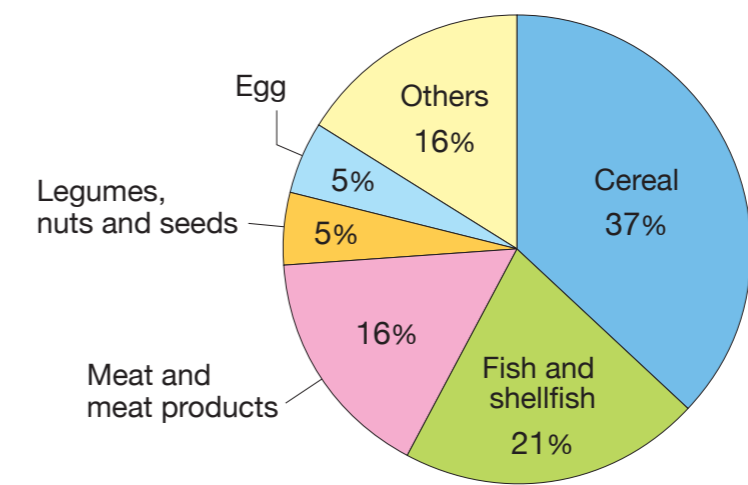
enzymes, and hormones.

Overweight and obesity, meanwhile, were observed in 3.2% of students. Prevalence of overweight was 2.1% among urban students¹³. Among students, 86.6% consumed junk food at least once a week and 21.9%, every day; 84.3% consumed soft drinks at least once a week and 11.8%, every day. One of the **Seven Key Messages** advises against excessive intake of salt or fat, and this helps prevent non-communicable diseases from developing. While child overweight and obesity are not an issue of high priority in Cambodia at present, it will become important to educate students on what diets help prevent non-communicable diseases.

Table 6.4 Comparison of nutrition statuses (age 6–17 years)

| | Urban | Rural |
|-------------|-------|-------|
| Stunting | 20.4% | 36.4% |
| Wasting | 10.4% | 16.1% |
| Underweight | 22.1% | 38.1% |

Source: FIDR, 2017¹³



Source: FIDR¹³

Figure 6.10 Sources of protein for children

Column: Dietary habits that prevent lifestyle diseases will also help prevent infectious diseases

Dietary guidelines implemented in Cambodia including the Cambodian Food Pyramid not only help prevent lifestyle diseases but infectious diseases as well. WHO has published “Nutrition advice for adults during #COVID-19¹⁴” (Table 6.5), emphasizing the importance of food: “Proper nutrition is vital. Eat a well-balanced diet every day to get the vitamins, minerals, dietary fiber, protein and antioxidants your body needs to be healthier with a stronger immune system and to lower your risk of chronic illnesses and infectious diseases.”

Table 6.5 Nutrition advice for adults during the COVID-19 outbreak¹⁴

Eat fresh and unprocessed food such as dark green leafy vegetables, orange/yellow colored fruit and vegetables, legumes (e.g., lentils, beans), nuts and whole grains (e.g., unprocessed maize, millet, oats, wheat, brown rice or starchy tubers or roots such as potatoes), and proteins (e.g., meat, fish, eggs, milk).

Drink 8-10 cups of water every day. Water is the best choice, but you can also consume other drinks (e.g., lemon juice diluted in water and unsweetened, tea and coffee – not too much), and eat fruits and vegetables that contain water (e.g., cucumber, tomatoes, spinach, mushroom, melon, broccoli, Brussels sprouts, oranges, apples, blueberries).

Eat healthy fats found in white meat (e.g., poultry), fish, avocado, nuts, olive oil, soy, canola, sunflower and corn oils, rather than fats found in fatty meat, butter, coconut oil, cream, cheese, ghee and lard. Avoid fats found in processed food, processed meats, fast food, snack food, fried food, frozen pizza, pies, cookies, margarines and spreads.

Limit your salt intake. When cooking and preparing food, limit the amount of salt and high sodium condiments (e.g., soy sauce, fish sauce). Limit your daily salt intake to less than 5 g (approximately 1 teaspoon), and use iodized salt. Avoid snack foods that are high in salt.

Limit your sugar intake. Choose fresh fruits instead of sweet snacks (e.g., cookies, cakes, chocolate). Limit your intake of soft drinks or sodas, still drinks and other drinks that are high in sugar (e.g., sweetened fruit juices, fruit juice concentrates and syrups, flavored milks, yogurt drinks).

Avoid eating out. Eating out during this COVID-19 pandemic increases your contact with other people and your chance of being exposed to the virus. So eat at home. Home-cooked food is the best choice, and is healthier and more nutritious for you than calorie-filled food from outside the home.

Reach out for help. During this COVID-19 pandemic, you may need support with your mental health and diet to ensure you keep in good health, especially if you are living with a chronic illness and have suspected or confirmed COVID-19. If you feel overwhelmed, seek help from trained professionals and through other trusted sources (e.g., digital, social, print and broadcast).

Exercises for further thought and research

- [6-1] Review and assess your own lifestyle habits.
- [6-2] Discuss issues of lifestyle habits with your group members, and offer advice to one another.
- [6-3] Examine lifestyle habits of people who are obese. What makes them different from those of people who are not obese? Do they wish to change their lifestyle habits and overcome obesity? Or are

they content to remain as they are? And what are their reasons? Explore answers to these questions.

- [6-4] Examine dietary habits of people who are very thin. Explore the reasons behind them and discuss what may be done to improve them.
- [6-5] Cases of eating disorders are on the rise among young women in Western countries as well as some Asian countries, including Japan and South Korea. Discuss if there are women who suffer from anorexia or bulimia in Cambodia.
- [6-6] Identify health problems among children and young people around you that are likely to be a result of an improper diet, and discuss as many factors as possible that may explain why they eat as they do.
- [6-7] Discuss what health impacts there may be when the body fails to maintain homeostasis.

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Infectious diseases and their prevention and protection

Learning objectives

You will be able to gain proper understanding and explain:

- The three major factors for the establishment of infection and the definition of infectious diseases.
- Common infectious diseases in Cambodia and their causes, symptoms, and treatment.
- Common infectious diseases in Cambodia and workable preventive measures by taking into account the three major factors for the establishment of infection.
- Discrimination and prejudices that may occur with an infectious disease, and then develop ways to prevent them.
- The functions of how the skin and mucous membranes as well as perspiration, tears, and saliva work to prevent foreign substances from invading the body from outside.
- The types of defense mechanisms your body has to eliminate foreign substances that have invaded the body.

This chapter illustrates infectious diseases, which represent important disease control issues in countries around the world. Specifically, we will consider basic knowledge of the pathogenic mechanisms of infection, how biological defenses and immune systems protect our health against infection with pathogens, characteristics of major infectious diseases, and measures to prevent infectious diseases. Sexually transmitted diseases will be discussed in Chapter 11.

1. Definition of infectious diseases and three major factors for the establishment of infection

1) Definition of infectious diseases¹

Infection refers to the invasion and growth of a pathogen inside or on the surface of the body of a host. A **pathogen** is a cause of infectious diseases, such as bacteria, viruses, and parasites that can produce diseases. A **host** is an entity such as a person or animal that is infected by bacteria or viruses. A disorder in vital functions of a host that results from infection is called a **symptom**, while the **manifestation of symptoms** or **onset of disease** refers to a state in which symptoms are present. Diseases that are caused in this manner are collectively referred to as **infectious diseases**.

How infection occurs can vary depending on the **time**, **place**, and **individual characteristics**. Infection requires three factors to be established, namely, **pathogens**, **infection routes**, and **host susceptibility** (Figure 7.1).

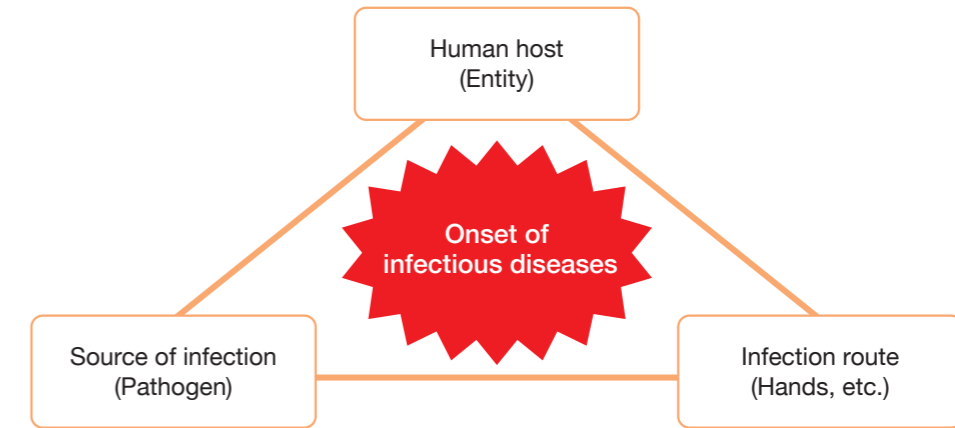


Figure 7.1 Three major factors for establishment of infection: agent, infection route, and host

2) Pathogens^{2,3}

Pathogens in general are small organisms that cause diseases. As shown in Table 7.1, pathogens may be divided into different categories depending on their size and structure, including **viruses**, **bacteria**, **fungi**, and **parasites**, each with different characteristics and causing different infectious diseases. Other transmissible diseases include **prion diseases**, which are caused by abnormal proteins called prions.

Table 7.1 Major pathogen categories and their characteristics³⁻⁵

| Pathogen categories | Biological classification | Characteristics | Examples |
|----------------------|---|--|---|
| Viruses | Nonliving things Measure approx. 1–10 nm | A virus consists of nucleic acid (DNA or RNA) and protein. Viruses are incapable of self-replication; They bind to living cells and get taken up, then use those to copy themselves. | Influenza virus, Ebola virus, coronavirus, human immunodeficiency virus, hepatitis virus, rabies virus, measles virus, rubella virus, chickenpox virus, <u>rotavirus</u> , <u>norovirus</u> , <u>adenovirus</u> |
| Bacteria | Prokaryotic Approx. 1–10 μm | Bacteria do not have a nuclear membrane but do have a cell membrane. | <i>Staphylococci</i> , <i>Streptococcus viridans</i> , <i>Clostridium tetani</i> , <i>Klebsiella pneumoniae</i> , <i>Chlamydia psittaci</i> , <i>Legionella pneumophila</i> , <u><i>Clostridium botulinum</i></u> , <u><i>campylobacter</i></u> , <u><i>Escherichia coli</i></u> , <u><i>Vibrio cholerae</i></u> , <u><i>Shigella dysenteriae</i></u> , <u><i>Salmonella enterica</i></u> , <u><i>Vibrio parahaemolyticus</i></u> |
| Fungi | Eukaryotic Approx. 10–100 μm | Fungi include yeasts, molds, and mushrooms. | <i>Candida</i> , <i>aspergillus</i> |
| Parasites (protozoa) | Eukaryotic | Protozoa are a type of parasite that are single-celled. | Malaria parasite, liver fluke, schistosome, <i>Trichomonas vaginalis</i> , <i>Toxoplasma gondii</i> |

Note 1: The pathogens underlined are major causes of food poisoning.

Note 2: Units: 1 nm (nanometer) = 10⁻⁹ m; 1 μm (micrometer) = 10⁻⁶ m.

Note 3: The Pathogens in italics are academic names.

Those that affect cows include bovine spongiform degenerative encephalopathy (also known as Mad Cow Disease), while human prion diseases include Creutzfeldt-Jakob disease (CJD).

3) Infection routes: vertical and horizontal transmissions

There are roughly two **routes of infection**, or ways through which a pathogen can enter a living organism: **vertical transmission** and **horizontal transmission**. Vertical transmission is the transmission of pathogens to a fetus or newborn that occurs during pregnancy or childbirth. It is commonly known as **mother-to-child transmission**. This can occur across the placenta, through the birth canal, or by breast milk.

Horizontal transmission is the spread of pathogens from the source of infection, such as people or objects, to others. It may take forms of **contagious transmission (oral, mucosal, or sexual transmission)**, **droplet transmission**, **airborne transmission**, and **fomite (vector) transmission**. Fomite transmission includes infection through blood, secretions, ingestion, and vectors. According to WHO⁶, over a million people die every year from infection via vectors such as mosquitoes, freshwater aquatic snails, ticks, and fleas. **Waterborne transmission** is a form of oral transmission and is a leading cause of diarrhea due to infection to the digestive tract, which can cause explosive outbreaks regardless of age and sex, particularly in developing countries⁷. It is responsible for 2.2 million deaths globally every year, and most of the victims are children in developing countries⁷.

4) Host susceptibility

When the same pathogens enter into living organisms, they may or may not develop symptoms. This is due to the differences in the amounts of invading pathogens and **host resistance**, or **activities of the immune system**. When a host is susceptible to pathogens, the activities of their immune system are compromised, and the host may develop symptoms if infected. On the other hand, when the host is not susceptible to the pathogens, which means that he/she has strong immune resistance, the immune system eliminates the pathogens that have invaded his/her body and prevents him/her from developing symptoms.

2. Biological defense mechanisms⁸

Living organisms have **biological defense mechanisms**, which help them protect themselves against pathogens and other foreign substances (i.e. substances that are not normal constituents of the body) (Figure 7.2).

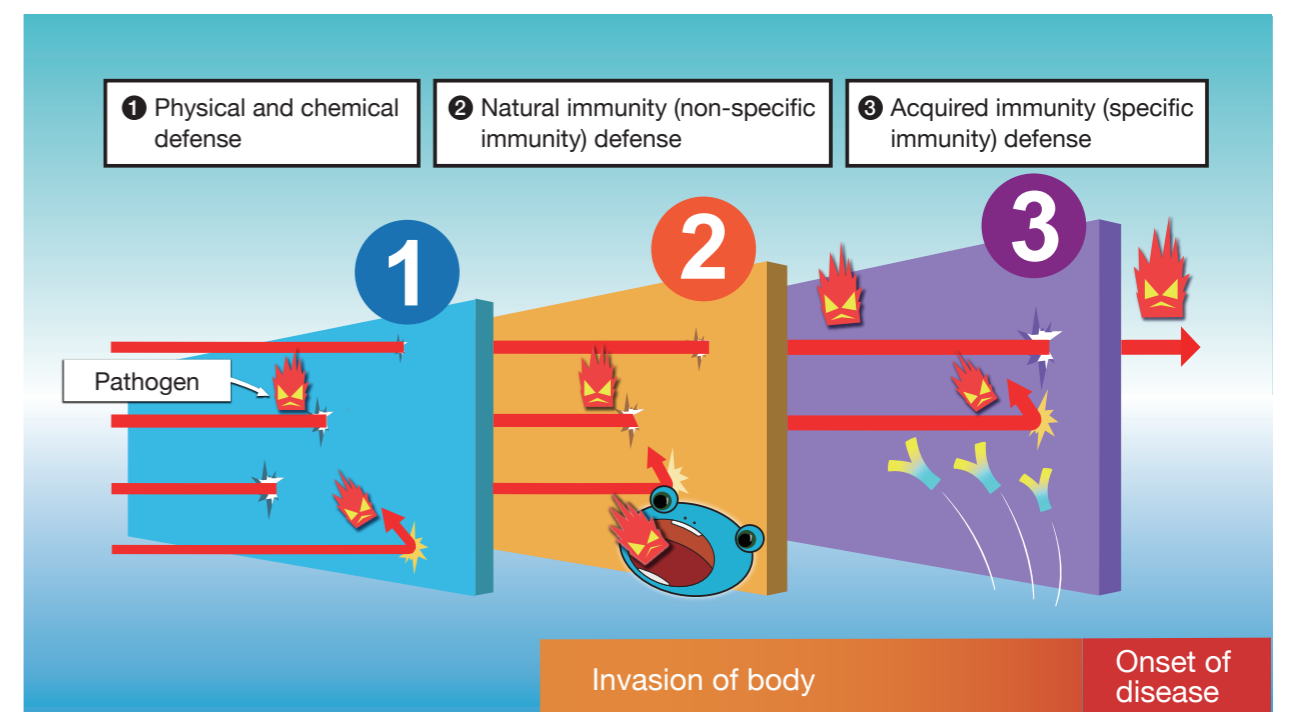
1) Physical defense

A living body is in contact with the outside world through the **skin and mucous membranes**. The skin and mucous membranes have **physical defense systems** that prevent foreign substances from invading the body.

The **stratum corneum**, which is found on the side of the skin that comes in contact with the outside world (i.e. the outermost layer), functions as a barrier. The stratum corneum barrier consists of corneocytes and stratum corneum intercellular lipids that fill the space between the cells. It functions to protect the body against the invasion of foreign substances and plays the role of retaining water in the body.

The digestive system, including the mouth, esophagus, and digestive tract, and the respiratory system, including the trachea, are separated from the outside world by **membranes**. The lumen of the digestive system is covered with membranes, which work to protect against the invasion of pathogens and other foreign substances. Living organisms have approximately 60–70% of their immune system in the digestive system, which protects the living organisms against infection with pathogens.

The respiratory tract is lined with hair-like projections called **cilia**, which move the mucous layer upward to eliminate foreign substances. The mucous layer captures foreign substances so as not to allow any pathogens or atmospheric particles to reach the lungs during breathing.



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Figure 7.2 Three defense mechanisms to protect the body

2) Chemical defense

Chemical defense is included as a part of the physical defense mechanism. Perspiration, tears, and saliva contain an enzyme called **lysozyme**, which breaks down cells of pathogens (“**bacteriolytic activity**”). Sebum and gastric acid have acidic pH conditions. This helps suppress the growth of pathogenic bacteria, which are not highly resistant to acids.

3) Immune system

If foreign substances such as pathogens have broken through the physical and chemical defense systems (the “first line of defense”), they are inside the living organism. The system that eliminates invading pathogens that have entered the body is called the immune system. The immune system consists of the **natural immune system** (the “second line of defense”) and the **acquired immune system** (the “third

line of defense”; also called the **adaptive immune system**). They work in stages: first the natural immune system, followed by the acquired immune system. The natural immune system represents primitive defense mechanisms that humans are born with, and it works to eliminate invading pathogens through **phagocytosis**. The defense provided by the natural immune system has limits, however, which is why the acquired immune system plays an important role.

Such immune responses involve a number of cells and organs, and **white blood cells** play a central role. White blood cells come from their precursor cells known as **hematopoietic stem cells** that are present in the bone marrow. When matured, they become cells such as **granulocytes** (neutrophils, eosinophils, and basophils), **monocytes** (which leave, or “migrate” from, the bloodstream into tissues that are invaded by foreign substances, and differentiate into dendritic cells and macrophages), **lymphocytes** (B cells, T cells — helper T cells and killer T cells —, and natural killer (NK) cells) (**Table 7.2**). Note that some other types of blood cells, such as platelets and red blood cells, also differentiate from hematopoietic stem cells. Of these types of white blood cells, those responsible for natural immunity are **neutrophils** (which account for 40–70% of white blood cells), **monocytes (dendritic cells and macrophages)**; approx. 5% of white blood cells), and **NK cells**, while acquired immunity involves **T cells (helper T cells and killer T cells)** and **B cells**. These are the typical immune cells. Eosinophils are responsible for the immune function that protects the body against parasitic infection.

Table 7.2 Types and functions of key white blood cells involved in the immune system

| Type of white blood cell | | Major roles | Type of immunity |
|--------------------------|---|--|------------------|
| White blood cells | Neutrophils | Phagocytic and bactericidal; cause inflammation. | Natural |
| | Dendritic cells (differentiated from monocytes migrating from the bloodstream to the tissues) | Phagocytic; communicate antigen information (“antigen presentation”). | |
| | Macrophages (differentiated from monocytes migrating from the bloodstream to the tissues) | Phagocytic and highly bactericidal; cause inflammation; present antigen. | |
| Lymphocytes | Helper T cells (differentiated from T cells which mature in the thymus gland) | Receive antigen information from dendritic cells and become activated, promoting proliferation and activation of B cells, which have the same antigen information; some become memory cells to prepare for invasion of the same antigen. | Acquired |
| | Killer T cells (differentiated from T cells which mature in the thymus gland) | Receive antigen information from dendritic cells, and attack and eliminate infected cells; some become memory cells to prepare for invasion of the same antigen. | |
| | B cells (differentiate and mature in the spleen) | Proliferate, become activated, and differentiate into antibody-producing cells (plasma cells) to produce antibodies that are specific to the antigen; present antigen; become memory cells to prepare for invasion of the same antigen. | |
| | Natural killer (NK) cells | A potent killer; directly attack and eliminate virus-infected cells and autologous cancer cells. | Natural |

(1) Natural immune system

a. Phagocytosis

When bacteria have entered into a living organism, cells such as **neutrophils, dendritic cells, and macrophages** migrate from the bloodstream and gather in the invaded tissues to take these bacteria into the cells. Known as **phagocytes**, these cells recognize “autologous” or normal components of the body, and “heterologous” or other components. Phagocytes digest and break down foreign substances that have been taken up with cellular enzymes. This process is called the **phagocytic mechanism**.

In the case of virus infection, unlike bacterial infection, phagocytosis has limits on its own. This is where **NK cells** come in, directly attacking and destroying the virus-infected cells. NK cells, too, recognize autologous and heterologous components, and usually do not attack uninfected or normal cells (see *Immunological tolerance*).

b. Inflammation

When natural immunity provided by phagocytosis has caused substantial damage to the body (such as mass cell deaths), **macrophages** recognize it and gather neutrophils in the bloodstream, causing a localized inflammatory response. As the capillaries relax and dilate, the blood flow is increased locally, which in some cases causes a plasma leakage, accompanied by tumefaction and rubor. Macrophages release substances into the bloodstream that work on the hypothalamus of the brain (i.e. interleukins), thereby increasing the body temperature (i.e. fever) and activating the immune cells. In other words, an inflammatory response is proof that the immune system is given a boost.

(2) Acquired immunity

a. Communication from the natural to the acquired immune system (Figure 7.3)

The acquired immune system is characterized by its specific activity against a specific kind of foreign substance. An **antigen** is a substance that induces acquired immunity. In general, exogenous pathogens are recognized as antigens. First, **dendritic cells** and **macrophages**, which work as a part of natural immunity, digest and break down the foreign substances such as pathogens through phagocytosis. Then they take up the foreign substances (antigens) and move to lymph nodes, where they present the antigen information on the cell surface, and deliver the antigen information to T cells (helper T cells and killer T cells), which work as a part of acquired immunity that follows. The mechanism in which antigen information is transferred from the natural to the acquired immune system is called **antigen presentation**.

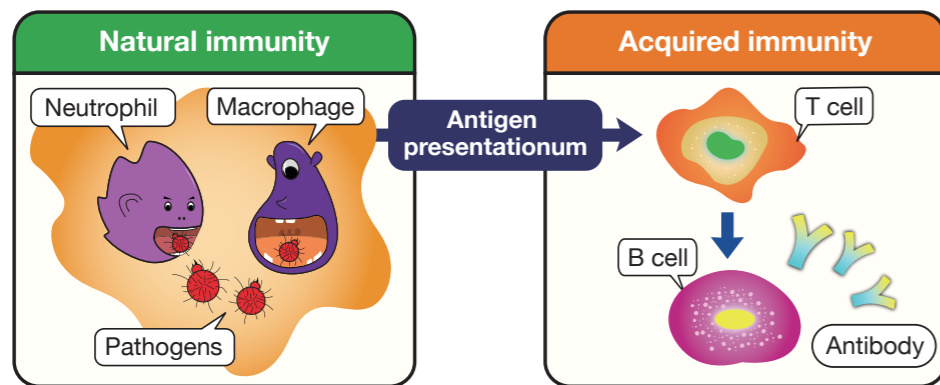


Figure 7.3 Antigen presentation from natural to acquired immune system

b. Cell-mediated and humoral immunity

The acquired immune system has two mechanisms, namely **cell-mediated immunity** and **humoral immunity**. In cell-mediated immunity, upon recognizing antigen presentation by dendritic cells and macrophages, helper T cells and killer T cells proliferate and become activated, and move to the infected site. There, **killer T cells** capture and destroy the infected cells in a specific manner. At the same time, proliferated **helper T cells** activate neutrophils, macrophages, and **B cells**. Even after the elimination of the antigen, helper T cells and killer T cells promote the differentiation of the activated B cells into **memory cells (i.e. memory B cells)**, which remain in the body for a long time to prepare for any subsequent infection. Meanwhile, some of the T cells become **memory T cells** (memory helper T cells and memory killer T cells) to prepare for any subsequent infection.

In humoral immunity, first proliferated helper T cells activate the B cells that have recognized the same antigen. Then the **B cells** differentiate into **the antibody-producing cell (plasma cells)**, and produce **antibodies**. Antibodies are made up of proteins called **immunoglobulin**, and they deactivate the **invading antigen by binding specifically to it ("antigen-antibody reaction")**. The deactivated antigen is eliminated through phagocytosis by neutrophils and macrophages. Once the antigen has attenuated in the living body, normally the antibodies also disappear in two to three weeks, but as described above, some of them remain in the body as memory cells to prepare for any subsequent infection.

c. Secondary immune response

In acquired immunity, upon invasion by the pathogens or other foreign substances that have the same information as that is stored in **memory cells**, B cells promptly differentiate into **antibody-producing cells** (plasma cells) to produce antibodies. In general, they produce antibodies in a larger amount and more quickly than when the first infection occurred and eliminated the pathogens. As a result, an individual may have relatively mild symptoms or may not manifest symptoms at all in a second or subsequent infection.

(3) Immunological tolerance

Immunological tolerance is the body's mechanism that prevents the immune system from wrongly recognizing normal autologous cells and tissues as antigens and attacking them. On rare occasions, this immunological mechanism fails to work properly, resulting in the immune system wrongly recognizing normal autologous cells and tissues as antigens and attacking them. This is called **autoimmune diseases**, which include type 1 diabetes and rheumatoid arthritis.

3. Prevention of infectious diseases

To prevent infectious diseases, it is necessary to cut off the chain of **three major factors for the establishment of infection** described earlier in 1. Specifically, it is necessary to eliminate pathogens (source control), block the routes of infection (control of infection routes), and boost the host resistance to diminish susceptibility to pathogens (susceptibility control) (Figure 7.4). By cutting off one of the factors of the three principles, an epidemic of infectious disease may be prevented after an outbreak. In addition, the practice of preventive behavior by individuals and improvements in the social system are required for the prevention of infectious diseases.

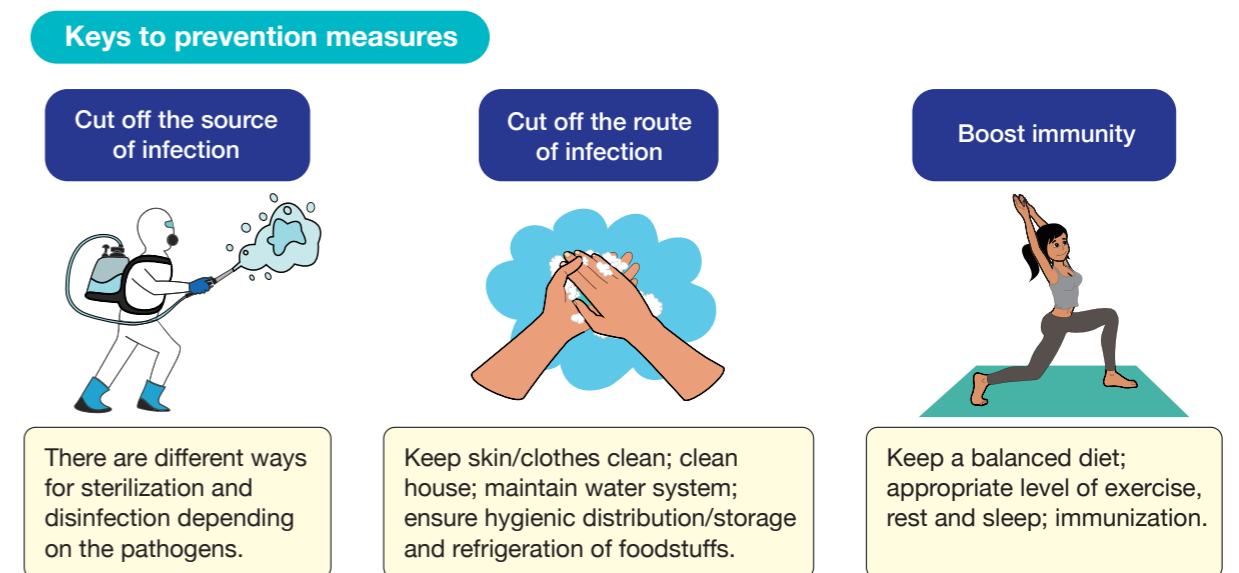


Figure 7.4 Keys to prevention measures to cut off the three major factors for establishment of infection

1) What can individuals do?

We will discuss measures an individual can take that are based on the three principles of infection. Source control measures may include proper management of food to prevent pathogens from growing, and **disinfection** and **sterilization** of pathogens. An important measure for the control of infection routes is **hand washing**. While the routes of infection vary among different pathogens, many of the pathogens that affect humans tend to adhere first to a hand; as the hand touches mucosal membranes of the nose, mouth, and eyes, the pathogens can be introduced into the body. Moreover, as a person's hands carrying pathogens touch many objects and other people touch such objects with their hands, the infection spreads. Washing hands thoroughly with soap is an effective way to prevent infection that anyone can do. For infectious diseases that are caused through **droplets** produced by coughing and sneezing, it is effective in reducing droplets by having infected individuals wear masks and maintain cough etiquette (e.g. cover your mouth and nose with a handkerchief or sleeve when you don't have a mask), and ventilating indoor spaces as well (see Chapter 4). As a susceptibility control measure, one can boost their immunity. For people to protect themselves from developing an infectious disease, and to keep it from becoming serious if they do develop one, it is important for them to boost their immunity. Specifically, they should form a healthy lifestyle based on a balanced diet, adequate sleep, and an appropriate level of exercise (see Chapter 5). **Vaccination (immunization)** is another effective measure for preventing infectious diseases.

From the standpoint of preventing waterborne infectious diseases, changing from open urination and defecation to the use of toilet facilities can prevent contamination of water lines, and thus help in the prevention of infectious diseases.

Column: Vaccines and immunization

Infectious diseases are caused by pathogens such as bacteria and viruses. However, the human body memorizes pathogens that once invaded and maintains a defense system that prevents the onset of diseases or alleviates symptoms caused by the second infection and thereafter. That is the immune system. Vaccination is a medical application of this mechanism. Vaccines contain weakened or detoxified pathogens. Vaccination helps not only to protect you from infectious diseases, but also helps prevent infections to those around you. However, vaccines are attenuated or detoxified pathogens, and the possibility of side reactions cannot be eliminated.

Column: Fighting smallpox

Humanity has fought many infectious diseases. The first infectious disease that humanity eradicated was smallpox. Extremely contagious, smallpox was feared as a fatal disease since pre-Christian times. At the end of the 18th century, noticing that milkmaids did not catch smallpox while they did catch cowpox, which is not fatal, an English physician named Edward Jenner developed immunization (the smallpox vaccine). Although the introduction of the smallpox vaccine dramatically decreased smallpox deaths, the vaccine was potent only for a few days at room temperature and could not be delivered to all corners of the world. In 1967, an initiative to eradicate smallpox was launched under

the leadership of the WHO. For the purpose of ensuring the quality of the vaccine, a manual on vaccine production was created and guidance given on its production, while a simplified technique for vaccination was developed. As a result, following the case of a young Somali man in 1977, no cases of smallpox have been reported. In 1980, the WHO announced the global eradication of the disease. The eradication of smallpox demonstrates that it is essential for countries to work together across national boundaries to control infectious diseases.

2) What are schools expected to do?

Since schools are where children learn in large groups, they are prone to the prevalence of **droplet transmission** and **contagious transmission**. For this reason, it is necessary to implement infectious disease control measures based on the three principles of infection prevention. Source control measures include improvement of the school environment. Drinking water stations and toilets, in particular, should be kept clean. It is preferable to inspect drinking water routinely to ensure that it meets safety standards (See Chapter 4 for drinking water standards).

Health education of pupils and students is important for the implementation of control measures for infection routes and susceptibility. Children should not only be given knowledge in class, but also learn to be mindful of preventive behaviors against infection in their school life, such as those concerning the use of toilets, hand washing after using the toilet, and cough etiquette. In Cambodia, prevention of infectious diseases represents an important challenge. For Cambodians to learn basic knowledge on infectious diseases and prevention skills at school helps them protect not only their own growth and health, but the health of their families and communities, as well.

3) What is society expected to do?

Because infectious diseases spread from person to person, it is necessary to ensure not only the practice of preventive behaviors by individuals but also the improvement of social systems. Specifically, this means improving public health systems such as water and sewage systems in order to prevent infectious diseases, implementing **quarantine** in order to prevent infectious diseases from getting into the country, and promoting immunization to give the population acquired immunity as prophylaxis. It is also important to develop a monitoring system to check on infection in the country, communicate appropriate information to the people, and make use of the information gathered in studies for future measures to be implemented.

Column: A new lifestyle

In the wake of the outbreaks of the novel coronavirus infectious disease (COVID-19) in 2020, a shift is called for to a new lifestyle, represented by mask wearing and maintaining a distance of at least 1 m between one another. These measures not only change the way we live our daily lives, but will lead

to changing how we work and how we live. We all feel reluctant to change the lifestyles we are familiar with. It is not all a bad thing, however. As we have gained the habit of washing hands to prevent COVID-19, morbidity due to influenza and food poisoning has also declined. As long as we are part of nature, there will always be infectious diseases caused by viruses. What we should aim for is not to overcome viruses but to co-exist with them while minimizing the damage they cause.

4. Common infectious diseases in Cambodia

An outline of infectious diseases commonly seen in Cambodia is given below.

1) Dengue fever

According to a WHO report⁹, a total of 9,108 dengue cases with 14 deaths had been reported in Cambodia by September 2020. This number of cases is only 15% of the 61,198 cases in the same period last year. Dengue fever is still one of the most serious infectious diseases in Cambodia, which has a tropical climate.

Dengue fever is an **infectious disease caused by the dengue virus** and spread by the **yellow fever mosquito** (*Aedes aegypti*) and the **tiger mosquito** (*Aedes albopictus*). The dengue virus is of the family *Flaviviridae*, and has four serotypes (DENV 1–4). The dengue virus forms a human-mosquito-human transmission cycle (Figure 7.5). It is believed that most of the cases of dengue virus infection end up being inapparent or subclinical.

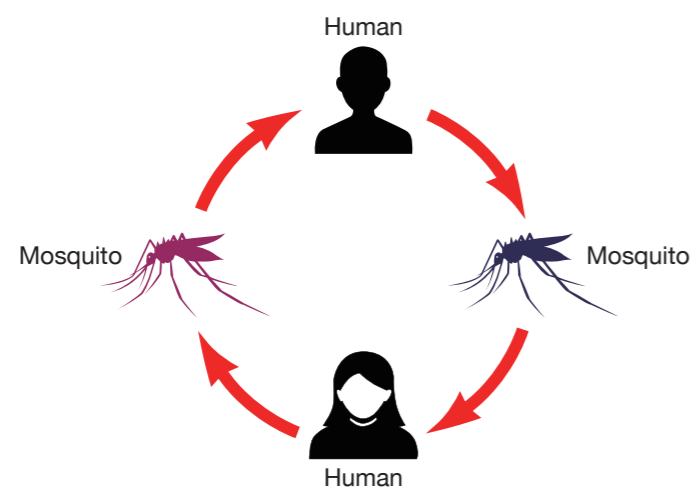


Figure 7.5 Transmission cycle of dengue virus

For those who do manifest symptoms, there are two types: a relatively mild form of dengue fever and dengue hemorrhagic fever, which is a severe form. Dengue fever manifests as a sudden onset of fever 3–7 days into infection, often accompanied by a headache (especially orbital pain), muscle pain, and joint pain. It may also be accompanied by a loss of appetite, stomachache, or constipation. Three to four days into infection, a red rash appears on the chest and trunk and then spreads to the limbs and face.

These symptoms disappear in about a week, and patients usually recover without sequelae. The severe form of dengue fever, namely dengue hemorrhagic fever, causes a patient to experience a sequence of dengue fever symptoms, but before recovery, they experience bleeding, hypotensive shock, and multiple organ failure. It is noteworthy that severe symptoms tend to appear when a fever recedes and the temperature begins to return to normal. Pleural effusion and ascites occur at very high rates. Patients may also experience enlargement of the liver, activation of **complements**, platelet depletion, and/or prolonged blood clotting. In addition, as the name “hemorrhagic fever” implies, 10–20% of the patients experience nasal and/or gastrointestinal bleeding. Treatment for dengue fever is symptomatic.

For the prevention of infection, it is important to take measures to avoid mosquito bites. Specifically, one should wear long-sleeved shirts and long pants, apply an insect deterrent, and sleep under a mosquito net. It is also important for the purpose of prevention to make community-wide efforts to exterminate mosquitoes and suppress breeding of mosquitoes (e.g. eliminating puddles, cutting grasses).

Column: What are complements?

Complements are a collective term for proteins that mediate immune response to eliminate antigens such as pathogens invading a living organism. They are so named because they complement the function of antibodies.

2) Malaria

Malaria is an infectious disease that results from the transmission of a malaria parasite into the human body via female anopheles mosquitoes. After 1–4 weeks of incubation, a malaria parasite proliferates in the hepatic cells and red blood cells, and causes symptoms such as fever (which has cyclicity of repeating febrile periods followed by afebrile ones), headache, joint pain, nausea, anemia, and spleen enlargement. Few patients develop all of the symptoms from the beginning; many follow atypical courses. There are four types of malaria that affect humans depending on the species of the parasites: *Plasmodium falciparum* (*P. falciparum*), *Plasmodium vivax* (*P. vivax*), *Plasmodium ovale* (*P. ovale*), and *Plasmodium malariae* (*P. malariae*). Incubation periods, fever cycles, and treatment methods vary depending on the type of the parasites. Treatment is provided by antimalarial drugs; the choice of drug depends on the type of the parasites. There is no immunization for malaria. For prevention, it is important to take measures to avoid mosquito bites (see *Dengue fever*).

3) Tuberculosis

Tuberculosis is an infectious disease caused by inhalation of tubercle bacilli. It is the leading cause of death linked to a single pathogen worldwide, followed by AIDS¹⁰. According to WHO statistics¹⁰, approximately 10 million (range: 9–11 million) patients contracted tuberculosis in 2018; the numbers have remained constant for the last few years. While tuberculosis affects people regardless of sex and

age, it was most prevalent in men aged ≥ 15 years, accounting for 57% of all the patients. It was estimated that women accounted for 32% and children of age < 15 years, 11%. Geographically, most tuberculosis cases were found in India (27%), China (9%), Indonesia (8%), the Philippines (6%), Pakistan (6%), Nigeria (4%), Bangladesh (4%), and South Africa (3%); these eight countries accounted for 67% of the world's patients. Cambodia is among the 30 countries with the highest tuberculosis burden, with 49,000 patients and an incidence of active tuberculosis of 302 patients per 100,000 population¹¹. This is approximately 2.3 times the average among the WHO Member States of 132 patients per 100,000 population, which warrants tuberculosis control measures¹².

While tuberculosis is a systemic infectious disease, **pulmonary tuberculosis**, which causes lung lesions, accounts for as much as approximately 80% of the cases. As the tubercle bacilli start to move hematogenously in the body, lesions form in a number of organs, including the pleura, lymph nodes, kidneys, and bones, and symptoms appear at each site. If the tubercle bacilli enter the lungs through the respiratory tract and cause a small initial focus of infection, it is regarded that initial infection is established (first infection). However, many such patients do not manifest symptoms and become **carriers**. They may spend years as **carriers** with the tubercle bacilli being established in the lung alveoli and may manifest symptoms only after several years to decades when they become seniors or become ill and have weaker immunity (second infection). Children often become infected through household transmission, in which most cases are primary tuberculosis (first infection). Common treatment for tuberculosis is a combination of anti-tuberculosis drugs. There are concerns over the emergence of multi-drug-resistant tuberculosis, however, and WHO¹³ recommends Directly Observed Treatment, Short-Course Chemotherapy (DOTS), where healthcare professionals, health nurses, and family members directly check on patients' compliance to help them avoid missing doses. Immunization is effective, and Cambodia recommends immunization of infants within the first 12 months after birth¹⁴.

Column: Carriers (asymptomatic carriers)

Some people may be infected with a virus and carry it inside their bodies, but do not manifest symptoms. This is a state where the strength of the pathogens and the person's immunity are well balanced, and which suppresses manifestation of symptoms. Even though they do not show any symptoms, such people still shed bacteria and viruses, and thus risk infecting others around them. Such people are called bacterial or virus carriers for bacterial or virus infection, respectively, and those who do not show particular symptoms are called asymptomatic carriers. In the spread of a new coronavirus, tuberculosis, and HIV, such carriers play a significant role, and it is important for people to exercise preventive measures and get tested even if they are not aware of any symptoms.

4) Rabies

Rabies develops when a person is bitten or scratched by a dog, cat, bat or other wild animal that is infected with the **rabies virus**, and the virus invades the body through the wound. The duration of incubation after infection, while it may vary depending on the site of the bite, is usually 1–2 months. Symptoms of a common cold may develop, including fever, headache, lethargy, muscle pain, tiredness, poor appetite, nausea/vomiting, sore throat, and dry cough. It may be accompanied by pain at the bite site and loss of sensation or muscle spasms around the site. Symptoms of encephalitis appear, starting with excitement, anxiety, and mania, followed by delirium, hallucination, aggressiveness, and muscle spasms such as hydrophobic fits. Patients eventually progress to coma and die of respiratory arrest. Rabies, once developed, has a mortality rate of almost 100%. Due to its long incubation period, its onset can be averted by continuous vaccination starting immediately after any events that may cause infection to happen. Since rabies is a **zoonosis**, wild dog management and immunization of domestic dogs are important for prevention.

Column: Zoonosis

A zoonosis is a disease that can be transmitted from animals to humans and vice versa. Zoonotic diseases make up for approximately 50% of all infectious diseases, and include a number of diseases other than rabies, such as avian influenza, SARS, clonorchiasis, and plague. For this reason, the concept of One Health, which means that human health and animal health are interdependent, is advocated primarily among veterinarians.

5) Parasitic infections

There are many parasitic infectious diseases found in Cambodia. Of these, those that are particularly common, namely trematode and nematode infections, are discussed in this chapter.

(1) Trematode infections

Trematodes bear two suckers, one at the end of the body and the other on the ventral surface, and are flat and symmetric. For them to grow, trematodes always require **intermediate hosts**, in which larvae multiply by division. They grow inside a first and second intermediate hosts, and eventually become adult in the **definitive host**. Common trematodes include **schistosomes**, which are transmitted via a percutaneous route and live in the host's blood vessels, and trematodes that settle in organs through oral transmission. Depending on the type of trematode, various symptoms develop. Particularly problematic in Asia are four species of foodborne trematodiasis (**Table 7.3**).

Trematodes infect freshwater aquatic snails as a first intermediate host. A second intermediate host may vary depending on the type of trematode; freshwater fish for **clonorchiasis** and **opisthorchiasis**, and crustaceans for **paragonimiasis**, while **fascioliasis** does not require a second intermediate host. The definitive hosts are always mammals. Humans become infected by trematodes by eating raw fish,

Table 7.3 Epidemiological characteristics of foodborne trematodiasis

| Disease | Infectious agent | Acquired through consumption of | Natural definitive hosts of the infection |
|-----------------|--|----------------------------------|---|
| Clonorchiasis | <i>Clonorchis sinensis</i> | Fish | Dogs and other fish-eating carnivores |
| Opisthorchiasis | <i>Opisthorchis viverrini</i> , <i>O. felineus</i> | Fish | Cats and other fish-eating carnivores |
| Fascioliasis | <i>Fasciola hepatica</i> , <i>F. gigantica</i> | Aquatic vegetables | Sheep, cattle and other herbivores |
| Paragonimiasis | <i>Paragonimus spp.</i> | Crustaceans (crabs and crayfish) | Cats, dogs and other crustacean-eating carnivores |

Note: Infectious agents in italics are academic name.

Source: World Health Organization¹⁵

crustaceans, or vegetables contaminated with larvae. According to estimations by the WHO Foodborne Disease Burden Epidemiology Reference Group (FERG) (2015)¹⁵, the leading four species of foodborne trematodes cause physical disorders in an estimated total of 200,000 people and more than 7,000 deaths per year. For treatment, patients take an **anthelmintic** (such as praziquantel) orally.

(2) Nematode infections

Nematodes have a cylindrical body. There are approximately 500,000 species known, of which some 50 parasitize human bodies. They do not always require an intermediate host, and some may repeat cycles of growth and reproduction inside the definitive host. Many nematodes are transmitted orally, but some are transmitted via a percutaneous route. In this chapter, we discuss the **roundworm** (*Ascaris lumbricoides*) and the **human pinworm** (*Enterobius vermicularis*). With ascariasis, a person becomes infected through ingestion of the worm's eggs with food. They typically show digestive symptoms, and may cause acute abdominal conditions in the case of erratic parasitism in the biliary tree. Enterobiasis is caused when a person happens to take stools or food contaminated with stools in the mouth, or eats with a hand that has touched a person or object contaminated with stools. It is particularly prevalent in children. The worms lay eggs around the anus, which causes itchiness around the area. Infection can also be transmitted orally via fingers that have scratched the area around the anus. It may lead to urethritis, vaginitis, or hepatitis. For treatment, patients take **anthelmintic** (e.g., pyrantel pamoate) orally for both the roundworm and human pinworm.

6) Enteric infections

Enteric infections refer to a group of diseases characterized by the manifestation of symptoms such as diarrhea, vomiting, and stomachache caused by bacteria, viruses, and protozoans. Since there are a large number of causative pathogens and their symptoms are similar, their diagnoses are challenging. It is however important to identify the cause as precisely as possible because the treatment varies depending on the type of pathogen. In this chapter, we discuss the most important type of enteric infection, namely **food poisoning**.

Food poisoning is a foodborne illness caused by intake of naturally occurring toxins, chemical substances, or pathogen found in food. Adverse health effects of exposure to naturally occurring toxins may be caused by an intake of wild mushrooms or plants, poisonous fish such as pufferfish, or molds.

Food poisoning is commonly caused by pathogens. Other causes include chemicals, such as metal poisoning caused by copper pots or dishes for eating or lead in canned food, and histamine poisoning caused by raw fish or processed fish.

(1) Food poisoning caused by pathogens

A common form of food poisoning is that caused by pathogens, which can be roughly divided into **bacterial food poisoning** and **viral food poisoning**. In general, bacterial food poisoning is common in an environment suitable for bacterial growth, namely when it is warm and humid. Viral food poisoning, on the other hand, tends to be more common when it is cold with low humidity.

a. Bacterial food poisoning

Common forms of bacterial food poisoning include cholera and dysentery, as well as infection with campylobacter living in the intestines of poultry. While many types of food poisoning occur as a result of infection with 100,000 to 1,000,000 viable bacteria, dysentery and Campylobacteriosis require a much smaller number of bacteria for infection. In many cases, predominant symptoms of food poisoning are vomiting, diarrhea, and fever, but some may be accompanied by a headache or neurological symptoms. Particular caution is required with infection with verotoxin-producing **Enterohemorrhagic Escherichia coli** (EHEC), O-157, O-26, O-111, and O-128. In addition to a high fever and severe diarrhea, they may cause hemorrhagic enteritis and hemolytic uremic syndrome, which may progress to kidney failure or encephalopathy resulting in death.

b. Viral food poisoning

Viral food poisoning occurs as a result of intake of a virus carried by shellfish or virus-contaminated water or food. Common forms include **norovirus** and **rotavirus** infections. While bacterial food poisoning is caused by bacteria that are attached to the surface of foodstuff and grow in the food, viruses do not grow in food but inside the body or cells of a host.

(2) Prevention of food poisoning

A key to the prevention of food poisoning is the exercise of the “**three principles of food poisoning prevention**,” which ensures that we “**do not allow pathogens to come in contact with food**,” “**do not allow pathogens to multiply**,” and “**destroy all pathogens**.” Heat kills many of the bacteria responsible for food poisoning. Bacteria such as campylobacter die when the contaminated food is heated at a center temperature of 75°C for 3 minutes or longer. Meanwhile, toxin-producing bacteria are more heat resistant. A toxin from *Staphylococcus aureus* will not die even after heating at 100°C for 30 minutes, but will be killed at 200°C for 30 minutes or longer. It is therefore common to use antibacterial agents.

Many pathogenic bacteria multiply by binary fission every 20–30 minutes. One *E. coli* bacterium, for instance, becomes eight after an hour, and 10²² after 24 hours. When food contaminated with pathogenic bacteria is left at room temperature, the bacteria multiply in a short period of time. They do

not die even in the refrigerator; they simply multiply at a slower rate. While antibacterial agents are effective against bacterial growth, they are not against viruses. Vaccines are effective against viruses, yet not all viruses have vaccines, and everyday exercise of preventive measures is important.

It is possible to prevent food poisoning by means of disinfection with 70–80% alcohol and invert soap. In the case of **norovirus**, however, alcohol is not highly effective, and disinfection with sodium hypochlorite is necessary.

Even when causative bacteria or viruses for food poisoning find their way into the body, how symptoms manifest can vary depending on the immune strength of the person infected. Because even asymptomatic carriers can spread infection through their hands or bodily waste, hand washing is extremely important.

Column: What is invert soap?

Although called “soap,” invert soap has properties that are opposite to those of regular soap. It is not capable of removing dirt or stain but has bactericidal and sterilizing properties to destroy the cells of molds and bacteria. It is not effective against viruses, which do not have cells. It is used for sterilizing fingers and dishes for eating, laundry, and cleaning. To sterilize fingers, one should first wash hands thoroughly with regular soap to remove any dirt, then disinfect with invert soap.

5. New challenges with infectious diseases

Throughout human history, we have fought many infectious diseases, and successfully overcome some by improving healthcare standards and public health. On the other hand, we are facing new challenges. One example is **emerging infectious diseases**. WHO¹⁶ defines emerging infectious diseases as “those due to newly identified and previously unknown infections which cause public health problems either locally or internationally.” While not all emerging infectious diseases are fatal, their causes and routes of transmission are unknown at the beginning, which can cause a quick spread of infection. One of the causes behind these diseases is the increasing proximity between wild animal and human populations by such activities as forest development. As there are more opportunities for humans to enter wildlife habitats, humans may contact viruses carried by wild animals, or a virus that should originally infect only animals may undergo the mixing of other viral genomes inside the cells of the animal and mutate into a new type of virus that may prove extremely pathogenic when transmitted to humans. Because it takes time to develop a new vaccine or therapeutic drug, emerging infectious diseases can pose challenges on the prevention and treatment front.

A second example is **pandemics**. A pandemic is defined as an epidemic of an infectious disease occurring across different countries and regions. With globalization comes greater movement of people, and this can cause an infectious disease in one area to rapidly spread to multiple countries and regions, resulting in a global outbreak. WHO declared the H1N1 pandemic in 2009^{17,18}, and the COVID-19 pandemic in March, 2020¹⁹. Because it is not possible to prevent a pandemic from occurring through individual countries’ efforts alone in implementing thorough infectious disease control measures, there

is a growing demand for enhanced public health systems based on international cooperation, for example, supported by WHO.

Other than those mentioned above, challenges we are facing include the rise of **multidrug-resistant organisms**, which are pathogens resistant to newly developed drugs, and animal-derived infectious diseases due to increases in imported pets and changes in how people interact with them.

Furthermore, infectious disease control measures always face discrimination and prejudice. Misconception, fear, and anxieties concerning an infectious disease can give rise to discrimination. With leprosy and HIV infection (AIDS), there were cases where national governments implemented control policies such as isolation of patients, even though the risk of transmission was low in everyday settings. Preventing infectious diseases is important, yet it is necessary to take into account the human rights of the infected when implementing measures, so as not to let them become a target of discrimination.

Column: Preventing discrimination and prejudice from being induced by infectious diseases

Year 2020 saw a global outbreak of **novel coronavirus infectious disease (COVID-19)**. COVID-19 is an emerging infectious disease, and we are faced with the challenge of responding to infection prevention. In the course of our tackling this crisis, prejudice against infected people occurred. This was nothing new. As the cases of AIDS and Ebola hemorrhagic fever are still fresh in our minds, infectious diseases and pandemics have historically induced prejudice and discrimination. Behind such discrimination are people’s anxieties over the illness. Prejudice and discrimination pose a public health threat. They not only cause damage to physical and mental health and welfare of the people who are subjected to prejudice, but they also make it difficult to contain the infectious disease. WHO recommends that governments, citizens, media, key influencers and communities should do their part to prevent prejudice and discrimination from spreading²⁰. Steps suggested to achieving this are: “Spread the facts”; “Engage social influencers”; “Amplify the voices of people with lived experience with the coronavirus”; “Portray diversity of ethnicity in public information materials”; “Promote ethical journalism”; and “Correct myths, rumors, and stereotypes that encourage prejudice”²¹.

Exercises for further thought and research

- [7-1] Do research on the laws and measures concerning infectious diseases and those concerning hygiene management in Cambodia and give a presentation about them.
- [7-2] Choose one infectious disease that is common in Cambodia and summarize the measures against it. In doing so, list up measures by the following categories: the three principles of infectious diseases; what individuals can do; what schools can do; and what society should do.
- [7-3] Create a poster promoting the prevention of food poisoning. Discuss as to where it should be posted for it to be effective, keeping your target audience in mind.
- [7-4] Discuss in groups what brings about discrimination and prejudice related to an infectious disease.

Eye and dental health

Plan a lesson on the theme of infectious diseases and human rights.

[7-5] Propose a new lifestyle for a new era of people living with the novel coronavirus in Cambodia.

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Learning objectives

You will be able to gain proper understanding and explain:

- How we can see an object and why refractive errors occur, and explain how we can prevent eye diseases.
- The function of a tooth, the causes of dental caries, gingivitis, and periodontal disease, and explain how we can prevent them.

This chapter explains the mechanisms of the eyes and the teeth, diseases related to them, and prevention of those diseases. Eyes and teeth, which are organs familiar to children in that they can easily observe them, provide them with opportunities to experience, for example, preventive measures in practice and make them realize the outcomes of health learning easily. Therefore, eye and dental health is one of the teaching and learning materials of school health familiar to all members of a class.

1. Eye health

1) Importance of eye health

Eye and dental diseases significantly affect our health not only during school age but also in adulthood. Loss of sight in particular is a serious issue. Cambodia implemented the national strategic plan to prevent loss of sight (2008–2015) with a focus on the **National Program for Eye Health**, and achieved the goal of making the rate of blindness 0.5% or lower.¹ Nevertheless, an estimated 28,800 people still suffer from loss of sight or visual impairment. The leading cause of loss of sight and visual impairment is cataracts (approx. 19,000 people), but they can also be caused by leaving refractive errors that occur during school age untreated. It is said that 80–90% of these causes are preventable or treatable.²

Meanwhile, about 20% of children have missed a class due to a toothache over the last 12 months, indicating that dental health is an issue that should be given priority for school-age children.³ The school age is a period in which milk teeth (deciduous teeth) are replaced by permanent teeth, and leaving dental caries or periodontal disease untreated during this period can invite exacerbation later and result in loss of teeth in adulthood.

Therefore, it is very important to learn eye and dental health in school health classes during school age.

2) How we can see an object

The **ophthalmus** is an intricate organ that allows us to clearly see things in the outside world and is often compared to a camera. The **cornea** and **crystalline lens**, which correspond to camera lenses, pass and refract light. The **retina** corresponds to camera film. An object in the outside world can be clearly seen when the image refracted by the cornea and crystalline lens is focused on the retina surface (**Figure 8.1**). The **ciliary muscle** surrounding the crystalline lens focuses an image on the retina by becoming tense or loose according to the distance to the object that is seen. Whether an image can be focused on the retina surface depends on the refractive power of the lens and the distance from the front surface of the lens to the retina (the axial length of the eye).

Column: Eye and ophthalmus

The eye covers a region that is larger than the region of the ophthalmus. The eye refers to the entire eye as a part of the face, including the eyelid, the inner corner of the eye, the outer corner of the eye, and the eyeball. Meanwhile, the ophthalmus, which is a term in medicine and physiology, refers to the **eyeball**.

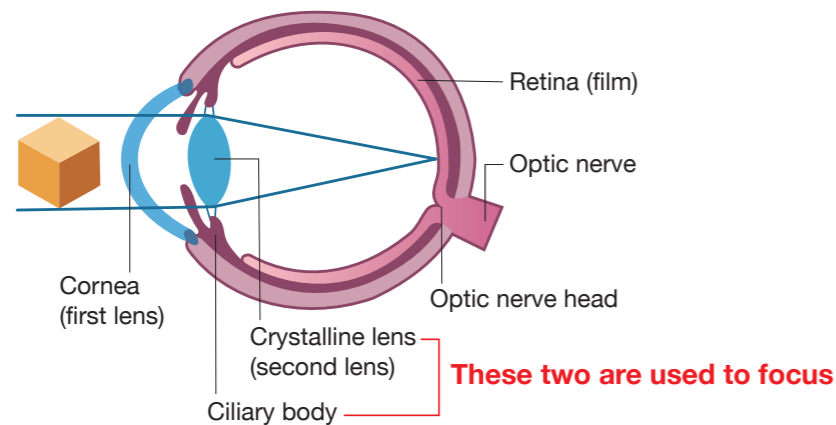


Figure 8.1 How we can see an object (Structure of the eyeball)

3) Eye diseases that can cause visual impairment

As diseases that can cause reduced vision or loss of sight, which are common in Cambodia, we can cite **cataracts, glaucoma, diabetic retinopathy, trachoma, vitamin A deficiency, and refractive error**.¹ Described below are the outlines of these diseases.⁴

(1) Cataracts

Cataract is a disease in which the crystalline lens becomes opaque. The opaque crystalline lens impairs light transmission, resulting in visual impairment and eventually loss of sight. The leading cause of cataract is aging, but there are also cases associated with systemic disease such as diabetes and atopic

dermatitis, cases caused by a traumatic injury like perforation or the contusion of the eyeball, and cases of congenital cataracts. There are drug therapies and surgical treatments. Drug therapy can slow the progression of the disease but cannot remove the crystalline lens opacity. Recovery of sight requires surgery in which the opaque crystalline lens is removed and replaced with an artificial lens.

(2) Glaucoma

Glaucoma is a disease in which increased intraocular pressure and the fragility of the optic nerve impair the optic nerve, resulting in visual impairment. **Intraocular pressure** is the pressure inside the eyeball and has the role of maintaining the shape of the eyeball. Symptoms of glaucoma are reduced vision and visual field defects, but often, no symptoms are developed in the early stage. If the state of increased intraocular pressure continues, it impairs the optic nerve and results in loss of sight. Although glaucoma is mostly primary (cases in which there is no original disease or the cause is unknown), there are also cases that occur secondary to other diseases. There are drug therapies and surgical treatments, one of which is selected depending on the pathological condition (state of the disease).

(3) Diabetic retinopathy

Diabetic retinopathy is a disease in which persistent hyperglycemia weakens vessel walls in the eye, causing angiopathic lesions of the retina. It is one of the three major complications of diabetes and occurs several to ten-odd years after the person is affected by diabetes. There are often no symptoms in the early stage, and retinopathy has already significantly advanced by the time symptoms are noticed. Symptoms are **misty vision** (the whole vision is blurred), **myodesopsia** (a symptom in which a small flying object like an insect appears in the vision), reduced vision, and visual field defect, which eventually result in loss of sight. Depending on the symptom, surgery to coagulate retinal tissue using a laser, or surgery on the vitreous body is performed. It is important to control blood glucose along with the treatment of diabetes.

(4) Trachoma

Trachoma is conjunctivitis caused by repeated infection with *Chlamydia trachomatis*. In severe cases, a lot of conjunctival vessels enter the cornea and make it opaque, resulting in loss of sight. It is common in preschool children. To treat the disease, new quinolone antibiotic eye drops or eye ointment are used, or a tetracycline or macrolide antibiotic is taken orally. Not sharing towels and bedding, as well as washing hands and faces frequently can help prevent home infection.

The real situation and magnitude of trachoma is still unknown. However, it is assumed that in Cambodia trachoma still remains a major public health problem, though no nationwide surveys have ever been carried out. Cambodia is a member of the WHO Global Alliance for Elimination of Trachoma. A rapid assessment of trachoma and its risk factors is planned in 3 provinces with objectives to determine the occurrence of blinding trachoma, measure its magnitude, and the severity of the problem.²

(5) Vitamin A deficiency

Vitamin A is a nutrient that is related to the reception of photic stimulation as well as the differentiation and functional maintenance of epithelial cells (see Chapter 5). Deficiency in vitamin A can cause **night**

blindness or make the conjunctiva and the cornea dry enough to cause visual impairment. Night blindness is a disease characterized by a significant reduction of vision in the dark, caused by impaired rod cells that usually function in the dark (see Chapter 2). When the conjunctiva is dried, moving the eyeball may make wrinkles in the conjunctiva, or show dull, dirty white spots (Bitot spots) in the palpebral conjunctiva. If the symptoms progress further to dry the cornea, an ulcer is formed, and in severe cases, a hole in the cornea may have been developed resulting in loss of sight. To treat the disease, vitamin A is administered. Intake of a proper amount of vitamin A is also effective in prevention.

(6) Refractive errors (hyperopia, myopia, and astigmatism)

Uncorrected refractive error is major cause of visual impairment. An estimate of prevalence of visual impairment due to refractive errors accounts for 52.8%. In children refractive errors affected approximately 10% in urban areas and 1.5% in rural areas.¹ Meanwhile, there is also a report stating that about 70% of refractive errors in children were **myopia**,² indicating the importance of early detection and prevention of exacerbation of refractive errors, particularly myopia, during school age.

Normal refraction refers to the condition of the ophthalmus in which parallel rays are correctly focused on the retina when an object is seen in the non-accommodative state (state in which nothing is being done). The condition in which they are not correctly focused is called **refractive error**. There are three types of refractive errors: **hyperopia**, **myopia**, and **astigmatism** (Figure 8.2).

a. Hyperopia

Hyperopia refers to the condition of the ophthalmus in which parallel rays are focused posterior to the retina in the non-accommodative state, thus producing an unfocused, unclear image on the retina. The causes of this include a short axial length of the eye and weak refractive power of the cornea or the crystalline lens. In hyperopia, it is difficult to clearly see both far and near objects, and particularly near objects. Consultation with a specialist is required depending on the severity, but leaving it untreated may lead to reduced vision or cause amblyopia or esotropia.

b. Myopia

Myopia refers to the condition of the ophthalmus in which parallel rays are focused anterior to the retina in the non-accommodative state, thus producing an unfocused, unclear image on the retina. The causes of this include a long axial length of the eye and strong refractive power of the cornea or the crystalline lens. In myopia, it is not possible to clearly see far objects but possible to clearly see near objects. School children with myopia may find it difficult to see letters on the blackboard. In addition, as they have to narrow their eyes, or knit their brows to see objects, they may experience headaches.

Column: Asians and myopia

The prevalence of myopia in schoolchildren has been reported to be higher in Asian countries than in Europe and other regions (20–30%), with the rate of myopia being 45.7% for high school students in Korea, 70.3% for those aged between 12 and 19 in Taiwan, 78.4%⁵ for those aged 15 in China (Guangzhou), and 76.5% for those aged between 6 and 11 and 94.9% for those between 12 and 14

in Japan (Tokyo).⁶ The high prevalence of myopia in school children is a major issue of school health and public hygiene in Asian countries.

The causes of myopia are thought to be related to genetic factors and the environment. It has been reported that seeing objects at a short distance for long hours during the growth period can affect the prolongation of the axial length of the eye, indicating that the use of mobile games and SNS could progress myopia; therefore, attention needs to be paid to lifestyles. Meanwhile, there is another survey of Chinese elementary school and junior high school children that reported that tasks performed at a short sight distance had no influence on myopia while a longer time of participation in outdoor activities was associated with a lower incidence of myopia in elementary school children.⁵ Moreover, it has been confirmed that increasing the time for outdoor activities at schools reduced myopia. Increasing the time for outdoor activities is not only good for eye health but also expected to be effective in preventing lifestyle diseases including obesity, and therefore, it is a good effort in school health.⁷ However, in Southeast Asian countries including Cambodia, where sunlight is strong and temperatures are high, it is difficult to increase the time for outdoor activities and some consideration is needed.

c. Astigmatism

Astigmatism is a condition in which parallel rays are not focused at a single point on the retina. This is caused primarily by an unequal curvature, instead of a spherical surface, of the cornea. In astigmatism, how objects are seen is different from, and more complicated than that in myopia and hyperopia. Objects look blurred regardless of the distance.

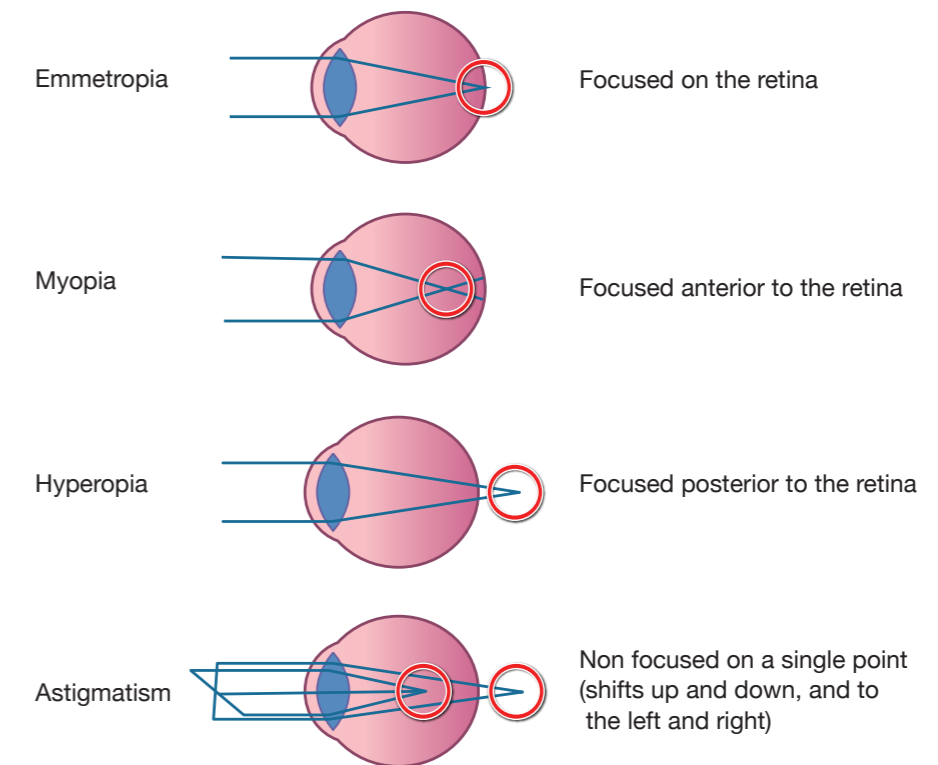


Figure 8.2 Emmetropia and refractive errors

4) Correction of refractive errors

(1) Glasses

Glasses are used to correct refractive errors. There are the two types of lenses for glasses: a **convex lens** and a **concave lens**. The convex lens is used in a magnifying glass, and its shape is round in the center and tapered in thickness toward the periphery. Meanwhile, the concave lens is thin in the center and thickens toward the periphery.

Since myopia is a condition in which rays converge anterior to the retina, **glasses with concave lenses** are used. The concave lenses converge rays posteriorly, thus adjusting the focal point to focus the image on the retina. In hyperopia, meanwhile, rays converge posterior to the retina, **glasses with convex lenses** are used. The convex lenses converge rays anterior to focus the image on the retina, making it possible to see the object clearly (Figure 8.3).

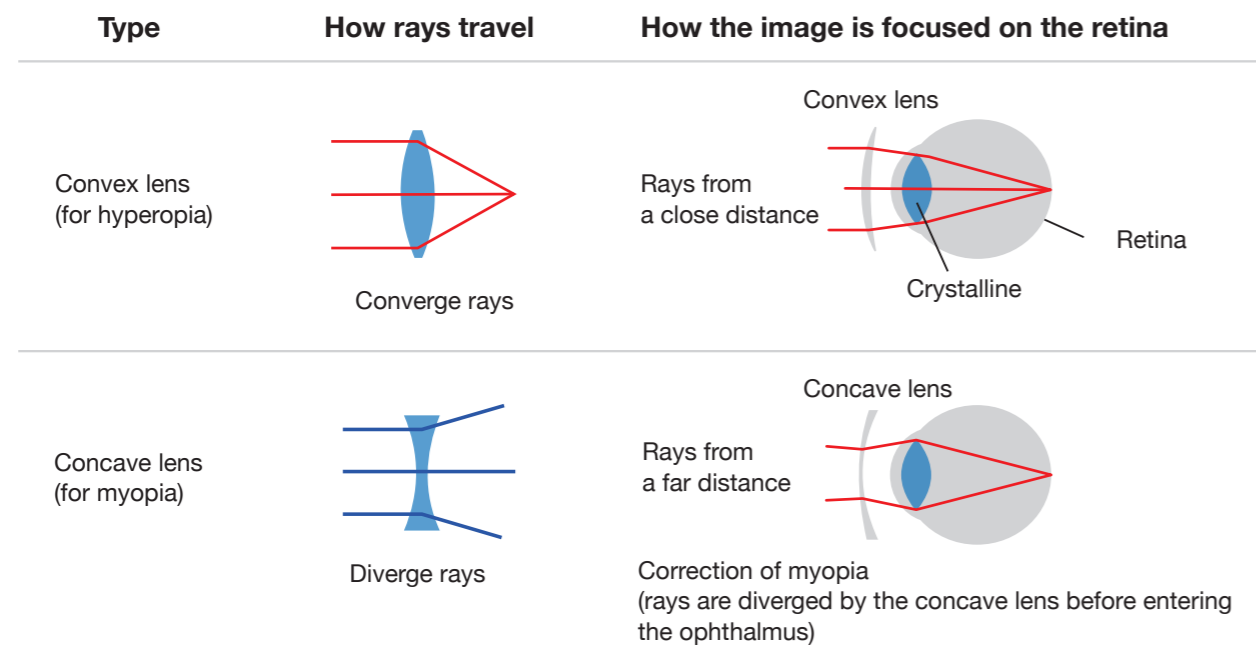


Figure 8.3 Mechanisms of visual correction by glasses

(2) Contact lens

A contact lens, which is a **medical device** placed directly on the cornea, can be used for various eye disorders, including myopia (nearsightedness), hyperopia (farsightedness), astigmatism, and presbyopia (poor focusing with reading material and other near vision tasks occurring typically in middle and old age). According to the material, it can be divided into hard contact lenses and soft contact lenses. The hard contact lens is made of a hard material and generally used for a long period while receiving maintenance such as cleaning. The soft contact lens is made of a material that softens with water and comes in different types: a single-use type, a type that is replaced every two weeks to one month, and a type that is used for a long period of time. The soft contact lens is slightly less effective in correction than the hard contact lens but has the advantages of giving the wearer a less uncomfortable feeling and causing less slipping and dropping.

In both types of contact lenses, attention needs to be paid to complications that may be caused by putting the lens on the surface of the cornea. Such complications include **corneal infection**, which is caused by damaging the cornea, **conjunctivitis**, which is caused by allergens attached to the contact lens, and **corneal epithelium disorder**, which is caused by decreased oxygen supply to the surface layer of the cornea that is covered. To reduce these complications, it is important to properly manage and use contact lenses. First of all, pay attention to how many hours per day. Depending on the type of lens and the condition of the wearer's eye, generally 12 to 16 hours per day is seen as a guide. Second, contact lenses should be kept clean, and contact lenses other than single-use lenses should be cleaned after use and stored in a clean container. Also important is having an eye examination at an ophthalmological clinic on a regular basis.

Column Fashionable contact lenses caused eye disorders!!

These days, some people use contact lenses not for visual correction but for fashion. They use colored contact lenses to change the color of the iris as well as circle contact lenses to make the pupil look larger. As with contact lenses for visual correction, contact lenses for fashion may also cause eye diseases if they are not properly used. Some people developed an eye disease by sleeping while wearing contact lenses, or borrowing/lending contact lenses from/to a friend. Avoid careless use, adhere to the same usage hours, and properly maintain the lenses. In addition, take care not to purchase inferior goods that use harmful substances to color the lenses. The abnormality of the eye or an uncomfortable feeling that people experience while wearing colored contact lenses is a sign of trouble in the eye.

5) Protecting your eyes

Because myopia often occurs during school age, the prevention of myopia is discussed here. Preventing the onset and progression of myopia can lead to the prevention of visual impairment in adulthood. The progression of myopia due to "environmental factors" can be prevented by reviewing daily life.

(1) Posture

It is said that sitting in a bad posture during class, or watching television or reading books while lying can exacerbate myopia. Pay attention to posture during class. Sit straight up, and allow a fist-size space between the desk and the belly. It is desirable that the height of the chair allow the bottoms of the feet to reach the floor entirely. If that is not possible, adjust the height of the chair or use a stool (Figure 8.4).

(2) Brightness

Classrooms and equivalent facilities require a brightness of 300 lux or more. Vertical TV and computer monitors should ideally give off 500–1000 lux (lux is a standard unit of measurement of light level intensity). In Japan, the "School environmental hygiene standards for environment of classrooms, etc." stipulate that when classrooms are used for learning, they are required to have a brightness of 300 lux or

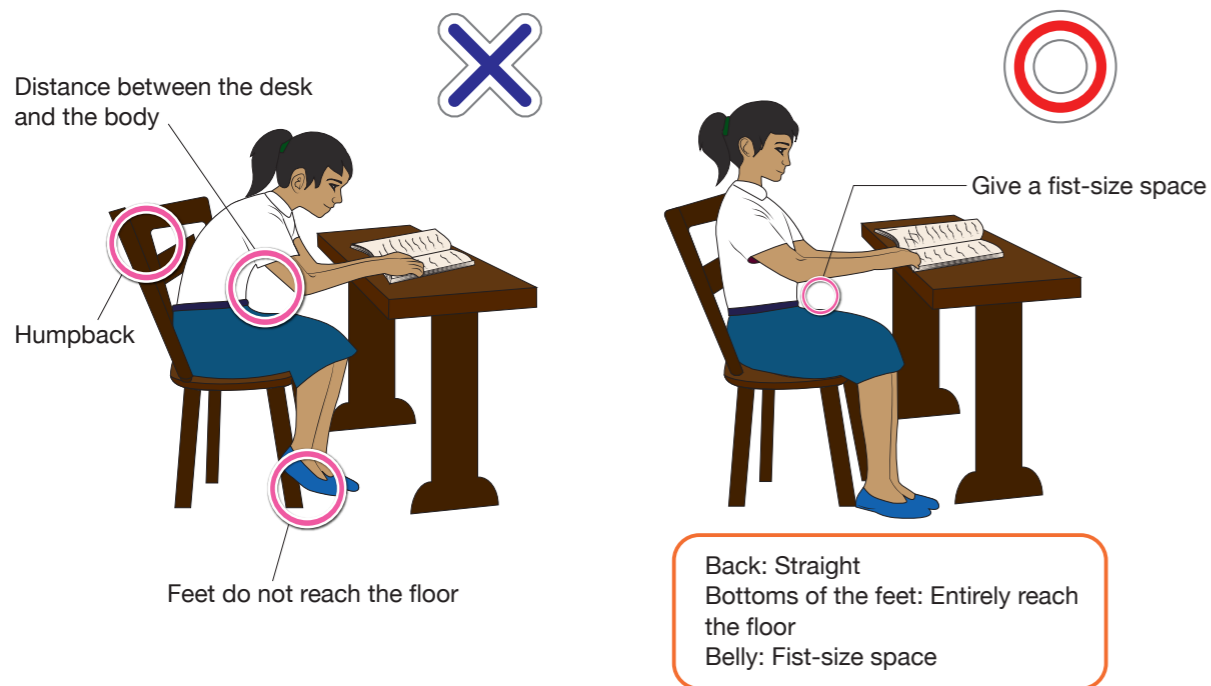


Figure 8.4 Bad posture and good posture during class

more for the entire classroom and a brightness of 500 lux or more for the blackboard surface.⁸

During class, students repeatedly look at the blackboard, a book, and a notebook. Therefore, a large difference between the brightness of the blackboard and that of the classroom causes eyestrain. In addition, attention should be paid to any direct sunlight from the window or a light source that interferes with the field of vision, as it can disturb visibility even if the intensity of illumination meets the standards.

(3) Rest eyes frequently

Staring at a close object for long hours will keep the ciliary muscle tense and likely exacerbate myopia. Recently, there have been increasing opportunities to look at small screens of devices such as smartphones and tablets. Small letters and screens make us particularly short-sighted and are likely to cause eyestrain; it is important to deliberately look away from the screen and look into the far distance to rest the eyes.

The American Optometric Association (AOA) recommends that **the 20-20-20 rule** should be followed in order to prevent eyestrain caused by continuing to stare computers or smartphone screens in particular. The rule is to take at least a 20-second break to view something 20 feet (approx. 6 meters) away every 20 minutes.⁹

2. Dental health

1) The roles and development of teeth

The functions of the teeth and the mouth are significantly related to vital functions including “eating,” “talking,” “creating expressions,” and “supporting movement and keeping a body in balance.”¹⁰ Among

these, the functions of “eating” and “talking” that are acquired in infancy as the teeth and the mouth develop are fulfilled by keeping those functions healthy throughout life. Therefore, keeping the teeth and the mouth healthy will improve the person’s quality of life (QOL) throughout their life. Although QOL can be interpreted variously depending on context, one popular understanding is that QOL represents the extent to which a person obtains satisfaction from life.

The number of teeth is 20 for milk teeth or deciduous teeth and 32 for permanent teeth. However, eruption of the third molars (the wisdom teeth) varies among individuals. Without the third molars, the number is 28. At around six months after birth, babies start teething with milk teeth and finish when they are around two and a half to three years old. The order of teething varies among individuals. The first permanent tooth to grow is often a mandibular central incisor or a mandibular first molar. Teething of permanent teeth is completed at 12 to 13 years old, with variations in the order of teething among individuals greater than those for milk teeth. Childhood is a period in which milk teeth are replaced by permanent teeth (Figure 8.5).¹¹ Because dental caries may affect how permanent teeth grow as well as the tooth alignment, childhood is viewed as an important period also from the standpoint of developing the characteristics, alignment, and occlusion of permanent teeth.

Individual teeth have shapes suitable for their roles concerning the function of eating. **Incisors** cut foods. **Canines** play a role in tearing foods into pieces. **Molars** play a role in grinding foods to change their shapes so that they can be easily swallowed. A tooth is comprised of the outside of very hard enamel, the body of dentine, and the root surface of cementum (Figure 8.6).

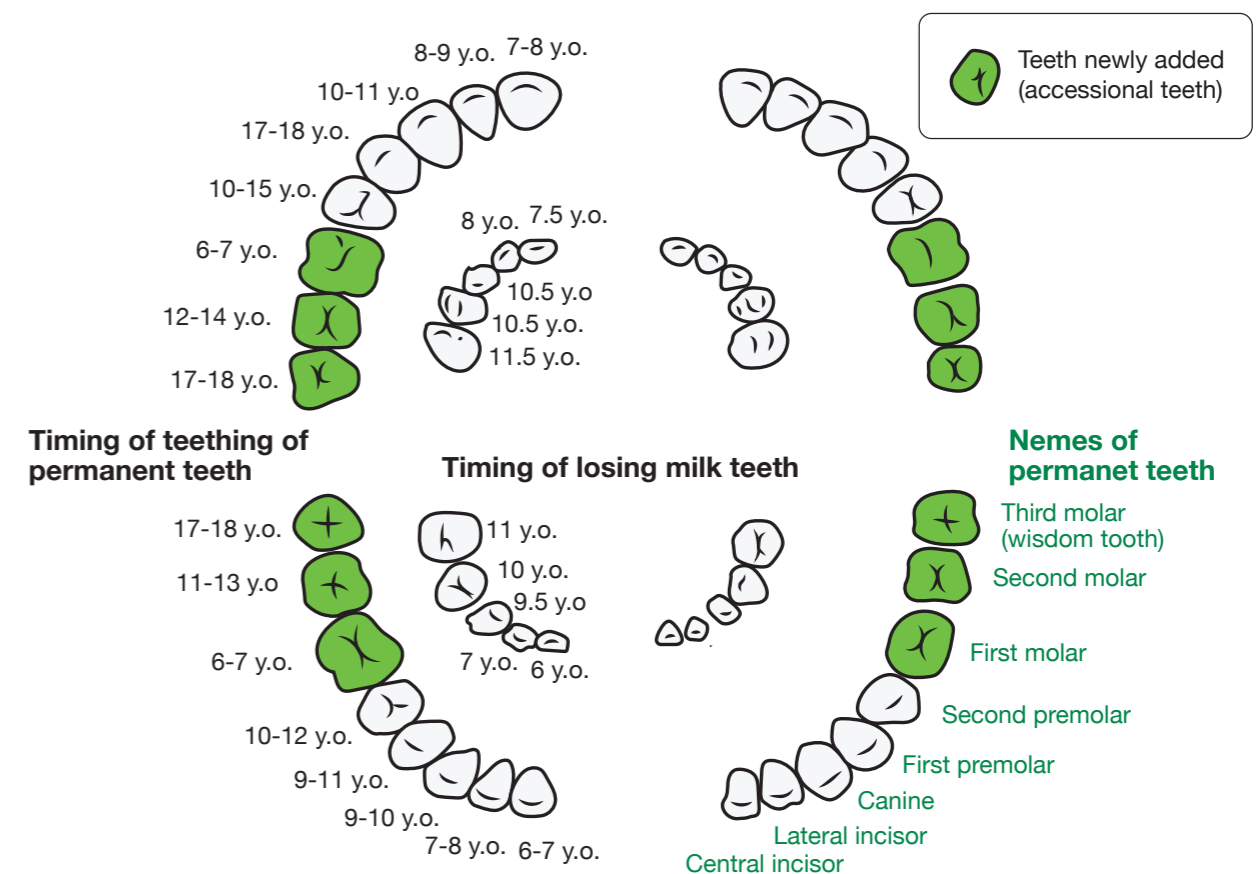


Figure 8.5 Timing of losing milk teeth and timing of teething of permanent teeth¹¹

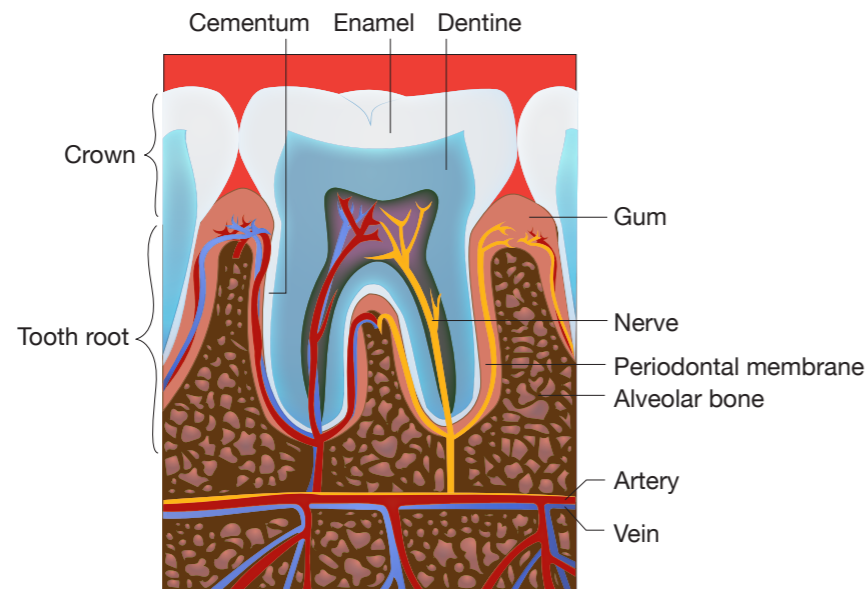


Figure 8.6 Structure of a tooth

2) Dental caries

Dental caries is a disease in which enamel or dentine is destroyed by acid produced by the activity of bacteria (mutans streptococci) and lactic acid bacteria in the mouth (see Chapter 4). Dental caries does not heal on its own, nor does a tooth with caries return to the original health even if it is treated. The Cambodia National Oral Health Survey, conducted in 2011, reported that the prevalence of dental caries is 93% for children aged six, and 80% for those aged 12 and 13 and aged between 35 to 44, indicating that dental caries is a major health issue not only for children but also for adults in Cambodia.¹²

(1) Mechanism of the development and progression of dental caries

Dental caries develops when the conditions of three factors, that is, bacteria, tooth quality/shape, and carbohydrate (sucrose or sugar) are met, and time passes. Described below is the mechanism of the development of dental caries (Figure 8.7).

- (i) Infection with **mutans streptococci** (formal name: *Streptococcus mutans*) is established.
- (ii) Mutans streptococci in the oral cavity uses carbohydrate taken as food to produce sticky glucan from sucrose. The glucan attaches to the surface of the tooth and produces plaque (see Chapter 4) with other oral bacteria. Thus, the plaque is an aggregate of various bacteria.
- (iii) Bacteria in the plaque further proliferate to produce acids using carbohydrates (sucrose) taken as food.
- (iv) When acidity in the plaque becomes $\text{pH} \leq 5.5$, enamel on the tooth surface begins to decay (**decalcification**; the dissolution of calcium and phosphoric acid from the enamel of the teeth).
- (v) Acidity in the plaque returns to the original pH level thanks largely to the effect of saliva, causing remineralization (restoration by the activity of saliva).
- (vi) Eating foods containing saccharides without a break leads to the disruption of the balance between (iv) and (v), which makes decalcification greater than restoration, resulting in dental

caries.

- (vii) Dental caries starts in enamel. Dental caries developed in enamel does not cause symptoms such as toothache or a pain sensitive to cold water or sweet foods. If left untreated, dental caries extends to dentine and the dental pulp (nerve). If dental caries extends to the dental pulp, a severe pain develops. Leaving this condition untreated results in the death of the nerve, and dissipation of the pain. Further progression of dental caries causes the crown to collapse and leaves only the tooth root. Because conservative treatment is impossible for this condition of a tooth, the tooth will be extracted.

Memo: Sucrose and sugar

Sucrose is the most common food sweetener. Industrial products mainly composed of sucrose are collectively called sugar.

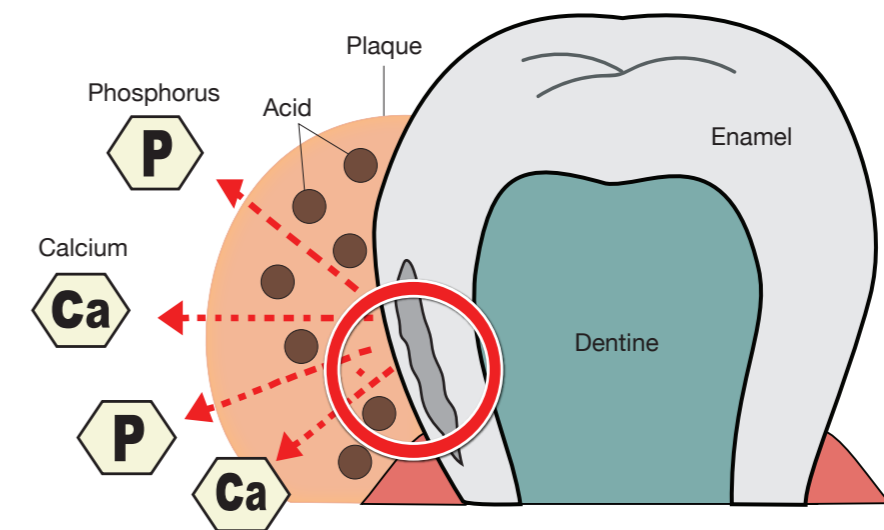


Figure 8.7 Mechanism of the development of dental caries

There are teeth and regions that are likely to cause dental caries. Among milk teeth, maxillary deciduous incisors as well as maxillary and mandibular deciduous molars are susceptible to dental caries. Among permanent teeth, the maxillary molar region is the most susceptible to dental caries. The regions that are likely to cause dental caries are grooves in molars, gaps between the teeth, and boundaries between the tooth and the gum (Figure 8.8). In these regions, food particles tend to remain and the cleaning effect of saliva is difficult to reach physically. Thus, the adhesion of plaque (see Chapter 4) is likely to occur.

In addition, newly grown teeth are likely to develop dental caries. When a tooth comes in contact with saliva, enamel absorbs calcium in the saliva to promote the crystallization of enamel, thus making the tooth resistant to dental caries. But this is said to take two to four years in general. Given that permanent teeth start to grow at six years old and complete growth by 12 or 13 years old, the school age is a period in which the development of dental caries is rather common. This is also a reason why establishing dental and oral health practice is necessary during school age.¹⁰

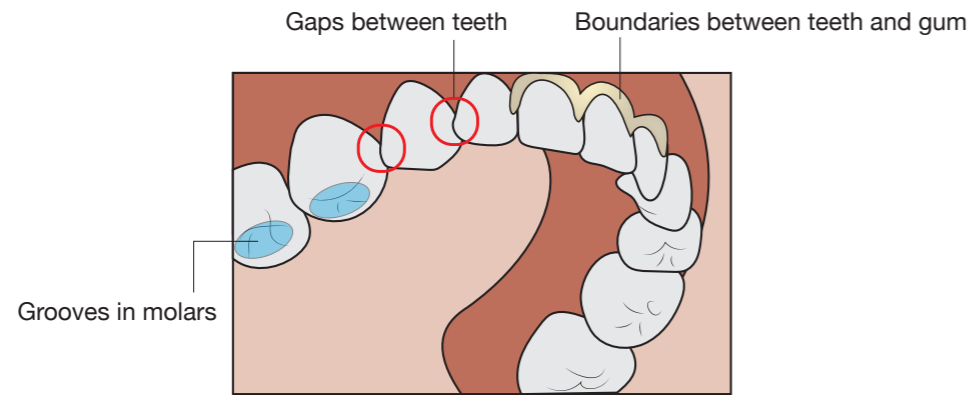


Figure 8.8 Regions that are susceptible to dental caries

3) Gingivitis and periodontal disease

Periodontal disease is a general term for conditions where periodontal disease bacteria have caused inflammation of the periodontia around the tooth (e.g., the gum, periodontal membrane, alveolar bone, and cementum). The condition in which inflammation is only caused in the gum is called **gingivitis**, and the condition in which inflammation extends to the alveolar bone and the periodontal membrane is called **periodontitis**. Having no subjective symptoms, gingivitis is often left untreated and progresses silently. By the time the disease is noticed, even the alveolar bone supporting the tooth has decayed due to a toxin from periodontal disease bacteria and inflammation. This is called the resorption of the alveolar bone, and in this condition, the tooth is wobbly, chewing foods becomes difficult, and eventually the tooth comes out.

Inflammation of the gum is caused by plaque that attaches to the boundary between the tooth and the gum and then increases. Plaque is an aggregate of various types of bacteria, and periodontal disease bacteria in particular, which like places where the amount of oxygen is small, enter the space between the tooth and the gum (**a periodontal pocket**) and destroy periodontal tissues with a toxin and acid (see Chapter 4). While periodontal disease affects many adults, gingivitis starts during elementary and junior high school age. Adolescent hormonal imbalance (particularly, changes in female hormone levels), stress, lifestyle habits such as smoking, and lifestyle diseases including diabetes are risk factors that can exacerbate periodontal disease.

Column: Causes and prevention of bad breath

Bad breath is a very common issue of oral hygiene. In most cases, causes are in the mouth; the two major causes are coating of the tongue and periodontal disease. Bad breath is caused by systemic diseases (metabolic diseases) such as diabetes, uremia, hepatic cirrhosis, liver cancer, and trimethylaminuria.¹³ The best way of making sure you do not have bad breath is to keep your teeth, tongue, and mouth clean. Preventive measures include twice-a-day gentle, careful brushing of the teeth, the gum, and the tongue, removing food particles from the space between the teeth, not smoking, and not taking in high-sugar drinks.¹⁴

4) Prevention of dental caries and periodontal disease¹⁰

The school age is a period in which milk teeth are replaced by permanent teeth and a lifestyle is established. It is therefore important to learn dental and oral health during school age. Establishing dental and oral health practice is a daily, common subject, in which it is easy to find challenges and see the process of solving such challenges. For this reason, dental and oral health is a valuable teaching and learning matter that enables the direct observation of the body condition and its changes. Here, brushing teeth and diet are discussed as preventive measures against dental caries and periodontal disease.

(1) Toothbrushing

Toothbrushing is effective in removing plaque (an aggregate of living bacteria) that can cause dental caries and periodontal disease. Plaque is milk white, a color similar to that of a tooth, and rough when it is tongued (see Chapter 4). Plaque tends to attach to gaps between the teeth, boundaries between the tooth and the gum, and the occlusal surface. Therefore, brush the teeth along the tooth alignment by brushing one area at least 20 times and keeping the following three tips in mind: (i) **properly place** bristle ends of the toothbrush against the boundary between the tooth and the gum as well as gaps between the teeth, (ii) **move it with light force** that does not allow bristle ends of the toothbrush to broaden, and (iii) **wiggle the toothbrush** within a range from approximately 5 to 10 mm, and **brush one by one** (Figure 8.9). Brushing the teeth in a predefined order will enable uniform, complete brushing.

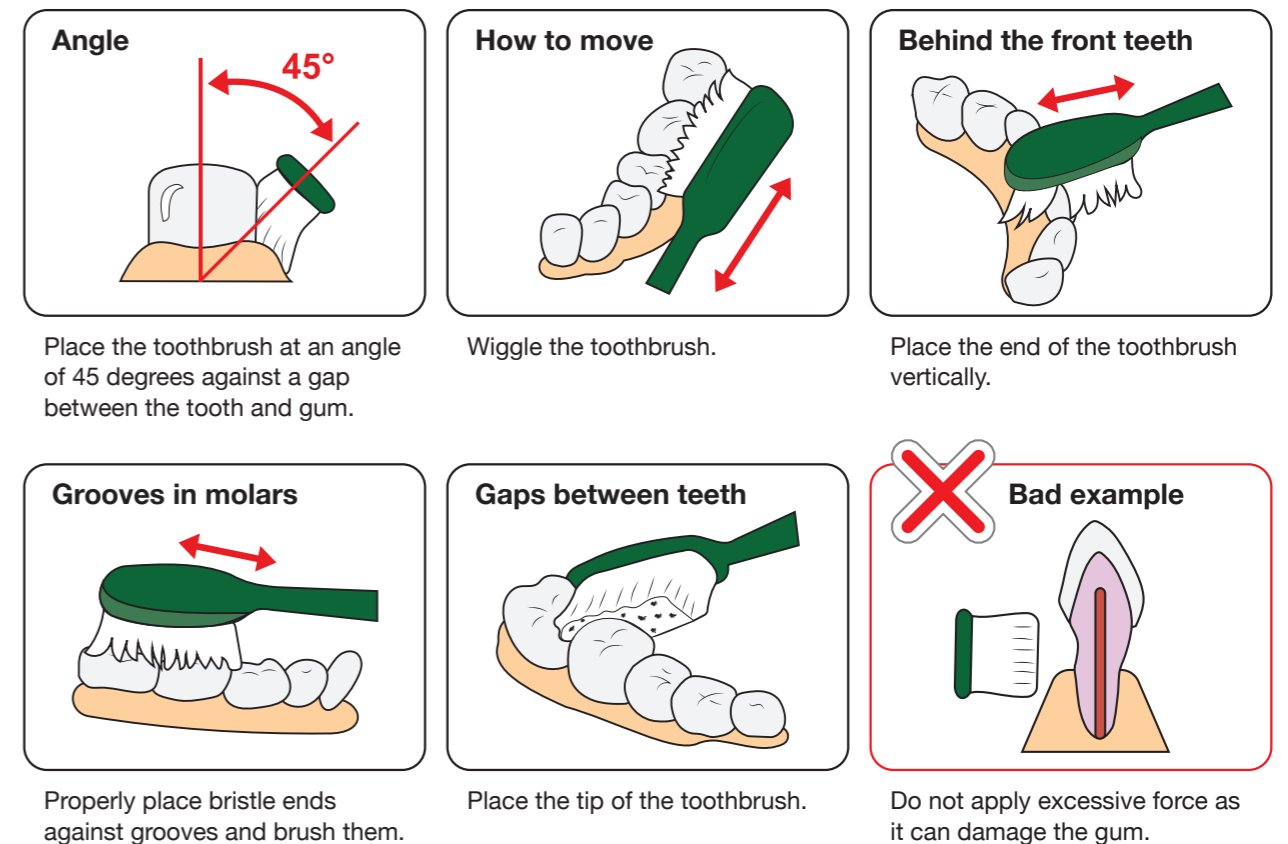


Figure 8.9 How to use a toothbrush

Make it a rule to brush the teeth after eating breakfast, lunch, and dinner in order to prevent the acid state of the oral cavity from lasting for a long time after meal ((iii), (iv), and (v) in the development and progression of dental caries described above). Brush the teeth particularly carefully before going to bed because, while sleeping, the amount of saliva secretion becomes small and the self-cleaning function decreases.

Column: A variety of toothpaste

What kind of toothpaste do you use? What standard do you apply to choose it?

Toothpaste contains various components. They include a polishing agent to remove stains (calcium carbonate, sodium bicarbonate), a refrigerant like mint, a forming agent to improve the feeling of brushing, and fluoride to prevent dental caries (sodium fluoride, sodium monofluorophosphate). It is only fluoride that has been shown to be effective in scientific studies. Although the foam of toothpaste makes us feel the teeth have been cleaned, foaming agents are not effective in preventing dental caries. The most important thing to prevent dental caries is to brush the teeth properly. It is recommended that you should start brushing without toothpaste and finish brushing with toothpaste. When you use toothpaste containing fluoride, it is also important to keep gargling to a minimum in order to allow the component to spread over and coat the teeth.

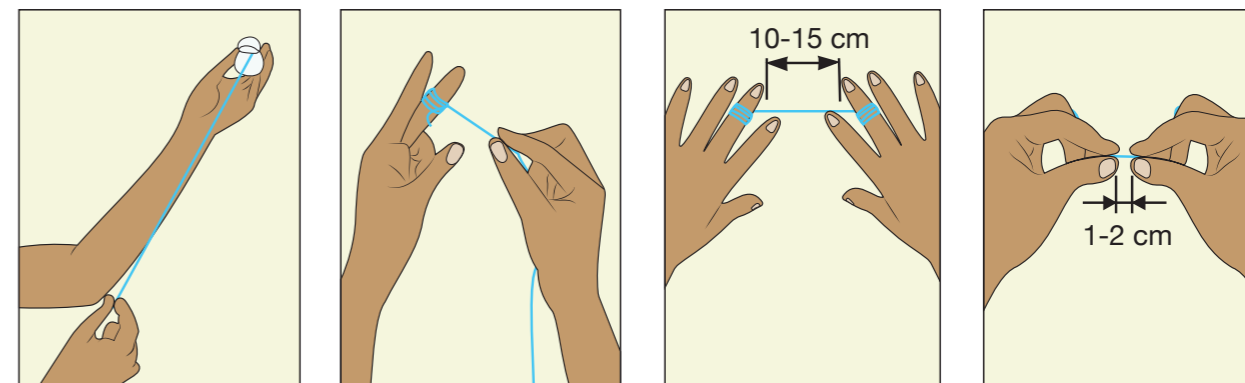
(2) Dental floss

It is difficult to remove plaque between the teeth with a toothbrush because bristle ends do not always reach between teeth. **Dental floss** is made of thin bundled fiber (Figure 8.10). This allows it to pass through a narrow gap between the teeth to scrape off plaque that cannot be completely removed with a toothbrush. Figure 8.11 shows the proper method for using dental floss.

Dental floss comes in two types: wax type and non-wax type. The wax type slides well and is easy to insert into gaps between the teeth; it is thus recommended for novice users. The non-wax type can scrape off plaque more efficiently because its fiber is not fixed with wax and thus can fit the surface of a tooth when it sticks to it.



Figure 8.10 Example of dental floss



Cut floss to a length of about 40 cm (length from a fingertip to the elbow).

Wind floss around both middle fingers (forefingers) several turns lightly. Wind a longer section around your non-dominant hand.

Adjust floss to make the space between both middle fingers 10-15 cm when floss is taut.

Hold floss with thumbs and forefingers and handle it while keeping a space of 1-2 cm.

Figure 8.11 How to hold dental floss

Let's experiment Experiment for effective toothbrushing

Preparation: Plaque disclosing tablets, toothbrush, mirror, cotton swab, towel, clothespin, water bottle (water for gargling), container to spit out water, etc.

Experimental method (Figure 8.12)

- (i) Put a towel around your neck and fix it with a clothespin.
- (ii) Brush your teeth.
- (iii) Chew one plaque disclosing tablet firmly into small pieces. Apply them to your teeth with your tongue with the aid of a mirror, then spit them out.
- (iv) Rinse out your mouth one or two times.
- (v) Observe areas that have been stained red in the mirror.
- (vi) Discuss regions that tend to remain uncleaned.



Figure 8.12 Staining experiment steps

(3) Eating habits to maintain dental health (how and what to eat between meals)

Among carbohydrates, sucrose (sugar) can be a primary cause of dental caries because “it is used as a material to produce plaque” and “it is used as a material for acid production by bacteria.” At the same time, sucrose is an important nutrient source. Therefore, the important thing is not just cutting the intake of sucrose but taking it in a wise way. Specifically, it is important not to take foods containing it frequently

or irregularly (not to eat without a break) because the constant presence of sugar in the oral cavity creates an environment in which acid is constantly produced and thus decalcification progresses (Figure 8.13). In addition, eating sticky foods such as snack foods should be discouraged because carbohydrates persistently remain in grooves in molars, which is a condition that is likely to cause dental caries.

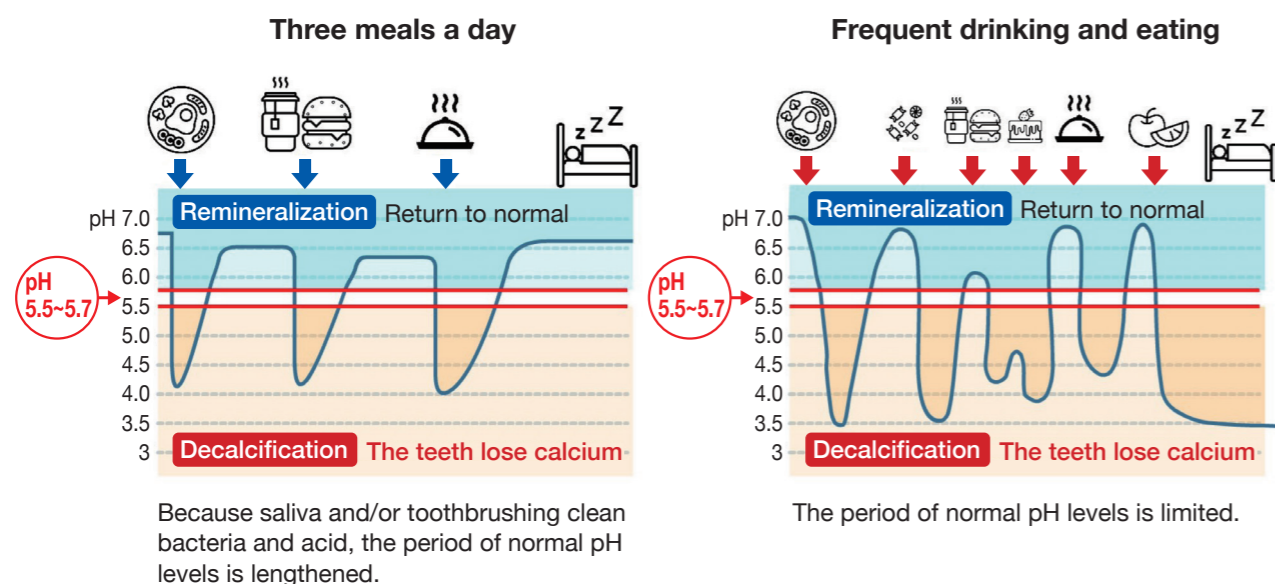


Figure 8.13 Relationship between diet and oral cavity pH (Stephan curve)

Exercises for further thought and research

- [8-1] The prevalence of myopia among school children is said to be lower in Cambodia than in other Asian countries. Find reasons for that. Predict whether or not the number of children with myopia will increase in the future by sharing views.
- [8-2] Assume that you give an eye health class to elementary school students, consider the content and method, and give a mock class.
- [8-3] It is difficult to increase time for outdoor activities in Southeast Asian countries including Cambodia, where the sunlight is strong and temperatures are high. Consider what kinds of measures can be taken to increase time for outdoor activities for children.
- [8-4] Investigate the habit of toothbrushing among elementary school students. Consider benefits and challenges based on the section of “Toothbrushing.”
- [8-5] Consider an effective method for teaching toothbrushing taking into account ages at which teeth are replaced by new growth.

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Significance of health checkups and their methods

Learning objectives

You will be able to gain proper understanding and explain:

- The significance of health checkups and learn to conduct health checkups correctly.
- Based on the results of health checkup, how to identify health issues of children, screen them, and consider appropriate measures at school.
- The importance of creating a system for conducting high-quality and continuous health checkups at schools.

In this chapter, you will learn about the significance of health checkups; specific procedures for measuring and recording height, weight, eyesight, and hearing; how to utilize these data; and how to plan and prepare for health checkups at the school.

1. Significance of health checkups

There are **two objectives for health checkups (health examinations and physical measurements)**:

The first is to check and evaluate whether children are growing steadily, and if abnormalities are discovered, refer to health services. The second is to identify the health issues of children as a group, and link to appropriate responses and health education at the school.

The primary goal of school health is for children to grow and develop soundly. As discussed in Chapter 3, the growth and development of children is promoted or interfered with by various factors (i.e., biological, behavioral, and physical/social environmental factors). Hence, it is important to regularly check, evaluate, and screen whether children are growing and developing soundly. If children are left in a state where their growth/development is inhibited, it can cause a negative spiral that interferes with learning and daily life and further inhibits growth/development. If the growth and development of a child is not smooth, it is vital to investigate the factors and make necessary improvements. Examples of factors that inhibit growth and development may include serious illnesses, nutritional conditions, unfavorable living environments, daily rhythm, and psychological stress.

Health checkups aim not only to evaluate the individual growth and development of children, but to identify and improve collective health issues. For example, suppose a school has discovered that many of its children have poor eyesight through a health checkup. To improve this, the school can propose to adjust the brightness of the classrooms, provide health education to the children regarding their posture and eye health, and take other measures on a schoolwide basis to improve the eyesight of the children. In this way, it is important to connect the health checkup to health education and school health activities.

Health checkup systems and programs vary from country to country. At present, most schools in

Cambodia do not conduct health checkups. However, all schools in the country are called on to conduct health checkups to ensure the sound growth and development of children (see the National School Health Policy 2019 in chapter 1). Some countries include clinical medical tests such as electrocardiography, radiography, and urinalysis in health checkups. This chapter will focus on easy and effective measurements and tests that are feasible in Cambodia: height measurement, weight measurement, eye test, and hearing test.

Column: Health checkup is “Screening.”

Screening means to group people into those who may have problems and those who do not through tests. Health checkups are a form of screening, not a diagnosis of illness. If a child is suspected of some possible health problems in a health checkup, it is important to refer the child to the appropriate health service.

2. Health checkup methods

This section explains procedures for height measurement, weight measurement, eye test, and hearing test, and for evaluating the measurement/test results. Screening can be performed properly without specialized equipment. Check the physical growth and health conditions of children with materials available at your school.

1) Height measurement and weight measurement

(1) Height measurement method

- a. Items for use: Measuring tape, triangle ruler, adhesive tape (**Figure 9.1**)



Figure 9.1 Items for measuring height (triangle ruler, tape measure, and adhesive tape)

- b. Set up the place for measuring height (**Figure 9.2**)
- Look for a **level floor and wall**. Even a pillar will work.
 - Hold the tape measure to the wall, making sure it is **perpendicular to the floor**.
 - Mark the floor where the child's feet should be.



Figure 9.2 Setting up the place for measuring height

- c. Procedure
- Call the names of the children one at a time.
 - Have them remove their shoes.
 - Have them **stand upright** with both heels touching the wall.
 - Make sure **both heels, buttocks, and back are touching the wall**. Be sure that the back of the head touches the wall. (**Figure 9.3**)

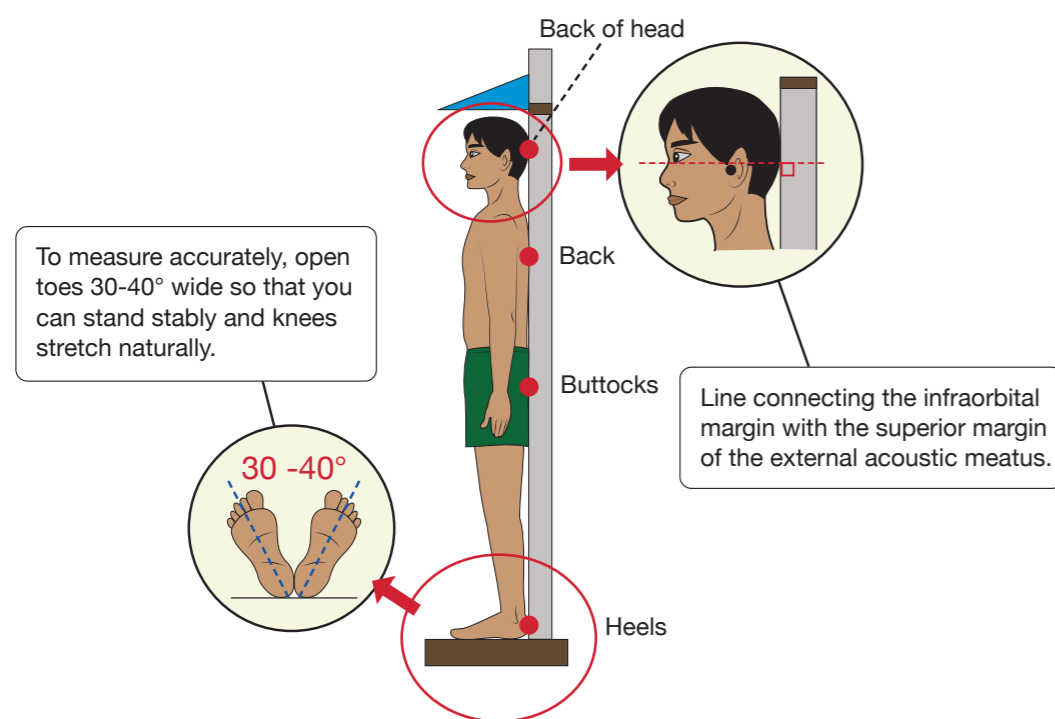


Figure 9.3 The correct posture when measuring height

- Have them hang their arms down the side of the body.
- Have them look straight forward.
- Lower the triangle ruler straight down along the tape measure, read, and note it down the value at the corner of the triangle ruler (**Figures 9.4 and 9.5**).

- d. Tips
- Make sure that the posture of the child is correct during measurement.
 - Measurement may not be accurate for children who tie their hair near the tops of their heads. Ask them for consent to untie or lower the knot.



Figure 9.4 Lowering triangle ruler



Figure 9.5 Scene of measuring height

(2) Weight measurement method

- Items for use: Scale
- Set up the place for weighing
 - Find a **level floor**.
 - Position the scale.
- Procedure (**Figure 9.6**)
 - Call the names of the children one at a time.
 - Have them remove their shoes. Have them take off their jackets and weigh without carrying anything unnecessary, such as mobile phones or watches.
 - Have them **stand gently on the middle of the scale**.
 - Ensure that they do not move while on the scale, and read and note down the number on the scale.



Figure 9.6 Scene of measuring weight

- d. Tips
- The method for turning on and using the scale differs for each scale. Check these methods before starting. For analog scales, make sure that the needle is pointing to 0. For digital instruments, check the batteries.
 - Avoid weighing immediately after eating, as this can affect body weight considerably.

(3) Assessing height and weight

Reference values for comparing measurements are essential for checking the growth and development conditions of an individual, in order to determine if there is any illness or growth bias such as obesity or thinness, and to know the position within the group.¹ **Physique indices** are used for evaluating growth based on height and weight. In addition to **the body mass index (BMI)** discussed in Chapter 6, they include the **Rohrer index, Kaup index**, the degree of obesity, and various other indices. BMI is used for adults worldwide while the degree of obesity and Rohrer index are also widely used for childhood assessment (**Table 9.1**).

However, note that BMI and Rohrer index must be used carefully. First, the formula for calculating BMI is universal, but the criteria for judgment differ by country. For example, BMI ≥ 30 is obese according to the WHO international standard² while ≥ 25 is obese in the Asia-Pacific region.³ Generally, the Rohrer index can be used for children who are 125 cm or taller. However, considering that height changes are complicated during growth from elementary school age to puberty, the Rohrer index may come out higher for children who are short.

Furthermore, given individual differences in childhood growth and development, just measuring how many centimeters a child has grown and how many kilograms the child has gained are not sufficient for appropriate evaluation of growth. For example, a sudden increase in height tends to be welcomed in most children but it may be a sign of precocious puberty (after an early growth spurt where there is a temporary sudden increase in height, growth stops with the body remaining extremely small) or abnormal growth where the body stops growing completely after such sudden growth, both of which require treatment.⁴ For this reason, it is important to not only evaluate the height and weight by simply comparing the previous data, but also to **continuously observe changes**, so as to ensure the sound growth and development of the child without overlooking any abnormal changes.

In the case of physique indices, the reference value differs depending on the age and is useful only for evaluating growth at a single point in time. This means that the value is not an index of continuous growth. Consequently, the use of **growth curves** is recommended for continuously evaluating the growth and development of children.⁵ A growth curve is a graph drawn by collecting measurements of height and weight of many children of various ages by gender, and connecting the average values of each age with a curve. Growth curves of +2SD (SD: standard deviation), +1SD, -1SD, -2SD (or percentile) of the average values are also shown. By entering the measured data of the child in the standard growth curve, you can see how tall or short, how heavy or light the child is. Furthermore, by entering values over time, the growth pattern of the child can be obtained and the progress of growth can be confirmed.

Although there are no currently available growth curves for children in Cambodia, the Foundation for International Development / Relief (FIDR)⁶ has proposed the appropriate height and weight of children (**Table 9.2**). With the spread of health checkups across the country and the accumulation of data on the height and weight of children in the future, it will be possible to create growth curves for children in Cambodia.

Column: What is standard deviation?

The standard deviation is an indicator of how much the distribution of data varies from the overall mean. Assuming that there are data measuring the height of 100 children, it means that about 68% (68 children) of the height data are between +1SD and -1SD. About 96% of the data are included between +2SD and -2SD. This means that children outside the range of + 2SD to -2SD are either very short or very tall and may have health issues.

Table 9.1 Physique indices used for children

| Physique index | Calculation method | Suited to | Appropriate values |
|-----------------------|--|--|-----------------------------------|
| Kaup index | Weight (kg) / Height (m) ² | 3 mo to 5 y | 3 mo to <1 y : 16 to <18 |
| | | | 1 y to <1 y 6 mo : 15.5 to <17.5 |
| | | | 1 y 6 mo to <3 y : 15 to <17 |
| | | | 3 y to ≤ 5 y : 14.5 to <16.5 |
| Rohrer index | Weight (kg) / Height (m) ³ × 10 | Elementary school children - Junior high school students | 115–145 |
| Body mass index (BMI) | Weight (kg) / Height (m) ² | Senior high school students and above | 18–22 |

mo=month, y=year

Table 9.2 Appropriate height and weight of children in Cambodian

| Appropriate Value for Height (cm) | | | Appropriate Value for Weight (kg) | | |
|-----------------------------------|---------|---------|-----------------------------------|-------|-------|
| Age (y) | Boy | Girl | Age (y) | Boy | Girl |
| 6 | 113–117 | 109–113 | 6 | 19–21 | 16–19 |
| 7 | 116–120 | 116–120 | 7 | 20–23 | 19–22 |
| 8 | 121–124 | 119–123 | 8 | 21–24 | 20–23 |
| 9 | 124–128 | 123–127 | 9 | 22–25 | 22–25 |
| 10 | 128–132 | 127–131 | 10 | 25–28 | 25–28 |
| 11 | 132–136 | 134–138 | 11 | 27–30 | 28–31 |
| 12 | 136–140 | 142–146 | 12 | 29–32 | 32–35 |
| 13 | 142–146 | 147–151 | 13 | 32–35 | 35–38 |
| 14 | 151–155 | 150–155 | 14 | 38–41 | 39–42 |
| 15 | 157–161 | 152–156 | 15 | 43–46 | 44–47 |

Source: FIDR, 2017⁶

Column: Situation of thinness and obesity in children in Cambodia

In Cambodia, height and weight are used to evaluate the nutritional status of children. Specifically, **malnutrition (nutritional deficiency)** or the state of lacking balanced nutrition for healthy growth are classified into **stunting, wasting, being underweight, and being overweight (Figure 9.7)**. Stunting is assessed by “Height-for-age” and is an indicator of long-term chronic nutritional status.^{6,7} Wasting is assessed by “Weight-for-height” and is often used to evaluate short-term acute nutritional status. Being underweight is assessed by “Weight-for-age,” and being overweight is assessed by “Weight-for-height,” as is done for wasting⁸

According to the Cambodia Demographic and Health Survey 2014,⁸ the nutritional status of Cambodian children has been improving since 2000 with a downward trend in all stunted, wasted and underweight children. However, results of every category differ by state significantly, suggesting contributions of differences between urban and rural areas and between rich and poor. In this way, although the number of overweight children is surging in urban areas, the problem of stunting is significant in Cambodia as a whole. Physiological tests are required for a detailed assessment of nutritional status. However, given that height and weight can be easily measured without discomfort, they can be considered an effective means for evaluating the growth and development status of children.

Normal height for age

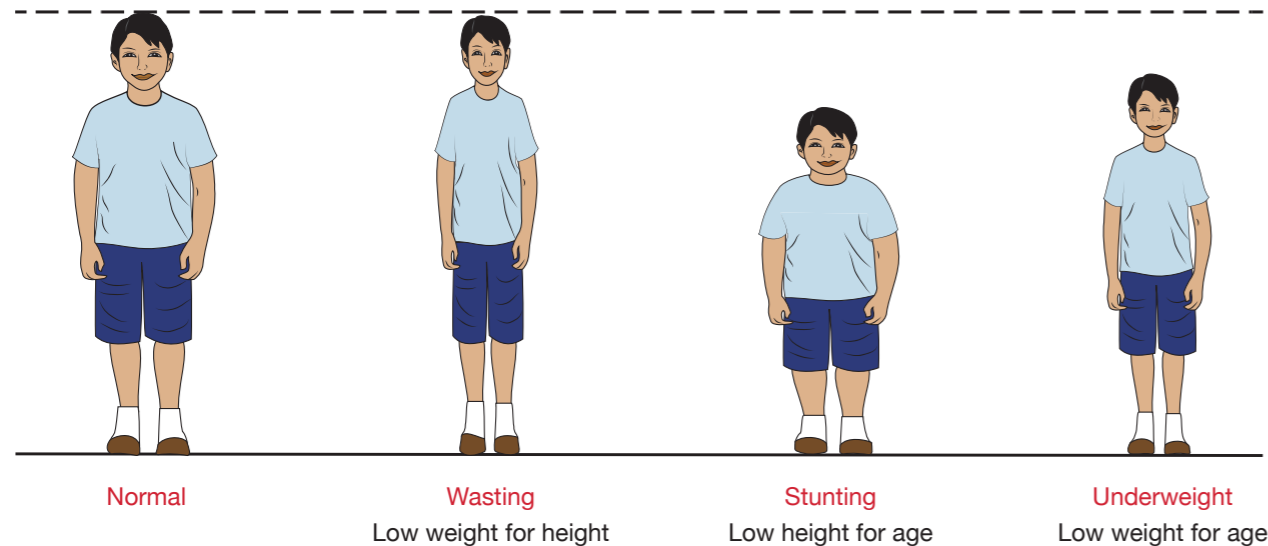


Figure 9.7 Different types of undernutrition

2) Eye test⁹

(1) Eye test method

- a. Items for use: **Eye chart** (see Exhibits for E chart), eye shield (**Figure 9.8**, if no eye shield, gently cover one eye with your own hand or paper)

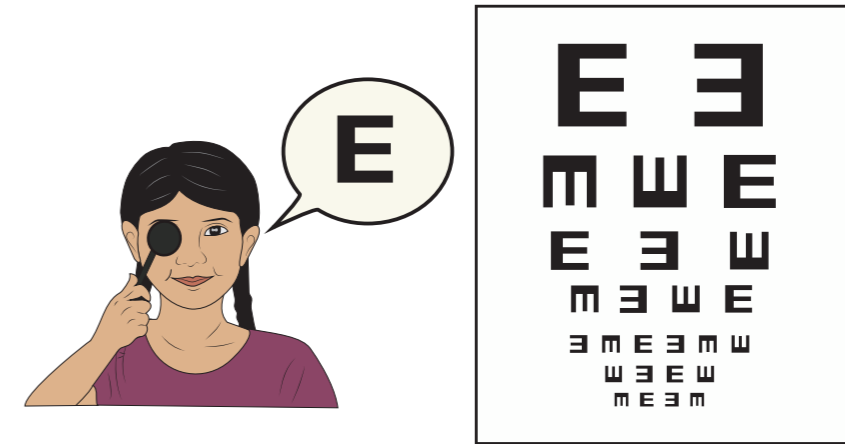


Figure 9.8 Eye shield

- b. Set up the place for performing the eye test
 - (1) Find a bright room that provides a distance of **at least 3 m** (turn on the light / open the window).
 - (2) Fix the eye chart on a wall or pillar with the big E at eye level. Mark the position 3 m from the eye chart to indicate clearly where to stand when taking the eye test.
 - (3) If the test is taken sitting down, prepare a chair that is 3 m from the eye chart.
- c. Procedure (**Figures 9.9, 9.10, and 9.11**)
 - (1) Before the test, explain to the children how to take the eye test in the classroom.
 - (2) Have several children line up at a time for the eye test to **wait quietly** for their turn.
 - (3) Call out their names one by one.
 - (4) Have those wearing eyeglasses to take the test with their eyeglasses on.
 - (5) Have the children stand or sit at a position 3 m from the eye chart (**Figure 9.9**).
 - (6) Have the children point their finger in the direction that E faces. Have them reply “can’t see” or “don’t know” if they cannot see (**Figure 9.11**).
 - (7) Testing the right eye. Tell the children to use an eye shield or something similar to gently hide the left eye. (**Figure 9.11**)
 - (8) **Ask the direction of each large E (6/60).** Record children who get all four directions (up, down, left and right) correct as Pass and all the other children as Fail. Those who fail in the large E test are not eligible for the test using the small Es.
 - (9) For children who passed the test using the large Es, **ask which directions the five small Es face in row (6/12).** Record children who could see 4 out of 5 as Pass, and 3 or less as Fail.
 - (10) Do the same for the left eye.



Figure 9.9 Scene 1 of the Eye test



Figure 9.10 Scene 2 of the Eye test



Figure 9.11 Scene of a student answering which way E is facing

d. Tips

- The eye chart is a tool for measuring human eyesight that can be measured using numbers, letters, and symbols. Here, a method using the E chart is introduced.
- If you do not have an eye shield, you can use your palm or paper.
- The description in this section is based on **the Guidelines for Vision Testing in School** (Department of School Health, Ministry of Education, Youth and Sport, Cambodia 2016).⁹

Column: Single eye chart

This chapter introduces how to test eyesight using an eye chart fixed on a wall or pillar. Sometimes, **a single eye chart** is used according to age and the level of eyesight (Figure 9.12). Since only one symbol is drawn on a single eye chart, children with low vision and/or who are young can answer them without confusion. A single eye chart is also convenient in that it can be hand held and does not require walls or pillars.

The teacher holds the eye chart and measures eyesight as he/she turns it around, but the basic procedure is the same.

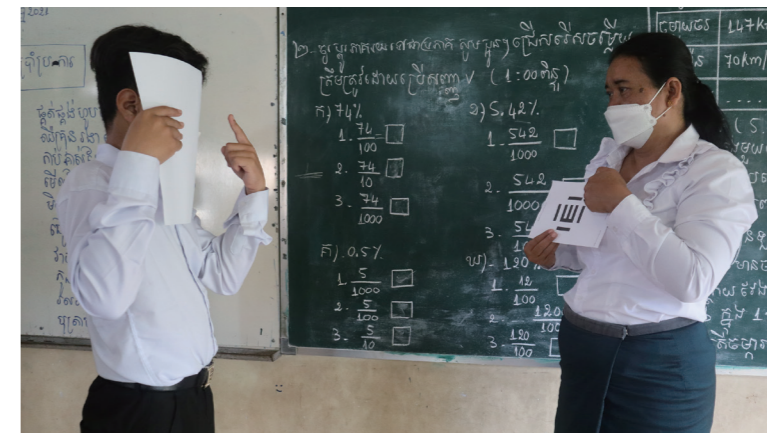


Figure 9.12 Example of the Single eye test chart

(2) Evaluation of eyesight

Refractive errors and diseases of the eyes cause weakening of eyesight. The difficulty in viewing faraway objects reduces concentration and limits activity. Some children may drop out of school because they cannot see the blackboard clearly and fail to keep up with their classes. In Cambodia, many children do not wear eyeglasses. Some children themselves or people around them do not even know that they have poor eyesight because they have never had their eyes tested before.

Eye tests are designed to check eyesight conditions. Examining children's eyesight by eye tests and taking the required action are important for promoting the growth and development of children. In the E chart method introduced in this chapter, it is desirable to be able to see both large Es (6/60) and small Es (6/12). If the children cannot see small Es, it means that their eyesight has deteriorated and a visit to basic eye care services available at 331 health centers (that is, 30% of the total health centers) in provinces, or ophthalmological services available in 21 referral-based hospitals (that is, 23% of the total referral-based hospitals) for an eye test and visual correction if necessary is recommended. If children cannot see a large E, they may have a very serious eyesight impairment and need to consult a medical specialist. However, at present, only 40% of the people in Cambodia have access to eye care services in 10 out of the 25 provinces. Therefore, expanding eye care services and training ophthalmologists are future issues to work on.¹⁰

Eye tests do not reveal the nature of refractive problems such as myopia or hyperopia or the presence of illness. Detailed ophthalmology tests are required. For children with poor eyesight, it is necessary to adjust their learning environment, for example, by setting their seats in the front row of the classroom. Please refer to Chapter 8 for details on eye structure, refractive errors, and diseases.

3) Hearing tests¹¹

(1) Hearing test method

- a. Item for use: Chair
- b. Set up the place for performing the hearing test
Find a quiet room because measurement cannot be performed correctly in a noisy place. Take measures such as closing windows and doors.
Position the chair.
- c. Procedure
 - (i) Call out the names of the children one by one in turn.
 - (ii) Have a child sit on the chair.
 - (iii) Perform a voice test. Ask the child for their name and grade and check if there is any problem with answering. If the answer is good, record it as “Pass.” If there is any problem, record as “Fail.”
 - (iv) Perform a hearing test (**Figure 9.13**). Tell the child to close their eyes and raise their hand on the side where they hear the sound of fingers rubbing together.
 - (v) Rub your fingers together about 5 cm away from the child’s ear. Repeat it on the left and right sides twice each. Record as “Pass” if they can hear and “Fail” if they cannot.



Figure 9.13 Scene of the hearing test

- d. Tips
 - Use the Voice test to check if children have any problems in daily conversation, and the hearing test to check if they can hear weak sounds.
 - Now smartphones have apps for simple hearing tests, which can be used to produce weak sounds in the hearing test.

(2) Evaluation of hearing

Deafness is the condition of not being able to hear sounds or words clearly or at all. It is a serious disorder that interferes with daily life, language development, and knowledge acquisition. Hearing tests are intended to check for the presence of deafness and its degree if any. It is extremely important to detect deafness and take early measures.

The structure of the ear is divided into the **outer ear**, **middle ear**, and **inner ear** (**Figure 9.14**). The

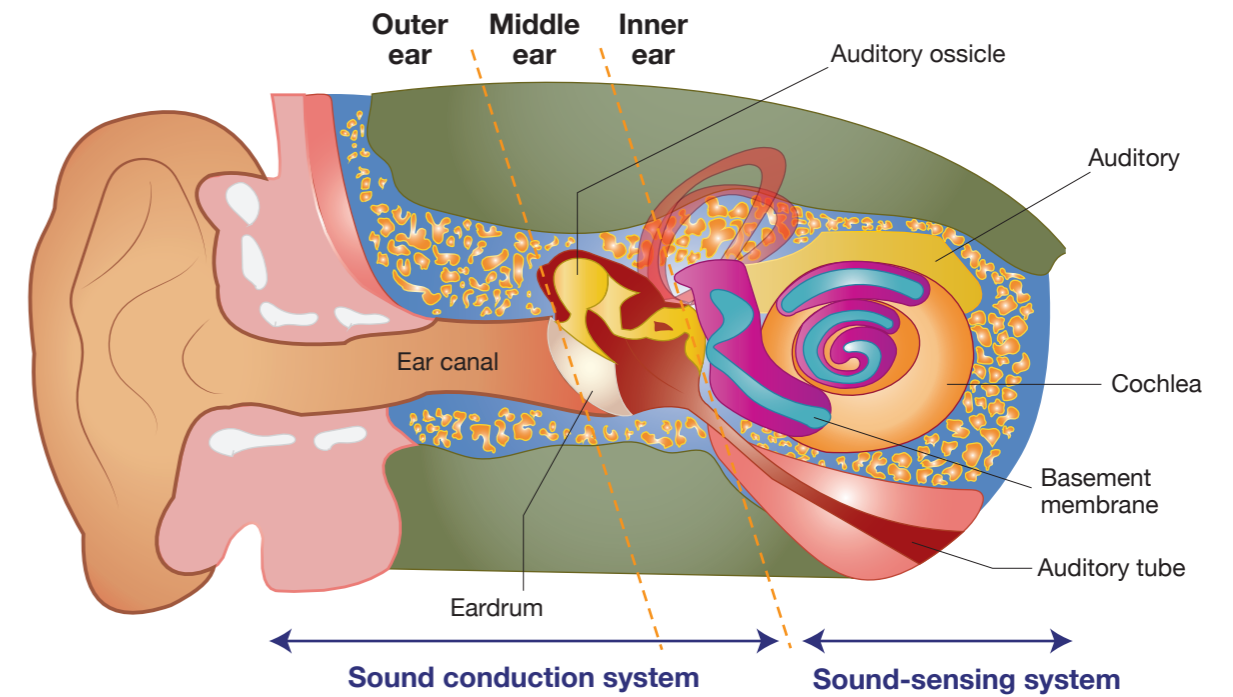


Figure 9.14 Structure of the ear

outer and middle ears play the roles of transmitting sound while the inner ear plays the role of sensing and transmitting sound to the brain. Deafness can be divided into two types: **conductive deafness** caused by poor sound transmission due to disorders of the outer and middle ears, and **sensory deafness** caused by problems with the inner ear that make it difficult to sense sounds. Conductive deafness is caused by otitis media, otitis externa, and cerumen impaction. Sensitive deafness often develops naturally (**congenital deafness**). It also includes **noise-induced deafness** caused by exposure to factory mechanical sounds or construction sounds at work and **acoustic deafness** caused by listening to loud sounds over headphone, etc., for long hours.

WHO warns that 1.1 billion young people around the world are at risk of **acoustic deafness** caused by listening to portable music players and smartphones.¹² Deafness caused by ear disease may progress slowly. In such cases, hearing is not lost overnight, and hence it is difficult for the person and others to notice the condition. Deafness in a child can be suspected not only from the results of hearing tests but also from other symptoms: the child always listens with one ear, turns up the TV volume, sits near the TV, and does not notice people who are out of sight talking. If hearing is poor, the child must see an otolaryngologist or an audiological clinic for a detailed examination.

4) Recording

Keep records carefully and correctly as omissions or mistakes will disable correct evaluation and appropriate screening. To accurately record the measurement results, set up a stand for writing in the recording sheets at each measurement location and deploy a recorder. Use standardized units, such as height in cm (e.g., 156.5 cm) and weight in kg (e.g., 45.5 kg). Regarding height and weight measurements, read to the first decimal place and record it. Be careful not to mistake the left and right sides for vision and hearing results.

The record table (see Supplemental material 2) must have fields for filling out the child’s name, gender, age, and date of measurement in addition to the field for entering the measurement results. To facilitate data organization, it may be a good idea to include fields for the child’s date of birth, grade/class, and school name. It would be ideal to prepare copies of the records for feedback to children and their families and for storage at the school. It is important to accumulate the results of health examinations not only for screening or cross-sectional evaluation but for **longitudinal evaluation**. For example, by using recording sheets that can keep records for 6 years of elementary school, you can understand the trajectory of the growth situation and characteristics of each student. The analysis of the accumulated data allows you to identify health issues in classes and schools. For details on using recording sheets, please refer to “4. Use of records” in this chapter.

Supplemental materials in the end part of this chapter show some examples of recording sheets. Edit them to a format that is easy to use or create your own recording sheets according to the situation of each school.

3. Practice

1) Flow of health checkups (Figure 9.15)

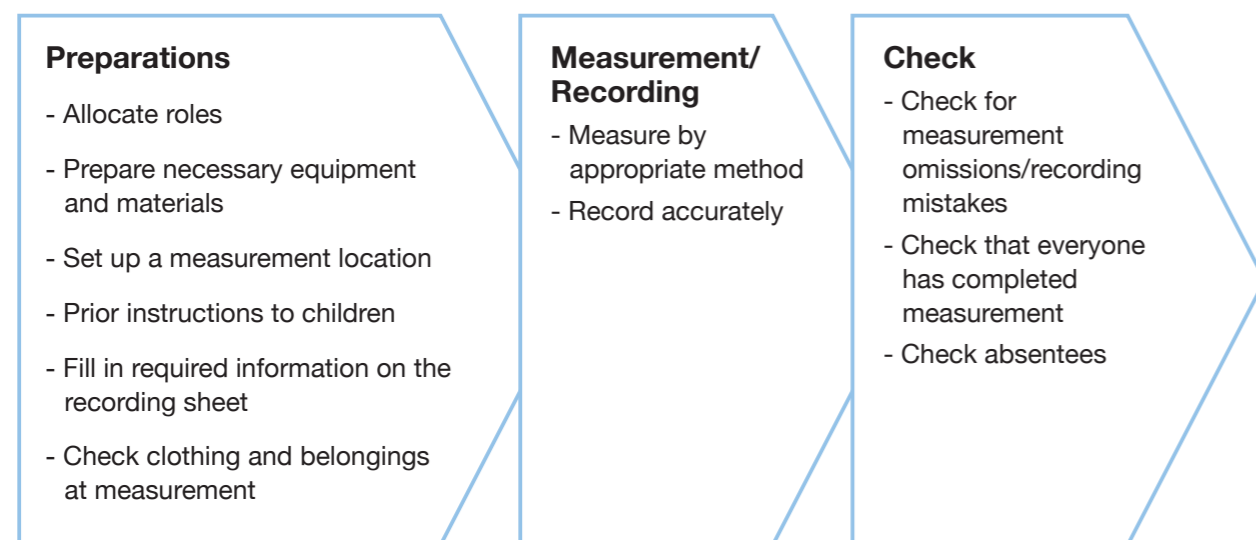


Figure 9.15 Flow of health checkups

2) Let’s practice for measurement

Step 1: Let’s measure each other

Decide the roles (person measuring, person recording, and measured children) and measure alternately so that everyone has the chance to play all roles. After the measurement, discuss which part was difficult and which should be improved.

Step 2: Let’s measure children

- (i) Decide the roles (person measuring, person recording, and person giving instructions).
- (ii) Give prior instructions to children. In order to conduct health checkup smoothly, it is recommended that a prior lecture be given to the children on the purpose and method of health checkup and how to answer the eye test. In particular, explain carefully to children who are taking the measurements/ tests for the first time and younger children.
- (iii) Precautions for measurement
 - Use signboards to indicate where the measurement is carried out. Also show notes on a poster.
 - During the eye test, make sure that the children waiting in the vicinity do not tell the answers to the child being tested.
 - During the hearing test, make sure that the children waiting in the vicinity are not noisy.
 - During the eye and hearing tests, if it is difficult to judge whether the child cannot see/hear or does not know how to answer, ask the child directly.
 - During the eye and hearing tests, **do not laugh or get angry** as it is not wrong to be unable to see/hear.

4. Use of records

Keeping records of each child over time enables tracking of growth longitudinally. The recording sheets should include the height, weight, and other numerical data not only at a single measurement but over time in a graph, and be bound into a healthcare notebook of the records for six years. By providing sections for the children, families, and school to make comments, and having the children bring the healthcare notebook home for families to write comments and then returning it to the school, the children will be able to visually understand their growth, and both the school and family members can keep track as well. Furthermore, by keeping records on eyesight and hearing, comparison of results can be made with those of the last year, consequently the school can provide families with advice on points to note in everyday life, and recommend medical consultation.

Records can not only be kept for saving individual growth but can also be used to statistically analyze the health status of children throughout the school. By comparing the height, weight, and obesity of one’s school with national and regional values by age and sex, the health issues of one’s school can be clarified and utilized for health education.

Figures 9.16 and 9.17 show the average and standard deviation for height and weight development among boys and girls through ages 6 to 12 years in Kandal Stung County, Kandal Province, calculated from data collected from nine schools that cooperated in the health checkup conducted by NGO Udon House in 2019. For example, the left side of **Figure 9.16** shows that between the +1SD and -1SD intervals, there is approximately 68% of the boys in the sample for each age. In the same way, between +2SD and -2SD, approximately 96% of the boys in the sample are counted.

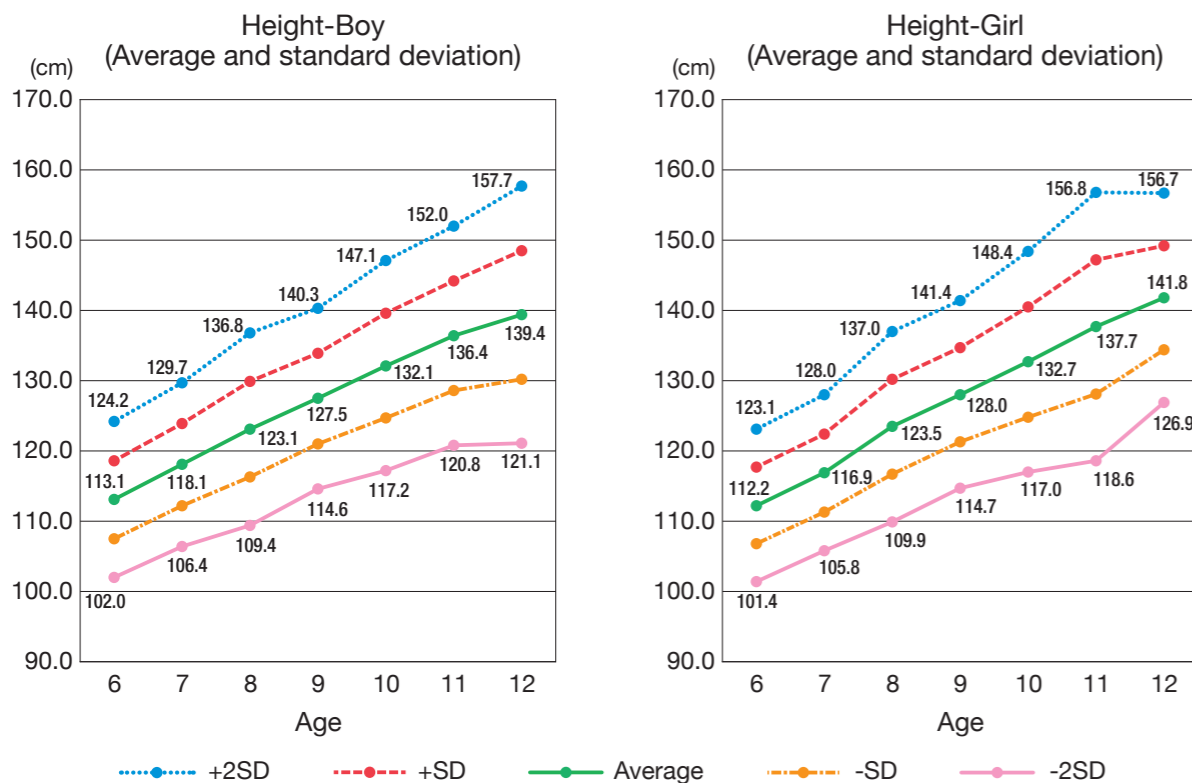


Figure 9.16 Average and standard deviation for height development among boys and girls through ages 6 to 12 years -9 elementary schools in Kandal Stueng County, Kandal Province-

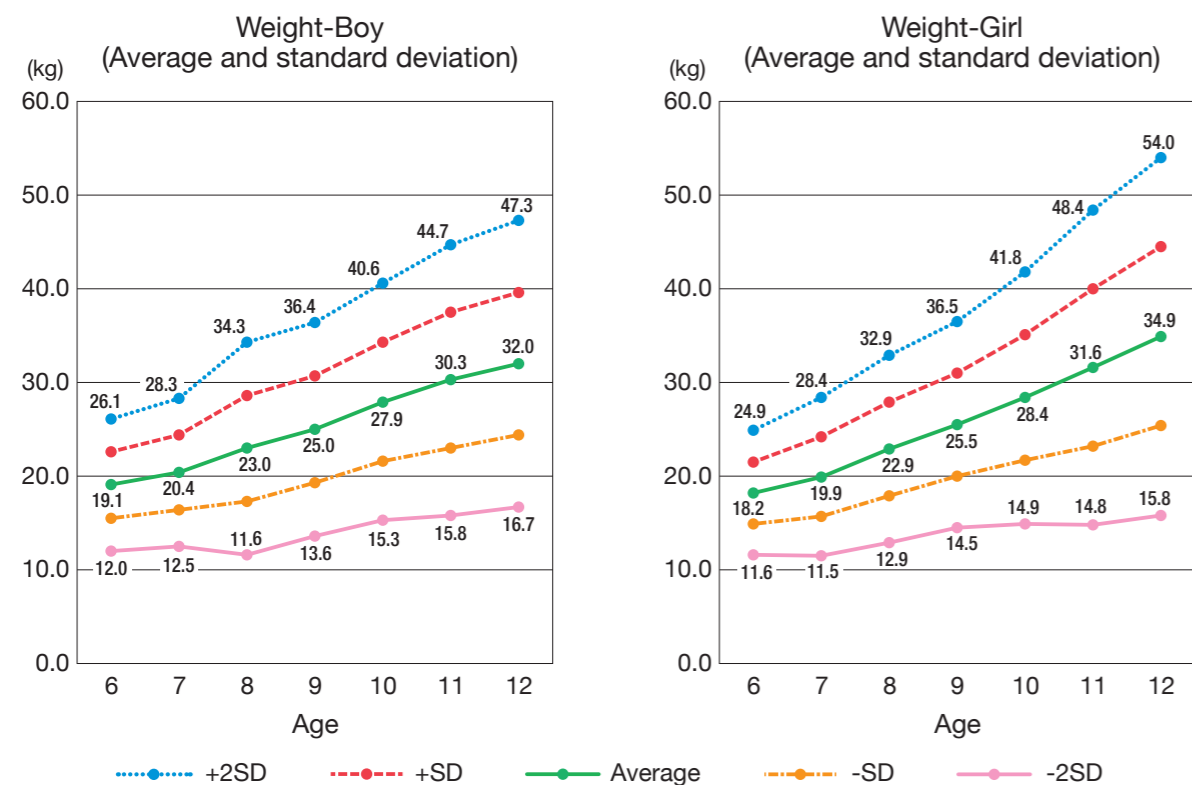


Figure 9.17 Average and standard deviation for weight development among boys and girls through ages 6 to 12 years -10 elementary schools in Kandal Stueng County, Kandal Province-

5. Implementation at schools

1) Importance of creating a school health organization

The understanding of managers and cooperation between teachers are indispensable for health checkups. It is hence important to build a framework within the school. Ideally, teachers should be able to share roles based on a common understanding, and the school should run the system for health checkups as a whole to ensure that checkups are conducted smoothly in a limited amount of time. It is also effective to hold an internal training program for the significance and methods of health checkups or position health checkups as a school event.

It is necessary to draw up an implementation plan according to the size and situation of the school. If the school has only a few teachers or many children, it is not necessary to take all the measurements of all the children at once. The implementation plan should be reasonable and continuously implementable at least once a year at the same time every year. Alternatively, by setting up a permanent health checkup area in the **Health Room**, which is expected to become widespread in Cambodia, health checkup will become more familiar to the children as a habit for them to check their own growth whenever they want. Health checkups serve an important health education opportunity for children to face and understand their bodies and should therefore be made good use of.

Column: Example of activities of Children's Health Club (Figure 9.18)

Since there is a shortage of teachers in Cambodia, it is difficult to conduct health checkups in some schools. One solution is to teach children to run the health checkup program together. By learning how to conduct health checkups and doing it themselves, it will not only reduce the burden on teachers, but also heighten the children's interest in health, encouraging voluntary learning. For example, having older children at the school organize a **Children's Health Club** and teach their classmates and younger children how to take measurements provides the opportunity to think about the health of others and also make new discoveries.

In neighboring Laos, there are elementary schools that actually operate children's health clubs. Children selected as members of the health club are taught by teachers about health checkups. Through repeated practice, they learn how to take measurements and perform tests correctly.

Members have fun measuring the height and weight of friends and younger children, and test their eyesight and hearing. If a younger student of an ethnic minority who does not understand the Lao language has difficulty taking the measurements and tests, an older student of the same ethnic group will explain the tests thoroughly in the ethnic language, helping the younger student understand the procedure and take the health checkup smoothly.

For the Children's Health Club to work, teachers must first understand the significance and methods of health checkups. Teaching children and getting them involved in activities takes a lot of time. But once these efforts take root, it will be a meaningful initiative that facilitates the management of health checkups and deepens children's learning.



Figure 9.18 Scene of a children's health club (Laos)

2) Example of implementation (Plan – Implementation – Evaluation)

When you conduct health checkup in your school, you can refer to an example of the procedure for health checkup in school described in Table 9.3.

Table 9.3 The flow of from planning to evaluation of health check-up in school

| Date/Implementation stage | Main details | Example | |
|---------------------------|---|--|---|
| Plan | | | |
| More than 1 week before | <ul style="list-style-type: none"> ▶ Prepare implementation plan | <ul style="list-style-type: none"> ● Consider the date and time and implementation method. Examples of methods include measuring by grade or type over several days, or measuring all children over one day. ● Check the roles of teachers on the day. ● Check the equipment and items required on the day. ● It is advisable to set aside a day to train teachers about health checkups, and/or a day to give prior instructions to children, apart from the day of the measurement/test according to the school situation. | <ul style="list-style-type: none"> ● Date and time: HH:MM to HH:MM on MMDD, HH:MM to HH:MM on MMDD. ● Implementation method: Perform all four measurements/ tests on all grades. ● Role: 6 persons carrying out measurements, 6 to record values, and two guides ● One place each for measuring weight, measuring height, and performing hearing test respectively. Two places for performing eye tests as it takes time. ● Give prior instructions to children on the day before. |
| | <ul style="list-style-type: none"> ▶ Decide place for performing measurements/ tests | <ul style="list-style-type: none"> ● Find a suitable place for measurements. Pick a place where the health checkup can proceed smoothly. | <ul style="list-style-type: none"> ● Appropriate places were selected assuming that the measurements will be carried out in the order of weight → height → eye test → hearing test. |

| Date/Implementation stage | Main details | Example | |
|---|---|--|---|
| Implementation | | | |
| Preparation | | | |
| <ul style="list-style-type: none"> ▶ Prepare required items | <ul style="list-style-type: none"> ● Prepare the necessary items for measurements and check if they can be used without problems. ● Print the recording sheets. | | |
| <ul style="list-style-type: none"> ▶ Provide prior instructions | <ul style="list-style-type: none"> ● Check the purpose and method of the health checkup, and points to note in measurements. By practicing how to take the eye tests in advance, the test on the day will proceed smoothly. ● Instruct children to fill in the required information on the recording sheet. In the lower grades, teachers can fill in them on their behalf beforehand. ● Check clothing and belongings when taking the health checkup. | | |
| <ul style="list-style-type: none"> ▶ Set up the place to carry out measurements/ tests | <ul style="list-style-type: none"> ● Use posters and signboards to indicate where the health checkup place is according to the situation of the school. | | |
| Measure/record | | | |
| Day before–day of measurement/ test | <ul style="list-style-type: none"> ▶ Perform measurements | <ul style="list-style-type: none"> ● Measure according to an appropriate method. ● Call children's attention if necessary. ● Prevent confusion among the children by having them line up, calling their names first before measurement, and placing guides. | <ul style="list-style-type: none"> ● Precautions on height measurement: Have children adopt a hairstyle suitable for measurement. ● Precautions on weight measurement: Have children take off their jacket and take out everything from their pocket. ● Precautions on eye test: Make sure that children waiting in the vicinity do not tell those who are taking the test the answers. ● Precautions on hearing test: Make sure that children waiting in the vicinity do not make noise. |
| | <ul style="list-style-type: none"> ▶ Take records | <ul style="list-style-type: none"> ● Write the results in the correct fields. ● Be careful not to make errors in writing. | <ul style="list-style-type: none"> ● Record weight in “kg” and height in “cm.” |
| Check | | | |
| | <ul style="list-style-type: none"> ▶ Check | <ul style="list-style-type: none"> ● Check for omissions or errors in measurements entered. ● Check that everyone has been measured/tested. ● Make arrangements for absentees to take the health checkup on a later day. | |

| Date/Implementation stage | Main details | Example | |
|---------------------------|--------------------|---|--|
| Evaluation | | | |
| Next day and afterwards | ▶Perform screening | <ul style="list-style-type: none"> ●Based on the results of health checkups, identify student with health problems. ●Continue to keep records and create graphs for future evaluations. | <ul style="list-style-type: none"> ●Height / Weight: Evaluate physique and growth. ●Eye test: Check for refractive problems and visual impairment, and the degree of interference with daily life. ●Hearing test: Check for hearing loss or impairment, and the degree of disability in daily life. |
| | ▶Follow-up | <ul style="list-style-type: none"> ●Support at school: Improve learning environment, provide follow-up, provide health education, and report to parents. ●If necessary, advise parents to consult a health center, or a clinic. | <ul style="list-style-type: none"> ●Support for students with weakening eyesight: Set their seats in the front row in the classroom. Check their posture during class. Check if they can see writing on the blackboard clearly during class. Provide health education on the use of smartphones. If school support is not enough, encourage parents to make eyeglasses for their children or visit basic eye care services at provincial health centers or ophthalmological services in referral-based hospitals. |

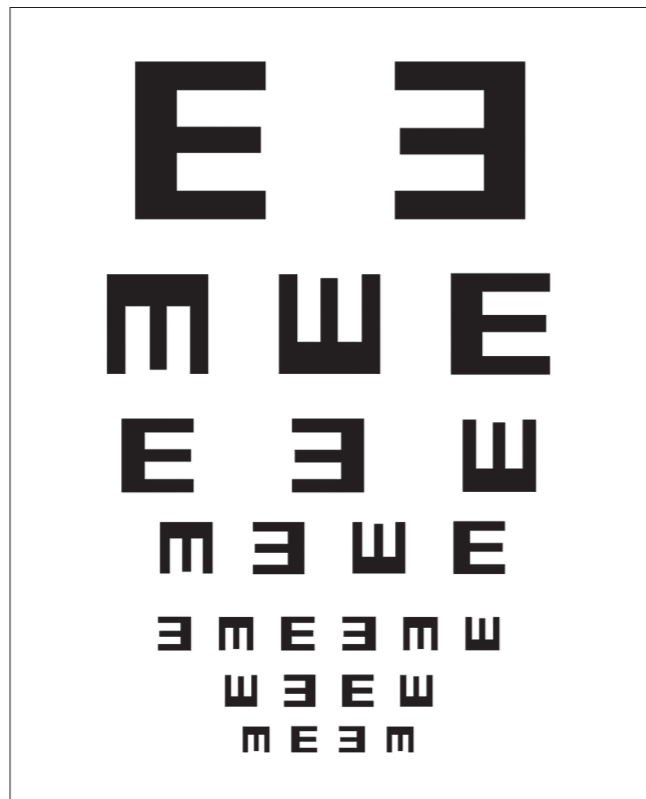
Exercises for further thought and research

- [9-1] Use your height and weight to calculate your BMI.
- [9-2] Share what you found difficult or noticed when measuring children. Also, calculate the average height and weight from the measurement results and compare them with the appropriate values indicated by FIDR (Table 9.2) and the average value of Kandal Stueng County (Figures 9.16 and 9.17). Calculate the Rohrer index with the children.
- [9-3] Make a preliminary guidance plan for children. How can you convey the purpose and significance of health checkups, measurement methods, and precautions to children in an easy-to-understand manner?

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Supplemental materials (Suppl.)



Suppl 9.1 E chart

Health Checkup Recording Sheet (For individual data) ✓...No problem

| | | | | | | | | | | | | | | | |
|-----------------|-----------|-------|-----------|-------|-----------|-------|-----------|---------------|-----------|---------|-----------|------------|-----|-----|--|
| Name | Sample | | | | Sex | Male | | Date of Birth | | | | 12/25/2009 | | | |
| Academic Year | 2015-2016 | | 2016-2017 | | 2017-2018 | | 2018-2019 | | 2019-2020 | | 2020-2021 | | | | |
| Grade and Class | Grade 1A | | Grade 2A | | Grade 3A | | Grade 4A | | Grade 5A | | Grade 6A | | | | |
| Month | Nov | Apr | Nov | Apr | Nov | Apr | Nov | Apr | Nov | Apr | Nov | Apr | Nov | Apr | |
| Age | 6 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | | | | |
| Height | 115.0 | 118.5 | 121.5 | 124.0 | 127.5 | 130.0 | 133.5 | 136.0 | 140.0 | 143.0 | 145.5 | | | | |
| Weight | 20.0 | 22.0 | 23.5 | 26.5 | 28.0 | 29.0 | 32.5 | 33.5 | 35.0 | 36.5 | 37.5 | | | | |
| Eyes | R | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Small E | Small E | ✓ | ✓ | ✓ | | | |
| | L | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| Ears | R | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| | L | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| Other | | | | | | | | | | Glasses | Glasses | Glasses | | | |

Health Checkup Recording Sheet (For class) ✓...No problem

Academic Year: _____
Grade and Class: _____

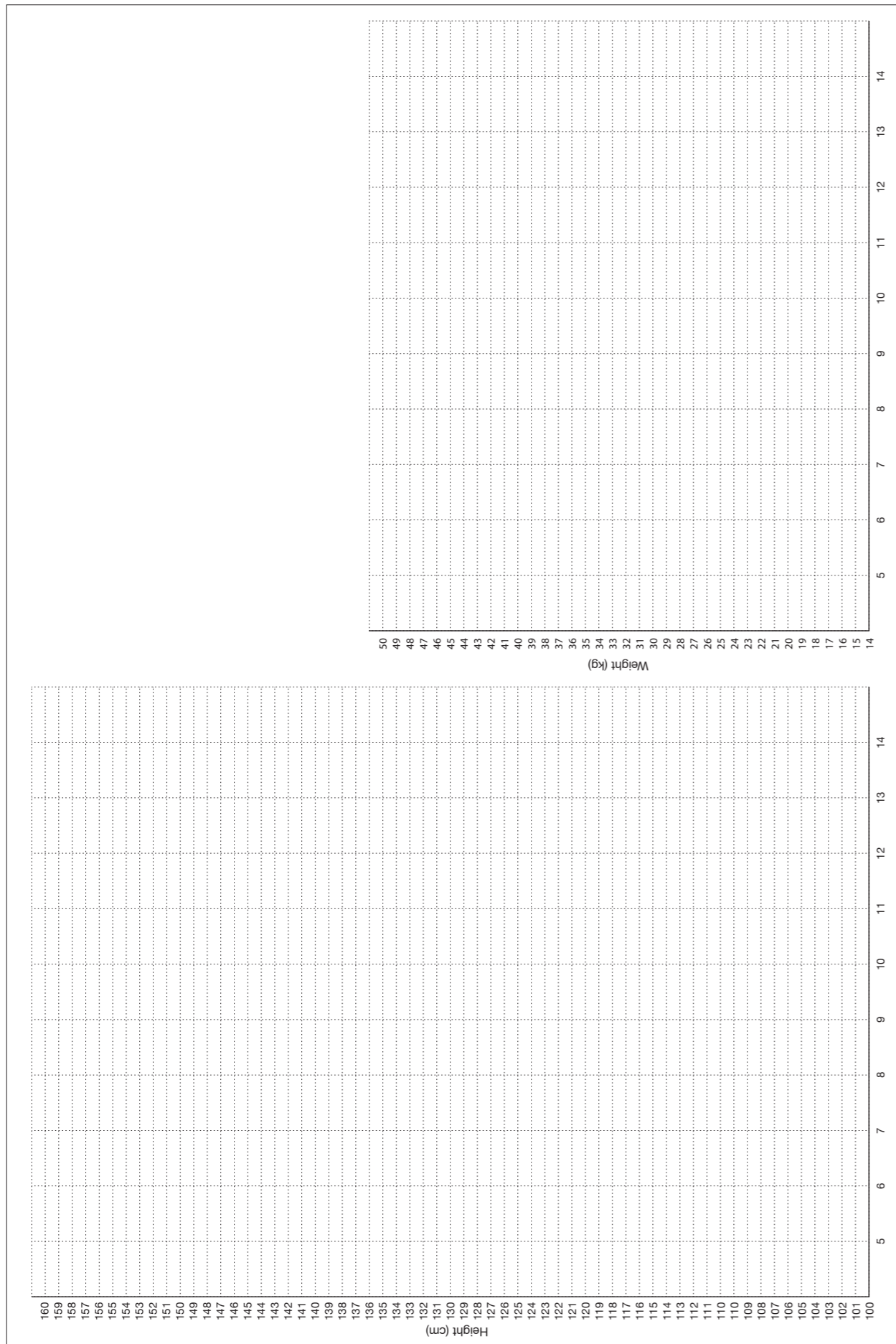
| No. | Name | Sex | Age | Date of Birth | Height (cm) | | Weight (kg) | | Eye(R) | | Eye(L) | | Ear(R) | | Ear(L) | | Other |
|-----|--------|-----|-----|---------------|-------------|-----|-------------|------|--------|-----|--------|---------|--------|-----|---------|-----|-------|
| | | | | | Nov | Apr | Nov | Apr | Nov | Apr | Nov | Apr | Nov | Apr | Nov | Apr | |
| Ex | Sample | F | 11 | 12/24/2009 | 140.5 | 145 | 35.0 | 37.5 | ✓ | ✓ | ✓ | Small E | ✓ | ✓ | QS test | ✓ | |
| 1 | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | |
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| 18 | | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | | |
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| 21 | | | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | | | | |

Suppl 9.2 Recoding sheet for class

Health Checkup Recording Sheet (For individual data) ✓...No problem

| | | | | | | | | | | | | | | | |
|-----------------|-----|-----|-----|-----|-----|-----|-----|---------------|-----|-----|-----|-----|-----|-----|--|
| Name | | | | | Sex | | | Date of Birth | | | | | | | |
| Academic Year | | | | | | | | | | | | | | | |
| Grade and Class | | | | | | | | | | | | | | | |
| Month | Nov | Apr | Nov | Apr | Nov | Apr | Nov | Apr | Nov | Apr | Nov | Apr | Nov | Apr | |
| Age | | | | | | | | | | | | | | | |
| Height | | | | | | | | | | | | | | | |
| Weight | | | | | | | | | | | | | | | |
| Eyes | R | | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | |
| Ears | R | | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | |
| Other | | | | | | | | | | | | | | | |

Suppl 9.3 Recording sheet for individual data



Suppl 9.4 Recoding sheet for graphing

Date of Today: _____

Name: _____ **Age:** _____ **Sex:** Male Female

Date of Birth: _____ **Grade and Class:** _____

Height: _____ **CM** **Weight:** _____ **KG**

Eyes: Large E <Right> Normal Impaired <Left> Normal Impaired
 Small E <Right> Normal Impaired <Left> Normal Impaired

Ears: Voice T <Right> Normal Impaired <Left> Normal Impaired
 Hearing T <Right> Normal Impaired <Left> Normal Impaired

----- Cutting off -----

Date of Today: _____

Name: _____ **Age:** _____ **Sex:** Male Female

Date of Birth: _____ **Grade and Class:** _____

Height: _____ **CM** **Weight:** _____ **KG**

Eyes: Large E <Right> Normal Impaired <Left> Normal Impaired
 Small E <Right> Normal Impaired <Left> Normal Impaired

Ears: Voice T <Right> Normal Impaired <Left> Normal Impaired
 Hearing T <Right> Normal Impaired <Left> Normal Impaired

----- Cutting off -----

Date of Today: _____

Name: _____ **Age:** _____ **Sex:** Male Female

Date of Birth: _____ **Grade and Class:** _____

Height: _____ **CM** **Weight:** _____ **KG**

Eyes: Large E <Right> Normal Impaired <Left> Normal Impaired
 Small E <Right> Normal Impaired <Left> Normal Impaired

Ears: Voice T <Right> Normal Impaired <Left> Normal Impaired
 Hearing T <Right> Normal Impaired <Left> Normal Impaired

----- Cutting off -----

Date of Today: _____

Name: _____ **Age:** _____ **Sex:** Male Female

Date of Birth: _____ **Grade and Class:** _____

Height: _____ **CM** **Weight:** _____ **KG**

Eyes: Large E <Right> Normal Impaired <Left> Normal Impaired
 Small E <Right> Normal Impaired <Left> Normal Impaired

Ears: Voice T <Right> Normal Impaired <Left> Normal Impaired
 Hearing T <Right> Normal Impaired <Left> Normal Impaired

Suppl 9.5 Recoding sheet: brief version

Health effects of tobacco use, alcohol consumption, and drug abuse

Learning objectives

You will be able to gain proper understanding and explain:

- The health effects of tobacco use.
- The health effects of alcohol consumption.
- The health effects of drug abuse.
- Why some people begin tobacco use and alcohol consumption while knowing that they are harmful to their health.
- Why it is difficult for people to stop tobacco use, alcohol consumption, and drug abuse.

In this chapter, you will learn the health effects of tobacco use, alcohol consumption, and drug abuse, and the factors underlying them. Specifically, you will learn about the spread of tobacco use, alcohol consumption, and drugs in Cambodia as well as what you can do to protect the health of young people from tobacco use, alcohol consumption, and drug abuse by understanding drug dependence, relationships between tobacco use and health, and relationships between alcohol consumption and health.

1. Tobacco use and health

1) Health effects of tobacco use¹

When lit by flame, tobacco generates various components (i.e., gas and particulate components). If these components are inhaled, they circulate around the body through the blood and do harm to many organs of the human body (Figure 10.1). The smoke inhaled by a smoker is called **the mainstream smoke**, and the smoke coming from the end of the tobacco is known as **the sidestream smoke**. The sidestream smoke contains more harmful chemicals than the mainstream smoke that is inhaled through a filter. This is why tobacco use has serious **health effects** not only on smokers but also on their children and partners who live with the smokers and are subject to **passive smoking**.

In pregnant women,² smoking and passive smoking can increase the possibilities of miscarriage and premature delivery. The chemicals of tobacco inhaled by a pregnant woman affect her fetus through the blood, increasing the risk of her delivering a **low-birth-weight baby (with a birth weight of less than 2500 g)** or delaying the development of the fetus. Attention should also be paid to smoking and passive smoking by breastfeeding women. The mother's milk, which contains harmful substances in two to three times higher concentrations than the mother's blood, can do harm to the infant (the lung and the brain in particular). Furthermore, smoking has been shown to decrease the amount of mother's milk secretion. Note that the benefits of breast-feeding are considered to outweigh the risks of mother's

smoking, and therefore, breastfeeding is recommended.

In young people, there are health risks, including the effects on physical activities and sports, contracting respiratory disease, progression to nicotine dependence, an increased risk for using alcohol and drugs such as cannabis and cocaine, and the fact that the younger they start tobacco use, the higher the risk for developing lung cancer becomes.³

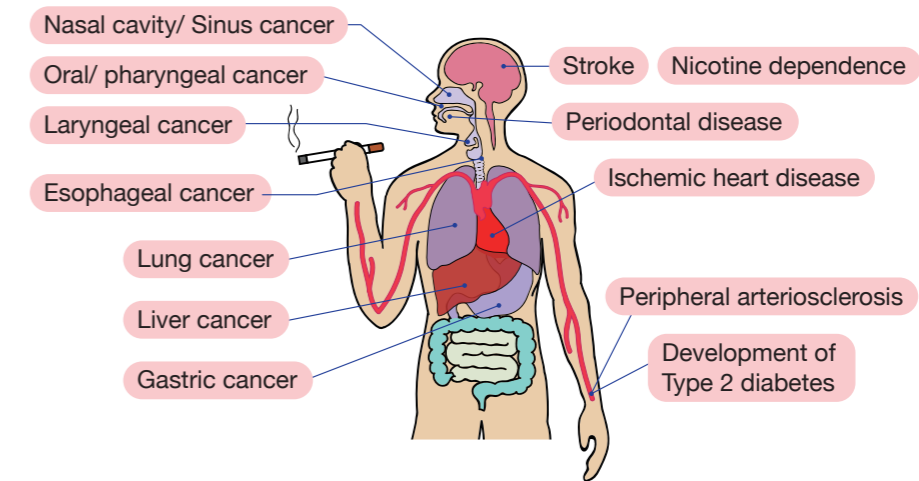


Figure 10.1 Health effects of tobacco use

2) Harmful chemicals contained in tobacco

Tobacco smoke contains approximately 5300 types of chemicals, of which approximately 50 to 70 types are shown to be carcinogenic. Among its gas components, **carbon monoxide** competes with oxygen to bind to hemoglobin in erythrocytes, decreasing the amount of oxygen carried by erythrocytes. If the state of oxygen deficiency chronically persists, red blood cell count may increase to maintain the delivery of oxygen, which increases blood viscosity and raises blood pressure. **Tar**, a particulate component, is a complex mixture that contains chemicals having carcinogenic effects, meaning they turn healthy cells into cancer cells, as well as cancer-promoting actions, which grow cancer cells. Nicotine, a type of alkaloid (a substance that neutralizes acid to form salt), is a deadly poison with strong neurotoxicity. After being taken into the body through tobacco smoke, nicotine rapidly spreads throughout the body. Because of **the dependency on nicotine**, it becomes difficult to give up the habit of smoking. In addition, it has a strong vasoconstrictor effect, which constricts capillaries and increases blood pressure. Although nicotine itself is not shown to be carcinogenic, nitrosoamines, which are produced when nicotine is broken down / metabolized in the body, are known to be carcinogenic.

Column: Emergence of heated tobacco products, a new type of tobacco⁴

Heated tobacco products (HTPs) are tobacco products that produce aerosols containing nicotine and other chemicals, and inhaled by users through the mouth. They contain the highly addictive chemical nicotine. They also contain additives and are often flavored. They also make people mimic

the behavior of smoking a conventional cigarette. The products include iQOS from Philip Morris International, PloomTECH from Japan Tobacco International, Glo from British American Tobacco, and PAX from PAXLabs. These products use a battery-powered heating system to heat tobacco up to 350°C in order to generate vapors containing nicotine.

Currently, there is no evidence to show that HTPs are less harmful than conventional tobacco products. However, some studies sponsored by the tobacco industry have claimed that they significantly reduce the formation of and exposure to harmful and potentially harmful components relative to standard cigarettes. Presently, there is no evidence suggesting that reduced exposure to these chemicals leads to reduced risk in humans. Therefore, in order to verify the claims of reduction of risks and harm, additional studies without conflicts of interest are needed. In addition, there is insufficient evidence regarding the effects of passive smoking caused by HTPs. Further studies are needed to assess the risk of being exposed to emissions released from HTPs.

All forms of tobacco use are harmful, including HTPs. Tobacco is inherently toxic and contains carcinogens even in its natural form. Therefore, HTPs should be subject to policy and regulatory measures applicable to all other tobacco products in line with the WHO Framework Convention on Tobacco Control (FCTC).⁵

The Phnom Penh Post reported in March 2021 that the National Authority for Combating Drugs (NACD) of Cambodia has directed all relevant ministries and agencies as well as organizations to take action to immediately stop the commercialization and use of HTPs.⁶

Column: What is a conflict of interest (COI)?

Take a study sponsored by the tobacco industry as an example. If a relationship based on interest is suspected between the company and a researcher who conducts the sponsored study, it will lead to a situation in which third parties may have doubts about the neutrality, objectivity, and scientific rigor of procedures that are required in the study of HTPs and health effects. That is, they may raise questions about the possibilities of data being falsified or fabricated to deliberately produce study results that support the interest of the tobacco industry. This situation is called a conflict of interest, and researchers are required to disclose relationships based on interest to ensure that public trust in the study will not be lost.

2. Alcohol consumption and health

1) Health effects of alcohol⁷

Alcohol is a central nervous depressant and has a relaxing effect if consumed in small amounts. However, before consuming alcohol, we need to understand that it has short- and long-term health effects. In the short term, it suppresses the brain function and has psychological effects, such as impaired judgment, and physical effects, including slower body movement. Moreover, consuming a large amount of alcohol in a short period of time can cause **acute alcohol intoxication**, resulting in life-threatening conditions,

such as vomiting, a depressed level of consciousness, and worsening of respiratory status. In the long term, meanwhile, it has effects on the liver, which bears the burden in breaking down alcohol, and on the whole body (Figure 10.2). Examples of the long-term effects include increased susceptibility to alcoholic hepatitis, cirrhosis, hypertension, cancer, diabetes, and cerebral atrophy.

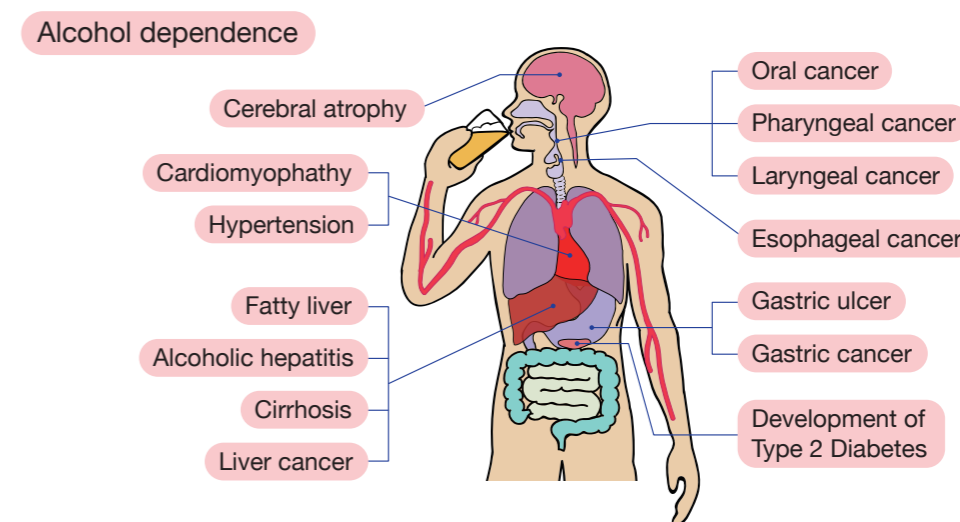


Figure 10.2 Effects of alcohol consumption on the body

2) Alcohol dependence⁸

Chronic consumption of large amounts of alcohol will develop **dependence on alcohol**, resulting in a persistent or chronic disorder of mental/physical function. Symptoms of dependence consist of **psychic dependence** and **physical dependence**. In psychic dependence, symptoms that may appear include a strong desire to consume alcohol, inability to control drinking behavior through one's own will (e.g., time and quantities), and a tendency to consume alcohol to cope with feelings of frustration, tension, and depression from daily stress. If psychic dependence progresses further, it leads to harmful behaviors, including spending most of a day consuming alcohol and sobering up by disregarding pleasures other than alcohol consumption, and not abstaining alcohol even though mental/physical problems have worsened. Thus, psychic dependence is a condition in which the habitude has changed in such a way that the person is driven by a strong desire to re-experience a pleasant sensation that can be obtained when alcohol activates the reward system of the central nerve, and this condition is the nature of dependence.

In physical dependence, **withdrawal symptoms** appear, including trembling hands and fingers and sweating, when alcohol is cleared from the body. These symptoms can lead to alcohol consumption at the workplace, a decline in work performance and absence from work, and human-relation problems at the workplace, causing difficulties in work. In addition, people who consume alcohol in the daytime can destroy their family lives for reasons including being unable to engage in housework or childcare, using violence toward family members, and borrowing money for alcohol consumption. In the case of students, they will not be able to continue their studies for reasons such as absence, poor academic performance, and dropping out.

In this way, if psychic and physical dependence are developed, social lives in one's workplace, family, school, and community can be destroyed.

3) Social impacts caused by alcohol⁹

A drunken condition (drunkenness) is a condition in which emotional control and judgment are impaired. It can cause social issues and problems such as traffic accidents resulting from drunk driving, accidents including falls, and high-risk behaviors such as unprotected sexual behavior and self-injurious behavior, as well as violent incidents, domestic violence/abuse, and involvement in crimes.

3. Harm of tobacco use and alcohol consumption by minors

Tobacco use and alcohol consumption by minors are said to cause greater health damage and are more likely to cause dependence. This is because the organs of the growing body are undergoing maturation, thus making them more susceptible to harmful chemicals and alcohol. Particularly, the period between 10 and 24 years of age, defined by the World Health Organization (WHO) as young people, corresponds to puberty/adolescence, which is not merely a period for becoming sexually mature and physically developing into an adult, but is also a transitional period toward psychosocially developing into an adult by achieving the developmental tasks of the relevant age group through brain development and maturation.¹⁰ Although the accomplishment of physical, cognitive, and psychosocial developmental tasks are affected by other factors mentioned in Chapters 3 and 11, alcohol has influences on the development of the brain of young people and is considered to have impacts on the accomplishment of developmental tasks as well.

This is why many countries define the minimum ages for tobacco use and alcohol consumption. In Japan, the legal minimum age is 20 years old for both. In Cambodia, the minimum age for tobacco use is 18 years old. Although the minimum age for alcohol consumption is not established as of 2020, there is a movement to it at 21 years old.

4. Drug abuse and health

1) What is drug abuse?

Drug abuse refers to the use of illicit drugs and the use of pharmaceuticals for purposes other than their intended use. Drugs that may be abused include stimulants, cocaine, the synthetic narcotic MDMA (methylenedioxy-methylamphetamine, known as Ecstasy), and heroin (Table 10.1). Among drugs, there are central nervous system stimulants (uppers) and central nervous system depressants (downers). Despite their different actions, they eventually increase dopamine activity in the brain, excite nerve cells

Table 10.1 Types of drugs and examples of symptoms

| Type | Symptom |
|---|---|
| Stimulant (central nervous excitation) | Exhibits a neuroexcitatory action for several hours. Then, severe weakness, fatigue, and malaise occur. Hallucinations and delusions appear. Results in death if consumed in large amounts. Likely to develop toxic psychosis . May cause flashbacks even after stopping use. |
| Cocaine (central nervous excitation) | Alkaloid contained in coca. Gives the experience of extreme euphoria and a feeling of being full of energy. Hallucinations and delusions appear. A large amount of consumption causes generalized seizure and difficulty of breathing, resulting in death. |
| MDMA (Ecstasy) (central nervous excitation) | A type of synthetic narcotic. Changes perception. Increases a feeling of well-being and a sense of closeness to others. On the other hand, increases sleeplessness and uneasiness. Gives a strong psychic dependence. A large amount of consumption results in hyperthermia and death. |
| Heroin (central nervous depression) | A drug made from poppy. Causes severe withdrawal symptoms, including severe pain, chill, vomiting, and fainting. A large amount of consumption results in difficulty of breathing, and coma followed by death. |



in **the reward system circuit**, and produce pleasure. Both of them affect the brain and may result in death if consumed in large amounts at one time.

Note that besides tobacco, alcohol, and the drugs listed in Table 10.1, there are other drugs and chemicals that may be abused, such as volatile organic solvents (e.g., lacquer thinners and toluene for painting, and adhesive bond) and pharmaceuticals (e.g., analgesics, purgatives, antitussives, sleeping pills/antianxiety drugs, and cold medicine), which are easily available and thus require attention.

Column: Is cannabis legal or illegal?

The possession and use of cannabis have been illegal for many years. It is also true, however, that it has historically/traditionally been used as medicine and food materials.

In recent years, there have been growing movements to legalize cannabis in some countries and regions. Cannabis is used for recreational, medical, and industrial purposes. It is used for personal, recreational enjoyment, to provide analgesia/sedation as a medicine, and to process clothes, cosmetics, and foods in industry. Cannabis for industrial use does not have euphoric effects and is said to pose little risk of being abused as a drug.

Currently, cannabis for recreational use is legalized nationwide in Uruguay, Canada, and Mexico. In the United States of America, it is prohibited by the federal government but legalized by some state governments. The aims of legalization are to conduct proper management by setting the legal age for cannabis use and the maximum amount that can be possessed, and to cut off funding sources for criminal organizations by restricting the cannabis trade on the black market.

There are arguments for and against the legalization of cannabis, and it has been discussed at the WHO and the United Nations as well. Cannabis is said to be a **gateway drug** (drugs that serve

as a gateway to the use of other substances with stronger dependence and adverse reactions, such as stimulants, heroin, and cocaine). This is because those who become unsatisfied with cannabis will begin to use other drugs for a stronger stimulus. The legalization of cannabis use may promote the abuse of other drugs.

It has been pointed out that cannabis use would affect the health of young people, including cognitive distortion, impairment of concentration, mental disease, excessive vomiting, and dependence. In puberty and adolescence in particular, it may affect the development of prefrontal cortices as well as the neural circuit and neural structure of the hippocampus, having negative effects on brain functions to control attentiveness, thinking, and behavior as well as on memory; it is considered that the earlier they begin to use cannabis, the greater the effect becomes. Therefore, regardless of whether it is legal or illegal, cannabis should not be used during the ages in which the brain develops, as in the case of alcohol consumption and tobacco use.¹¹

For adults, in whom the period of brain maturation has finished, societies will consider how they should deal with cannabis use from various perspectives, including risks, traditional / medical values, and impacts of legalization on communities.

2) What is drug dependence?

Drug dependence refers to a condition in which people cannot give up using a drug on their own as a result of the continued use of the drug since stopping makes them feel unpleasant (Figure 10.3). Because obtaining the drug becomes the highest priority in their daily life, they may have difficulty leading a normal life, or may try to obtain the drug without a thought for how they look. Using a drug as a one-time experiment may result in drug dependence, or some cue may prompt a person who stopped the use of a drug to begin it again.

Drug addicts have a strong desire to use a drug when its effect wears off. As a result, money to buy the drug becomes necessary, and they even commit crimes, such as shoplifting, robbery, and prostitution, to obtain the drug. They cannot control their desire by themselves even if they think that they do not want to use the drug or they want to give it up after using a certain amount. Stopping drug use may lead to sleeplessness/hypersomnia, depression, anxiety, fretfulness, hallucination/delusion, muscle/joint pain, convulsive seizure, hyperphagia, weakness, vomiting, diarrhea, abnormal sweating, and withdrawal symptoms. The habitual use of a drug builds up **tolerance** to the drug, increasing the amount necessary to gain pleasure.

No specific medicine or therapeutic method is available for curing drug dependence. The only possible way is to continue to live without using a drug. Receiving appropriate advice from experts and continuing to live without using drugs will make it possible to return to social life. This is called **recovery**. In order to effectively achieve this recovery, people suffering from dependence on alcohol or illicit drugs, such as stimulants, should accept that they cannot voluntarily control their behavior and try to keep themselves away from drugs through ties with people who have also suffered from drug abuse by joining a mutual self-help group.

In this connection, Al-Anon, a **mutual self-help group** that started in the United States in 1951 and

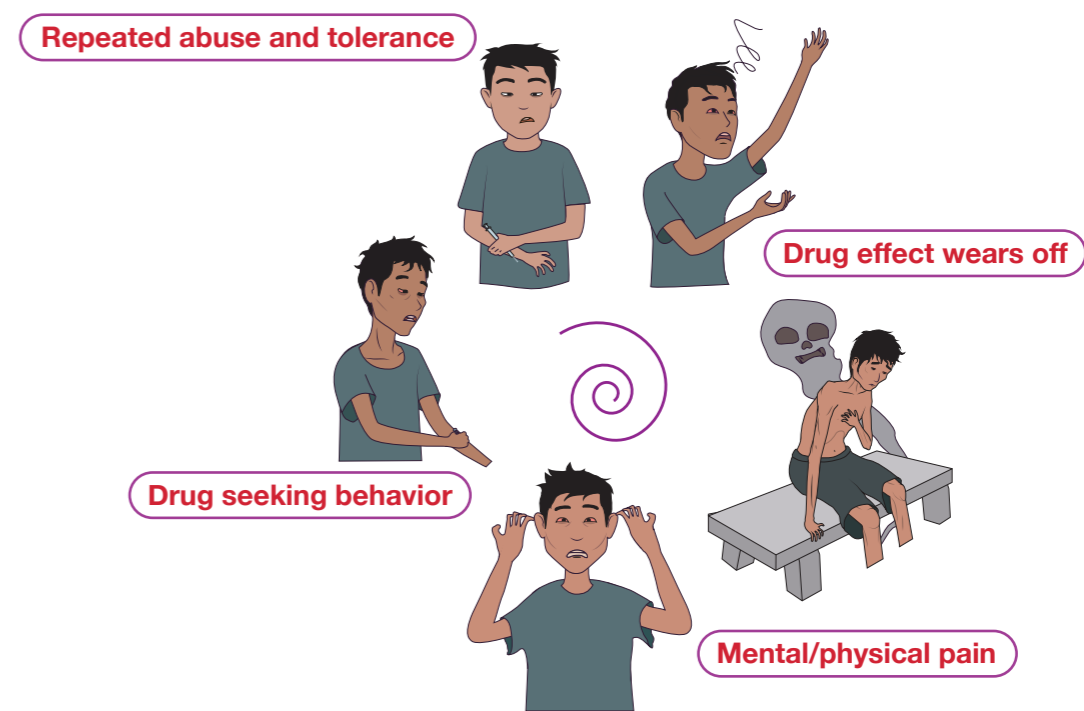


Figure 10.3 Cycle of drug dependence

has since spread to more than 130 countries around the world, proposes The Twelve Steps as a guide to recovering from alcohol dependence. The first step is a “powerless declaration” saying: *We have admitted we are powerless over alcohol—that our lives have become unmanageable.* Al-Anon has a base in Phnom Penh, while Alcoholics Anonymous (AA), a likeminded mutual self-help group, holds meetings in Phnom Penh, Siem Reap, and Battambang. Mutual self-help groups aiming for recovery from drug dependence are also expected to play an active role in Cambodia.

Column: What is drug tolerance?

Tolerance to a drug develops when the body gets used to the drug by taking it repeatedly, and thus the amount of the drug necessary to get the same effect increases. One of the physiological mechanisms that develops tolerance is a faster excretion of the drug from the body, as a result of increased metabolic efficiency of the drug or the creation of a new metabolic pathway (metabolism level). In addition, decreased sensitivity to the drug in the bodily tissues can also be raised (bodily tissue level).

3) Spread of drugs in the Western Pacific region¹²

The Golden Triangle, an area covering Myanmar, Thailand, and Laos, is known as a production/distribution area for opium (Figure 10.4). Myanmar in particular has become famous for its abundant poppy fields. In recent years, the types of **narcotic drugs** produced in this Golden Triangle have changed from opium and heroin, which are made from poppy, to stimulants (synthetic narcotics). Stimulants are

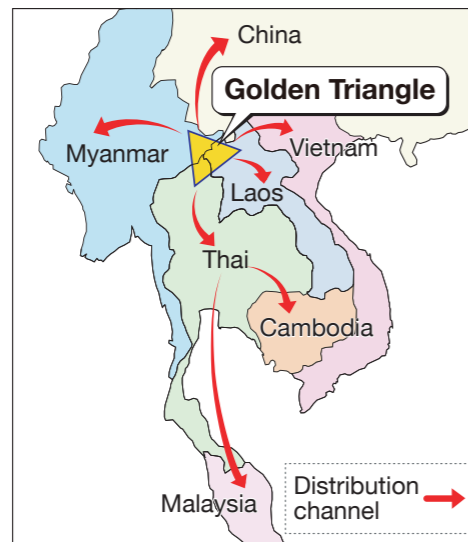


Figure 10.4 Golden Triangle

not only consumed in Myanmar, Thailand, and Laos, but also smuggled into the surrounding countries: Cambodia, Vietnam, Bangladesh, India, and China. Moreover, they spread to the entire Asia-Pacific region, including Japan, Korea, Taiwan, Indonesia, Malaysia, Singapore, the Philippines, Australia, and New Zealand. Besides the Golden Triangle, there are many areas where narcotic drugs are produced around the world. Drugs including narcotics, which are smuggled across borders, are threatening the health of people around the world.

Column: What are narcotic drugs?

Narcotic drugs originally referred to various substances that numb sensation to reduce pain. Today, opium, opium derivatives, and opioid medications synthesized from opium extracts are called narcotic drugs. However, because narcotic drugs can refer to other drugs, they are collectively called opioids for clarification. Opioids are a class of drugs that include heroin, morphine, and codeine¹³

5. Spread of tobacco use, alcohol consumption, and drugs in Cambodia

1) Tobacco use in Cambodia

The WHO's Report on the global tobacco epidemic 2019-Cambodia Country Report-¹⁴ states that the latest surveys of tobacco use in Cambodia are the National Adult Tobacco Survey of Cambodia (2014)¹⁵ and the Global Youth Tobacco Survey (2016).¹⁶ Described below is the present situation of tobacco use in Cambodia based on these reports.

According to the National Adult Tobacco Survey of Cambodia (2014), as of 2014, 22% (approx. 1.68 million) of Cambodian people aged 15 years and older use some form of tobacco product, with the

prevalence of **smoked tobacco** standing at 16.6% for the entire group, 32.9% for men, and 2.4% for women. Meanwhile, the use rate of **smokeless tobacco (chewing tobacco)** among people aged 15 years and older is 0.8% for men and as high as 8.6% for women.¹⁵ The material that is mainly used as smokeless tobacco is betel quid, which generally refers to a mixture of betel nut / Areca catechu and slaked lime wrapped in a betel leaf (**Figure 10.5**). It has been shown that one out of ten rural women uses this type of smokeless tobacco, with the use rate increasing with age.¹⁵ Although smokeless tobacco has been culturally/traditionally regarded as medicinal in some cases, it is considered to have an adverse effect (the risk of oral cancer) on the human body, like smoking.



Figure 10.5 Betel quid

Concerning the use of tobacco products by the younger age group, 6.4% of children aged 13 to 15 years old have used tobacco products (smoked and/or smokeless), with 2.4% presently using tobacco products.¹⁶ There are many advertisements in urban districts that encourage people to smoke, and the media report scenes in which tobacco is used. In addition, cheap tobacco prices may be another reason that the younger age group can easily begin using tobacco.

On the other hand, there are many adults who think tobacco use can cause heart disease and lung cancer, and support restricting tobacco use in public places and increasing the tobacco tax.¹⁵ Like adults, children also understand the impacts of tobacco on their health and the importance of restricting tobacco use in public places (**Table 10.2**).¹⁶

Table 10.2 Students' knowledge and attitudes toward smoking

| Knowledge and Attitudes | % |
|---|--------|
| Students who definitely thought other people's tobacco smoking is harmful to them | 78.50% |
| Students who favored prohibiting smoking inside enclosed public places | 60.70% |
| Students who favored prohibiting smoking at outdoor public places | 60.80% |

Source: WHO. Global Youth Tobacco Survey Cambodia 2016¹⁶

2) Alcohol consumption in Cambodia

As for Cambodian peoples' alcohol consumption, the annual per capita consumption of alcohol among drinkers aged 15 years and older is 21.7 liters (Table 10.3).¹⁷ This represents the consumption converted to pure alcohol; the annual consumption is equivalent to 434 liters in the case of beer with an alcohol content of 5%.

Table 10.3 Total alcohol per capita consumption, drinkers only (in liters of pure alcohol)

| Cambodia | Japan | Thailand | Myanmar | Vietnam | Lao PDR |
|----------|-------|----------|---------|---------|---------|
| 21.7 | 14.1 | 20.3 | 17.6 | 22.8 | 25.9 |

Source: WHO. Global Status Report on Alcohol and Health 2018¹⁷

According to the results of the 2013 Global School-based Student Health Survey (GSHS),¹⁸ among boys and girls aged 13 to 17 years old, the percentage of those who consumed at least one drink of alcohol in the last 30 days was 12.5% (N=1250) for boys and 4.4% (N=1526) for girls. The percentage of those who have ever consumed alcohol was 28.7% for boys and 12.7% for girls. The percentage of those who have had problems resulting from alcohol consumption, including problems with family members or friends, absence from school, and brawls, was 2.6% for boys and 1.6% for girls.

Currently, Cambodia has a minimum level of legal restrictions on alcohol without the established minimum age for alcohol consumption or restrictions on advertisements for alcohol. Although there are blood alcohol concentration limits for driving, it is unclear whether a crackdown on drunk driving is properly carried out on the basis of the limits. There are also cases in which unofficial manufacturers' tax payment is evaded because of lax restrictions (Table 10.4).¹⁹ To solve these challenges, there is a movement to revise the law. Restricting accessibility to alcohol leads to not only the prevention of health damage and dependence but also the prevention of incidents and accidents, including drunk driving, brawls, domestic violence, and sexual deviancy.

Table 10.4 Issues in legal restrictions on alcohol

1. Inadequate age restrictions
2. Inadequate restrictions on the hours for sales of alcohols
3. Emasculated blood alcohol concentration limits for driving
4. Inadequate restrictions on advertisements
5. Lack of laws regulating sponsors and sales promotion
6. Non-mandatory inclusion of warning messages in packages and advertisements

Source: The Asia Foundation (2016)¹⁹

Column: Most At Risk Young People (MARYP) Survey at Hot Spots²⁰

A survey of socially vulnerable young people aged 10 to 24 years who engage in high-risk behavior was conducted in 2010. The aim of the survey was not to understand the situation of general young people but to identify the behavior and consciousness of MARYP, who manifest high risk behavior related to alcohol, drugs, and sex and flock to "hot spots" (e.g., bars, karaoke places, massage salons, and game centers), in eight states where high-risk behaviors for HIV infection have spread.

Among those aged 10 to 19 years who were surveyed, 81.4% of men and 57.6% of women responded that they have experienced alcohol consumption. Of these people, 2.3% of men (1.9% of the total) and 18% of women (10.4% of the total) are aware that their alcohol consumption is high. The awareness of high alcohol consumption differs between the sexes, and the difference is even greater in the age group of 20 to 24 years old. This is probably because young women who work at karaoke bars and night clubs have many opportunities to consume alcohol with their customers.

The survey shows that reasons for alcohol consumption by MARYP include curiosity to experience something new; coping with stress and depression; coping with events that occurred at school (i.e., failure in the exam, pressure of deadlines, altercations with friends, and love relationships); alcohol consumption by family members; frequent encounters with alcohol consumption/drug use/tobacco use in the neighborhood or community; avoiding ostracism from friends; and psychosocial reasons such as peer pressure. It also indicates that they think, from their point of view, that education does not guarantee success in life, and stylish appearance is very important, with alcohol consumption seen as a stylish behavior.

3) Drug abuse in Cambodia

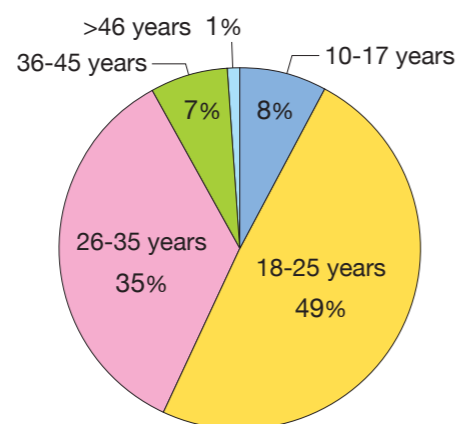
As described in "Spread of drugs in the Western Pacific region" in this Chapter, Cambodia is not included in the Golden Triangle, but drugs come into the country for trafficking from neighboring Thailand, Laos, and Vietnam. In Cambodia, stimulants (methamphetamine tablets and crystalline methamphetamine), Ecstasy, heroin, and ketamine are abused. Since 2017, because of the launch of the **anti-drugs campaign** by the government, a crackdown on drugs has been intensified and the amount seized has increased year by year (Table 10.5).²¹ However, drug dependence remains a challenge, and it is said that more than 20,000 people are in rehabilitation facilities under the control of the Ministry of Health. Drug abuse is spreading particularly among young people, and 49% of the people admitted to drug treatment centers are reported to be young people aged 18 to 25 years old (Figure 10.6).^{21,22}

Drugs pose a threat to children as well. A survey of children between 13 and 18 years of age²³ has shown that 15.9% of the children have seen the trading of drugs in the area where they live. The percentage of children who have seen someone abusing a drug was 18.9%, of which 70.2% said they saw it in the area where they live. The percentage of children who have been offered drugs by a friend or a neighbor was 4.9%. It has been reported that children who have seen the trading of drugs in the area where they live and those who have been offered drugs by their friends or neighbors tend to feel anxious when staying at home alone or dislike going to school or public places. For healthy growth and

Table 10.5 Seizures of selected drugs in Cambodia 2014-2019 -UNODC 2020

| Drug type | Unit | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|-----------------------------|---------|--------|---------|---------|---------|---------|---------|
| Methamphetamine tablets | tablets | 87,000 | 265,760 | 490,689 | 371,556 | 77,000 | 483,402 |
| Crtstalline methamphetamine | kg | 29 | 72.9 | 66.3 | 80.1 | 306.6 | 384.9 |
| Ecstasy | tablets | 10,533 | 70 | 5,509 | 83,533 | 599,200 | 382,728 |
| Cannabis herb | kg | 19.9 | 1,511.5 | 37 | 116.3 | 74.0 | 102.8 |
| Cocaine | kg | 7.9 | 5.3 | 14 | 12.8 | 5.4 | 61.1 |
| Heroin | kg | 1.8 | 2.5 | 6.2 | 22.5 | 1.3 | 47.9 |
| Ketamine | kg | 0.0 | 0.1 | 1.1 | 6.3 | 36.3 | 33.1 |

Source: United Nations Office on Drugs and Crime (UNODC) : Synthetic Drugs in East and South-East Asia: Latest developments and challenges. 2020



Source: UNODC: Synthetic Drugs in East and South-East Asia: Latest developments and challenges. 2020

Figure 10.6 Drug treatment center admission in Cambodia by age group -UNODC 2020

development of children, it is important to have a drug abuse prevention program aimed at **creating a safe community**, in which social norms are developed to enhance a sense of unity in the community and to **refuse drug use**. To achieve this, it is necessary to improve the community’s socioeconomic and cultural environments, such as addressing the community’s poverty, unemployment or lack of employment, social unrest, and high density of shops that sell alcohol and tobacco.

4) Psychological/social factors related to tobacco use, alcohol consumption, and drug abuse

Column: As touched on in the section on the Most At Risk Young People (MARYP) Survey at Hot Spots, triggers for high-risk young people to begin tobacco use, alcohol consumption, and drug abuse are casual curiosity such as “I just wanted to try something new,” or “I just gave it a try,” or the influence of family members/friends or advertisements such as “they looked cool,” “they looked tasty,” and “I saw advertisements.” Some young people began when they become depressed because of a problem with a friend, lover, or family member. In addition to these, offers or pressure from friends is another factor.

Many young people were worried that they might be excluded from a group if they refused such offers, and accepted the offers to maintain friendships. In all of these cases, they intended to try just once but came to use habitually.^{20,24}

It is thought that there is a relationship between alcohol consumption and tobacco use: men who smoke are more likely to consume alcohol than men who do not smoke. Although the relationship is not as clear as in men, women who use smokeless tobacco are said to be more likely to consume alcohol.²⁵

In order to change interrelated risk behaviors, that is, alcohol consumption, tobacco use, drug abuse, and unprotected sexual acts, it is necessary to reduce social stress as well as steadily carry out health education and social policy to change values.

Column: Global strategies regarding tobacco and alcohol (Figure 10.7)

As a global tobacco strategy, the **Framework Convention on Tobacco Control**⁵ was adopted at the 56th World Health Assembly in 2003 and entered into force on February 27, 2005. The objective of the Convention is to protect present and future generations from the harmful health effects of tobacco use, etc. To achieve this objective, the Convention includes “Protection from exposure to tobacco smoke,” “Ensuring that tobacco product packaging and labelling do not promote tobacco products by any means that are false, misleading, deceptive or likely to create an erroneous impression, and health warnings shall be no less than 30% of the principal display areas,” “A comprehensive ban or restrictions on all tobacco advertising, promotion and sponsorship,” “Taking measures to eliminate illicit trade in tobacco products, including requiring unit packets and packages of tobacco products to carry effective marking indicating the final destination,” “Implementing effective measures to prohibit the sales of tobacco products to minors,” “Establishing the Conference of the Parties that keeps under regular review the implementation of the Convention and takes decisions necessary to promote its effective implementation,” and “Each Party shall submit to the Conference of the Parties periodic reports on its implementation of this Convention.”⁵



Figure 10.7 Social measures (warning messages on tobacco packages)

Meanwhile, “the global strategy to reduce the harmful use of alcohol”²⁶ was unanimously adopted at the 63rd WHO general assembly in 2010. The objective of this global strategy is to reduce morbidity and mortality related to alcohol as well as the resulting social impacts, and to improve the health of individuals, families, and society, in order to significantly curb the use of alcohol, which is the third largest factor adversely affecting health and societies in the world. To achieve this objective, the strategy calls for a broad range of measures, including restrictions on advertisements, bans or restrictions on bargains and all-you-can-drink offers, and alcohol price increases through taxation and minimum price systems.²⁶

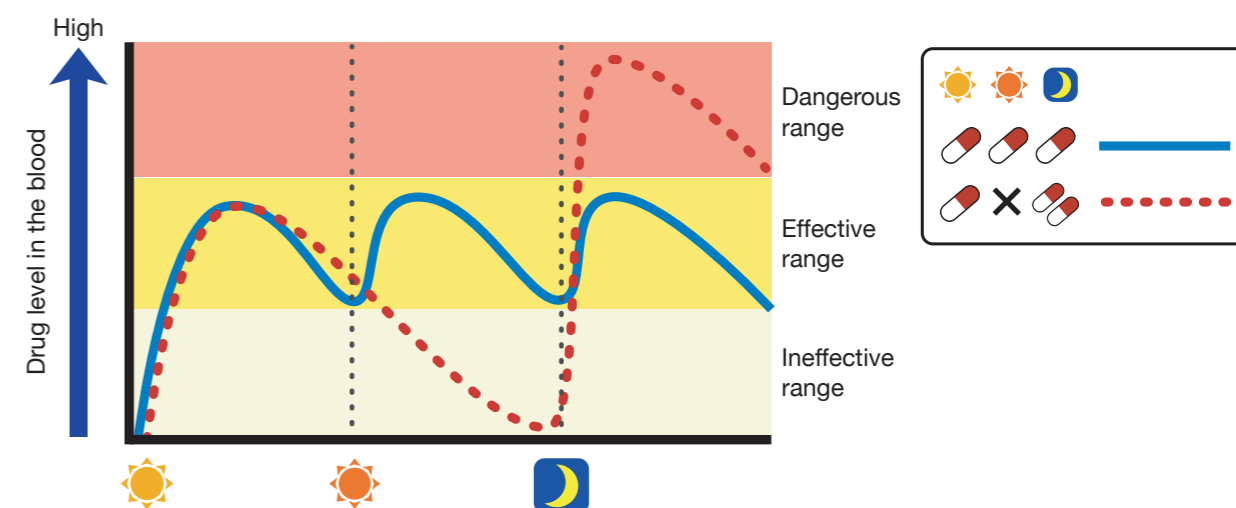
Column: How to use pharmaceuticals

Although pharmaceuticals are originally designed to alleviate or cure human diseases and disorders, they need to be properly used because even beneficial pharmaceuticals can have adverse effects on health if used in the wrong way. Pharmaceuticals have, by nature, “**main effects**,” which are to achieve the intended purposes of easing and curing the symptoms of disease, and “**side effects**,” which are adverse influences on the body resulting from the use of the pharmaceutical. Side effects can occur with any pharmaceutical as well as in people with certain predispositions or conditions.

Pharmaceuticals are drugs designed to be used for the diagnosis, treatment, or prevention of human and animal diseases. They have the components and forms (e.g., liquid, semisolid, and solid) that are suited for the effect and efficacy (e.g., easing pain). In addition, usage (dosage and administration, and timing) is established so that pharmaceuticals can properly exhibit effect and efficacy.²⁷ However, even pharmaceuticals can cause side effects if used in the wrong way. For example, if you miss a dose of a drug that needs to be taken three times a day and take a double dose of the drug at one time, drug levels in the blood can rise to a dangerous degree, possibly causing anaphylactic shock. Or, if you adjust the dose of a drug and take a subtherapeutic dose, drug levels in the blood will be too low to be efficacious (Figure 10.8). Therefore, in using drugs, it is important to carefully consult a physician, pharmacist, or pharmacy personnel about the usage of the drug, and to follow the dosage and administration stated on the package.²⁷

Low-quality pharmaceuticals and counterfeit medicines, which include those with false labeling of contents and ingredients, those not meeting quality standards or specifications, and those that have not been assessed or approved by regulatory authorities, are rapidly increasing mainly in Asia, South America, and Europe. The WHO’s survey²⁸ reports that low-quality pharmaceuticals and counterfeit medicines account for approximately 10.5% of available pharmaceuticals in low- and middle-income countries. It also reports that these pharmaceuticals particularly affect pneumonia and malaria in children. There is a concern that the spread of the internet may increase the online sales of low-quality pharmaceuticals and counterfeit medicines.

In Cambodia, the estimated percentage of these pharmaceuticals widely varies from 4% to 90%. Particular attention should be paid to drugs that community stores sell in loose form as they contain many low-quality pharmaceuticals, counterfeit medicines, or unapproved drugs.²⁹ Pharmaceuticals should be obtained at reliable places, such as hospitals and pharmacies.



Source: Risk/Benefit Assessment of Drugs - Analysis and Response. Kusuri Guidebook. Copyright ©RAD-AR Council, Japan. All rights Reserved. Translated with permission.

Figure 10.8 Drug levels in the blood and drug efficacy²⁷

Exercises for further thought and research

- [10-1] As restrictions on advertisements for alcohol consumption, there are “bans on advertising appealing to minors” in Canada, and “bans on advertising on television and movies” in France. Consider what kind of social measures can be taken in Cambodia to create an environment for preventing tobacco use and alcohol consumption among children.
- [10-2] Smokers say that they feel refreshed after smoking tobacco and that they cannot help smoking tobacco when they feel stressed. Present your counterarguments against these opinions.
- [10-3] Consider what you need to create a society in which drugs have no place.
- [10-4] Understand the relationships between risk behaviors related to tobacco, alcohol, and sex, and consider why young people display those behaviors.
- [10-5] Consider what should be done to encourage children to refuse drug offers.
- [10-6] Consider how a teacher should act if a child reports that he/she witnessed a person abusing alcohol or a drug, or trading drugs in the area where he/she lives.
- [10-7] Research cannabis restrictions in Cambodia. Study how cannabis has been historically and culturally used in Cambodia.

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Mental and physical changes during adolescence

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Learning objectives

You will be able to gain proper understanding and explain:

- The mental and physical changes and the issues associated with growth and development during adolescence and how to handle them.
- Pregnancy and childbearing and sexually transmitted infections in youth.
- The social challenges regarding sexual health in Cambodia and discuss their solutions.

In this chapter, you will learn about the following three topics: characteristics of mental and physical growth and development in adolescence in the context of sexual health; basic information about pregnancy/childbearing and sexually transmitted infections, and the current landscape and challenges in Cambodia concerning these issues; and the current state of sexual health and its handling in Cambodia.

1. Characteristics of mental and physical growth and development in adolescence (Table 11.1)

1) Physical changes

(1) Significance of adolescence as a period of transition from childhood to adulthood¹

Adolescence is a period when a child undergoes dramatic changes biologically, physically, and socially. During this period, one experiences the **appearance of secondary sexual characteristics** due to hormonal changes in the body, while mentally, one goes through rapid cognitive and emotional development. The human brain continues to develop until around the age of 25; during adolescence, one becomes able to control their impulses and make more rational judgments as they grow older.

The first half of adolescence is a period during which, as one grows, one becomes increasingly more susceptible to the influence of people of the same age group, while becoming less dependent on their parents. What you should keep in mind when addressing adolescence is the fact that the duration of adolescence is growing “longer.” Specifically, most men and women today are experiencing the appearance of secondary sexual characteristics earlier in life, while entering into a period in life when they assume social roles expected of adults, such as those connected to marriage, later, compared to what they used to assume.

(2) Secondary sexual characteristics²

During the second half of adolescence (ages 15–19), one experiences **sexual development and maturation** following the growth spurts in the first half of adolescence. Physical growth and **sexual**

Table 11.1 Physical, cognitive, social, and psychological development in adolescence¹

| Changes during early adolescence (ages 10–14) | |
|---|---|
| <p>■ Physical changes</p> <ul style="list-style-type: none"> • Start of puberty (typically ages 8–14 in females) • Muscle acquisition and growth spurts • Menstruation and breast growth (females) • Voice change and facial hair growth (males) | <p>■ Cognitive, social, and psychological changes</p> <ul style="list-style-type: none"> • Appearance of self-consciousness and low self-esteem • Feelings of awkwardness or discomfort related to physical changes • Susceptible to peer pressure (influence by friends and peers) • Improved ability to engage in abstract thinking and introspection • Tendency to focus on the present rather than the future |
| Changes during late adolescence (ages 15–19) | |
| <p>■ Physical changes</p> <ul style="list-style-type: none"> • Continued physical growth, especially for males | <p>■ Cognitive, social, and psychological changes</p> <ul style="list-style-type: none"> • Increased independence and feelings of invincibility • Tendency to seek out novel and varied experiences • Increased interest in opposite-sex friendships and romantic relationships • Continued improvements in abstract thinking and introspection • Improved decision-making, critical thinking, planning skills, and moral development |

Source: Skolnik R. Global Health 101 Third Edition. Jones & Bartlett Learning, 2016 (Kihara M and Kihara M, Trans., and Ed. Gurobaru herusu: Sekai no kenko to taishosenryaku no saishin doko [Global Health: Latest Trends in World's Health and Health Strategies]. Medical Science International, 2017).

maturation are considered to be based on different mechanisms from one another. However, when you consider the onset of menstruation, which is a typical occurrence that represents sexual maturation in girls, one does not experience the onset of menstruation until after she has reached a certain level of physical growth (see Column: Factors contributing to the onset of menstruation and health consequences of age for menarche).

The most representative changes during adolescent sexual development are the **onset of menstruation** for girls and **spermarche** for boys. These occurrences of sexual maturation are caused by the actions of **sex hormones**; there are also other changes such as the growth of pubic hair, voice changes, and enlargement of breasts. These are collectively referred to as **secondary sexual characteristics**. As the appearance of secondary sexual characteristics is one of the most characteristic features of adolescence, it is generally common to refer to ages between 15 and 19 years as “adolescence.” In the second half of adolescence, the development of secondary sexual characteristics is nearly complete, as adolescents come close to sexual maturity, and the physical build of their bodies is nearly that of an adult.

Such occurrences of the **adolescent growth spurt** (the dramatic increase in height during adolescence) and secondary sexual characteristics are not random incidents, but sequentially ordered by the genetic program.

Column: Factors contributing to the onset of menstruation and health consequences of age for menarche

The age of onset of menstruation is influenced by heredity and environment, which are intricately related to one another. As early as the 19th century, the physical maturation of girls was considered to be influenced by climate (especially the mean annual temperature), ethnicity, social status, place of residence (urban or rural), physical activity, level of education, sexual stimulation, housing, inheritance, and health status.³ The 20th century saw further additions to the list of factors that affect the onset of menstruation, including season and month of birth, physique (e.g., BMI), dietary habits, position in sibship, family income, education and occupation of parents, and family size. A recent review pointed out that, while the onset of menstruation was now known to be controlled by a complex neuronal network as well as genes, it was also influenced by factors other than genetics, including socioeconomic and environmental factors, BMI, exercise, dietary habits, and geographical factors, and that more studies were needed.⁴

In the context of health implications, early menarche is associated with increased risks of cardiovascular diseases and breast cancer mortality, and higher susceptibility to health issues of a psychosocial nature, such as anxiety, depression, premature intercourse, and violence. Late menarche, meanwhile, has been associated with an increased risk of osteoporosis and bone fracture.⁴ Further research is needed in order to find out what consequences early menarche may have on women’s health later in their lives.

(3) Functions of the male reproductive system

This section gives an overview of the functions and anatomy of the reproductive system and sexual response in males.⁵

a) Anatomy and function

Sperm is a cell that consists of a head of 4–5 μm in diameter and a long, thin tail, with an overall length of approximately 60 μm. Sperm produced in the testes do not move at all at first; as they leave the testes and move through the epididymis, sperm start swimming and gain fertilizing capability. Sperm swim at a rate of around 1–4mm per minute. Sperm production begins as a male reaches puberty, and it continues mostly throughout the rest of his life. The two testes of an adult male produce over 120 million sperm every day, but the number significantly declines as one reaches old age. Around 100–400 million sperm are released in a single ejaculation. Once expelled, sperm can live only for 24–48 hours at human body temperature. Yet, they may be preserved for years if frozen at –100°C. Low sperm count, abnormal sperm morphology, or low sperm motility can be a **cause of male infertility**.

See Chapter 2 for the anatomy of the male reproductive system (i.e., a cross-section).

b) Sexual response

The male penis becomes erect in response to sexual stimulation. Penile erection is a phenomenon in which the firmness and size of the penis increase, and it occurs as the corpora cavernosa fill with blood.

Upon receiving sexual stimulation, the pelvic parasympathetic nerves send stimulation to the penis, causing arterioles to dilate. This allows blood to flow into the corpora cavernosa, but as the venous outflow is restricted, the corpora cavernosa fills with blood and becomes firm, which results in **penile erection**. If a man is exposed to further sexual stimulation and becomes highly aroused, the **ejaculation** of seminal fluid out of the urethra occurs. The seminal fluid consists mainly of fluids secreted from the seminal vesicles, prostate glands, and bulbourethral glands, and contains sperm produced in the testes. The volume of seminal fluid ejaculate is 2.5–3.5 mL, and the sperm count is 100 million per 1 mL of seminal fluid.

When either ejaculation occurs or sexual stimulation is interrupted, the sympathetic nervous system becomes dominant. This removes the restriction of venous outflow, allowing the blood retained in the corpora cavernosa to flow out, which ends erection.

(4) Functions of the female reproductive system

The female reproductive system functions in two different periods: the **preconception period with a reproductive cycle of 28 days on average**; and the **period of pregnancy**. A preconception period involves two reproductive cycles: the **ovarian cycle**, which refers to a series of periodic changes that occur in the **ovaries**; and the **menstrual (uterine) cycle**, which occurs due to periodic changes in the volumes of the hormones secreted by the ovaries.

A female has **1–2 million oocytes (immature ova)** in her ovaries at birth; the number decreases down to 300–400 thousand by the time one reaches puberty. Each oocyte is surrounded by a layer of follicular epithelial cells, forming an ovarian follicle. Once a female reaches puberty, one of the follicles becomes mature, and **ovulation** (the follicle ruptures at the surface of the ovary and releases ova) occurs every 28 days. Supposing a female has menarche at age 12, ovulates 13 times in each of the successive years, and has menopause at age 50, the number of ova ovulated over her lifetime would be around 500. The remaining oocytes reduce by the hundreds or up to one thousand every time ovulation occurs; following menopause, there is no oocyte remaining in her ovaries.

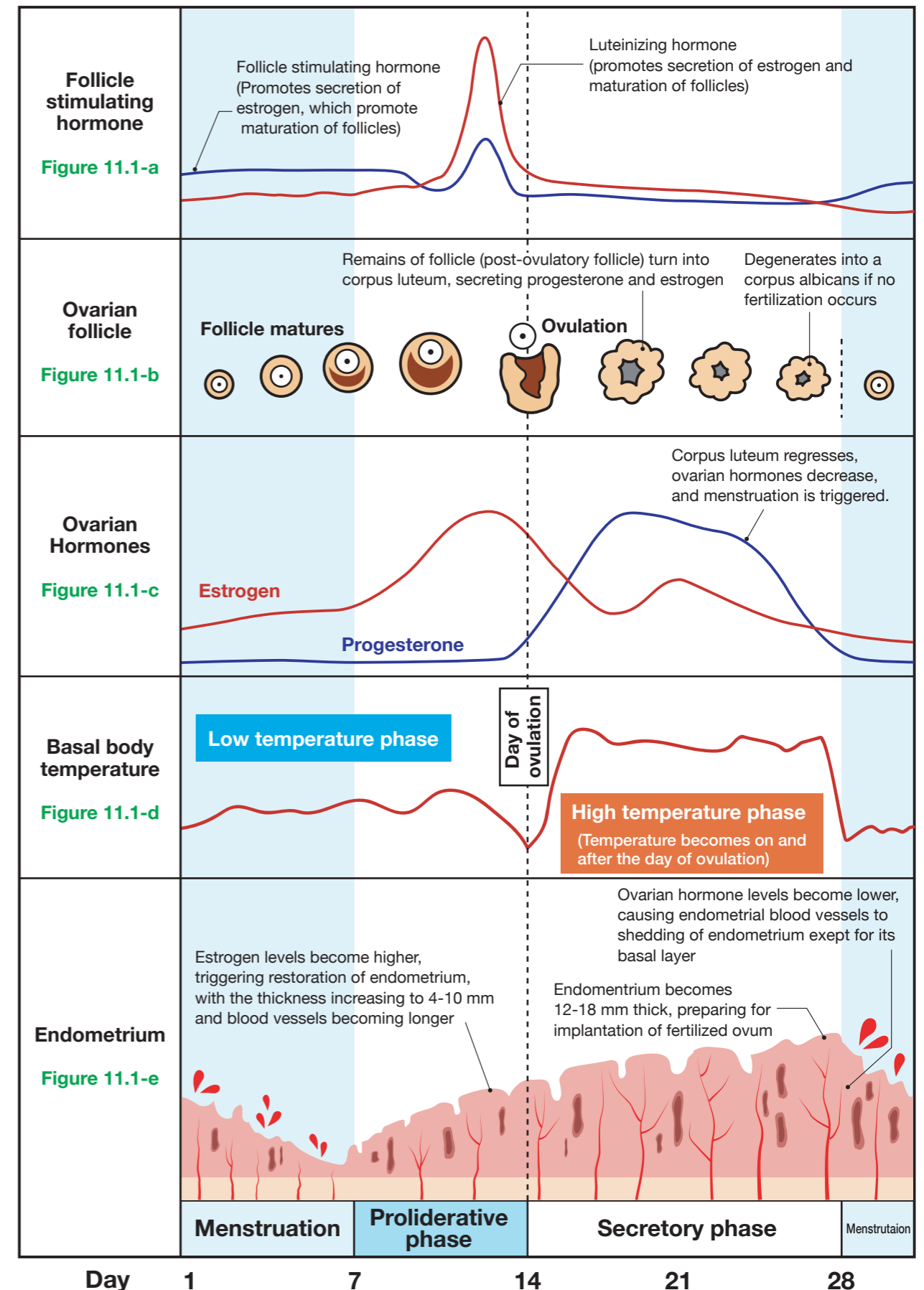
a) Ovarian cycle (Figures 11.1-a, b, and c)

The ovarian cycle is divided into the **follicular phase** and the **luteal phase**.

During the follicular phase, a number of ovarian follicles begin maturing, but only one of them continues to mature while the rest regress. **Follicle stimulating hormone (FSH)**, secreted by the pituitary gland, stimulates the maturation of follicles. Mature follicles within them produce **estrogen**, which works on both the follicles and the uterus; it stimulates follicles to mature further while promoting the proliferation of the endometrium. On the 14th day after the start of the follicular phase, the secretion of **luteinizing hormone (LH)** sees a spike, causing **ovulation**.

Ovulation is followed by the luteal phase. After the release of the ovum, follicular epithelial cells remain on the surface of the ovary, and these cells form the corpus luteum. Stimulated by LH, the corpus luteum releases small amounts of estrogen and progesterone. **Progesterone** is involved in the maintenance of the proliferated level of the endometrium and the preparation of the uterus for implantation of a fertilized ovum.

Female body temperature undergoes periodic changes on a cycle of around 4 weeks. It is lower



The period from the first day of the start of menstruation to the day before the start of the next menstruation is called the menstrual cycle, and one cycle is about 28 days.

Figure 11.1 Reproductive cycles

during the follicular phase (i.e., after menstruation) and higher during the luteal phase (i.e., before menstruation), with a fluctuation of 0.2–0.4°C. In addition, it dips during ovulation, then becomes higher from the day of ovulation onward (Figure 11.1-d).

b) Menstrual cycle (Figure 11.1-e)

The menstrual cycle is divided into the **menstrual phase**, the **proliferative phase**, and the **secretory phase**. The duration of each of the phases varies among individuals; Figure 11.1 is based on a 28-day cycle, which is a typical duration.

During the **menstrual phase**, the secretion of female sex hormones, i.e., estrogen and progesterone, from the corpus luteum decreases, causing the endometrium to degenerate and eventually be shed through the vagina along with blood. An unfertilized ovum dies and is shed during menstruation. The menstruation phase lasts from 5 to 7 days, with the first day of menstruation being Day 1.

The **proliferative phase** sees the maturation of the follicles, which results in increases in the secretion of estrogen and significant proliferation of the endometrium. As a result of the proliferation of the basal layer and the development of the glands and blood vessels, the thickness of the endometrium increases from 1 mm at the beginning to around 5–6 mm. The proliferative phase lasts until Day 14.

As the corpus luteum develops after ovulation, progesterone secreted from the corpus luteum puts the uterus into the **secretory phase**. The glands and blood vessels develop further, and the glands secrete a fluid containing glycogen. A number of folds appear on the surface of the endometrium, which facilitates the implantation of a fertilized ovum.

If pregnancy occurs, the corpus luteum will be sustained. As progesterone will also be produced by the placenta, the endometrium will be kept at its secretory phase. If, on the other hand, no pregnancy occurs, the secretion of progesterone will decline, and the endometrium will degenerate in around 12 days, leading to the start of another menstrual phase.

Column: Keep track of your menstrual cycle⁶

Are you female readers keeping proper track of your menstrual cycle? If you know your cycle, you won't need to feel worried if you have irregular menstruation, and you can detect irregular menstruation early should you have it. Irregular menstruation may affect any future pregnancy; if you keep experiencing irregularities years after your first menstruation, it will be reassuring to determine the cause. If you are not pregnant but experiencing amenorrhea, or the absence of menstruation, and that lasts for six months or longer, you should see a doctor (or consult an expert) at an early date.

You should also be aware that extreme diets, stress, or irregular/unhealthy lifestyles can also be the cause of amenorrhea. Your menstrual cycle provides important information to understand your physical condition and when you are more likely to get pregnant. For these reasons, and to know precisely when your due date will be if you do become pregnant, it is important that you always keep track of your menstrual cycle. If your menstruation lasts only for 1–2 days or for 8 days or longer, it may potentially be due to amenorrhea or some other factors; in such a case, you are advised to talk to your doctor or an expert first.

(5) Sexual desire⁶

As a child reaches adolescence, the release of the sex hormones leads to the development of secondary sexual characteristics, and their body matures into an adult body capable of reproduction. During this period, it is natural for adolescents to realize their interest in sexuality is heightened and that their desire for a closer relationship with someone of the opposite sex is strengthened. It has been said that men have a stronger sex drive than women do. Considering that male sex hormones are responsible for sexual desire and that they are found in women's blood at a level around one-tenth of that found in men, it may be reasonable to say that men may indeed have stronger libidos and sexual desire. This, however, varies considerably among individuals, and it does not remain constant but fluctuates greatly depending on factors such as one's physical condition or the situation they are in, their values, experience, environment, and personal relationships.⁶

2) Mental and social changes⁷

(1) Understanding mental development and problem behaviors during adolescence

Adolescence is a period when one comes to establish an identity as an adult human being while also being influenced by others around them. **Peer groups** have a substantial role to play in this process, and peer problems can have consequences on the adolescent's mental development and any problem behaviors. In addition, in order for you to understand, and take action to address, adolescent problem

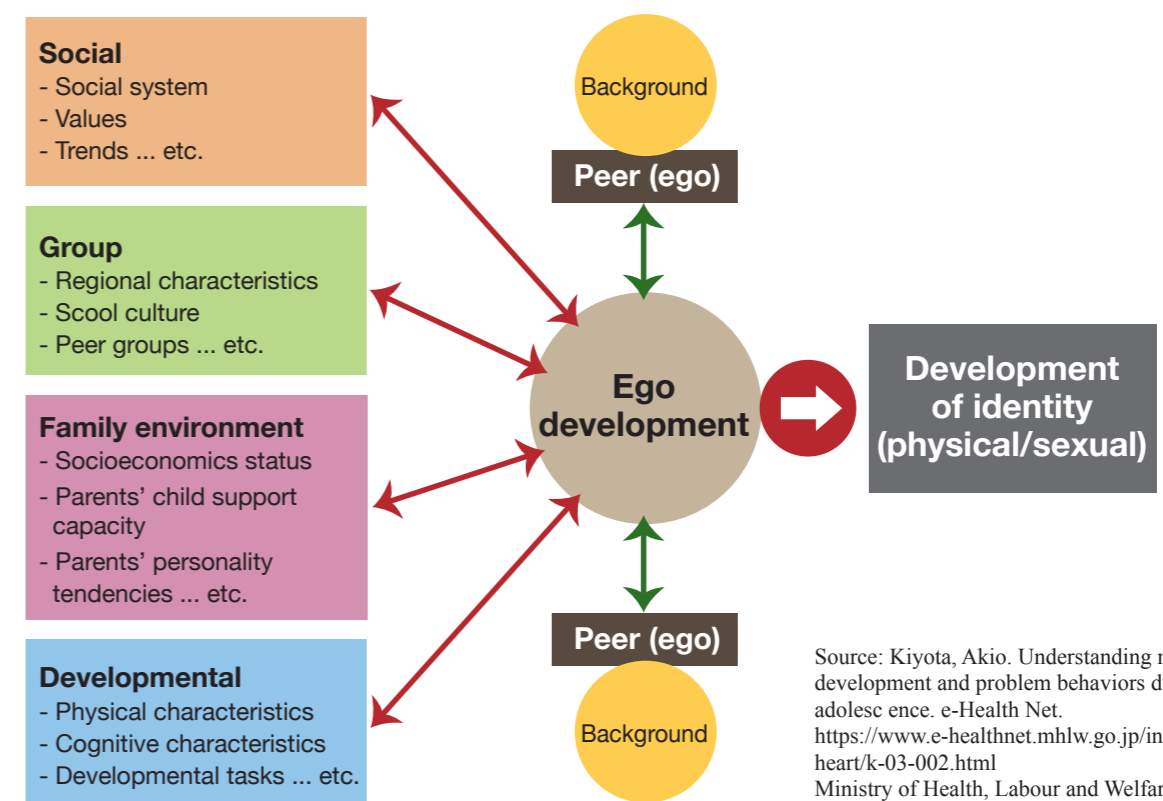


Figure 11.2 Adolescent mental development and relevant factors⁷

behaviors, you need to understand what their aims are and the diverse factors behind their behaviors.⁷ One of the keys to understanding adolescence is “**ambivalence**.”

Mental development during adolescence involves a number of physical, psychological, and social factors. In terms of development, at an individual level, adolescents experience significant physical and mental changes, including secondary sexual characteristics, and as they undergo sexual development and maturation, levels of sexual energy become higher. Meanwhile, the values, trends, and institutions of the groups to which one belongs, such as their school, peer groups, and family, as well as society at large, have a psychosocial influence on one as a member of these various societies as they explore how they want to live their lives and gradually form their own identity as an adult individual. Adolescence is a period in one’s life when they “achieve a self-identity” like this, but some of the influence put on them during this process may lead to problem behaviors (Figure 11.2).

Column: What is ambivalence?

Ambivalence is one of the key concepts in addressing adolescence.⁷ Ambivalence is to have and/or express two contrasting emotions or attitudes towards a certain object simultaneously, such as the kind of affection and aversion that an adolescent girl and her mother may have towards one another. Adolescence is a time when one often feels conflicted over the gap between justice or idealism and reality, or about autonomy from, and dependence on, parents, and this means that they experience stronger ambivalence and tendencies of extreme behaviors. It is the role of adults who are around a child to help the adolescent contain such swings to a state that will not interfere with their social life. With proper support from others around them, and through the twists and turns of life, an adolescent will achieve a healthy self-identity and grow into an adult.⁷

If, however, ambivalent emotions or attitudes in adolescence manifest in the form of drug abuse, eating disorders, violence/delinquency, truancy, or certain physical symptoms, it will become necessary to consult school staff, experts, or specialist organizations. In Cambodia, human resource development in school counselors, social workers, and other specialists providing support to children, their parents and guardians, and teachers, remains a challenge that needs to be addressed. And adults who are close to children, including teachers, families, and relations, as well as their elders, will play a large role in such endeavors.

a) Autonomy and peer relationships

In adolescence, while one’s desire to become autonomous from parents becomes stronger, they also feel anxiety and a sense of loss or sadness over being more distant from parents. As if to compensate for the unstable emotions, adolescents associate themselves with their peers in an attempt to have a sense of security and approval of being accepted by their peers and a sense of belonging to peer groups. For a child in the last years of primary school up to middle school, in particular, what plays a significant role is groups of peers of one’s own sex, those that are characterized by a sense of unity and closeness based on inner similarities. Although this allows adolescents to act autonomously from parents, it may also lead them to take on socially deviant behaviors (e.g., crime and bullying) or health risk behaviors (e.g.,

drinking and smoking) in order to conform to peers out of fear of rejection or isolation from their peers, or by peer pressure. How peer relationship dynamics work among children of these ages has a significant impact on their mental development and socially deviant behaviors.

By the time they are in high school and have developed a sense of “I am me, and they are them,” they become able to accept others who are different from themselves in some ways.⁷ In this phase, the peer relationships develop into those in which adolescents accept one another’s differences as autonomous individuals, both inside and outside. Through the experience of such relationships, they gain a sense of self-contentment and security, which helps their mental development and builds a base for achieving self-identity.

b) Understanding symptoms and problem behaviors observed in adolescence

Adolescence is also a period for a child who has not successfully accomplished the developmental tasks for school-age to return to the past developmental tasks and redo or re-experience them. For instance, a middle-school child who has not fully experienced a sense of unity or intimacy with peers mentioned above may resort to self-harming or truancy out of anxiety or lowered self-affirmation. It is not uncommon for adolescents to demonstrate different problem behaviors or physical/mental symptoms, but these may be interpreted as signs for such children to have another chance to go through developmental challenges they have yet to accomplish.

To handle such symptoms or problem behaviors in an appropriate manner, it is important that you understand which developmental task(s) the child needs to try again. You also need to explore underlying developmental factors to find out why the task(s) have been allowed to remain unaccomplished up to now. Simply looking at the problem behaviors or symptoms that manifest on the surface will not be enough to remedy the situation. In order for a teacher to provide support to these children, a teacher needs to understand child development (see Chapter 3).

2. How pregnancy and childbirth work and the current situation around them⁵

1) Pregnancy

Pregnancy brings significant changes to the physiology and shape of the mother’s body. While many such changes are designed to prepare the body as an ideal environment for the fetus’s growth, maturation, and delivery, there may also be secondary changes that result from pressure from the enlarging uterus or the changing hormone balance.

(1) Somatic changes

Physiological weight gain during pregnancy is approximately 8–10 kg. This is partly due to the growing body of the fetus itself, but other factors also account for the gain, including the enlargement of the uterus and **increasing volume of extracellular fluid including blood** due to the body’s tendency for fluid retention as a part of physiological changes caused by pregnancy. Other changes include **increased**

insulin resistance, increases in postprandial hypertension and fasting hypoglycemia, decreased tubular reabsorption of glucose, which can all often lead to a diabetic state. In addition, **increases in serum lipid levels** may also be observed; the levels can be markedly high, especially in late pregnancy.

(2) Changes to the uterus

The most notable pregnancy-related changes are naturally found in the uterus. In a woman who is not pregnant, the uterus is approximately 7-cm long, 5-cm wide, and 3-cm thick. Towards the end of pregnancy, the measurements can increase to 35 cm × 25 cm × 22 cm. This is due to the enlargement of uterine smooth muscle, as well as the enlargement and growth of connective tissue. Uterine blood flow also increases to around 500 mL per minute at the end of pregnancy.

2) Childbirth (delivery)

By around the 270th day after implantation, the uterine cervix becomes softer, and the uterine muscle layer's oxytocin sensitivity is increased, making it ready for delivery (childbirth).

The course of parturition (childbirth) is divided into three stages.

(1) First stage of parturition (dilation stage)

Once regular **uterine contractions (labor)** have started, and the uterine cervix has extended to the point the external os of the uterus is open to the full dilation (10 cm), the release of oxytocin increases, and labor intensifies. Labor intervals gradually become shorter until eventually the amniotic sac breaks, and the amniotic water is released (**water breaking**).

(2) Second (expulsion) stage to third (placental) stage of parturition

These stages represent a period from the full dilation of the external os until the fetal expulsion. The fetus is gradually expelled toward the birth canal. The force to expel the fetus (**expulsive force**) gradually becomes stronger, and when it reaches its peak, the fetus is pushed out of the mother's body, and takes its first breath. A fetus commonly comes out head-first; if however, its buttocks and/or legs are to come out first, it can make for a difficult delivery. Following the expulsion of the baby, fetal appendages, including placentas are expelled, to complete the delivery.

There are no national data available on weight and length at birth for children in Cambodia. However, statistics on 4,991 newborn children born in health facilities (in a five-year period between 2010 and 2014) show that the average birth weight was 3,100 g, with the prevalence of low birth weight being around 7% on average.⁸ For reference, data from a Lao hospital showed the average birth weight among newborn children born at the hospital in 2013 to be 3,049 g (in 3,912 children).⁹ While average birth weight and length varies among different nationalities, ethnicities, socioeconomic statuses, and sexes, typical birthlength and birthweight are approximately 48–50 cm, and 2.9–3.5 kg, respectively.¹⁰

3) Today's circumstances surrounding pregnant and nursing mothers¹¹

Cambodia's maternal and child health situation, despite the large amount of foreign aid it had received, used to fare poorly on such indicators as maternal mortality and infant mortality until as recently as the beginning of the 2000s. To address this, the Cambodian Ministry of Health positioned maternal health as one of the key issues in its Health Strategic Plan 2003–2007 and set a goal to promote perinatal checkup by healthcare professionals and skilled birth attendance. As part of this, it established a midwifery training program and had all regional centers employ midwives. Thanks to these efforts, maternal mortality in particular saw dramatic declines, with the rate per 100,000 live births down from 472 in 2005 to 161 in 2015.

Besides medical issues, there are more fundamental issues such as regional differences in infrastructure and disparities in wealth. Data from 2010, for instance, showed stark differences in child mortality (per 100,000 live births), with 13 in the capital Phnom Penh on the one end, compared to 95 in two northeastern provinces of Preah Vihear and Stung Treng on the other, the worst in the country. The absence of a health insurance system is one of the reasons people hesitate to seek medical attention or have surgery; in addition, there are a number of regions where people lack physical access to a health center, are situated far away from a provincial hospital that provides surgery, and/or have no means of transportation in case of an emergency that requires surgery.

While a mountain of issues still remains, there are signs of change in parts of the rural areas that are close to urban areas. One such sign is receiving skilled birth attendance at home by calling in a midwife affiliated with a healthcare institution, in place of aging traditional birth attendants. Maintaining the practice of home birth helps to preserve its beneficial aspects, such as the traditional healing procedure known as **Ang Pleung** (see Column: Traditional culture that supports childbirth (Ang Pleung) and changes in childbirth), and for an expecting mother to have her family and neighbors around her during delivery. In addition, it also provides secondary benefits through contact with a **midwife**, such as more people acquiring family planning knowledge, and families getting sound advice, including a switch to facility birth if necessary. This may be an example of coexistence, or harmony, between traditional wisdom and modern medicine.

Column: Traditional culture that supports childbirth (Ang Pleung) and changes in childbirth

Takahashi¹¹ reported that “there is a traditional healing procedure in Cambodia called Ang Pleung, in which a postpartum mother rests on a delivery bed with charcoal fire underneath her to warm her body over several days. It is believed to be practiced widely in rural areas. The mother as a rule sleeps and eats in an area separated from others throughout the period of the procedure. Ang Pleung is completed on the day the fire is put out, and the newborn and the new mother for the first time leave the enclosed area and undergo a ritual presided over by Kru Khmer, or a practitioner of traditional medicine.” However, hospital checkups and delivery are becoming mainstream in many parts of the country, especially urban areas, where Ang Pleung is no longer practiced; the situation is very different from that of rural areas where access to modern medicine is often difficult.

According to a recent study¹², the percentage of women seeking support from health facilities during delivery increased from 8% in 2000 to 82% in 2014, showing that more women are delivering babies at facilities, both in urban and rural areas. While the increases are more rapid in rural areas, the number of facility deliveries is greater among those in urban areas, as it is in more highly educated and economically advanced populations, which shows that regional and socioeconomic disparities remain unresolved. As a health facility delivery has beneficial influence on the child's future health outcome, improvements in maternal and child health services targeting women and children are hoped for.

4) Contraception

Pregnancy can threaten or damage a woman's health. Can you say that your knowledge of **contraception** is accurate? Have you been able to talk about contraception with your partner? An unexpected and unwanted pregnancy may lead to abortion, and birth resulting from an unexpected pregnancy is a high-risk factor for child abuse. Contraception is a means for you to determine the interval between pregnancies on your own, and it protects the human rights of women and children born as a result of an unexpected pregnancy. Unwanted pregnancies are avoidable, and we should ensure that pregnancy does not change the course of a woman's life against her will.⁶

(1) Methods of contraception

Although there are periods of time when a woman is more likely to become pregnant and those when she is not, there is no true "safe day." And considering how pregnancy works, the window of fertility is quite wide. Whenever one has sexual intercourse, they should be aware that there is always a possibility of pregnancy. Men, in particular, should recognize that theirs is the sex that can cause a woman to become pregnant, and make sure they use a secure form of contraception where necessary.

One of the male-based contraceptive methods, for instance, is **condoms**. They are inexpensive and readily available, free of adverse reactions, highly effective when used properly, and effective in preventing sexually transmitted infections as well. However, cases of contraceptive failures are common due to improper use. **Oral contraceptive pills** are a female-based method. They contain female sex hormones, which inhibit ovulation when taken orally. While proper use of these pills is highly effective for contraception, they can be expensive, and some women cannot use them depending on their constitution or pre-existing conditions. Unlike condoms, they have no effect against sexually transmitted infections.

There are multiple methods of contraception, yet none is 100% reliable. Even so, using a combination of contraceptive methods can boost contraceptive effectiveness. One needs to understand the advantages and disadvantages of each method, and have thorough discussions with one's partner to choose methods that are best suited to them.

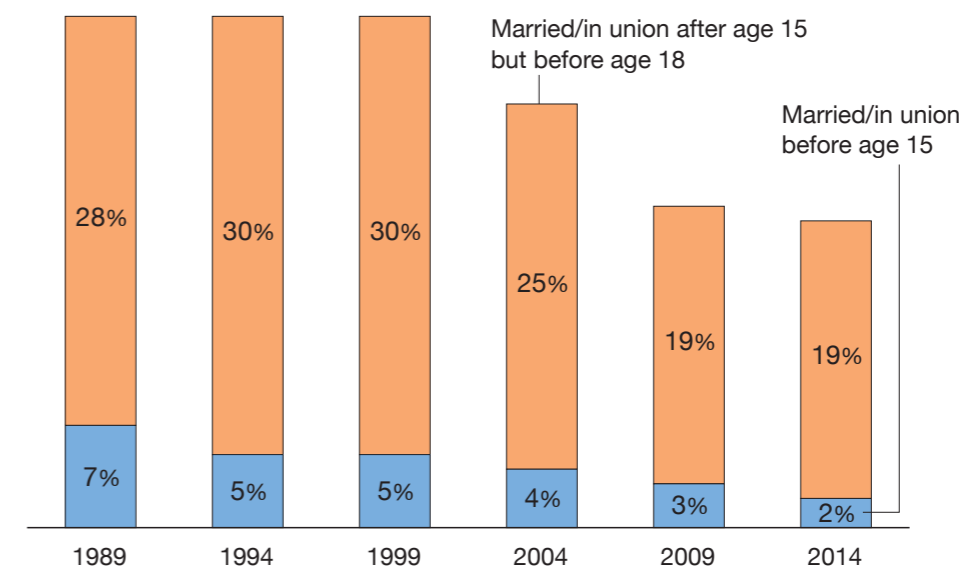
5) Youth sexual health and its challenges in today's Cambodia

This section outlines the circumstances that surround youth sexual health in Cambodia and its challenges.^{13, 14}

(1) Child marriage

Child marriage in Cambodia has been in decline over the years. In 1989, 28% of women aged 20–24 were married before the age of 18, compared to 19% in 2014 (**Figure 11.3**). The marriage of girls under the age of 15 declined from 7% in 1989 to 2% in 2014. However, the overall number of child marriages was comparable to that of 2009. The median age at first marriage among women in Cambodia has remained largely unchanged at 20–21 years over the past two decades.

Child marriage is known to be widespread among certain ethnic groups and in certain parts of the country. The percentage of young women aged 20–24 years who were married before the age of 18 varies pretty widely by region, ranging from 36% in Monduliri and Rattanakiri to 5% in Phnom Penh.

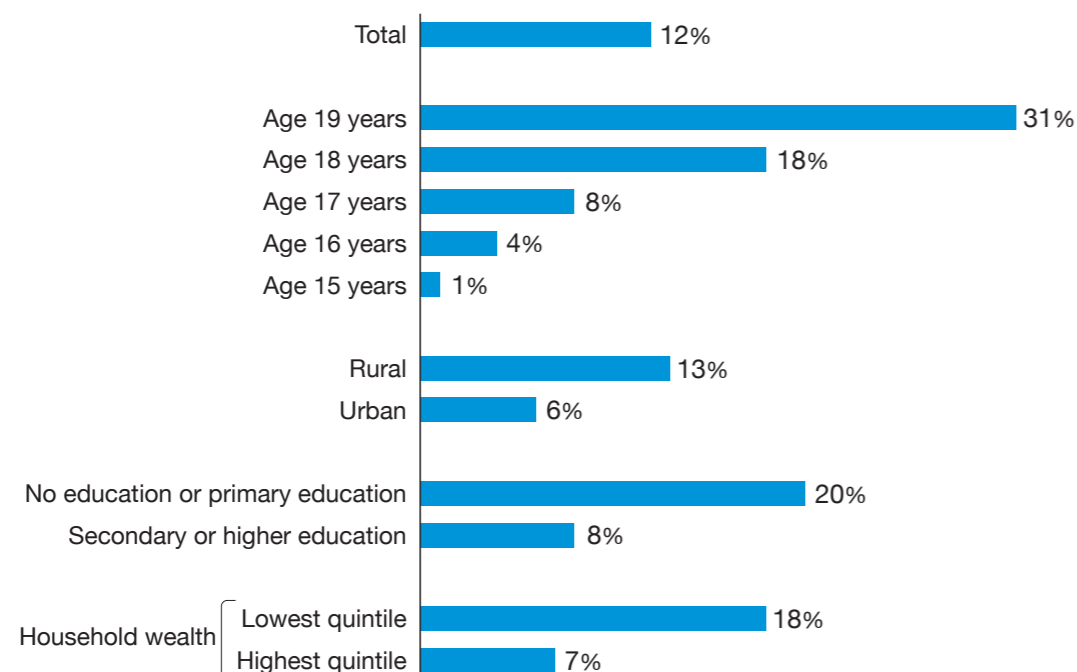


Source: UNICEF Cambodia and Division of Data, Research and Policy, UNICEF New York, A Statistical Profile of Child Protection in Cambodia, p.11, United Nations Children's Fund, New York, March 2018.

Figure 11.3 Child marriage today¹³

(2) Youth pregnancy and childbearing

In Cambodia, roughly one in eight girls aged 15–19 experiences childbearing. The percentage of girls aged 10–19 varies across regions, with the provinces of Battambang and Pailin being the lowest (4%) and Monduliri and Rattanakiri, the highest (34%). The percentage of girls aged 10–19 who experience childbearing decreases with urbanization, household wealth, and education (**Figure 11.4**).



Source: UNICEF Cambodia and Division of Data, Research and Policy, UNICEF New York, A Statistical Profile of Child Protection in Cambodia, p.6, United Nations Children's Fund, New York, March 2018.

Figure 11.4 Youth pregnancy and childbearing today¹³

(3) Use of contraception during sexual intercourse

The percentage of people who use condoms during sexual intercourse in Cambodia, as shown below, varies depending on the place of residence, socioeconomic status, and level of education.¹⁴

The percentage of males aged 15–24 who use condoms varies by the place of residence, and it has been consistently higher among those who live in urban areas than in rural areas (Table 11.2).

The use of condoms varies by socioeconomic status, as well. The percentage is higher in wealthier populations than in poorer ones (Table 11.3). While the percentage declined from 2005 to 2014, it remained largely unchanged in the middle class.

Whether or not one has a comprehensive knowledge of HIV and AIDS varies by place of residence, and the percentage of those who have a comprehensive knowledge has been consistently higher among those who live in urban areas than in rural areas (Table 11.4). The percentage is also higher among those with higher levels of education (Table 11.5).

Table 11.2 Percentage of use of condoms (males aged 15–24) by place of residence (%)

| Place of residence | 2005 | 2010 | 2014 |
|--------------------|------|------|------|
| Urban | 57.7 | 50.8 | 57.2 |
| Rural | 23.3 | 9.5 | 10.3 |

Source: UNFPA, Sexual and Reproductive Health in Cambodia, 2016¹⁴

Table 11.3 Use of condoms by socioeconomic status (%)

| Socioeconomic status | 2005 | 2010 | 2014 |
|----------------------|------|------|------|
| Poorest | 8.3 | 10.1 | 4 |
| Poorer | 11.2 | 8.4 | 8.7 |
| Middle | 16.4 | 14.5 | 16.9 |
| Richer | 29.1 | 43.1 | 17.6 |
| Richest | 63.3 | 52.4 | 44.9 |

Source: Based on Reference¹⁴

Table 11.4 Comprehensive knowledge about HIV and AIDS by place of residence (%)

| Place of residence | 2005 | | 2010 | | 2014 | |
|--------------------|--------|------|--------|------|--------|------|
| | Female | Male | Female | Male | Female | Male |
| Urban | 62.5 | 58.6 | 54.9 | 67.1 | 55.3 | 64.7 |
| Rural | 48.1 | 43.2 | 42.1 | 38.1 | 34.2 | 43.6 |

Source: Based on Reference¹⁴

Table 11.5 Comprehensive knowledge about HIV and AIDS by the level of education (%)

| Level of education | 2005 | | 2010 | | 2014 | |
|--------------------|--------|------|--------|------|--------|------|
| | Female | Male | Female | Male | Female | Male |
| No education | 19.7 | 21.9 | 16.2 | 9.7 | 17.9 | 20.1 |
| Primary | 42.1 | 30.3 | 33.4 | 28.5 | 25.7 | 31.0 |
| Secondary | 72.0 | 60.7 | 54.2 | 51.0 | 42.5 | 53.7 |
| Higher | 89.9 | 87.9 | 71.5 | 84.3 | 74.6 | 76.2 |

Source: Based on Reference¹⁴

Column: Sexual behaviors among university students in today's Cambodia

A 2015 study conducted on sexual behaviors among 1,359 university students in Cambodia (mean age: 21.3 years; 690 males and 669 females)^{9, 15} reported the following results. The subjects included a small number of those married and/or cohabitating (2.1%).

- 144 subjects (10.6%) had sexual intercourse; the figures showed sex differences, with 119 male students (17.3%) compared to 25 female students (3.7%).

The results of detailed analyses of those who had experience of sexual intercourse are as follows:

- Age at first sexual intercourse was 20.7 years for males and 20.2 years for females; no gender difference.
- Condom use during the most recent sex among those who had experience of sexual intercourse was 57.6%; the rate was lower among females at 32.0%, compared to 63.0% in males.
- 9.2% had had sex in exchange for money/gifts, and all were males (11.2% of males).
- 7.1% had had a sexually transmitted infection in the previous 12 months.
- The percentage of the subjects who had ever made someone pregnant/been pregnant was 12.7%, with 12.0% for males and 16.0% for females.

These results, which indicate that many of the male students had experience of sexual intercourse and that around 40% had sex without using a condom, point to the importance of sex education among male students.

According to Sexual and Reproductive Health of Adolescents and Youth in Cambodia (2016),¹⁶ Cambodia has a large youth population with the percentage of those aged between 15 and 24 years among the highest in Southeast Asia. And this young population has issues such as sexually transmitted infections, unwanted pregnancies, and unsafe abortions, whose likely causes include the lack of information on sex, poor educational attainment and high school dropout rates, and rural-to-urban migration for employment. The study subjects referred to in this column are students of two universities who had received a certain level of education. Taking these results into consideration, one may surmise that high-risk sexual behaviors may be even more prevalent among young people who have received lesser degrees of education or those in rural areas.

6) Reproductive health and rights⁶

The concept of **reproductive health and rights** was proposed at the International Conference on Population and Development held in Cairo in 1994 and has been widely supported across the world. The concept recognizes the **basic human right** (a right to which a person is inherently entitled as a human being) of people to: have a safe and satisfying sex life; freely decide whether or not to bear a child, when to have one, and how many to have; and have information and the means to do so.

Although it is a woman who becomes pregnant and gives birth, or undergoes an abortion, it is the responsibility of a couple, both the man and the woman, to not cause or have an unwanted pregnancy. It is difficult for a couple to ensure contraception unless they have accurate knowledge, care about their sex lives and the lives of one another, and have a relationship in which they respect one another and

work together on equal terms. For this reason, it is important for a couple to be able to have serious conversations about contraception and build a relationship of mutual cooperation before they have a sexual relationship.

3. Sexually transmitted infections

1) AIDS

Acquired immunodeficiency syndrome (AIDS) is a condition caused by the **human immunodeficiency virus (HIV)**. If not treated properly, **severe systemic immunodeficiency** can lead to **opportunistic infections** or malignancies. With dramatic advancements in the development of medications in recent years, it is now possible for a patient to lead a normal life without weakening their immune system if they start taking medicine at an early stage. It is therefore critical that a patient takes tests and detects the infection early, receives proper treatment, and continues proper medication as instructed for life.

Meanwhile, as of the end of 2019, 38 million people worldwide were living with HIV, 1.7 million had become newly infected, and 690 thousand people had died a year.¹⁷ This shows that HIV remains one of the most severe infectious diseases that humankind is faced with today. In Cambodia, however, HIV infections among those aged 15–49 have declined, from 2% in 1998 to 0.7% in 2013 and 0.6% in 2014. The estimated number of people living with HIV is 74,298, and an estimated ten thousand people do not know they are infected with HIV.

(1) Causes and routes of transmission

The pathogen is the **human immunodeficiency virus (HIV-1 and HIV-2)**. The primary route of transmission is **sexual contact**, in which the virus contained in seminal or vaginal fluids of a patient is transmitted via mucous membranes (of the urethra, vagina, or anus). Other routes include **mother-to-child transmission** (transmission during pregnancy, birth, or breastfeeding) and **bloodborne transmission**, which includes needlestick injuries and needle sharing.

(2) Symptoms and course of the disease

The natural course of HIV infection has three stages: **primary HIV infection (acute stage)**, **asymptomatic HIV infection**, and **AIDS (Figure 11.5)**. Throughout the infection, patients sustain progressive destruction of the immune system, which leads to immunodeficiency in most of those infected.

- Primary HIV infection (acute stage):** 2–3 weeks after infection, the level of HIV in the blood rapidly reaches its peak. During this period, patients develop influenza- or mononucleosis-like symptoms, such as fever, sore throat, muscle aches, rash, lymphadenopathy, or headache. The intensity of the symptoms varies widely; some may feel virtually no symptoms, while others may suffer from aseptic meningitis. Early-stage symptoms may last for around ten weeks, and may subside on their own.

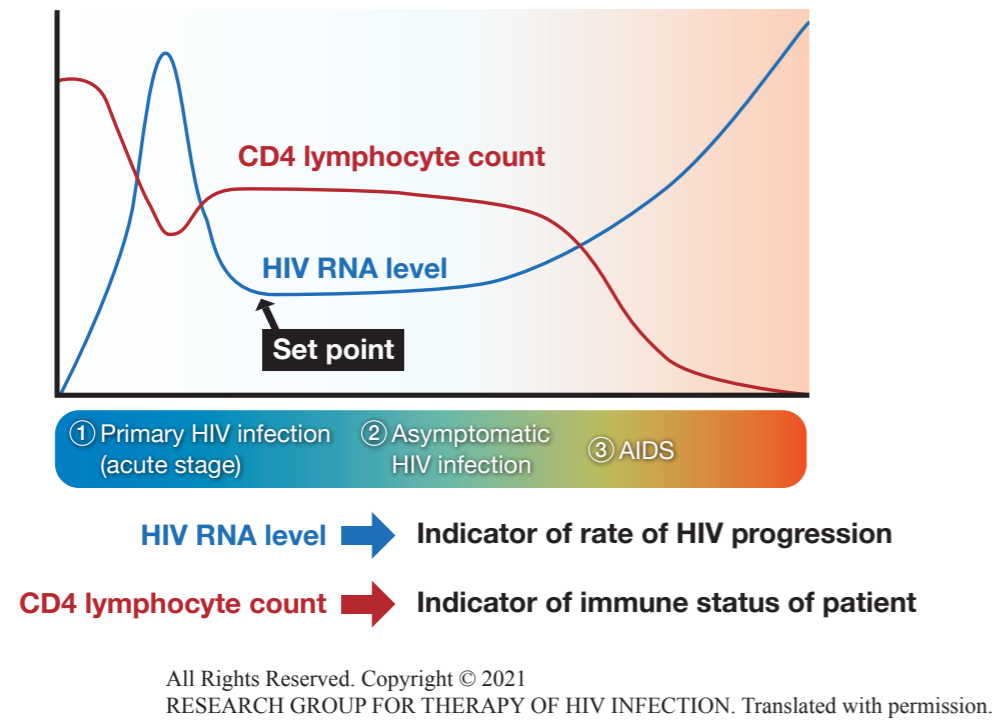


Figure 11.5 Course of HIV infection¹⁹

- ii. **Asymptomatic HIV infection:** As a result of the immune responses following infection (such as Cytotoxic T Lymphocytes (CTLs) induction and antibody production), the viral load, after reaching its peak, decreases to a certain level after 6–8 months and reaches a steady state. Patients may then be asymptomatic for several years or up to ten or more years; after this period, they are likely to develop symptoms such as fever, tiredness, and lymphadenopathy, as well as shingles. During this period, few symptoms characteristic of HIV infection occur.
- iii. **AIDS:** If a patient does not receive anti-HIV treatment following infection, the HIV infection further progresses, and CD4-positive T cells are rapidly depleted. If a patient’s CD4 lymphocyte count falls below 200/mm³, they become susceptible to **opportunistic infections** such as *Pneumocystis carinii* pneumonia; if the CD4 lymphocyte count drops further and falls below 50/mm³, a patient may develop opportunistic infections that are rarely seen in people with a normal immune status, such as cytomegalovirus infections, atypical mycobacterial infections, and malignant lymphoma of the central nervous system, as well as malignancies. Symptoms such as loss of appetite, diarrhea, malnutrition, and debilitation also become marked. (Source: Yoshimura K. What is AIDS (Acquired Immunodeficiency Syndrome)? -Clinical Symptoms. National Institute of Infectious Diseases website.¹⁸)

(3) Issues surrounding sexually transmitted infections (prejudice/discrimination against people with HIV/AIDS)

Since the world’s first reporting of cases in 1981, HIV/AIDS has spread throughout the world. In its early years, there was no treatment for AIDS, and media reports would emphasize the dangers of the disease alone. This created misconceptions and prejudices among people, which led to human rights

abuses, such as people having job offer withdrawn due to HIV infection or facing discriminatory attitudes or refusal of care by healthcare facilities.

There are only three routes of HIV transmission, namely transmission through sexual contact, bloodborne transmission, and mother-to-child transmission. HIV does not spread through ordinary everyday contact, such as shaking hands, sharing everyday items, or going into a pool or bath together (Table 11.6). It is not transmitted through coughing or sneezing, either. In other words, one does not contract HIV through everyday activities, but only through sexual contact. However, because one may not experience many symptoms even when infected with HIV, there are cases where an infected person passes it on to others through sexual contact, etc., without knowing about their own infection. In this regard, HIV infection is not someone else’s problem but is something that can happen to you or someone close to you. It is, however, preventable by using condoms correctly.

In addition, HIV infection does not equal AIDS, and there may be a long latency period before one develops AIDS if at all. Today many medicines have been developed, and more are coming; early detection of HIV infection and early start of treatment makes it possible to suppress the development of AIDS. This means that even if one is infected with HIV, one can go on with their social life by receiving proper treatment.

In the United States, the **Red Ribbon campaign** started in the 1990s when AIDS was becoming a social issue to commemorate people who lost their lives from AIDS and show understanding and support for those who are suffering from it. The campaign has since spread across borders and grown into a global movement. The red ribbon conveys that you do not have discriminate against people living with AIDS. See Chapter 7 to learn more about prejudice/discrimination against infectious diseases.

Table 11.6 Common misconceptions and assumptions about HIV infection and AIDS and correct knowledge²⁰

| Common misconceptions/assumptions | Correct knowledge |
|---|---|
| <ul style="list-style-type: none"> • It spreads by shaking hands or talking • You catch it by going into a bath or pool with an infected person • It spreads through coughing or sneezing • You catch it by sharing everyday items, such as a toilet seat, dish, or towel • You catch it through the bite of a mosquito or tick that has consumed infected blood | <ul style="list-style-type: none"> • There are only three routes of HIV transmission, namely transmission through sexual contact, bloodborne transmission, and mother-to-child transmission; it does not spread through ordinary everyday contact • The development of HIV medicines has made it possible to suppress the development of AIDS among people infected with HIV through early detection of infection and early start of treatment • Recently, cases of HIV transmission through sexual contact are on the rise; even steady partners cannot be ruled out for risk of transmission. HIV is an issue that can affect anyone |

Source: Japanese Government Public Relations Online, Eliminating Prejudice and Discrimination against HIV and Leprosy. <https://www.gov-online.go.jp/useful/article/201108/3.html>

2) Other sexually transmitted infections¹

Table 11.7 provides a list of sexually transmitted infections that are common around the world. One should take particular note of the fact that women are more susceptible to sexually transmitted infections. This is due to biological factors such as that women have more exposed mucosal surfaces and that they often show no symptoms of those diseases; as well as social factors such as that women are forced into a disadvantageous position, which makes them less likely to receive treatment for sexually transmitted infections than men.

If a woman has a sexually transmitted infection other than HIV and does not receive treatment in a timely and appropriate manner, it can have a number of long-lasting effects on her health, such as pelvic inflammatory disease, chronic pain, ovarian abscesses, ectopic pregnancies, and infertility.

4. Social challenges and solutions surrounding sexual health

1) Handling information concerning sex

Today's highly advanced information society provides an environment where we have constant access to an internet connection, and children are exposed to staggering amounts of information in their everyday lives. They also have easy access to information concerning sex. This is leading to instances where children who do not possess **information literacy** are sexually victimized through the Internet and social media. It can also become their first contact with drugs.

Social media can have an impact on the values about, attitudes to, and norms for sex. We should aim to ensure that children can acquire basic knowledge about sex and help them develop capabilities of gathering information they need on their own and making the right decision or choosing the right action (i.e., **sexual health literacy**).

Table 11.7 Types and overview of sexually transmitted infections ²¹

| | Pathogen | Route of transmission | Latency period | Symptoms |
|----------------------|---|--|---------------------------|--|
| Syphilis | Treponema pallidum | Direct contact with skin or mucosal lesion via sexual contact | Approx. 3 weeks | <ul style="list-style-type: none"> • Red and hard lumps or sores appear on the original site of infection (e.g., genitals, mouth), accompanied by swollen lymph nodes in the vicinity (primary stage). Around 3–12 weeks later, systemic symptoms such as fever and general malaise appear along with various types of rash on the skin (secondary stage). It affects the heart, blood vessels, or brain over the next 10–30 years (latent and tertiary stages). If left untreated, the disease gradually progresses from primary to secondary, latent, and tertiary stages. It can cause neuropsychiatric symptoms and can even be fatal. • A newborn may have congenital syphilis when the mother with syphilis has passed the infection on to the baby. |
| Gonorrhea | Neisseria gonorrhoeae | Direct contact with mucosal lesion via sexual contact | 2–7 days | <ul style="list-style-type: none"> • Pain when urinating and pyuria for men, and vaginal discharge and vaginal bleeding between periods; however, symptoms may often be too mild for patients to notice. • May cause infections in the rectum and throat, but patients often have no symptoms and may therefore fail to notice the infection. • May result in infertility if left untreated. • A baby born to a mother infected with gonorrhea may develop gonococcal conjunctivitis. |
| Chlamydia | Chlamydia trachomatis | Direct contact with mucosal lesion via sexual contact | 1–3 weeks | <ul style="list-style-type: none"> • Pain when urinating and itchy urethra for men; women may often have mild or no symptoms. • May lead to infertility and miscarriage/stillbirth if left untreated. |
| Candida infections | Candida yeasts | Candida yeasts are transmissible via sexual contact, but may not necessarily lead to disease | Varies | <ul style="list-style-type: none"> • It is not common for symptoms to manifest among men with Candida infection; women may experience itching of the vulva and increased vaginal discharge. • People can have Candida in their body without it causing any problem. • If left untreated, the symptoms persist, recur, or relapse; it can not be cured without treatment. |
| Condyloma acuminatum | Human papillomavirus (often types 6 and 11) | Direct contact with skin or mucosal lesion via sexual contact | 3 weeks Up to 8 months | <ul style="list-style-type: none"> • Warts that look like a chicken's comb appear around the genitals and anus. • If left untreated, it resolves spontaneously within 3 months in 20–30% of the cases; some may see a malignant transformation, however. |

Source: Japanese Foundation for Sexual Health Medicine. A List of Common Sexually Transmitted Infections. <https://www.jfshm.org/>
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2) Sexual violence

According to WHO, sexual violence is defined as “(a)ny sexual act, attempt to obtain a sexual act, unwanted sexual comments or advances, or acts to traffic, or otherwise directed against a person’s sexuality, using coercion, intimidation, or violence, by any person, regardless of their relationship to the victim, in any setting, including, but not limited to, home and work.”²²

Globally, sexual violence takes various forms, and they may include, but are not limited to, rape, sexual harassment, sexual abuse/assault, forced marriage or cohabitation, genital mutilation, forced prostitution, and trafficking of people for the purpose of sexual exploitation. Sexual violence may include intimate partner violence. WHO defines intimate partner violence as “(b)ehaviour by an intimate partner that causes physical, sexual, or psychological harm, including acts of physical aggression, sexual coercion, psychological abuse and controlling behaviours.”

3) Sexual norms in Cambodia²³

Cambodia has cultural codes of sexual conduct known as the **Chbab Pros** and the **Chbab Srey**, the former applies for men, the latter, women. They have a significant impact on people’s perceptions, behaviors, and health. The male code of conduct says that men are strong and ambitious, serve as the head of the household, and should be treated with respect and deference. If a man deviates from the male code of conduct, it is not common for him to be subjected to sharp criticism or discrimination from society, and their sexual conduct is likewise tolerated. The female code of conduct, on the other hand, is extremely strict; it forbids premarital or extramarital sexual intercourse, and directs women to care for the family, perform all household duties, not defy parents, and obey their husband once married. In addition, any deviation from the code committed by a woman will subject her to harsh judgment from society; in rural areas, in particular, their “value as a woman” will be questioned. It has been pointed out that these cultural codes of sexual conduct help conceal violence against women committed by their spouses or other men. Women who have suffered premarital rape or human trafficking, in particular, and who should be protected as victims, are often expelled from society on the grounds of the female code of sexual conduct and become desperate as a result.²³

Such instances of gender inequalities are not limited to Cambodia but are a global issue that affects women’s opportunities in educational, political, social, and economic activities as well as their health. In the field of international cooperation, the approach known as “gender and development” has become mainstream since the 1980s. A key to sustainable development in Cambodia is the type of support that empowers women in order to eliminate factors that threaten women’s living environment (such as poverty, violence, and human trafficking) and discriminatory traditions and customs that have a harmful impact on women, by understanding specific needs for men and women, and securing understanding and involvement from men.

Column: Harmful practices performed around the world²⁴

Harmful practices against young girls inflict severe and lifelong trauma on them and deprive them of the rights to fulfill their potential. For instance, gender inequalities and negative attitudes towards women and girls are causes of such harmful practices. According to a survey conducted in countries that account for 80% of the world population, 90% of people had certain kinds of prejudice against women, and over 140 million females were considered “missing” as a result of sex selection at birth or child neglect (i.e., extreme son preference, which privileges sons over daughters).

Today, around 200 million girls and women have experienced some form of **female genital mutilation (FGM)**. These harmful practices are being imposed on girls by their family members, and supported by discrimination and community norms. The country where FGM is most prevalent in Asia is Indonesia, where 49% of girls aged 11 and under have experienced it. Half of the women and girls who have experienced FGM believe the practice should be abandoned.

4) Comprehensive sexuality education

Sex education incorporating international policies is actively practiced across the world. This section provides an outline of the **International Technical Guidance on Sexuality Education**, which is an international standard for such practice.^{25, 26, 27}

To meet the need for education on sexual health and rights, UNESCO published the International Technical Guidance on Sexuality Education in 2009, in partnership with UNAIDS, UNFPA, WHO, and UNICEF. In light of the accumulation of practice implemented around the world over nine years, as well as the emergence of new concerns such as the influence of the Internet and social media, the content of the guidance was reviewed, and a revised edition was published in 2018.²⁷ In addition to providing the latest scientific evidence, the revised edition presents an updated set of eight key concepts, topics, and learning objectives, organized into different age groups (four groups: 5–8 years; 9–12 years; 12–15 years and 15–18+ years) (**Figure 11.6**). The guidance also contains the means of institutionalization for implementing **comprehensive sexuality education** and specific recommendations on how to deliver effective programs.

Comprehensive sexuality education (CSE) is a curriculum-based process of teaching and learning about the cognitive, emotional, physical, and social aspects of sexuality. It aims to equip children and young people with knowledge, skills, attitudes, and values that will empower them to: realize their health, well-being and dignity; develop respectful social and sexual relationships; consider how their choices affect their own well-being and that of others, and; understand and ensure the protection of their rights throughout their lives.

The fundamental components of comprehensive sexuality education are summarized in the ten elements shown in **Table 11.8**. As shown here, comprehensive sexuality education regards sex education as a **sexual right**. It is based on respect for human rights that is built on perspectives of gender equality and diversity of gender. Comprehensive sexuality education has been practiced in many countries and territories, including Thailand, China, Taiwan, South Korea, Australia, New Zealand, Canada, the United

States, and the Republic of South Africa, among others.



Source: UNESCO. Revised edition International technical guidance on sexuality education: An evidence-informed approach. 36. 2018 https://www.unaids.org/sites/default/files/media_asset/ITGSE_en.pdf

Figure 11.6 An overview of key concepts, topics, and learning objectives²⁷

Table 11.8 Basic learning contents of comprehensive sexuality education²⁷

| Elements | Specific learning content |
|---|--|
| 1. Scientifically accurate | The content of comprehensive sexuality education is based on facts and scientific evidence related to sexual and reproductive health, sexuality, and behaviors |
| 2. Incremental | Comprehensive sexuality education is a continuing educational process that starts at an early age and where new information builds upon previous learning, using a spiral-curriculum approach |
| 3. Age- and developmentally-appropriate | The content of comprehensive sexuality education is responsive to changes that accompany the child's development |
| 4. Curriculum based | Comprehensive sexuality education serves as a guide for teachers in their efforts to support child's learning |
| 5. Comprehensive | Comprehensive sexuality education is supported by comprehensive, deep, and iterative learning |
| 6. Based on a human rights approach | Comprehensive sexuality education aims to encourage people to recognize their own rights and those of others, and advocate for those whose rights are violated |
| 7. Based on gender equality | Comprehensive sexuality education addresses how gender norms can create inequality and how they can harm people's overall health and well-being and have an impact on sexually transmitted infections, unintended pregnancies, and gender-based violence |
| 8. Culturally relevant and context appropriate | Comprehensive sexuality education encourages learners to challenge and practice how cultural structures and norms affect individuals' formation of relationships of their choice, and acquire skills to build responsible relationships |
| 9. Transformative | Comprehensive sexuality education contributes to the formation of a more fair and compassionate society and transformation |
| 10. Able to develop life skills needed to support healthy choices | Comprehensive sexuality education aims to cultivate the ability to make informed decisions, communicate effectively, and demonstrate assertiveness |

Source: UNESCO. Revised edition International technical guidance on sexuality education: An evidence-informed approach. 16-17. 2018 https://www.unaids.org/sites/default/files/media_asset/ITGSE_en.pdf

5) Menstrual hygiene management

In the field of international development, menstruation has recently come to be discussed in association with issues such as school attendance and hygiene and is now considered a matter that requires improvement.²⁸ In Cambodia, issues concerning menstruation that have been identified include the sexual code of conduct mentioned earlier, the cultural norms that regard secrecy and silence about menstruation as virtuous, and a sense of shame and traditional taboos surrounding menstruation.²⁹

Menstrual hygiene management (MHM) refers to access to the following: accurate knowledge about health; clean menstrual hygiene materials to absorb or collect menstrual blood; space that provides privacy for changing materials as often as necessary during a period of menstruation; soap and water for

washing the body when necessary; and disposal facilities for menstrual materials.²⁹

The International Technical Guidance on Sexuality Education discussed earlier identifies the topic of menstruation as one of the learning objectives for the age group 9–12 years under Key Concept 6.3 Puberty. The key idea is “Menstruation is a normal and natural part of a girls’ physical development and should not be treated with secrecy or stigma,” and what learners will be able to do are as follows:

- (a) describe the menstrual cycle and identify the various physical symptoms and feelings that girls may experience during this time (knowledge);
- (b) describe how to access, use and dispose of sanitary pads and other menstrual aids (knowledge);
- (c) recall how gender inequality can contribute to girls’ feelings of shame and fear during menstruation (knowledge);
- (d) recognize that it is important for all girls to have access to sanitary pads and other menstrual aids, clean water, and private toilet facilities during their menstruation (attitudinal); and
- (e) demonstrate positive and supportive strategies for girls to feel comfortable during their menstruation (skill).”

5. Sexual diversity

1) Gender

Gender is a social/cultural distinction, as opposed to **sex which is a biological distinction**, and it refers to differences that are born out of different roles men and women play in society (i.e., **gender role**). It is used as a term that expresses social or cultural conceptions of “masculinity” and “femininity,” such as “men work outside the home” and “women do housework and care for children.”

In the International Technical Guidance on Sexuality Education mentioned earlier, discussion of issues that concern **sexual orientation and gender identity** is recommended under Key Concept 3: Understanding Gender.

Specifically, the guidance suggests goals such as the following:

For learners aged 5–8 years,

- (a) define gender and biological sex and describe how they are different (knowledge), and
- (b) reflect on how they feel about their biological sex and gender (skill).

For learners aged 9–12 years,

- (c) define gender identity (knowledge),
- (d) explain how someone’s gender identity may not match their biological sex (knowledge),
- (e) acknowledge that everyone has a gender identity (attitudinal), and
- (f) appreciate their own gender identity and demonstrate respect for the gender identity of others (skill).

The aim is for children to acquire basic knowledge, attitudes, and skills by the time they are in the last years of primary school, and it sets more advanced learning objectives for older learners.

At the same time, the learning objectives presented in the guidance are to be interpreted by curriculum developers at the local level. “The guidance is voluntary and non-mandatory, based on universal evidence

and practice, and recognizes the diversity of different national contexts in which sexuality education is taking place.”

The guidance also notes that “a **positive school environment** has been shown to facilitate the full implementation of programs, thus supporting their effectiveness.” It identifies “making the school a safe environment for the provision of [comprehensive sexuality education], for example by having zero-tolerance policies for sexual harassment and bullying, including stigma and discrimination on the grounds of sexual orientation and gender identity” as one of the duties of the school.

2) Gender identity³⁰

Gender identity refers to the concept of personal sense of one’s own gender. It may be called “psychological gender” or “brain gender.” While many people identify with “being a male” or “being a female,” there are a variety of forms of gender identity, such as “not identifying with either male or female,” “not sure,” or “don’t want to pick.”

Many people have a gender identity that matches their biological sex, namely, they are **cisgender**. Some people are **transgender**, meaning they have a gender identity that does not align with their biological sex.

3) Sexual orientation^{22,30}

Sexual orientation refers to the pattern of sexual attraction to other people. Many people are heterosexual, or they are sexually attracted to people of the sex opposite to their own. There are, however, different categories of sexual orientation, including homosexuality (sexual attraction to people of the same sex as their own), bisexuality (sexual attraction toward both males and females), and asexuality (the lack of sexual attraction to others).

Column: Ingenuities for lessons and guidance on sex at school

To what degrees are lessons and guidance on sex offered at schools in Cambodia? Some teachers may find it difficult to teach the subject as they are hesitant to offer such guidance to children of different sex to their own. Some teachers may not have any experience in giving guidance on sexual diversity. If you find yourself in a situation that involves teasing of, or discriminatory comments against, a child of a sexual minority, how should you handle it as a teacher?

One thing you can do is to change the way of giving guidance according to the learning content. For instance, with the topic of menstruation, it may be a good idea to have boys and girls take lessons separately or to have children take lessons from a teacher of the same sex as that of themselves. If the school has only male teachers, one way of going about it is to ask community health workers or people from relevant NGOs to give lessons.

What about guidance on sexuality for boys? It has been reported that boys may feel flustered by

the physical and mental changes they experience when they reach spermarche, or feel repulsed or embarrassed during an ejaculation. Acquiring accurate information and correct knowledge helps them build a good relationship with their partner and conduct appropriate sexual behaviors. Giving guidance on sexuality for boys is important to ensure that they accept their mental and physical changes positively.

Exercises for further thought and research

- [11-1] How do one's feelings towards and perception of sex change during adolescence? Take a specific example and look into it.
- [11-2] What kinds of environmental improvement or institutions are necessary to support pregnancies and parenting? What kinds of facilities and services are available in the area where you live?
- [11-3] How can one cope with the changes that happen to their feelings towards sex? Use your own experience as a child as a sample case and discuss.
- [11-4] What should one do to communicate their intentions to their partner? Think of a scenario and do a role-play.
- [11-5] Pick a case of challenges associated with sex in Cambodia and discuss possible measures for improvement.
- [11-6] What are the challenges one faces when giving children guidance on sex? Give examples and discuss.

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Mental health

Learning objectives

You will be able to gain proper understanding and explain:

- The concept and development of the mind from biological, mental/psychological, and social aspects.
- Mental health, psychological conflicts and defense mechanisms, the mind-body relationship and the stress theory, and stressful events. And by taking these factors into account, you will also be able to consider ways to cope with stress and social support.
- Cambodia's challenges in mental health and consider ways to address those challenges.
- How to listen to children with a supportive and receptive attitude.

This chapter provides an overview of mental health issues in Cambodia. It first describes ways to understand the mind and theories of the development of the mind that provide a basis for considering mental health, then explains the definition of mental health by the World Health Organization (WHO), the stress theory, and contemporary mental health challenges in Cambodia.

1. Concept and development of the mind and mental health

1) Three viewpoints on the mind

What is the mind? Does the mind really exist in the first place? Is it an illusion created by the brain? We consider what the mind is by assuming three general aspects:

The first aspect sees the mind from **the perspective of biomedical psychiatry and brain science**. This perspective views the mind as brain functions. It considers that each of the various actions of the mind is controlled by the region that localizes it in the brain. It therefore assumes that mental illnesses/ disorders and poor health of the mind are caused by damage to, or is a dysfunction of, a certain brain region.

The second aspect, which is adopted in some fields including psychoanalysis, depth psychology, and counselling, **assumes the existence of "the mind"** to be something that cannot be understood objectively or with natural science, such as **unconsciousness** and a soul. This view believes that the accumulation of individual life experiences shapes the mind as a subjective world. It therefore assumes that mental illnesses/ disorders and poor health of the mind are greatly related to matters of one's way of life or life experiences, or those of one's subjective self-being.

In the third aspect, the mind is **understood as** not only a series of functions within the individual's brain/central nervous system and inner self but also a series of **functions in connections with people**

and interactions with the social environment. Given the fact that the brain, unconsciousness, and soul function in response to stimulation through interaction with the surrounding environment, the mind appears to be something that does not work independently within the individual but rather is something that functions only when relationships with surroundings are brought into the individual. It also incorporates history and culture to shape itself. In other words, it is only in a dynamic interaction between the individual and the surrounding environment or history/culture that the mind works. This aspect therefore assumes that mental illnesses/ disorders and poor health of the mind are greatly related to issues of relationships or interactions with surroundings, or those of individual adaptation to the environment or history/culture.

As a matter of course, these three aspects of the mind are not independent but linked to each other. That is, the human mind, which is one phenomenon, is viewed from three aspects: the biological, mental/psychological, and social aspects. The mind has a totality that integrates at least these three aspects. This means that in considering mental health, issues need to be viewed comprehensively from the biological aspect, which mainly includes the growth/development of the cerebral nervous system and other body parts, the mental/psychological aspect, which focuses on individuals' experiences and ways of life, and the social aspect, which consists primarily of interactions of individuals with the social relations surrounding them such as their family, school, local community, and nation, and the history/culture of their country or region.

2) Development of the mind

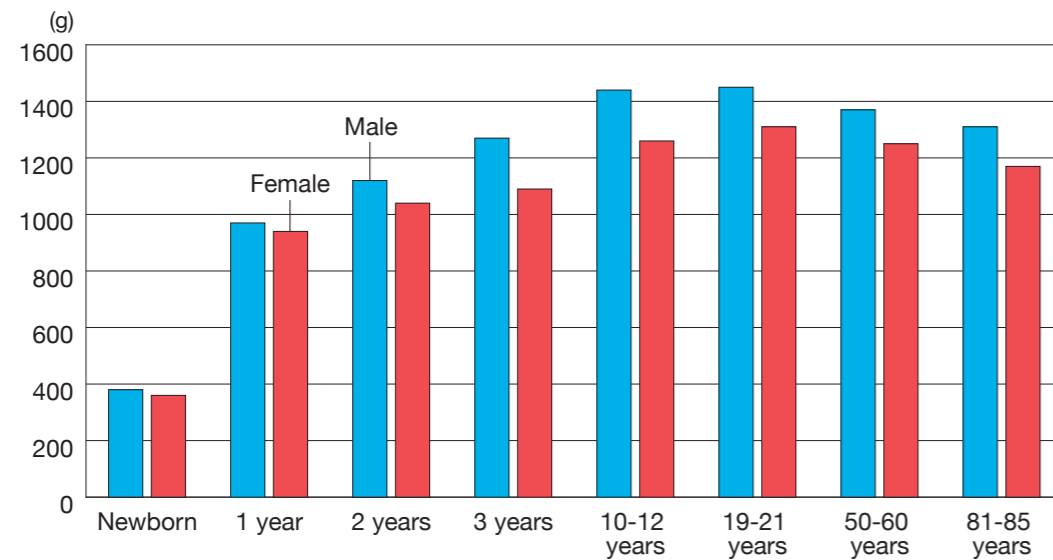
(1) Mental development in the biological aspect

As in the case of the mind, we examine the development of the mind from three aspects, namely, the biological, mental/psychological, and social aspects.

First, **the development of the mind in the biological aspect** is based on the growth/development of the cerebral nervous system. Thus, it is supported by physical growth and development as well. According to Dekaban and Sadowsky,¹ the brain already weighs 360 g in a newborn girl and 380 g in a newborn boy, as shown in **Figure 12.1**. In one year from birth, it grows by approximately 1.6 times to 940 g for a girl and 970 g for a boy. The weight of the brain is known to reach 90% of that of an adult at around 6 years old. After that, the growth rate of the brain decreases, with the brain size reaching almost its peak at 19 to 21 years old. Due partly to differences in physical constitutions, brain weight differs between the sexes; it is 1310 g for women and 1450 g for men, indicating that men have a heavier brain than women. Brain weight starts to decrease in the late fifties as people age.

Meanwhile, concerning changes in synaptic density² in **the prefrontal cortex**, which is responsible for high-level human cognitive functions such as control of language and thinking, the density at 4 years after birth is known to reach double that of an adult. Synaptic pruning starts to progress slowly after around 4 years old, and intensely accelerates at around 14 to 16 years during adolescence. While networks of synapses used frequently remain, those not used are pruned and eliminated.

A higher synaptic density does not necessarily provide a better function; an overly complicated network cannot process information efficiently as it can be imagined from a labyrinthine information



This figure is created based on data obtained from “Dekaban, A.S. and Sadowsky, D., Changes in brain weights during the span of human life: relation of brain weights to body heights and body weights, Ann. Neurology, 4:345-356, 1978”

Figure 12.1 Human brain weight by gender and age

network. Rather, as **synaptic pruning** progresses, information transmission becomes more efficient as it can be imagined from networks of major roads. Because this synaptic pruning occurs through the interaction between the body and the environment, the environment in which one has spent during adolescence is important. Adolescence, during which intense synaptic pruning occurs, is a period in which the brain structure is drastically reconstructed; therefore, it is considered to be a period in which mental disease is likely to develop (**susceptible period**) and deviant behaviors tend to occur. It is estimated that it takes about 25 years for **the frontal cortex** to mature to the adult level.

Column: What are the prefrontal cortex and synapses?

The brain can be broadly divided into the cerebrum, the cerebellum, and the brain stem (a collective term for the midbrain, the medulla oblongata, and the pons). Among these, the cerebrum is separated into four regions: the frontal lobe (with functions primarily related to thinking, judgment, and action), the parietal lobe (chiefly perception and sensation), the occipital lobe (vision), and the temporal lobe (hearing and memory). The prefrontal cortex is more developed in humans than in any other animal, accounting for approximately 30% of the frontal lobe and approximately 10% of the entire brain. The prefrontal cortex is responsible for cognitive functions necessary to live humanly, including reflecting/thinking, controlling actions and emotions, communicating, controlling memory, making decisions, solving problems, and acting with long-term goals.

In the nervous system, nerve cells (neurons) are responsible for information transmission. Nervous cells are not linked to each other but adjoin with gaps. A connection from the end of one nerve cell to the next nerve cell is called a synapse. A neurotransmitter is released in this gap, and information is transmitted from one nerve cell to another. For example, when the sympathetic nervous system is activated, noradrenaline is released, making the state of mind and body active, while the activation of the parasympathetic nervous system leads to secretion of acetylcholine, creating a relaxed state of the mind and body (see Chapter 2).

(2) Mental development in the mental/psychological aspect

Although there are a variety of theories about **mental development in the mental/psychological aspect**, two theories can be presented as representatives: Piaget’s theory of intellectual development and Erickson’s life span development theory.

a. Piaget’s theory of cognitive development (Figure 12.2)

According to the theory of cognitive development by **Jean Piaget** (a Swiss developmental psychologist, 1896-1980)^{3,4}, children aged from 0 to 2 are in **the sensorimotor stage**, in which the knowledge of the world around them is limited to what they can sense and touch. As the sense of their own existence begins to grow, they start to understand that things exist even though they cannot see, and also understand causal relationships between actions and consequences. Then, children aged from 2 to 7 are in **the preoperational stage**, in which they begin to think using images, and fantasies appear in their words and play. They enjoy using animism to think of natural phenomena such as an angry mountain. Their thinking is still self-oriented. The period from the ages from 7 to 11 is called **the concrete operational stage**, in which children begin to think logically and become less self-centered and able to see things from various aspects. For example, they acquire **the concept of conservation**, that is, the amount of water remains the same even after it is transferred from one container to another with a different shape. After this stage, from early adolescence, **the formal operational stage**, in which adult thinking is acquired, begins. In this stage, they acquire abstract thinking and begin to think about things according to visions and ideals without concrete experience. For example, they can think scientifically and make a hypothesis for estimation and compare the result with a fact to draw a conclusion.

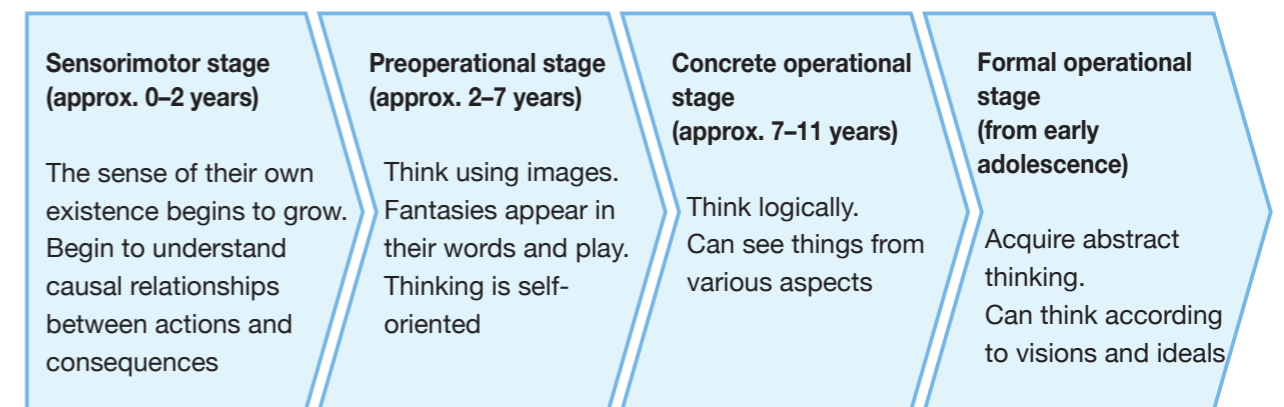


Figure 12.2 Piaget’s theory of cognitive development

b. Erickson’s life span development theory

Erik H. Erickson (an American developmental psychologist and psychoanalyst born in Germany, 1902-1994)⁵ divided the period of life from infancy to maturity into eight developmental stages by characterizing each stage according to specific skills acquired and behavioral tasks achieved, or **developmental tasks**. They are infancy (basic trust vs mistrust), early childhood (autonomy vs shame/doubt), preschool (initiative vs guilt), school age (industry vs inferiority), adolescence (identity establishment vs diffusion),

young adulthood (intimacy vs isolation), middle adulthood (generativity vs stagnation), and senium (integrity vs despair).

In Erikson's view, if the developmental tasks of each developmental stage are successfully achieved, the person will acquire a desirable nature, but if not, the person will emerge with an undesirable personality trait. For example, a main task for children of preschool age (about 3 to 4 years old) is to "do things on their own or depend on others," and then experience developmental crises, depending on whether they develop autonomy, or feel shame and doubt (e.g., a crisis over autonomous evacuation). If they can successfully achieve the task, they will acquire the spirit of independence and the sense of control, which will develop their will, but if they fail, they will lose confidence in their ability and feel ashamed of themselves. A task for children of early school age (about 4 to 5 years old) is whether they can do things on their own initiative, and they experience a crisis in which they face initiative or feelings of guilt about their negative attitude. If they successfully achieve it, they will develop a sense of purpose and the will to try new things, but if they fail, they will develop feelings of guilt or become passive. Children of late school age (about 5 to 12 years old) experience a crisis in which their ability to do things well is tested. After entering school, they begin to shift the focus of their social relations from the family to friends and teachers. If they play with friends, learn in class, do homework, and participate in school events well, they will come to feel confidence and pride in their ability, which will develop the industry necessary to work hard in school. Meanwhile, if they feel they do not do those things well enough compared with their friends, they will come to feel a sense of inferiority or a lack of confidence, which will increase the sense of maladjustment to school life. Through these experiences, a concept of self in school-age children is developed. Without question, support from parents, teachers, and friends, if provided to address the developmental tasks of this stage, will allow children to achieve the tasks more easily and their minds to develop even more healthily. It will also help address developmental tasks related to the establishment of identity in adolescence.

In adolescence (about 12 to 19 years old), children face the question of who they are and experience the major challenge of establishing identity. Once they obtain their roles in society through various experiences in studies, work, and social relations, they will be able to deepen self-understanding and become clearly conscious of themselves. Those who fail to find their roles or places to which they belong in society may become adults with vague self-consciousness. The development during and after young adulthood is not discussed in detail here.

(3) Development of the mind in the social aspect

Lastly, we discuss theories about development of the mind through social relations. The individual's self-recognition of "who I am" does not exist without the existence of others. That is because one needs another person who is different from oneself in order to confirm one another existence. For example, for development of the mind in infancy, relationships between the infant and the caregiver and fostering environment are important. **Rene Spitz** (an American pediatric psychiatrist and psychoanalyst born in Vienna, 1887-1974)⁶ discovered **hospitalism**, a phenomenon in which infants who are fostered in an institution away from their parents for some reason experience a delay in physical, intellectual, emotional, or language development because of a lack of adequate stimulation from parents, that is, a physical contact and emotional relationship with parents; this phenomenon had already become an issue in the

19th century. Infants develop their mind by interacting with their caregiver and fostering environment through the body.

The environment with which they interact is, according to a model presented in Adolescent health 21st century⁷, considered to be a **social ecosystem** consisting of schools, families, neighbourhood, and macro society. This social ecosystem affects human health throughout the entire life course from prior to birth to senium. Accordingly, the development of the human mind continues to be affected by the social ecosystem.

3) What is mental health?

According to the WHO, **mental health** is more than a condition free from mental disorder; it is the ability to think and learn and understand others' emotions and respond to them, as shown in the WHO's definition of health (see Chapter 1).⁸ In addition, mental health is a condition in which an individual's physical, psychological, social, cultural, and spiritual health and other related factors are balanced, and in which the individual is harmonized with the environment.⁸ Therefore, mental health is health with a totality that cannot be considered separately from things like physical, psychological, and social health. Moreover, it is health that is also inseparable from the environment.

The WHO also states that it is a condition in which an individual can smoothly exhibit his or her ability, cope with various stresses in daily life, and engage in work and studies to contribute to society. The WHO emphasizes the importance of mental health by describing that mental health is the foundation of abilities of groups and individuals that enables people to think humanly, communicate with each other, earn a living, and enjoy life.⁹

Given all of these things, mental health is considered to be a condition in which a person has the ability to live with independence (or sense of agency) as a human in this world and can display that ability. Thus, mental health in the developmental stage is viewed as a condition in which children can effectively exercise their abilities to, for example, think, learn, communicate, control behaviors and emotions, make decisions, and cope with stress in daily life according to their age (see the function of the prefrontal cortex), and at the same time, it is a condition in which those abilities can be enhanced to the highest levels that individuals can achieve because children are in the midst of growth and development.

4) Adolescents in the world and mental health

The WHO estimates that 10% to 20% of the adolescents in the world have mental health issues that are undiagnosed or untreated.¹⁰ Furthermore, young people with mental health issues are victims of a human rights violations as a result of social exclusion, discrimination, and **stigma** (a negative, discriminatory attitude that sees a person's specific characteristics as something shameful, abominable, and stained), and tend to have learning difficulty, show dangerous behaviors, and have physical health issues. The most common cause of mental health issues in young people is depression.

2. Stress in daily life and mental health

1) Mechanism for protecting the mind

To maintain mental health, we must continue to protect the mind by coping with various stresses and conflicts in daily life. The world has entered a stage in which our health is threatened by various stresses caused by social life, which came after the threat of infectious disease and the spread of lifestyle diseases. This section explains about **the psychological defense mechanism** that enables us to cope with various frustrations and conflicts inherent to human life.

Austrian psychoanalyst **Sigmund Freud** first proposed the defense mechanism, and Anna Freud (a daughter of Freud) developed it. Freud believed that the human mind consists of three layers: **superego, ego, and id** (es, unconsciousness). The superego is a sociocultural moral code that is internalized through, for example, parental discipline, and represents the mind consisting mainly of conscience, which takes actions by judging norms, morals, and right and wrong, while the id represents the mind of instinctive desires and drives, emotions, and the accumulation of past experiences. The ego represents the defensive function of the mind that receives moral requests from the superego (e.g., prohibition, ideals, and consideration for others), and desires and drives as well as emotions from the id (Freud attached particular importance to sexual desire and drive), experiences a conflict between the superego and the id, and seeks for reality adaptation by coordinating with the reality of the outside world.

The psychological defense mechanism is the action of the mind to mitigate unpleasant emotional experiences such as anxiety, depression, guilt, and shame that are caused when the ego is exposed to the instinctive desires and drives as well as emotions of the id, and is the unconscious action of the mind by which the ego attempts to resolve the crisis and readapt to reality.¹¹ In general, the defense mechanism is the means that the ego or the self uses to protect itself from desires that it wants to reject and unpleasant emotions and notions, and is a normal action of the mind that everyone experiences. However, if the defense mechanism is excessive or inadequate, it can lead to social maladjustment, causing problematic behavior or impairing the health of the mind and body.

The most basic example of the psychological defense mechanism is **repression**. It is the action of the ego that unconsciously excludes desires that it wants to reject (e.g., sexual desire), unpleasant notions and emotions (e.g., hostility), and threatening experiences from consciousness and puts a lid on them so that they will not enter the consciousness.¹² The id is assumed to be an unconscious space to store these unpleasant things through repression. Although repression can give a temporary escape from unpleasantness, the memory of a very difficult experience may enter the consciousness as an unexplained anxiety later, causing damage to mental health. Or it may appear as physical symptoms such as the inability to speak, walk, or sleep, despite no physical dysfunctions.

Another example of the defense mechanism against unacceptable notions, emotions, thoughts, and memories of experiences is **isolation**. It is the action of the mind that attempts to separate those unacceptable things from oneself and keeps them away. Unbearably difficult experiences may be confined so as not to be remembered, which is called dissociative amnesia.

Meanwhile, the psychological defense mechanism has not only unhealthy responses but also healthy or mature ones (e.g., altruism, humour, sublimation, and suppression).

Column: Various emotions and the control of emotions

A person has various emotions. According to the classical theory of emotional development, a person first acquires emotions of pleasantness and unpleasantness in infancy, and pleasantness is divided into joy and affection while unpleasantness is divided into anger and hatred; a person develops more complicated emotions with age. It has been said that the basic elements of emotions develop by 2 years of age and emotions become as various as those of adults by 5 years of age. However, recent studies point out that emotions such as joy, anger, and fear emerge as early as infancy.

Emotions themselves cannot necessarily be classified into good and bad ones, and there is no need to deny any emotion. Meanwhile, positive emotions such as enjoyment, joy, affection, trust, happiness, and surprise are easy to accept, but negative emotions including anger, jealousy, fear, conflict, hatred, sorrow, and shame are hard to accept. Thus, if negative emotions become excessive, they can result in problems by causing antisocial behavior such as harming oneself or others. One of the mechanisms of the mind that controls these negative emotions is the psychological defense mechanism. Coping behavior, social support, mindfulness, and meditation, which are discussed later, are also psychosocial means to control negative emotions.

2) Relation between mind and body, and psychosocial stress

(1) Hans Selye's stress theory¹³

Stress is originally an engineering term that means “pressure” applied to an object. In the late 1930's, Hungarian-Canadian physiologist **Hans Selye** found that strong demand from the outside world disturbs homeostasis (see Chapter 2) and causes nonspecific, physiological responses to the living body (e.g., swelling of the adrenal cortex, atrophy of the thymus, spleen, and lymph node, and gastric and duodenal bleeding/ulcers) in experiments with rats, and published the stress theory.¹³ Selye's stress theory was soon applied to humans, and research on the relation between stimulation from the psychosocial environment and human response began.

Environmental triggers that induce stress responses are stressors, which are largely classified into **physicochemical stressors** (e.g., noise, vibration, temperature, and chemical substances) and **psychosocial stressors** (e.g., human relations, events in school life, duties, characteristics and atmosphere of organizations including school, and economic conditions). In **psychosocial stressors**, there are **acute stressors**, which are **stressful life events**, and **chronic stressors**, which are **daily hassles**.

Stressful life events refer to events that cause changes to life and require efforts to adjust life and readapt. According to the scale that measures stressful life events,¹⁴ the stress level of changes in life after marriage is set at 50 as the standard, and rates the death of a spouse at 100, which is the highest level. A survey of Cambodian university students¹⁵ reported the three most common life events that they found difficult were as follows:

1. Marked decrease in your or your family's income
2. Frequent minor illness

3. Seeing poverty in Cambodia

Meanwhile, **daily hassles** refer to irritating or frustrating events that occur in interactions in one's daily life. In the daily life of university students, daily hassles may be an inability to understand classwork, excessive examinations and assignments including making reports, insufficient daily living expenses, or concerns about securing a job after graduation. The ten most common daily hassles for Cambodian university students¹⁵ are reported as follows:

1. Too many things to do at once
2. Struggling to meet academic standards
3. A lot of responsibilities
4. Important decisions about your future career
5. Poor health of a friend
6. Hard effort to get ahead
7. Financial burden
8. Difficulties with transportation
9. Social conflict over smoking
10. Social isolation

There are two ways to harm health: one is through stressors caused by events that in turn cause major changes to life, and the other is through stressors attributed to accumulation of daily irritations. Both stressful life events and daily hassles vary depending on society, culture, and living conditions, and it is therefore necessary to consider what constitutes stressors that harm human health by taking into account the society, culture, and living conditions of each country and region (urban areas or remote mountainous areas), including Cambodia's group harmony-oriented culture, which is different from Western individualism.

In any case, if harmful stressors cannot be removed and exposure to them continues, **stress responses (strain)** occur. Stress responses appear largely in the physical/physiological aspect (physical symptoms including elevation of blood pressure, palpitation, and headache/abdominal pain), the psychological

Table 12.1 Examples of areas and types of stress responses

| Area of stress responses | Types of stress responses |
|-------------------------------|--|
| Physical/physiological aspect | Elevation of blood pressure, malaise, dyspepsia, fatigability, sweating, insomnia, anorexia, palpitation, headache, abdominal pain, diarrhea, being prone to colds, substantial change in weight |
| Psychological aspect | Anxiety, tension, helplessness, depression, decrease of confidence/self-esteem, irritation, difficulty in concentrating, deterioration of memory/judgment, being passive |
| Behavioral aspect | Withdrawal, tardiness/ early leaving /absence, decrease of work efficiency and morale, increase of aggression, being pessimistic, being suspicious, diet refusal/overeating, tics, starting or increasing the amount of smoking/ alcohol drinking/drug intake, decrease of cooperativeness, change in appearance, unsanitary behavior, increase of errors and accidents, suicide attempt/suicidal ideation/self-harm |

aspect (psychological symptoms including anxiety, depression, and irritation), and the behavioral aspect (aggression, withdrawal, tardiness/absence, and errors and accidents) (Table 12.1).

Column: Mental health of Cambodian people

In a study of Cambodians' psychological symptoms, conducted by Dubois, et al.¹⁶ in the Kampong Cham province, 55% of the people reported experiences of violence and poverty related to the Khmer Rouge, and 42.4% had symptoms corresponding to the diagnosis of depression according to the DSM-4 standards while 53% and 7.3% had symptoms corresponding to the diagnoses of anxiety disorder and PTSD (Post-traumatic stress disorder), respectively. In addition, many people had multiple symptoms. The three most common stressful life events were lack of food and water, access to medical care, and housing. The frequency of PTSD was 28.4% in a study by De Jong, et al.¹⁷ and 14% in a study by Sonis, et al.,¹⁸ showing some difference due to study populations and periods. In addition, these studies are limited by simply applying the Western psychiatry diagnostic categories for PTSD, depression, and anxiety disorder to the stress experiences of Cambodian people.¹⁹

According to Nou,¹⁵ Cambodian university students' major stressors can be classified into five categories, one of which is their difficulty in getting white-collar jobs after graduation, such as non-manual work, specialists, or engineering/development work. Moreover, social disparities that allow only rich students to get good jobs have become a stressor. The subsequent stressor is changes in life, including the death of or separation from family members, a decrease in income, and poverty and the uncertain future of Cambodian society. Others include changes in society; Cambodia's political and social uncertainty have affected university students' daily life. The last is malnutrition resulting from environmental pollution (dust from unpaved roads) and poverty, which is reported to be a stressor that many university students suffer from. Further studies of life stressors are needed in the context of Cambodian life and society in detail.

The challenge of school mental health is to identify the stressors, stress responses, coping behaviors, supportive human relations, and a sense of control in the lives of elementary school, junior high school, and senior high school students in Cambodia.

(2) Mechanism of the mind-body connection

The remarkable points about the stress theory are that it revealed that stimulation from the psychosocial environment can induce responses in the physical/physiological aspect and cause physical diseases, and so it created the concept of **psychosomatic disease**.

For example, if a human relation problem such as bullying, harassment, or discrimination occurs, people will recognize and evaluate it. If the stimulation persists and it is determined by the cognitive appraisal to be a threat that cannot be eliminated soon, it will become a stressor, leading to various emotional responses, autonomic nervous system excitation, transmission of this excitation throughout the whole body via synapses, and evoking the body's responses (see Chapter 2 for responses of the autonomic nervous system). The cognitive appraisal of a stressor causes excitation of the sympathetic

nervous system or the parasympathetic nervous system. A body's responses vary depending on the released neurotransmitter. Representative hormones that transmit stress information are **cortisol** and **adrenaline**, which transmit excitation of the sympathetic nervous system. If this stress condition becomes chronic, the body will soon be exhausted and unable to maintain homeostasis, resulting in the onset of disease.

However, not all stresses are necessarily harmful. Good stress is called **eustress** and is conceptually distinguished from the harmful stress **distress**. Eustress leads to fulfillment in life and a sense of accomplishment and is referred to as "the salt of life." It is a metaphor meaning that consuming it too much will do harm to health, but we cannot live without taking it.

Column: Stress hormones and happy hormone

Cortisol and adrenaline are major hormones released when the human body responds to stress. These hormones elevate blood pressure and prepare the body for fight or flight response (see Chapter 2). Cortisol is a steroid hormone released by the adrenal cortex. Depending on the amount of secretion, it increases blood pressure and blood glucose levels, resulting in, for example, a decline in immune function.

Meanwhile, when a joyful or good thing (eustress) happens, dopamine, which is known as "the pleasure hormone," is released. As a result, the person is motivated to make better things happen. Besides dopamine, there are serotonin (known as "the hormone of reassurance") and oxytocin (known as "the hormone of love").

Column: Psychosomatic disease

Psychosomatic disease is a physical disease, whose onset and course are affected by psychosocial stress, and in which organic or functional abnormalities are confirmed. To understand psychosomatic disease, the mind-body connection is important for explaining the relation between psychosocial stress and physical symptoms or physiological abnormalities. Representative psychosomatic diseases include irritable bowel syndrome, gastric ulcer, bronchial asthma, hyperventilation syndrome, essential hypertension, and headaches (e.g., tension-type headache and migraine). Note that physical symptoms complained of by patients with depression or schizophrenia are not included in psychosomatic disease.

Column: Manic defense

There are many types of defense mechanisms that protect the ego when the person feels psychological stress, ranging from **immature defense mechanisms** (e.g., isolation of affect, rationalization, denial, and somatization) that tend to lead to maladjustment and mental health disorder to **mature defense mechanisms** (e.g., humour and suppression).²⁰

We introduce manic defense here. It is a behavior intended to hide from others by forcing oneself to be cheerful, to laugh, or become excited as if nothing happened, in order to divert the mind from

anxiety, depression, loneliness, and despair that result from psychosocial stressful events such as unpleasant or disappointing events and the experience of being hurt. However, such defense will not last long, and in fact, the person will soon be exhausted and feel seriously depressed. To avoid this situation, it is important to have someone reliable who will listen to and accept.

(3) Coping behavior toward, social support for, and a sense of control over stress

As a means to protect health of the mind and body from psychological conflicts and psychosocial stress, there are coping behaviors and social support in addition to psychological defense mechanisms.

a. Coping behavior

Stress-coping behaviors are actions and skills used to reduce threats, harmfulness, and stress responses that result from a stressor, and include **emotion-focused coping** that attempts to maintain the person's composure by controlling emotions (e.g., vent of emotions, resignation, and wishful thinking), **problem-focused coping** that tries to solve the problem (e.g., seeking for information and support and implementing solutions), and **cognitive appraisal-focused coping** that perceives the problem differently (e.g., redefinition and denial of the problem).

b. Social support

It is support that is provided and received in social relations. Although there are several classification methods, it can roughly be divided into emotional support, instrumental support, and appraisal support. **Emotional support** includes approaches to the emotional aspect, such as sympathetic understanding and sharing an experience. **Instrumental support** further includes **support by means, i.e. aid**, which is a direct intervention or support to solve the problem (e.g., lending money and giving assistance), and **informational support**, which is an indirect support through advice and information provision. Plus, there is **appraisal support**, which works to change perspectives and views on stressful events, or provides a positive appraisal.

Stress coping behaviors are the actions that people take when a stressor occurs. Social support, on the other hand, includes various types of support, such as support related to the occurrence of the stressor and support for coping with the stressful situation. Thus, social support has the effect of preventing the occurrence of stressors, reducing stress levels when stressors occur and people feel stressed, and providing support when stress responses occur. Therefore, in order to maintain mental health, it is important to establish reliable relationships with people who can provide support (e.g., family members/relatives, friends, and teachers) and to learn about socially provided programs and services. In Cambodia, however, the challenge is a lack of facilities, services, and programs that can provide mental health care.

c. Sense of control²¹

The key to overcoming difficult situations is to have the belief that one can overcome them by changing the surrounding circumstances, or the belief that one can overcome them by receiving the surrounding circumstances and adjusting them toward a solution. These senses are called **senses of control**. These senses of control are important psychological resources to adapt to developmental challenges and changes in each age group, and have positive effects on aspects of life, including health, studies, and work. The former self-initiated sense of control is **the primary sense of control**, which is emphasized in Western societies. Meanwhile, the harmonious sense of control is **the secondary sense of control**, which is a sense of control widely shared by people in East Asia. In the Asian cultural sphere, in order to cope with stressful events, it is important not only to aim to change the circumstances to meet one's desires but also to try to adapt oneself to the circumstances to reach a solution in which both are harmonized.

Column: The Western mind and the Asian mind

The concepts of the mind and mental health in psychology and psychiatry have been theorized on the basis of traditional Western social culture and modern Western science. Careful consideration must be given to determine whether this Western concept of the mind can universally be applied to non-Western social cultures, such as those in Asia, India, the Middle East, and Africa. Asia is divided into six areas, i.e., East Asia, Southeast Asia, North Asia, South Asia, West Asia, and Central Asia, and includes people who believe in religions representing various tenets of Buddhism, Islam, Hinduism, Judaism, and Christianity; therefore, it is better to think that the concepts of the mind and mental health based on Western values are different from those in Asian countries.

Take **mindfulness** as an example, which has recently been a topic of discussion. It originates from *sati*, a Pali word used in Theravada Buddhism. In Buddhism, a Western self-centered self-consciousness, which focuses on “me” separated from others (e.g., people and the environment), is denied, and instead of reducing all events to their elements and viewing them separately, people recognize that all events are mutually linked to take place and value the overall harmony. They concentrate on “the present moment” “as it is” with an unbiased mind through specific Buddhist practices, including meditation, and strive to reach “a constantly calm behavior (state) of the mind.” The concepts of the ego and the mind in Asian Buddhist thought are different from those in the West, and the healthy state of the mind also widely differs from the WHO's concept based on a demonstration of individuals' abilities as described above.

Note that there is mindfulness as a method for reducing stress, which is separated from religious significance and practiced for therapeutic effects. Nevertheless, mindfulness is something that aims for not only individuals' inner peace but also the peace of the group or the society that surrounds individuals.

3. Mental health challenges in Cambodia

1) Externalizing problems and internalizing problems

According to Achenbach, et al., the most common categories describing behavior disorders in psychopathological studies are “**internalizing**,” in which behavioral problems appear internally, and “**externalizing**,” in which they are expressed externally²². The American Psychiatric Association's diagnosis manual also explains that classifying behavior disorders broadly like this is more useful than looking at individual behavior disorders. For example, internalized problem behaviors include anxiety, depression, loneliness/sorrow, despair, suicidal ideation, physical symptoms, and withdrawal, and these represent a group of behaviors that are neurotic and excessively suppressed. It has been pointed out that these are frequently seen among girls in elementary, junior high, and high schools and increase their risks of dropping out of school, using drugs and suicide²³. Meanwhile, externalized problem behaviors include destructive/aggressive/antisocial behaviors (i.e., acts of violating rules and laws, such as fights, subversive activities, thefts, and telling lies) and hyperactive behaviors, and these represent a state in which behavioral suppression is insufficient²⁴. Note that externalized and internalized problem behaviors coexist and cannot be considered separately because anxiety or depression may be hidden behind antisocial behaviors.^{23,24}

A study of Cambodian-Americans²⁵ states that, although the use of official mental health services as well as guidance from parents, relatives, friends, and other people are necessary to address externalized problems (a 14-year-old boy's alcohol drinking in this research) and internalized problems (11-year-old boy's depression), it is effective for coping with externalized problems to administer punishment, teach manners, and place children in a training facility to discipline them. This view requires attention because it can create a foundation that allows for physical punishment. To address internalized problems, meanwhile, the study recommends letting children do what they like to do and spend their time as they please. It is necessary to develop coping methods that are effective in Cambodia by promoting the understanding of mental health through health education while taking into account Cambodian peoples' beliefs.

2) Post Traumatic Stress Disorder (PTSD) in relation to the Khmer Rouge and 2nd generation PTSD

It is estimated that approximately one-fifth (approx. 2 million people) of the Cambodian population died because of torture, execution, forced labour, hunger, or disease during the Khmer Rouge era (1975–1979). Even today, about 40 years later, some of the survivors and their children's generation are still suffering from **PTSD**, physical symptoms, and social maladjustment. A special tribunal, which started in 2006, is ongoing, and there are concerns over what influences the tribunal can have on Cambodian people. It is suspected that the tribunal may cause the people to reexperience past hardships, retraumatizing those who are seized by anger and a desire for revenge, which may lead to increasing the prevalence of PTSD among them. In previous studies, the prevalence of PTSD widely ranges from 7% to 86% among different studies.²⁶

Hinton, et al.²⁷ created the Cambodian Symptom and Syndrome Inventory (CSSI), a questionnaire sensitive to Cambodian culture to measure psychological health in order to assess the influences of psychic trauma experiences on Cambodian refugees who fled the massacre perpetrated by the Khmer Rouge (Table 12.2). It is a questionnaire that asks how much they suffered from these symptoms in the past four weeks. Respondents are requested to choose from among five ratings: 0 (not at all), 1 (a little bit), 2 (moderately), 3 (quite a bit), and 4 (extremely). It is shown that among these symptoms, the symptom of “13. thinking too much” (kut caraeum) among the “syndromes” is a key indicator of distress, and those with higher scores of this indicator tend to have higher DSM-IV PTSD scores. People with this symptom think too much about upsetting topics, past traumatic events, and death of/separation from loved ones. “Kut caraeum” may lead to physical symptoms such as headaches, dizziness, “wind attacks,” depletion of bodily energy, heart weakness, and memory loss.

Table 12.2 Contents of the Cambodian symptom and syndrome inventory (CSSI)

| Somatic symptoms | Syndromes |
|--------------------------------------|---|
| 1. Dizziness | <p>Somatic-focused syndromes</p> <ol style="list-style-type: none"> 1. Khyâl attacks 2. Standing up and feeling poorly to the point you feared fainting, khyâl overload, or heart attack 3. Neck soreness to the point you feared the neck vessels would burst 4. “Heart weakness” 5. Sputum moving upward and causing you to feel you couldn’t breathe or might have a heart arrest 6. Khyâl hitting up from your stomach, making you fear you might die of asphyxia 7. Fear of “death of the hands, death of the arms” (slap day slap ceung) 8. Excessive inner hotness (kdaw khnong) 9. Having a partial or full malaria attack 10. Out of energy to the point you feared having a khyâl attack or dying from depletion <p>Agoraphobia/motion-sickness syndromes</p> <ol style="list-style-type: none"> 11. “Poisoned by cars” (pul laan) 12. “Poisoned by people” (pul meunuh) <p>Emotion-focused syndromes</p> <ol style="list-style-type: none"> 13. “Thinking too much” 14. Toxique <p>Cognitive-capacity syndrome</p> <ol style="list-style-type: none"> 15. Forgetfulness/mental distraction (phluc pheang) 16. Light in the body as if your soul was not in your body 17. Fear that someone has sent an ampuu into your body 18. Fear of having low spiritual luck (rieusuy), high bad luck (krueh) 19. “Ghost pushing you down” (sleep paralysis) |
| 2. Standing up and feeling dizzy | |
| 3. Blurry vision | |
| 4. Tinnitus | |
| 5. Headache | |
| 6. Neck soreness | |
| 7. Palpitations | |
| 8. Shortness of breath | |
| 9. Chest tightness | |
| 10. Rising sputum | |
| 11. Stomach bloating/discomfort | |
| 12. Cold hands and feet | |
| 13. Numbness in the arms and feet | |
| 14. Sore arms and legs | |
| 15. Trembling of the arms and legs | |
| 16. Weakness | |
| 17. Poor appetite | |
| 18. Feeling of lightness in the body | |

This table cited from “Hinton et al., The relationship of PTSD to key somatic complaints and cultural syndromes among Cambodian refugees attending a psychiatric clinic: The Cambodian Somatic Symptom and Syndrome Inventory (CSSI). *Transcultural Psychiatry*, 50:347-370. 2013.”

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The 2nd generation PTSD due to transgenerational trauma is a concept that considers PTSD as a result of traumatic events experienced by parents’ generation affects their children, who did not directly experience those events, thus causing psychopathological symptoms. A study of Cambodian families has not clarified the mechanism of PTSD transmitted between generations but has shown that the higher the level of traumatic stress that a mother experienced in her life, the higher the daughter’s PTSD symptom rating. Psychic trauma experiences in the Khmer Rouge era are transmitted from mothers to daughters, and therefore, not only caring for mothers suffering from PTSD but also providing mental health care for their children is an important issue for Cambodia.

3) Bullying, violence, and harassment

a. Bullying

According to the 2013 Global School-based Student Health Survey (GSHS),²⁸ the percentages of elementary, junior high, and high school children who were **bullied** at least one day in the past 30 days in Cambodia were 22.4% for those aged 13 to 15 years and 22.3% for those aged 16 and 17 years, with no marked difference between the sexes. In this study, bullying was defined as follows: “Bullying occurs when a student or group of students say or do bad and unpleasant things to another student. It is also bullying when a student is teased a lot in an unpleasant way or when a student is left out of things on purpose. It is not bullying when two students of about the same strength or power argue or fight or when teasing is done in a friendly and fun way.”

UNICEF Cambodia²⁹ defines these three points as characteristics of bullying: an intentional (malicious) act that causes physical or psychological pain; a patterned, repeated behavior; and an attack by a stronger child. It recommends parents and teachers observe children by paying attention to the points below so that they will not miss any signs of bullying.

- Physical marks such as unexplained bruises, scratches, broken bones and healing wounds
- Fear of going to school or joining school events
- Being anxious, nervous or very vigilant
- Having few friends in school or outside of school
- Losing friends suddenly or avoiding social situations
- Clothing, electronics or other personal belongings being lost or destroyed
- Often asking for money
- Low academic performance
- Absenteeism, or calling from school asking to go home
- Trying to stay near adults
- Not sleeping well and having nightmares
- Complaining of headaches, stomach aches, or other physical ailments
- Regularly distressed after spending time online or on their phone (without a reasonable explanation)
- Becomes unusually secretive, especially when it comes to online activities
- Being aggressive or having angry outbursts

Recently, **cyber bullying** has become an issue not only in Cambodia but also around the world. The Mobile Phones and Internet Use in Cambodia 2016³⁰ reports that 48% of people access the internet or Facebook. In the meantime, the Digital 2021 Cambodia³¹ estimates that 8.86 million (54.2%) of the country's population (16.83 million, as of January 2021) are internet users, indicating that about half of the total population use the internet. The spread of social media creates new forms of bullying, violence, and harassment. According to a five-week public-opinion poll conducted by UNICEF, 85.7% of Cambodian youths aged 15 to 25 years are exposed to the risks of online violence, cyberbullying, and digital harassment.³² To address this situation, UNICEF has requested the Cambodian government develop new policies for protecting children from bullying and violence using cyber means such as SNS.

In UNICEF's study,³³ the definition of cyberbullying is as follows:

“Cyberbullying is bullying with the use of digital technologies. It can take place on social media, messaging platforms, gaming platforms, and mobile phones. It is repeated behavior, aimed at scaring, angering, or shaming those who are targeted. Examples include: spreading lies about or posting embarrassing photos of someone on social media, sending hurtful messages or threats via messaging platforms, impersonating someone and sending mean messages to others on their behalf.”

The study points out that cyberbullying has an impact on children psychologically (feeling upset, embarrassed, stupid, even angry), emotionally (feeling ashamed or losing interest in the things you love), and physically (tired (loss of sleep), or experiencing symptoms like stomach aches and headaches).³³

Although it is not easy to prevent bullying, it is important, first of all, for children to understand “what constitutes bullying” and not to blame themselves for being bullied. Children who are being bullied as well as those around them should say that bullying has occurred and tell adults. In addition, the adults and children around them need to create a safe classroom and school environment where bullying is not acceptable. In the current situation of most schools in Cambodia, the awareness and support of teachers and friends is essential as there is still no school counsellor. It is important to recognize that not only children who are being bullied but also those participating in bullying might be suffering from mental problems and seeking help.

b. Violence against children by teachers

The 2013 Cambodia Violence against Children Study³⁴ reports increasing violence against children in Cambodia. With regard to children aged 13 to 17 years, the percentage of those who have experienced physical violence was 58.2% for boys and 61.1% for girls, and approximately 68% suffered violence for the first time between the ages of 6 and 11 years, that is, during their elementary school age. Outside homes, violence is used by teachers. Concerning physical violence used against girls aged 13 to 17 years, 58.6% of the girls suffered violence from male teachers and 20.5% from female teachers; as for boys of the same age, the percentages were 51.7% and 18.0%, respectively.

Bullying mentioned above as well as violence by adults are thought to be two of the most stressful life events to which children are exposed. UNICEF estimates that children who experience violence will be subject to long-term negative effects on their intellectual, physical, and emotional development, which can result in a decline in labor power in the future and an economic loss of US\$168 million (accounting for 1.1% of the GDP in 2013), and points out that violence against children will cause

substantial damage to Cambodian society³⁵. In response, teachers have begun to receive training to learn educational methods that do not use violence in correcting children's behaviors and managing classes and how to build good relationships with children. Teachers in Cambodia are strongly required to serve as mentors of children and guide them in the right direction, build relationships in which children are respected, and understand different characteristics of children at different developmental stages ([see Chapter 3](#)).

4) Loneliness, anxiety, and depression

According to a study of people aged 21 and older across Cambodia, conducted using the Hopkins Symptom Checklist-25³⁶ in 2011, the percentage of people with high anxiety symptom scores (referred to as “anxiety”) was 18.35% for men and 31.72% for women, which represented a statistically significant difference between the sexes; and the percentage of people with high depression symptom scores (referred to as “depression”) also showed a difference between the sexes, with the percentages being 10.21% for men and 19.69% for women, indicating that the percentages of anxiety and depression are higher in women. Interestingly, in both psychological symptoms, no difference was found between urban and rural areas, but there was a difference with regards to educational background. The percentages of anxiety and depression were higher in those with lower education, and among those with no education, the percentages of anxiety and depression were 32.51% and 20.37%, respectively. In the general population, women with low education are presumed to be at high risk.

Meanwhile, in the results of the **GSHS-2013 Cambodia**, which surveyed elementary, junior high, and high school children, 49.0% “sometimes” feel **loneliness**, 4.8% feel it “most of the time,” and 0.9% “always” feel it. This indicates that 54.7% of the children feel loneliness sometimes or more frequently. A comparison of this percentage with the GSHS results of the neighbouring countries Laos (32.8%) and Vietnam (44.5%) shows that the percentage of children who feel loneliness is higher in Cambodia by 10%–20%. However, there was no marked difference in the percentage of those who answered that the number of close friends is 0, which was 5.0% for Cambodia, 4.8% for Laos, and 5.5% for Vietnam. Loneliness itself is something that everyone sometimes feels and not a mental health issue. Nevertheless, Cambodian children, who feel loneliness more frequently than their counterparts in neighbouring countries, might be at higher risk of depression, anxiety, low self-esteem, sleep disorder, self-mutilation, and suicide.

The results of the GSHS-2013 Cambodia²⁸ also shows that 42.4% of the children “sometimes” had the experience of “being unable to sleep at night because of worries,” 5.0% had it “most of the time,” and 1.0% “always” had it. This distribution is similar to that of loneliness, and 48.4% of the children experienced sleeplessness because of worries sometimes or more frequently. In a study conducted in Laos using the same items, “sometimes” was 29.9%, “most of the time” was 3.9%, and “always” was 1.1%, which totaled 34.8%. This is lower than the percentage in Cambodia by approximately 15%. These results suggest that the mental health of Cambodian children is poorer than that of their counterparts in neighbouring countries.

5) Suicide attempts, suicide

Suicide not only takes the life of a person but also constitutes a public health issue that can have a deep influence on the family and people around the person, as well as the school and the region. The suicide rate (the number of people who committed suicide per 100,000 population) in Cambodia for men was 6.2 in 2000, which slowly increased to 8.0 in 2007 and then gradually decreased to 7.0 in 2019. The rate for women, meanwhile, decreased every year from 3.9 in 2000 to 2.8 in 2019 (**Figure 12.3**).³⁷ The 2019 global average suicide rates are 12.58 for men and 5.68 for women, and Cambodia's suicide rate appears to be substantially lower than the global level. However, there is a previous study that reported a high suicide rate of 13–44 per 100,000 population,²⁶ and this warrants a highly accurate epidemiological study of suicide and statistics.

Concerning suicidal ideation and suicide attempts of young people, the GSHS-2013 Cambodia²⁸ shows that the percentage of those who seriously considered committing suicide during the past year is 6.4%, those who made a suicide plan was 8.8%, and those who made a suicide attempt was 6.7%. These children are at high risk of committing suicide in the future.

There are many possible psychological circumstances that may push children into suicide. Such circumstances are as follows:

- i) loneliness and isolation, which make them feel that they cannot trust anyone and are helpless;
- ii) a feeling of worthlessness, which makes them think it is not worth living;
- iii) unfocused intense anger because they cannot blame anyone for their sufferings and cannot solve them;
- iv) an assumption that their sufferings will never end and a feeling of despair; and as a result,
- v) psychological visual field constriction, which makes them preoccupied with suicide as the only solution.

As measures to counter suicide, there are **prevention** and **postvention**. Prevention means building relations with those who are close to children in daily life and who notice these changes; those who talk to them, and who are easy to talk to about their worries; and building relationships of trust with teachers. In many schools in Cambodia, systems that allow children to convey their worries, including allocation of health room teachers (like a school nurse) and school counsellors, are not in place, and therefore, it is necessary to train general teachers to listen to children receptively and supportively, as training to improve the quality of teachers.

Meanwhile, because one person's suicide can trigger a chain reaction or cluster of suicide, postvention aims to carefully observe children who are shocked by someone's suicide and depressed, as well as those who are feeling guilty about someone's suicide, and to consult with them to create an atmosphere in which they can easily talk. A triggering suicide is the suicide of someone such as a celebrity, like an actor, a person of the same age with the same trouble, a family member, a boyfriend or girlfriend, or a close friend. The principal and teachers are required to deal with the family of the child who committed suicide, and students in the same school and their guardians. In dealing with these people, it is necessary not to glorify or criticize the suicide and to be considerate to prevent the family of the deceased from suffering the **stigma** of suicide.

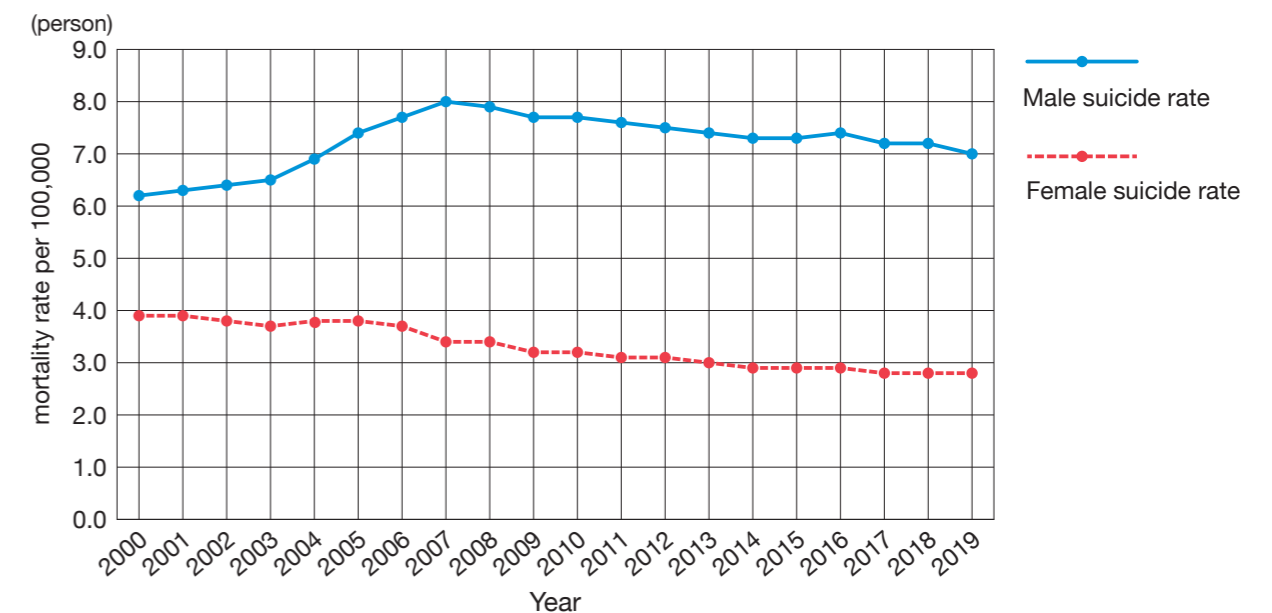
In school classes, health education can be provided, which includes methods for coping with stress,

how to send out an SOS and seek help, and learning the importance of life. In addition, one possible suicide prevention measure is to provide training for teachers so that they can learn how to listen to children and have a receptive attitude. It is also important to create a system that allows children to consult with adults in school, the community, and through SNS as an effort of society. At the same time, adults, including teachers and guardians, must pay careful attention to the fact that SNS may include information that induces suicide.

In suicide prevention measures, although individual measures are also important, the key is the whole school approach, in which the entire school considers the health of children as a whole and creates a healthy and supportive school environment (e.g., curriculums, school management policies, caring relationships, school culture and value, and the leadership of management and teachers) as explained in Chapter 1.

Column: Whole school approach

The whole school approach is thought to be the most effective health promotion method in which children, teachers and other staff of the school, guardians, and community members collaborate at the school in order to change the present situation of the school and improve the health and well-being of all the people. The whole school approach is characterized by, first of all, its perception that a school is the aggregate of many systems that depend on each other. The second characteristic is, therefore, efforts by all related people, who collaboratively participate in the process for changing the school to improve the health and well-being of all the people related to the school who change the system of the school as a whole by capitalizing on the resources and strengths of everyone.



This figure is created based on data obtained from The World Bank. Suicide Mortality Rate, Cambodia.
 Male: <https://data.worldbank.org/indicator/SH.STA.SUIC.MA.P5?end=2019&locations=KH&start=2000&view=chart>
 Female: <https://data.worldbank.org/indicator/SH.STA.SUIC.FE.P5?end=2019&locations=KH&start=2000&view=chart>

Figure 12.3 Mortality rate caused of suicide (per 100,000) in Cambodia

Column: Loss and grief, and grief care

There are various events in life that may include suicide, disasters and accidents, diseases, and unemployment, and we may be overwhelmed by sorrow when we lose loved ones, such as family members or someone close to us, or things that are important to us; or when we become ill or disabled and lose our health. The psychological (e.g., denial, depression, anger, sorrow, anxiety, and helplessness), physical (e.g., fatigue, sleep disorder, anorexia, and autonomic imbalance), and social (e.g., withdrawal, isolation, and increased alcohol drinking) reactions we experience when we lose loved ones are called **grief reactions**. These are normal reactions to loss; if we suppress sad feelings, we will suffer from psychological difficulties for a prolonged period, making such difficulties even harder to overcome. Grief is a long process, from the occurrence of an event to healing, and this process is called **grief work**. In the **grief care** part of this grief process, the most important thing is to respect and sympathetically listen to, as a person, the story of the person who is suffering from total (i.e., psychological, physical, social, and spiritual) pain. We must refrain from easily encouraging, persuading, or curing such a person.

6) Addiction and dependence

People can be dependent on various things besides alcohol. **Dependence** can broadly be divided into dependence on chemical substances (e.g., alcohol, cigarettes/nicotine, caffeine, amphetamine, narcotics, stimulants, and cannabis), which is **substance dependence**, and dependence on behaviors (e.g., eating disorder/overeating, gambles, games, internet, sex, and shopping/waste), which is **behavioral addiction**. Dependence is caused by changes in the functions of the brain, mind, and body due to the habitual use of a chemical substance, including alcohol and cigarettes, or a repetition of a behavior, such as gambling or games. Taking alcohol or engaging in a gambling activity gives the experience of enjoyment and a good feeling and stimulates a circuit in the brain called the reward system that transmits pleasure. The brain releases a neurotransmitter called dopamine that enhances this pleasure, creating a strong desire to experience this pleasure again. The desire to repeatedly experience this pleasure is satisfied, and when the drug use behavior is repeated, **resistance** develops because the same stimulus will no longer have the same effect as what was previously obtained from the drug or behavior. In this way, repeating drug ingestion or gambling change the functions of the brain, mind, and body, resulting in dependence. Therefore, in dependence, a condition in which the functions of the brain and body have been changed, the behavior cannot be stopped by one's own will.

There is **psychological dependence** and **physical dependence**. The former is, for example, the behavior of searching for a cigarette to get it when the person feels tempted to smoke, and the latter is, in the case of tobacco dependence, a condition in which **withdrawal symptoms**, such as irritation and hand tremors, occur when the nicotine concentration in the body decreases. In the case of alcohol dependence, autonomic nerve hyperactivity (e.g., sweating, hand tremors, elevation of blood pressure, and tachycardia) and psychological symptoms (e.g., hallucination, irritation, anxiety, and excitation) can appear. Note that not all chemical substances that cause substance dependence necessarily result in

physical dependence.

For information, the number of abusers of major drugs (amphetamine/methamphetamine [stimulants], cannabis, heroin, and narcotics) in Cambodia is estimated to exceed 2% of the population (for the 1998–2004 period), which makes the country one with the highest drug abuser rates in the Asia-Pacific region, which includes Hongkong, the Philippines, Thailand, Indonesia, Laos, and Malaysia.²⁶

Those who develop dependence need to receive medical care to treat their physical symptoms instead of trying to cure them on their own. A self-help group, which supports mental health, is effective at changing behaviors of dependence and addiction. Therefore, Cambodia is expected to set up self-help groups on various addictions.

4. Common mental diseases (schizophrenia and epilepsy)

1) Schizophrenia

Schizophrenia is one of the most common chronic mental diseases, affecting 7 to 10 people per 1000 population irrespective of differences in backgrounds such as society, culture, and ethnicity, and which can develop severe chronic psychological symptoms. The WHO estimates that 20 million people are affected by schizophrenia around the world.³⁸ Since no epidemiological study of schizophrenia has been conducted in Cambodia, the approximate number of patients, including those untreated and treated, is unknown. It has been reported that due to insufficient social understanding of the disease and psychiatric care, it takes 47 months for patients to start treatment.³⁹

Disorders resulting from schizophrenia appear in thinking, recognition, emotions, language, self-consciousness, and behaviors, and typical symptoms include delusion (e.g., being monitored by neighbours), hallucination (e.g., hearing someone talking when no one is there), disorders of consistency in conversation and behavior, lack of emotion or motivation, disorder of ego (one's idea is known to others), and loss of insight into disease. Therefore, in addition to the suffering of the patient, the family members taking care of the patient bear a heavy burden and are likely to be discriminated against by people around them. The disease tends to manifest in a person's late teens to thirties, and although the exact cause is unknown, a study of twins reported that the probability of a pair of twins developing schizophrenia is 50%, suggesting that it may be related to heredity, the rearing environment, and shared experience of stressful events.

The WHO points out that schizophrenia can be treated or cured, but for that, drug therapy, rehabilitation (e.g., life skills training, social skills training), and acceptance by the community are important.

2) Epilepsy

Like schizophrenia, epilepsy is a general mental disease, and according to the WHO,⁴⁰ approximately 50 million people are suffering from the disease around the world, with 80% living in low-middle income

countries without receiving treatment. The prevalence of epilepsy in Cambodia is estimated at 5.8 persons per 1000 population and reported to be lower than that in neighbouring countries such as Laos (7.7/1000 persons), Vietnam (10.7/1000 persons), and Thailand (7.2/1000 persons).⁴¹

Epilepsy is a disease characterized by recurrent “epileptic seizures” that cause a person to become unconscious and unresponsive suddenly. Symptoms are transient and subside if “epileptic seizures” disappear. However, a person may be injured depending on the place where the person collapses after losing consciousness due to a seizure, so that it is important to reduce the frequency of seizures.

The disease is said to occur at any age but is particularly frequent in children and elderly people. The causes of epilepsy can be identified in some cases, which include a brain tumour and a posttraumatic cerebral symptom, but they are unclear in other cases. Because about 70% of the afflicted can lead a normal social life by receiving a proper diagnosis and taking antiepileptics, there is no need to excessively restrict school attendance and work. Despite this fact, many people suffering from epilepsy are subject to stigma and discrimination.

5. Mental health care

1) Help-seeking behavior

According to a survey of 391 high school students in Grades 10 and 11 in Phnom Penh and the Prey Veng province, which investigated **help-seeking behavior**, the person(s)/information source(s) from whom/which they most frequently seek help to cope with their personal and emotional problems were, as a whole, their mothers (74.4%) and friends (73.9%), followed by fathers (51.4%), other relatives or family members (38.9%), internet chat rooms (29.9%), teachers (28.9%), their boyfriends/girlfriends (19.2%), and information on the internet (18.7%). Mental health professionals, doctors, and telephone counselling were around 8 to 11%, indicating that these are not as accessible as informal information sources. Religious figures were also chosen by about 10% of the students as persons from whom they seek help.

This result shows that family members, students, and teachers are likely to be chosen as persons to whom they talk about their mental health problems, including anxiety and depression, and therefore, efforts for mental health education in communities and schools are important. In addition, since they use the internet to search for information about mental health and persons from whom they seek advice, creating an internet website that provides accurate information about mental health is also a goal. (See TPO Cambodia, <https://tpocambodia.org/tips-for-good-mental-health/>, etc.)

High school students’ help-seeking behaviors differ between the sexes and among regions. It is noteworthy that boys are more likely to use internet chat rooms and websites to seek information and help than girls are, and that high school students in rural areas seek advice from teachers more frequently than those in urban areas do. This suggests that teachers play a greater role in rural areas with poor mental health resources and thus are required to receive education/training on counselling.

2) Counselling, mental health services

Globally, mental health issues are increasing, as are needs for counselling and mental health services. However, systems are insufficient in low- and middle-income countries, and particularly Cambodia, where mental health services and psychiatrists suffered devastating damage during the Khmer Rouge era, lagging far behind in this field. Moreover, mental health receives a lower policy priority than public hygiene challenges such as infectious diseases and lifestyle diseases; the challenge is to give a higher policy priority in light of the present situation of mental health in Cambodia.²⁶

Meanwhile, regarding the question of whether counselling is really effective in Cambodian society, it has been pointed out that building a healing relationship between an individual and a counsellor through “talking and listening” is effective in Cambodia as well. For counselling and mental health services to be in place, the challenges need to be addressed first, which includes the spread of education and knowledge on mental health, the human resource development of professionals (i.e., psychiatrists, nurses, clinical psychologists, and social workers) and subprofessionals (e.g., general practitioners, teachers, and community/health workers), as well as the improvement of the quality of training, and the improvement of the quality of mental health services as well as the elimination of the gap between urban and rural areas.²⁶

Counselling basically requires active listening skills, the ability to reflect on one’s own thinking and emotions, and the power to accept human diversity. Listed below are the 11 points that teachers should keep in mind support children with a mind adequate to counselling. Nevertheless, teachers are not mental health professionals and should fully understand their limitations.

- i) Do not try to elicit a solution or answer to the problem.
- ii) Create a receptive and relaxed atmosphere, and accept the child’s feelings.
- iii) Ask open questions. Do not interrogate.
- iv) Wait for the child’s answer as long as possible, and endure silence.
- v) Use the child’s words to convey the message that you “understand” them.
- vi) Express a positive interest in the child.
- vii) Show a natural, reasonable empathy.
- viii) To clarify the feelings of the student, use or appropriately paraphrase the child’s words.
- ix) To organize issues, summarize the story.
- x) Look at the problem from the child’s perspective and seek meaning from that perspective.
- xi) Believe in the child’s abilities to grow and solve problems.

Exercises for further thought and research

[12-1] What does it mean to have a healthy mind?

[12-2] Research the defense mechanism of the mind by referring to resources such as Britannica: Defense mechanism (<https://www.britannica.com/topic/defense-mechanism>). Discuss what kind of defense mechanism is commonly used in Cambodia. Research mature psychological defense mechanisms in particular.

[12-3] What is a mechanism by which the mind and the body are mutually affected?

- [12-4] What influence does stress have on mental health?
- [12-5] What are challenges in mental health in Cambodia? Discuss how they should be addressed.
- [12-6] Give examples of internalized and externalized problem behaviors. Summarize what you think about how to respond if a child seeks advice on such mental health problems, and discuss this topic in a group.
- [12-7] Discuss the reasons for and the backgrounds behind teachers' use of physical punishment in the education of children. How can you guide children without relying on physical punishment? Exchange ideas for alternatives.
- [12-8] Consider the person you will seek for help first when facing a personal problem, and why you chose that person.
- [12-9] Reflect on your experiences of being asked by your friends and family members about how they should address their problems, and review whether you practiced the points for supportive listening.

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Environment and health / Ecohealth

Learning objectives

You will be able to gain proper understanding and explain:

- What makes environment important for health of humans and survival of life.
- What effects each has on the health and lives of humans with several examples each of physical, chemical, biological, and cultural/psychosocial environments.
- The relationship between an environmental factor and human health based on its dose-response relationship.
- Through group work, and giving presentations, what impacts Cambodia's social and economic development has on the health of ecosystems, people's lives and main occupations (livelihood), and human health.

This chapter will discuss the effects environment has on human health, focusing on each of the following: categories of environmental factors as health risks; health effects of environmental pollution; the relationship between exposure levels and biological reaction; and environmental health issues of Cambodia addressed using an ecological health approach (loss of mangroves, deforestation and declining biodiversity, soil degradation, water pollution, vulnerability to climate change and natural disasters, landmines and unexploded ordnance, and deteriorating urban environment).

1. Importance of environmental health

First, we will look at what environmental health is and why it is important for human health. There are different definitions of “environmental health;” according to WHO:¹

“Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, chemical, biological, social, and psychosocial factors in the environment. It also refers to the theory and practices of assessing, correcting, controlling, and preventing those factors in the environment that can potentially affect the health of present and future generations adversely.”

Human health and quality of life are determined by physical, chemical, social, and psychosocial factors that are present in the environment. The prevention of illnesses and disabilities, therefore, calls for theories and practices to assess, correct, and control these environmental factors.

This means that, in the context of school health, environmental health provides educational opportunities for children to gain a deeper understanding about the environment, learn about risk factors in the environment that cause human illnesses and disabilities and about present-day environmental

issues, and think, together with teachers, about what can be done to maintain and improve the health and quality of people's lives in Cambodia as well as other countries.

What makes it important to address environmental health? According to WHO estimates, an unhealthy or unsanitary environment was responsible for as much as 23% of total global mortality or 12.6 million deaths worldwide, and for 26% of deaths in children younger than 5 years in 2012, which indicates that the environment has a large impact on human health.² Of the environmental factors, **environmental pollution** is the largest environmental cause of diseases and **premature deaths**. Diseases caused by environmental pollution were responsible for an estimated 9 million premature deaths or 16% of all deaths worldwide in 2015; this is estimated to be three times more deaths than from AIDS, tuberculosis, and malaria combined, and 15 times more than from all wars and other forms of violence.² It is evident that polluted environments significantly affect human health.

Among the different forms of environmental pollution, those of particular concern are **outdoor and indoor air pollution, water pollution, soil and food contamination by pesticides and other chemicals, and toxic/hazardous occupational exposure**. It should be noted that, compared to high-income countries, pollutants cause greater harm to the environment and human health in low- and middle-income countries, particularly pregnant women, fetuses, and infants, poor and minority populations, and residents of rural areas who make a living from agriculture and fisheries.² As a result of globalization, foreign capital seeking to secure food is making inroads into the agricultural and fishery industries of low- and middle-income countries, causing pollution of soil and waterways/groundwater through coastal development, deforestation, and use of pesticides/insecticides. In recent years, many countries are experiencing a concentration of population in cities, bringing global attention to the deterioration of urban environments such as vehicular exhaust and greenhouse gas emissions, domestic sewage pollution of rivers, and treatment of large quantities of waste. Cambodia is no exception. Though different countries and regions may face different pollutants, environmental pollution presents a major risk to the health of humans.

In low- and middle-income countries, including Cambodia, however, **environmental monitoring systems** are not well established yet, and few data are available on environmental pollution and other environmental issues. Building a system to gather and analyze environmental data is an undertaking that is necessary to promote effective environmental health measures. In the context of school health, providing environmental health education and Ecohealth education is a key to ensure understanding of the relationship between environment and ecosystems, human health, and social development.

2. What is an environment?

What does **environment** refer to, exactly? Living organisms are surrounded by many different conditions, objects, or circumstances of the external world, which are what constitutes the **environment**.³ For the purpose of this chapter, “environment” refers to that for humans, namely the conditions, objects, organisms, and circumstances of the external world that surround humans. While the external world that surrounds humankind is a limitless expanse, like outer space, we primarily discuss the **biosphere** (i.e., the life-supporting parts that extend around the Earth including the layers on and under the ground, the

atmosphere, and the hydrosphere; a sum of ecosystems where living and non-living things interact), and limit our discussion at most to the extent to which humankind has thus far reached into outer space. That being said, we may need to take certain other things into consideration, such as the sun and meteorites; humankind has not reached the sun, and yet it has tremendous influence over the Earth, while a meteorite can cause major climate or environmental change or disasters if it hits the Earth, which makes meteorites something that we may not be able to ignore for their influence over our environment and health.

Of the biosphere that is the **Earth's environment**, environments and ecosystems relevant to the quality of life and well-being of human will be discussed in this chapter (see [Chapter 1 for a definition of health](#)).

3. Human survival and the Earth's environment

Now, why is the **Earth's environment** important for us? As we all know, it is because it is the environment that possesses all the conditions that have made it possible for life (including humans) to begin, evolve, and prosper as humankind does today. These conditions, for instance, include at the very least: the atmosphere; water; food; stable climates; protective layers that shield against harmful cosmic rays and radiation; biological diversity; and adequate supply of thermal energy from the sun. These are the conditions that are indispensable for life activities of organisms, which means that if these conditions of the Earth's environment are disrupted, it poses a threat to the health, or even the survival, of humans.

One grave issue that have faced in recent years is the fact that human activities can cause environmental destruction, which threatens human health and survival. In particular, it is our short-sighted activities in pursuing immediate economic interest and social utility. In fact, it has been pointed out that some ancient civilizations collapsed as a result of serious environmental issues. One example is Easter Island, known for its giant stone statues. It has been established that the civilization on the island collapsed because its inhabitants harvested its scarce forest resources to build roads to transport the stone statues to various ritual platforms across the island, which resulted in soil sliding and erosion, making it impossible to produce enough food to sustain its population.⁴ Japan, in its effort to bounce back from its defeat in World War II, pursued a ten-year plan to double its national income starting in 1961 and promoted rapid industrialization, ultimately achieving spectacular economic growth. Behind these accomplishments, however, the nation suffered a tragedy; hazardous substances spewed from factories and polluted the environments and ecosystems, which destroyed the health of people in the communities, as represented by what are known as **the four big pollution diseases of Japan**, namely Minamata disease, Yokkaichi asthma, Itai-itai disease, and Niigata Minamata disease.⁵

What conditions, circumstances, or substances that are present in environments affect human health, including our quality of life and well-being? And what human or social behaviors cause what forms of ecosystem degradation and again affect human health, including our quality of life and well-being? We need to learn about these issues and consider what we can do to achieve **ecological health**, where environments/ecosystems are in harmony with human and social behaviors and human health (see [Chapter 1 to learn more about ecological health approaches](#)).

Column: Environmental pollution of methylmercury and the health of people

Minamata disease describes the poisoning from methylmercury compounds that affected the Minamata area along the coast of the Yatsushiro Sea in Kumamoto Prefecture, Japan. The cause of the environmental pollution was the release into the sea of methylmercury compounds, a by-product that occurs during the production of acetaldehyde, in the industrial wastewater from a factory owned by the Japan Nitrogenous Fertilizer Company. The methylmercury compounds polluted the environment of the Yatsushiro Sea, where fish and shellfish consumed the methylmercury compounds and passed them along the **food chain** in the ecosystem. This led to **bioaccumulation** of the pollutant, bringing about central nervous system disorders among humans and cats that ate polluted fish and shellfish due to mercury poisoning (see the Dose-Response Relationship section in this chapter to learn more about these symptoms).

The first patient identified was a young child who, in April 1956, exhibited severe symptoms, including difficulty speaking, walking, or eating. It was not until twelve years later in 1968 that the national government finally officially recognized Minamata disease as a pollution disease. During this twelve-year period, the nation experienced a plethora of social issues: various different theories and misunderstandings concerning the cause of the disease; counterarguments made by the company; prejudice, discrimination, and stigma against the patients and the local communities; lawsuits over patient certification; medical researchers making judgments in favor of the government and the company, and so on. It surfaced only recently that people inland had also suffered central nervous system disorders due to mercury poisoning after eating fish and shellfish from Minamata Bay, yet held back from seeking patient recognition for fear of discrimination, and that such inland sufferers had not received relief as the government would only certify coastal residents as Minamata disease patients. More than 60 years on, Minamata disease is still an issue.

Environmental pollution of mercury has raised concerns not only in Japan but in many countries. For instance, pollution of metallic mercury used for the refining of gold has been detected in the Brazilian Amazon basin, the Philippines, Tanzania, and Indonesia. In Cambodia, too, mercury was found at high concentrations in the hair of people who were living in fishery villages and who consumed large quantities of fish and shellfish, or those who were sorting waste at landfill sites.⁶ Increasing environmental pollution and resulting health hazards caused by mercury are of great concern in Cambodia.

4. Health and environment

1) Host-environment interaction

Broadly speaking, there are two ways to understand the relationship between our health and the environment. One is to find out what kinds of health issues and diseases occur as a result of exposure to the conditions, objects, or circumstances in the environment. The purpose is to identify hazardous substances or conditions in the environment and eliminate or improve them in order to secure health and

safety. This is an important and fundamental approach in environmental health and hygiene for the purpose of protecting the safety and health of workers, especially in work settings where workers are exposed to substances and environmental conditions that are different from those they are faced with in their everyday lives. This approach concerns the relationship between **environmental exposure** and **human health**.

For instance, the WHO Regional Office for the Western Pacific (where Cambodia is one of the non-Pacific Islands Countries and Areas) regarded unsafe water, poor sanitation, air pollution, hazardous chemicals and poisons, occupational hazards, and extreme weather as being examples of environmental determinants of health.⁷

With this approach, the relationship between humans and the environment may be understood as **host-environment interaction**, with environmental factors organized according to a category of the environments, such as **physical, chemical, biological, and cultural/psychosocial environments** (Table 13.1). In the real world, these environmental factors do not exist independently from one another; rather, they form the environment in combination and exert influence over the health and lives of humans as such (Figure 13.1). Figure 13.1 shows a model that illustrates the relationship between humans and their lifestyle activities and environment, in which an entity that has certain genetic characteristics and constitution as its internal environment, namely a human (i.e., host), comes in contact, through their lifestyle behaviors, with environments (physical/chemical, biological, and/or cultural/psychosocial) of the external world, and as the two influence each other, the health condition of the human is determined by the results of such interactions.

Take a working environment at a building construction site as an example. A worker who has certain genetic characteristics, constitution, and lifestyle would be exposed to physical factors such as vibrations, noise, high temperatures, ultraviolet light, and dust from building construction work. They may also be exposed to chemical factors such as organic solvents used for painting and adhesion, and if they smoked during a break, they would inhale various chemicals contained in the cigarettes, as well. If someone at

Table 13.1 Categories of environment and examples of environmental factors as health risks

| Category of environment | Examples of environmental factors |
|-------------------------|---|
| Physical | Vibrations, noise, electromagnetic waves, high temperatures, low temperatures, high voltage, humidity, radiation, ultraviolet, airborne particulate matter |
| Chemical | Dioxins, asbestos, organic solvents, mercury, lead, arsenic, pesticides/insecticides, food additives, pharmaceuticals, cosmetics, cigarettes and alcohols, illicit drugs, and other synthetic chemicals |
| Biological | Pathogenic microorganisms and parasites such as Escherichia coli O157, SARS, HIV (AIDS), and SARS-CoV-2, venomous snakes, wild animals, hygiene pests, mosquitos, plants |
| Cultural/psychosocial | Social systems and social organizations, political regimes, social norms, legal systems, values, discrimination/stigma, human relationships (including violence/abuse and bullying), overcrowding, family/kinships, religions, working conditions, financial situation, science and technology, academia, art |

their work site had COVID-19, they would have a higher likelihood of catching the virus, which is a biological environmental factor, as a close contact. Furthermore, at their workplace they may be influenced by cultural/psychosocial environmental factors, including working conditions (such as long working hours, working at high places, and uncertain employment contacts), stress from work relationships, and social norms of the employee population. Such diverse working environments are

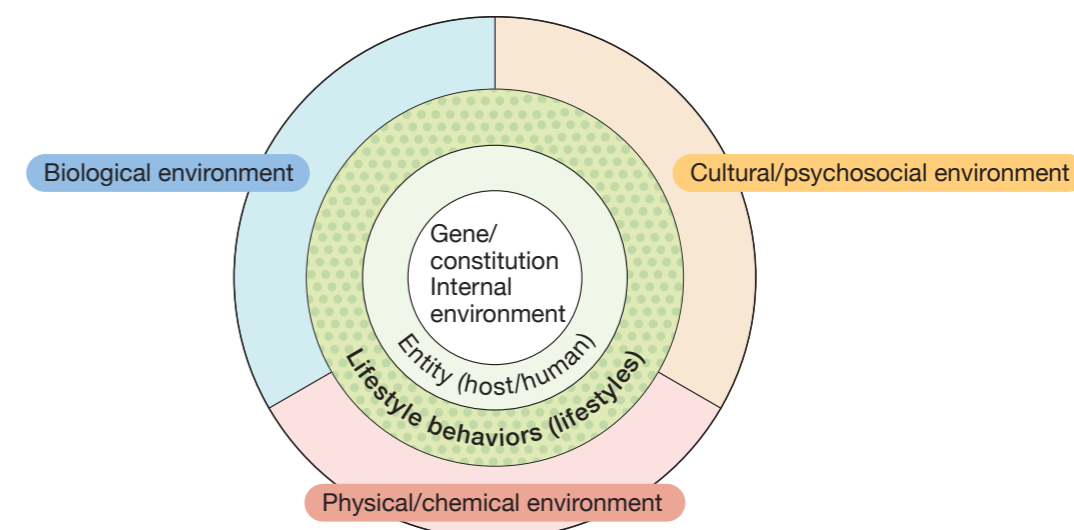


Figure 13.1 Model for the relationship between humans and their lifestyle behaviors and environment

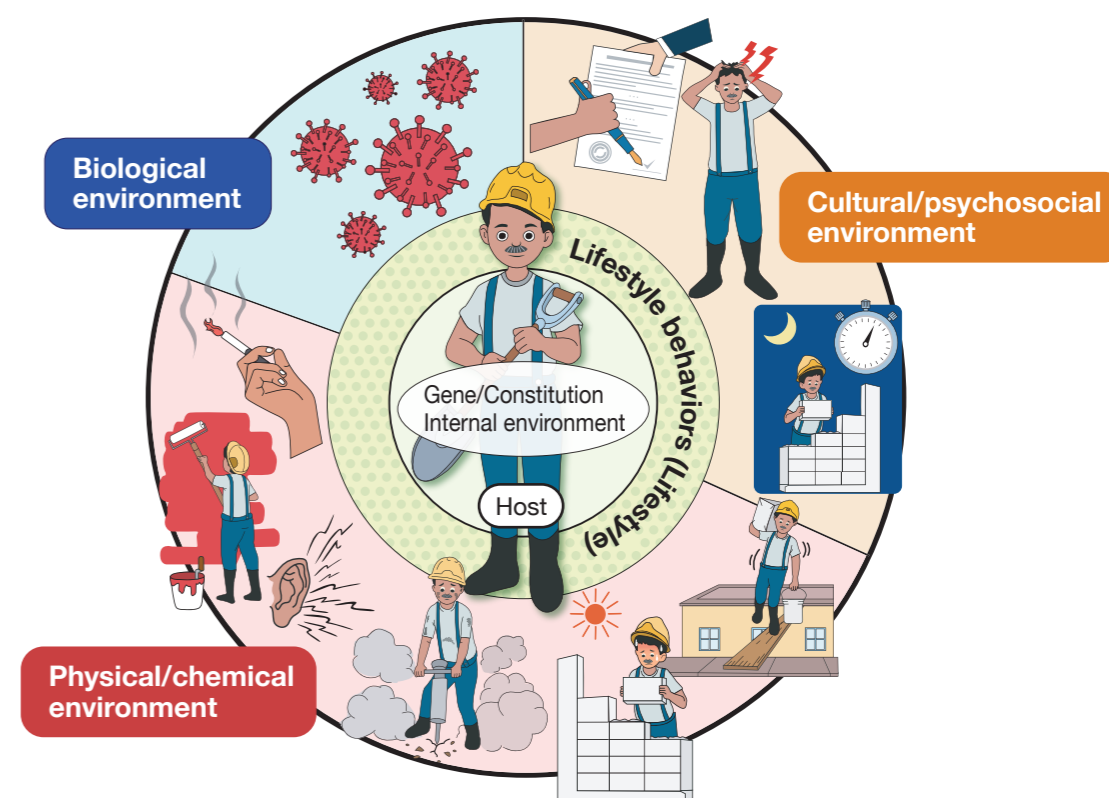


Figure 13.2 Human-environment relationships. A case of construction workers

believed to interact with a worker's biological and psychosocial characteristics, defining the health of the worker (Figure 13.2).

In a school environment, children's physical, mental, and social health is influenced by physical environment (e.g., light, sound, electricity, and temperature), chemical environment (water, air, and disinfectants), and biological environment (bacteria, viruses, and animals), which are explained in Chapter 4 in the discussion of school environmental health, as well as cultural/psychosocial environment, including children's relationships among themselves and with teachers, and classroom culture, which may involve issues such as bullying.

In the category of cultural/psychosocial environment, psychosocial stress has become an important issue as a factor that damages health. The health effects of life stress that people experience in their working, family, or school environment are addressed in Chapter 12 in the discussion of mental health.

2) Dose-response relationship

One of the ways to determine what kinds of health issues or diseases humans may develop as a result of exposure to a condition, object, or circumstance in the environment is to analyze its **dose-response relationship** (Figure 13.3) and show the related levels of harm and margin of safety. These provide a basis for establishing **environmental safety standards** or **permitted levels** for it.

This is a method to assess what kinds of health effects may result from what amount of exposure to a physical factor in the environment, such as radiation, or by taking in what amount of a chemical factor, such as organic mercury.

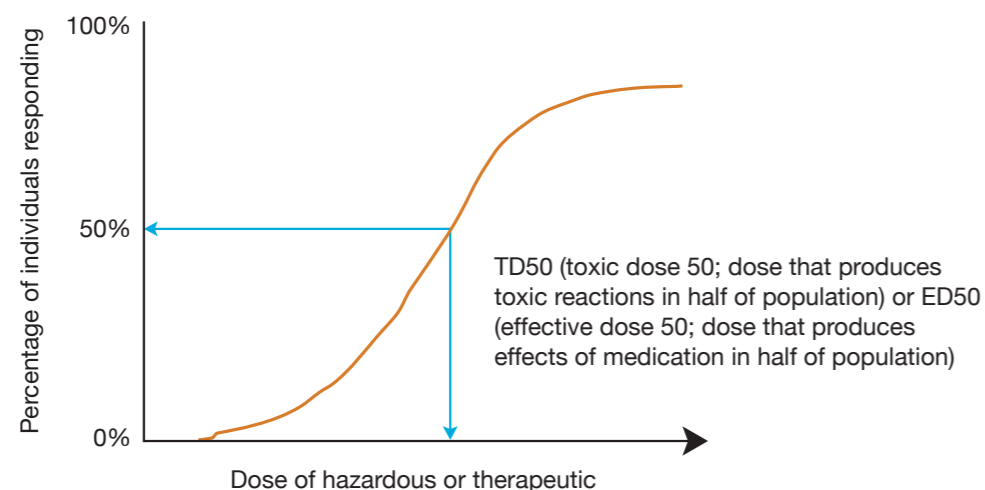


Figure 13.3 Sample dose-response curve

Figure 13.3 illustrates how this may look using **TD50 (toxic dose 50)**. Take methylmercury poisoning as an example. It is a form of health hazard caused by mercury contamination of the environment/ecosystem that is represented not only by Japan's Minamata disease but seen widely across the globe. Its TD50 refers to the dose at which half of the population exhibit the symptoms of methylmercury

poisoning, such as impairment of sensory functions, including seeing, hearing, smelling, tasting, and touching, and impaired ability to control the movements of limbs. In a case of a chemical used as a treatment, **ED50 (effective dose 50)** is used instead as an indicator of its efficacy, referring to the dose that produces a therapeutic effect in half of the population. In either case, the dose-response relationship such as the one illustrated in Figure 13.3 is used to evaluate levels of harm, therapeutic effect, and safety.

Column: Environmental risk factors in low-middle income countries

The **disability-adjusted life year (DALY)** is a summary measure of the overall impact of disease on the health of a human population. This measure is used to assess the impact of a disease on humans in a population level, based on the number of years of life lost due to premature mortality caused by the disease and the number of lost years of healthy life due to disabilities caused by the disease. The number of years "lost" used to be calculated using the **life expectancy** (i.e., the average number of additional years that a person of a given age is expected to live) of the Japanese as the standard, as Japan has historically had the longest life expectancy in the world. Recently, however, different approaches have sometimes been taken, such as the use of national life tables for individual countries.

Note that one DALY represents one year of healthy life lost in life expectancy because of a disease. A higher DALY value indicates a greater burden posed on human health and life by the particular disease or health risk.

Using DALYs as a measure, the Global Burden of Disease Study 2019 estimated the 20 leading risk factors for countries grouped according to the levels of their social and economic development.⁸ Thanks to its recent economic progress, Cambodia was now included in the group of low-middle-income countries.

For the group of these development levels, the leading environmental risk factors to health for females were⁸:

- Household air pollution (5th);
- Ambient particulate matter (7th);
- Unsafe water (8th);
- Unsafe sanitation (14th); and
- Handwashing (17th).

For males:

- Ambient particulate matter (6th);
- Household air pollution (8th);
- Unsafe water (12th);
- Unsafe sanitation (14th);
- Occupational injury (16th); and
- Handwashing (18th).

These data show that environmental pollution represents a significant health risk and that males, in particular, are exposed to occupational risk factors.

5. Ecosystem health and human health

As an approach to understand the relationship between health and the environment, we discussed the approach of looking at exposure to environmental factors and human health in the previous section. Another approach is that of environmental health, focusing on impacts of economic development on ecosystems based on the **development-ecosystem-life or main occupation (livelihood)-health** relationships. To help understand the social and economic development-ecosystem-life and main occupation (livelihood)-health relationships, we use examples of banana plantations in the column below.

Column: Truth behind banana plantations

It is believed that over a thousand kinds of bananas of different colors, shapes, and sizes are produced and consumed around the world. However, the Cavendish type makes up 47% of global production and 99% of exports. Cavendish bananas are all genetically identical clones, and overdependence on a single cultivar, or monoculture, poses the risk of disease spreading globally and causing tremendous damage to crops.⁹

While it is difficult to cite exact statistics on annual banana production, records show it was 114 million tonnes in 2017. The world's largest producer of bananas is India (29 million tonnes produced annually), followed by China (11 million tonnes) and the Philippines (7.5 million tonnes), with Ecuador and Brazil tying for 4th place (7 million tonnes). A majority of bananas produced in India and China are for domestic consumption with very little left for export; Ecuador, the Philippines, Costa Rica, Colombia, and Guatemala are the large exporters. India and China have seen expansions in domestic demand as a result of population growth, and between 2000 and 2015, they had an increase in production by 48% and 83%, respectively.⁹

Issues that surround banana plantations include the use of large quantities of chemicals, including pesticides, insecticides, and chemical fertilizers, to prevent diseases in banana crops and increase productivity, which can create soil and water pollution, exposing workers and residents to environmental pollution. In addition, the development of plantations may result in deforestation or land acquisition or leasing, which causes farmers to lose their land.

In Laos, for instance, many Chinese companies began arriving around 2010 and started operating banana plantations in the mountainous northern parts of the country, such as the provinces of Oudomxay and Luang Namtha. Bananas produced there were all for export to China. While these banana plantations generated jobs and income for the poor areas, they also brought about pollution of the local ecosystems and health hazards. Pollution of nearby rivers also killed large quantities of food fish, causing fisherfolk to lose work.¹⁰

In the summer of 2016, flooding led to massive spills of chemicals, polluting the ecosystems and environment of the region, and affecting the lives and health of the residents. This forced the Lao government to issue a ban on Chinese-owned banana plantations.¹⁰

Similar cases of soil and waterways/groundwater pollution and health hazards to residents caused by large-scale pesticide spraying and extensive use of insecticides and chemical fertilizers

have been seen in the Philippines, Mexico,¹¹ and Ecuador.¹²

1) What is an ecosystem? What is an ecological health approach?

An ecosystem is a concept of seeing all the organisms that live within a certain area, together with the abiotic environment, as one cohesive system, focusing on energy flows, food chains, and geochemical cycles (cycles of earth materials). Multiple layers of micro-ecosystems form one large ecosystem that is the Earth.

In the case of humans, for instance, ecosystems exist at multiple levels, from individual to family, neighborhood, school, and workplace, municipality, county, and province, nation, and the world; across these levels are cycles or flows of energy, materials, information, cultures, politics, and economy. In other words, all these levels, from individual to global, are linked together and influence one another through such cycles and flows.

Applying the concept of ecosystems to human health is known as the **ecological health approach**. According to these approaches, the health and healthy behaviors of humans are influenced by factors at various different ecological levels, while the behaviors and lives of humans exert influence over and bring about changes to ecosystems at various different levels. This means that the health and healthy behaviors of children who live in a given area of Cambodia are influenced by, and have influence over, ecosystems at different levels on a global scale, albeit to varying degrees.

When it comes to defining different levels of ecosystems, an article titled Adolescent health in the 21st century, for instance, suggests the following levels (from smaller to larger): individual adolescents; school/friends; family; neighborhood; and macro-level society.¹³ The US Centers for Disease Control and Prevention (CDC), meanwhile, as a framework for the prevention of violence, presents a social-ecological model, which comprises the following levels: individual; relationship; community (schools, workplaces, and neighborhoods), and societal (i.e., a larger society that forms norms and cultures concerning violence, or a society that has common politics, social policies, economy, and educational systems in it), which surround the lower levels.¹⁴

Using an ecological health approach, we can rearrange the health risk factors in the environment that are shown in **Table 13.1**; they exist in each level of an ecosystem, and they influence one another within a given level as well as across different levels, determining the health, healthy behaviors, and lives of individuals.

Column: Ecohealth and systems thinking

A system is a dynamic and complex whole, within which different elements influence one another. An ecosystem is a typical system where cycles or flows of energy, information, and materials occur among various elements that constitute the ecosystem. **Systems thinking** that is based on an ecological health approach is a concept that holds that, in an ecosystem which comprises multiple levels, different elements influence one another within or across levels, thereby defining the health of the ecosystem and that of humans. In cases of health issues such as dizziness, headaches, and

diarrhea among residents living near a banana plantation, for instance, issues of ecosystems and those of human health may be rising out of a complex web of elements influencing one another, including: the decisions made by the local authority to accept the company; standard of living, state of employment, and land use in the area; background factors for the company's entry into the area; operating policy and safety and health measures at the plantation; amounts of fertilizers and pesticides/insecticides used for banana plants and their levels of harm; geographical conditions of the rivers as sources of water; ways of life and main occupations of local residents; and levels of financial hardships of the residents. **Ecohealth** employs systems thinking to analyze and map such relationship, clear up complex issues, and find solutions.

2) Economic growth and social development in Cambodia

Cambodia is one of the more natural resource-rich countries in Southeast Asia, with resources including farmland, water/fishery/forest resources, minerals, oil, and natural gas. Putting these resources to good use promotes economic progress; in fact, the country has achieved steady economic growth over the past 20 years at an annual rate of 7.6%. Further economic progress may potentially reduce poverty.¹⁵ Cambodia is a country of great opportunities.

What we need to take into consideration here is that a prerequisite for economic progress based on natural resources is social development. Depending on the kind of development that is carried out, it can produce impacts not only on economic progress but also on the environment and ecosystems where the resources exist. It is therefore important to continuously monitor any impacts on the natural environment and ecosystems produced by development that is made for the sake of economic progress, because some of these impacts may have negative effects on the lives and health of people (see Column: Truth behind banana plantations). In addition, whether or not economic progress leads to a reduction in poverty also depends on social systems, such as redistribution of wealth and social security, as well as the national political system that is in place. Poor people and rural and remote areas where poverty rates are high and building an economic base is challenging are also the people and areas that are more vulnerable to issues related to natural environment and ecosystems.

3) Environmental issues in Cambodia

What kinds of environmental issues face Cambodia today? We will address this by referring to two reports, one by the University of Gothenburg in Sweden,¹⁵ and the other by the Ministry of Environment of Cambodia, titled Cambodia Environment Outlook.¹⁶

The primary environmental issues in Cambodia identified by the two reports include: **loss of mangroves; deforestation and declining biodiversity; soil degradation; water pollution; vulnerability to natural disasters (floods, droughts, and windstorms); climate change; land mines and other unexploded ordnance; waste pollution; and deteriorating urban environment.**^{15,16} These issues represent impacts on the ecosystems that are produced in ways that are connected to Cambodia's

economic growth and social development, and they arise in a complex, interconnected manner. If such an impact exceeds **ecosystem resilience**, even if economic growth and social development bring economic wealth to people's lives in the short term, ecosystem degradation will produce health hazards, which ultimately makes any such growth or development not worthwhile in the long term for people who live in the ecosystem. In other words, we cannot call it sustainable development.

(1) Coastal development and loss of mangroves

Mangroves are communities of plants that grow in intertidal zones (i.e., brackish water where freshwater and seawater mix, primarily in coastal areas or estuaries) in the tropics and subtropics. In addition to absorbing CO₂, mangroves help protect fishing grounds and biological diversity, and mitigate damage from cyclones and high tides. Cambodia's coastline (443 km), which makes up 14.7% of the country's borders, is on the Gulf of Thailand. A large portion of the coastline is found in the province of Koh Kong, which used to be the country's largest home to mangroves, accounting for 75% of all mangroves in Cambodia in 1992. However, illegal logging of mangroves by local inhabitants for the purpose of charcoal production destroyed the mangrove forests over a vast area. Over the course of around 30 years between 1973 and 2002, 40% of the mangrove areas were lost. Although reforestation efforts through replanting of mangroves have been made since 2000, the loss of mangroves has not been curbed, with as much as 45% of the mangroves lost by 2016/2017 compared to 1973.

Shrimp farms, which were introduced in 1989 and started expanding in 1991, also stimulated mangrove deforestation. Shrimp farming is practiced in four provinces, namely Kampot, Kep, Preah Sihanouk Ville, and Koh Kong, where large ponds were created close to or within mangrove forests.¹⁷ For that purpose, large swaths of mangrove forests were cut down. In Cambodia, the rapid destruction of mangrove forests has caused soil and water degradation, adversely affecting the lives of residents living on coastal fishing (i.e., livelihood). Furthermore, organic matter and chemicals, phytoplankton, and bacteria that are present in the effluent from shrimp farms may potentially degrade the ecosystems along the coast.¹⁷ If these issues cause the yields of fish to decrease and lead to declines in fisheries, it may result in food problems for Cambodia.^{15,17}

In addition, there are concerns that large-scale port development projects, offshore oil and natural gas drilling, and other development projects by the hotel business and tourism may also lead to mangrove deforestation.¹⁵

(2) Deforestation

Forests provide people with a place to preserve their traditional culture and gather food and fuelwood. In the context of the environment, forests help regulate climate at local levels, filtrate water, retain water to control river volumes, or prevent floods or mudslide disasters.^{16,18} Degradation of such forests is one of the environmental issues facing Cambodia.

The percentage of Cambodia's total land area covered by forest (forest area) was 75% in the late 1960s, but it declined to 60% in 1993, 59% in 2006, and was down to 47% in 2018. It has been pointed out that this rate of reduction in forest area in Cambodia is considered to be greater than those in its neighboring countries or international standards.¹⁶

Causes for deforestation include rubber tree plantations and logging for timber or charcoal

production.¹⁸ They also include constructing roads or securing land for residential use to accommodate an increasing population. Illegal logging is thought to account for 90% of deforestation, attributable to the lack of a forest management system, absence of rules and laws on land ownership, and the corruption that surrounds logging.^{15,16,18}

(3) Soil degradation

Cambodian soil tends to be of low fertility, and land productivity is low. According to 2001 statistics, agriculture accounts for only 21% of the total land area.¹⁶ To make matters worse, deforestation promotes soil erosion, while excessive use of pesticides to increase crop yields creates pollution of soil, water, and crops. These forms of pollution can ultimately threaten the safety of food and the health of humans. Agricultural practice that involves excessive use of pesticides is not sustainable.

The annual sum of pesticides imported to Cambodia was around 37,500 metric tonnes in 2019. It was approximately 3,300 metric tonnes for Laos, one of its neighbors; this means that, while their populations and land areas differ widely, Cambodia is importing, and presumably using, approximately ten times more pesticides than Laos. The sum was approximately 48,000 metric tonnes for Myanmar, while it was approximately 199,000 metric tonnes for Vietnam, which makes it a large importer.¹⁹

(4) Water pollution and water shortages

Cambodia is generally considered a water-rich country. However, around 3.4 million people, many of whom live in rural areas, lack access to safe water, and 5 million people have no access to improved water (see Column: Drinking water situation in Cambodia in Chapter 4). In five of thirteen provinces, naturally occurring arsenic has been detected in 9% of the groundwater sources at levels above the WHO standards, which makes the water hazardous for drinking.¹⁵ Furthermore, pesticides, when used in large volumes as mentioned earlier, are released not only into soil but into groundwater and rivers as well, polluting the water sources. Securing safe water in sufficient quantities is a challenge for Cambodia.

Meanwhile, the construction of impounding dams upstream in the Mekong River may have impacts on the flood pulse, fish resources and fisheries, agriculture, and downstream water supply. So far, the impacts of industrial effluents on water quality have been small, owing to slow industrial development.¹⁵

(5) Climate change and natural disasters

Cambodia is not yet highly industrialized and therefore has very low emissions of CO₂ and other **greenhouse gases**, which are contributing factors to **climate change**, with a per capita CO₂ emission of 0.97 metric tonnes in 2019,²⁰ compared to 4.14 metric tonnes for Thailand, 4.58 metric tonnes for Laos, 0.49 metric ton for Myanmar, and 2.57 metric tonnes for Vietnam.

The country has been less affected by climate change so far. Potential future increase in volume and frequency of rainfall and intensity of windstorm as a result of climate change, however, may lead to unseasonal floods, which, combined with soil degradation/erosion due to deforestation, may produce mudslide disasters. Such events may well produce extensive damage, given Cambodia is not highly resilient to natural disasters. Flooding itself has served to make the soil more fertile and produce benefits, and people have adjusted to dealing with seasonal flooding over the ages. Floods that come at unexpected times of the year due to climate change are difficult to respond to, however, potentially causing flood

damage and health hazards. Mudslides caused by soil degradation/erosion can deprive people of their houses or farmland, which may force them to relocate.¹⁵

In addition, if global warming brings about sea-level rises and mangrove forests are no longer in brackish water, it may also affect the ecosystems in the coastal areas.¹⁵

Health effects of concern produced by climate change or extreme weather events that are not natural disasters include vector-borne diseases (e.g., malaria, dengue fever), food security (malnutrition, famine), water-borne infection, food poisoning, rodent-borne infection, and non-communicable diseases.²¹

Column: Community-based tourism and ecotourism

Tourism is a growing industry globally. In 2014, it generated revenues of US\$7.6 trillion, which accounts for 10% of global GDP, and 277 million jobs. In the past, however, tours would be organized by travel agents both small and large, and such companies would take most of the profits, leaving very little to local communities. Tourism has also been responsible for environmental issues. As an alternative to such traditional tours, various types of **community-based tourism (CBT)** recently emerged in many countries, including Cambodia. With CBT, tours are organized and operated by members of the community. This makes their tours more aligned to the preservation of the local natural environment, society, and culture, while profits are given back to the community, which helps raise the standard of living of community members and empower the community. Compared to conventional styles of travel, CBT may also minimize damage to the local environment, society, and culture.

Community-based ecotourism that utilizes Cambodia's nature as an environmental resource may help improve the well-being and economic life of people while protecting the society and culture of the community as well as the well-being of ecosystems. People of the local community can earn income, which allows them to live in a manner that helps protect forest resources and valuable ecosystems such as mangrove forests. Tourists, meanwhile, can experience the true Cambodian nature, society, and culture. Hopes are high that community-based ecotourism will grow into a new style of tourism that is in keeping with the philosophy of Ecohealth, which promotes a harmonious balance among development, ecosystem health, life, the main occupations of people, and their health.

(6) Land mines and unexploded ordnance (UXO) (Figure 13.4)

It is estimated that there are **100 million mines buried in the ground globally**. As a result of the Vietnam War followed by a civil war that went on for around 20 years, Cambodia may have four to six million mines and over 2.4 million pieces of unexploded ordnance (UXO),²² leaving 40% of arable land inaccessible (see Column: Measures related to land mines in Cambodia in Chapter 14).

Between 1979 and 2015, land mines and UXO caused approximately 65,000 casualties. The number has been on the decline; according to the Cambodian Mine Action and Victim Assistance Authority, Cambodia recorded 111 casualties (18 killed; 93 injured) of mines and UXO in 2015. According to the



Photos provided by NGO JMAS (Japan Mine Action Service)

Figure 13.4 Mines and unexploded ordnance (UXO) in Cambodia

recorded cumulative total of casualties, 30% were killed, 56% were injured, and 14% had legs amputated. Casualties are unevenly distributed across the country, with Battambang being most heavily affected, followed by Bantey, Meanchey, and Siem Reap.²³

The effects of land mines and UXO span a broad range, from local economic activities such as agriculture and tourism to people's everyday lives, access to medical treatment, mental and physical health, and burden on families caring for victims. Specifically, mine injuries leave the victims and their families emotionally traumatized, negatively affecting their mental health; people who live in the area cannot feel safe; and mines and UXO restrict access to land that may be used for food production through farming or stockbreeding, other facilities, services or markets, or safe drinking water. These constraints, in turn, give rise to issues such as the following: food production, distribution, and supply are affected, causing food shortages and ultimately malnutrition; as the number of injured people increases, medical care, which is poor to begin with, becomes even more strained; financial burdens become greater due to medical fees for the treatment of casualties and a loss of earnings because they are unable to work; municipal governments have to divert funds for clearance of mines and UXO away from other local public services, including healthcare and education.²³ On the flip side, clearance of mines and UXO will resolve these issues; this is why international cooperation and aid for clearance of mines and UXO are important.

However, the area of land that was cleared of land mines and UXO during a five-year period between 2014 and 2018 was 190.52 km², compared to 890 km² of remaining contamination, which is 4.7 times as large as that of the cleared area.²⁴ At this rate, it will require another 25 years to rid Cambodia of mines and UXO.

In order to help keep people from falling victim to land mines and UXO, it is important to provide **mine risk education** in school health.²⁴ According to statistics, youth under 18 account for 11% of casualties, and a majority are boys (9%). What should we teach? A Japan-based international NGO²⁵ that is active in Myanmar, Afghanistan, and Uganda teaches the following:

- (i) The colors, shapes, and sizes of mines and UXO
- (ii) The typical locations where mines and UXO are found
- (iii) What to do if one encounters a mine or UXO

(7) Urban environment and health issues

As a result of population growth, many countries are seeing a migration of population from rural to urban areas, which is creating a concentration of people in cities, thus giving rise to various environmental and health issues that are unique to cities.

In Cambodia, population was growing at an annual rate of 2.2% up until 1970, when it reached 6.8 million. It then saw a sharp drop due to genocide under the Khmer Rouge. The population then recovered to its pre-genocide levels, and from 2010 onward, it grew at a rate of around 1.5% to reach 16.25 million in 2019. People in rural areas would depend on the use of natural resources in the environment for their livelihood; as a result of resource decline, however, there arose a trend of migration to urban areas to search for employment.^{15,16} According to estimates in World Urbanization Prospects,²⁶ **the rate of urbanization** (i.e., percentage of people living in urban areas) in Cambodia was 22.0% in 2020, compared to 78% of the population living in rural areas. The rate is estimated to reach only 36% by 2050. For reference, the 2020 estimate was 36% and 31% for Laos and Myanmar, respectively. Japan's rate of urbanization is approximately 92%.

While the advancement of urbanization is slow in Cambodia as a whole, Phnom Penh does have some concentration, with a population of 2.13 million (2019), which accounts for 14% of the overall population of the country. This is even higher than the proportion of Japan's national population living in metropolitan Tokyo (9%). The urbanization of Phnom Penh brings about levels of concentration of population that are comparable to those of capitals in European and North American countries. Phnom Penh's social infrastructure, however, is said to be not adequate to accommodate such a large population. The city's unemployment rate is twice as high as that of rural areas, at 9.2% versus 4.7%.¹⁵ The vulnerability and insufficiency of infrastructure in Phnom Penh is reflected in issues of waste treatment, drinking water, and wastewater treatment discussed in Chapter 4.

Urban environmental issues, unlike those of rural areas which concern natural environment and natural ecosystems, are issues of the **built environment** (Figure 13.5), which is created by people; it



Figure 13.5 The urban environment in Phnom Penh

involves many elements, including buildings, neighborhoods, streets, parks, transportation systems (including cars), housing, water supply and sewage disposal, energy grids, recreational facilities, distribution systems, information systems, industrial facilities, and commercial facilities (Figure 13.4).²⁷ Built environments, therefore, have large impacts on the **urban ecology** and human health. Human health may be determined by the following dichotomies, for instance: if one's physical activity is promoted or hindered; whether or not one can obtain health-promoting food; if one enjoys good or poor indoor or outdoor air quality; if one is socially excluded or isolated, or has smooth social relationships; whether or not one has access to safe water; whether or not there is a safe transportation system; whether or not one can get a job; whether or not one has elevated opportunities to become infected due to crowding, and so on.²⁷ It is necessary to monitor how Phnom Penh's built environments affect human health.

Exercises for further thought and research

- [13-1] Name environments that are important for the health of humans and survival of life and discuss why they are important.
- [13-2] Give one example each of physical, chemical, biological, cultural/psychosocial environments, and look into how they are related to human health.
- [13-3] Look for a case where Cambodia's social and economic development produces impacts on the health of ecosystems, people's lives and main occupations (livelihood), and human health. Review the case and draw a chart that illustrates what links lead to health issues.
- [13-4] Pick up one issue associated with urban built environments in Phnom Penh and look into how it is related to lives and health of humans.
- [13.5] Have a group discussion about which of the SDG 17 goals (Cambodia Sustainable Development Goal: <https://csdgs.org/km/>) the environmental health and ecological health issues correspond to.
- [13-6] Do research on organizations that are engaged in the protection of the environment or ecosystems and report the results.

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School safety and crisis management

Learning objectives

You will be able to gain proper understanding and explain:

- The concept of safety as well as the theory and method of crisis management.
- The present situation and characteristics of accidents involving children.
- The concept of, and measures for, school safety (i.e., daily life safety and traffic safety) that should be pursued in the future.

This chapter explains the basic concept of, and measures for, school safety. First, the outlines of the concept of safety, the psychological and physical traits of children, and the characteristic of their accidents are given. Then, explanations are provided about the present situation of traffic safety and the need for traffic safety education in Cambodia, and the basic concept of safety management and safety education in schools that should be pursued in the future.

1. Concepts of safety and danger

First, an explanation is given about the basic concepts of safety and danger.¹

1) Concept of safety

Safety refers to “a condition in which the lives and property of people are protected without being exposed to natural or unnatural harm in daily lives,” while “a factor or condition that can undermine the safety of people” is called a **danger** or **hazard**. A thing that can be evaluated with probability as a product of the seriousness of the hazard (the magnitude of the hazard and damage) and the probability of occurrence of the hazard is called a **risk** (see [Column: Hazard risk model](#)). A thing that cannot be evaluated with probability is an **uncertainty**, which is distinguished from a risk. A condition in which a risk has actually caused some kind of damage to the lives or property of people is called an **accident**, and damage to the human body caused by an accident is referred to as an **injury**.

For people who have undergone a certain level of development, it is easy to avoid “**visible danger (explicit danger)**” but difficult to avoid “**invisible danger (latent danger)**,” which often causes accidents. The basic measure to prevent accidents comes down to the detection and removal of danger before an accident occurs.

Column: Hazard risk model

To achieve safety, multiple basic safety theories have been developed from the standpoint of accident prevention. A hazard risk model, one of these theories, is explained in this chapter.

A hazard risk model is a theory on safety that has recently become common understanding in the fields of safety engineering as well as occupational safety and health.¹ This theory basically divides the concept of danger that can lead to the occurrence of harm (damage actually incurred) into hazard and risk. The methods for estimating risks vary among fields and disciplines, and the definition below is adopted for the prevention of accidents in the concept of crisis management in nursery/educational settings.

$$\text{Risk} = \text{Gravity of hazard} \times \text{Probability of occurrence of damage caused by the hazard}$$

Even when a hazard exists and its seriousness understood, if the probability of the hazard causing harm to people is zero or close to zero, then the risk will also be zero or close to zero.

Examples of hazards include bicycles, steps, doors, desks, and raised playground equipment. These are hazards that can cause collisions, stumbles, and falls. For the prevention of accidents, **the viewpoint of environmental improvement** is important, which includes eliminating hazards and taking effective measures to keep children away from hazards (e.g., attaching cushioning material to the corners of desks).

2) Disasters and accidents

A **disaster** refers to the occurrence of some kind of injury or damage to the lives, bodies, or property of people, which is caused by a danger resulting from a natural phenomenon or a human factor. Disasters can be divided into **natural disasters** (e.g., meteorological disasters and earthquakes) and **man-made disasters** (e.g., life disasters, traffic disasters, industrial accidents, criminal damage, and war damage that are caused in daily lives). Most man-made disasters are brought about by accidents. Accidents can be divided into **traffic accidents** in a broad sense (i.e., car, railway, airplane, and marine accidents) and **life accidents** caused in various situations in daily lives in general, including schools, homes, and communities (unexpected accidents that occur in daily lives, including suffocation, and stumbles/falls). Life accidents that occur in schools, including falling down stairs and injuries caused by aging playground equipment, can occur even during a break (see “6. School safety”).

2. Characteristics of accidents involving children from the standpoint of developmental stages

What kinds of accidents and injuries can occur from early childhood to adolescence? This section explains the characteristics of accidents and injuries that can occur from early childhood to adolescence, as well as the factors behind them.² Because the growth and development of the mind and body are

immature in these periods, it is necessary to deepen children’s understanding of safe behavior while improving the safety management of their surroundings.

1) Characteristics of the mind and body and behavior in early childhood

Early childhood is a period in which both mind and body significantly grow and develop. It is also a period in which the ability to communicate with others develops. Major physical characteristics in early childhood are as described below:

- i) Early childhood is a period in which relatively stable physical growth is seen.
- ii) It is a period in which visual and auditory functions develop toward completion.
- iii) The nervous system significantly develops, and coordination between multiple functions develops.

From the standpoint of behaving safely by avoiding danger, there are characteristics of growth and development that need to be taken into consideration. For example, immaturely developed visual and auditory senses may cause a delayed perception of danger. Although eyesight significantly develops in infancy, it is only when children turn five or six years old that it stabilizes to visual acuity of 1.0 or above. Binocular stereopsis is said to fully develop at around five years of age.

For auditory function, the important ability related to safety is the ability to determine sound localization (the position of a sound source), which also develops throughout early childhood. To avoid danger by quickly detecting the position of a car, it is essential to precisely determine the position of the sound source. However, even if visual and auditory functions have developed, the detection of danger may be delayed in cases where children are short in stature and have difficulty detecting things around them or in cases where children have little experience of danger. Because the adults’ perspective alone is likely to overlook danger, sufficient attention is needed from the children’s perspective.

The development of exercise capacity is another important factor to avoid danger. In exercise, coordination between the visual observation of the target and body movements is important. The rapid development of this coordination is a characteristic of early childhood.

2) Characteristics of the mind and body and behavior of elementary school students

During the six years of elementary school, major changes are seen in growth and development. In particular, children from 10 to 12 years of age are in the secondary rapid growth period and show a spurt of growth, which is represented by height growth. In this period, exercise capacity also develops, establishing the physical foundation needed to behave safely.

However, from the standpoint of safety, psychological/social or behavioral changes are characteristics that are more important than physical growth (Table 14.1). Elementary school students greatly expand

their field of activities, which is markedly different from early childhood, during which they lived under the protection of their parents. Accordingly, the possibility of encountering danger increases, which requires them to choose safe behavior on their own.

In the upper grades in particular, their inability to solve psychological problems can cause unstable conditions, which may then lead to a major accident/disaster; therefore, guidance, management, and consideration by adults around them are important. In addition, basic lifestyle habits centered around eating, exercise, and rest tend to become irregular as the child ages. After returning home on weekdays, elementary school students spend more time watching screens, including TV, games, and smartphones, except for the time spent on their assignments and chores. This kind of lifestyle pattern is likely to break the regularity of children’s lifestyle habits and involves the risk of having consequences on their health (see Chapter 5). Although this does not have direct effects on safe life, it may cause distractions in daily life or lead to dangerous behavior, which is mentioned later; thus, it cannot be ignored from the standpoint of safety education as well (see life accidents mentioned earlier).

Table 14.1 Psychological, social, and behavioral characteristics of elementary school students

| School age | Psychological, social | Behavioral |
|--------------|--|---|
| Lower grades | <ul style="list-style-type: none"> • Become able to understand the consequences of their behavior. • Come to have their own opinion and sometimes rebel against their parents. | <ul style="list-style-type: none"> • Impulsive behavior decreases. • Activities in a group consisting only of children increase. • Become able to show appropriate behavior by understanding the consequences of their behavior. |
| Upper grades | <ul style="list-style-type: none"> • Psychological problems increase, such as feeling stress and being unable to control their emotions. | <ul style="list-style-type: none"> • Tend to attach greater importance to relationships with friends than to those with adults (teachers, parents). • The inability to appropriately cope with problems may cause a psychologically unstable state and result in violence against people or destruction of things. • Come to show the behavior of losing control. • Come to exhibit a breakdown in basic lifestyle habits. • Spend more time on screens (TV, games, and smartphones) after returning home. |

Source: Adapted from Reference²

(1) Challenges in the safety education of elementary school students

Psychological development associated with the cause of behavior and the prediction of its consequences is an important factor from the standpoint of predicting and avoiding danger. Elementary school children come to easily understand this kind of causal relationship from the lower grades, allowing for effective

safety education in elementary schools. In elementary schools, students are required to start with the creation of an awareness of dangers around them through experiences and then gradually increase their knowledge of dangers and disasters. Particularly in the upper grades, it is effective to use information from mass media (TV, radio, and newspapers/magazines) and the internet to help students understand and consider safety in safety education.

Elementary school students are in a period in which they have a high normative consciousness and are willing to accept the guidance of adults; this period is considered suitable for safety education. However, in addition to providing safety education, it is also important for adults to serve as models of safety behavior. It is the basis of safety education for adults to set an example first, such as complying with regulations. Moreover, it is also important to gradually add consideration for the safety of others, particularly the safety of their family members, juniors, and elderly people, to the contents of teaching.

3) Characteristics of the mind and body and behavior of junior high school students

Reaching puberty in this period, students move toward being mentally independent from their parents, or they rebel against their parents and school more often than before. In junior high schools, the number of incidents of bullying and violence is larger than that in elementary and senior high schools, indicating that it is also a period in which the possibility of dangerous behavior, including problem behavior, increases (see Chapter 11).

The decline in normative consciousness is cited as a factor for dangerous behavior. Junior high school students tend to be more permissive about acts against social rules. Such examples include crossing a road by ignoring the traffic light and using a mobile phone/smartphone while walking. The decline in compliance with social norms does not directly lead to problem behavior, but as its relationship to drug abuse, for example, has been pointed out,³ it constitutes one of the important background factors.

Susceptibility to peer pressure is also a characteristic of this period. Students begin to show a tendency to be afraid of being left out of the group and thus dare to do something dangerous in order to attract attention from peers and enhance a sense of belonging to the peer group.

(1) Challenges of the safety education of junior high school students

The tendency to try to engage in **dangerous behavior** is not limited to particular children. Instead, it is generally seen in young people's normal process of development and plays an important role, good or bad, for their growth into adulthood. Dangerous behavior is a means of become independent from parents and get peers. Conversely, it may lead to a decline in the sense of compliance with social norms represented by school rules. This triggers various dangerous behaviors. It is thought that most dangerous behavior in this period is exploratory behavior (attempts), with only some leading to significant deviations and continuous dangerous behavior.

However, if it is a behavior that may lead children to damage themselves or others and possibly cause them to die, teachers are required to correctly tell their students the importance of respecting their own lives and those of others as well as the consequences of reckless behavior, and to provide justification

for behaving safely.

In addition, students need to learn in safety education not only the risk of becoming a victim of an incident/accident but also the potential risk of causing damage to others. For example, riding a bicycle recklessly or without a light can cause a collision with a pedestrian and may even take a person's life in the worst case. Even junior high school students need to be fully aware of their responsibility for traffic safety as citizens.

3. Causes of injuries in accidents involving minors⁴

Traffic accidents in Cambodia account for the largest percentage of injuries due to accidents, with 71.8% of those who were injured in the past 12 months being related to road accidents (Table 14.2). Of the injuries, falls and stumbles accounted for 9.7%, followed by snake or animal bites at 5.1%, violence at 2.4%, severe burns at 1.2%, and guns, drowning, and poisoning at less than 1% each. Others or unknown causes accounted for 9.2% of the injuries.

For **the injuries in those aged 0–9 years**, the leading cause was traffic accidents at 48.7%, followed by falls and stumbles at 22.5%, snake or animal bites at 13.5%, severe burning at 2.0%, violence at 1.5%, and other or unknown causes at 11.7%.

Among **injuries of those aged 10–19 years**, the leading cause was traffic accidents at 67.8%, followed by falls and stumbles at 9.2%, snake or animal bites at 5.1%, violence at 3.7%, severe burns at 2.0%, and others or unknown causes at 12.1%.

Table 14.2 Causes of injuries by age

| Age | Type of accident | | | | | | | | | |
|----------------|------------------|-------------------------|-------------------|----------|--------------|---------|----------------------|----------|--------|--------------------|
| | Road accident | Fall from tree/building | Snake/animal bite | Violence | Severe burns | Gunshot | Poisoning (chemical) | Drowning | Others | Don't know/missing |
| Injured | | | | | | | | | | |
| 0-9 | 48.7 | 22.5 | 13.5 | 1.5 | 2.0 | 0.0 | 0.0 | 0.0 | 6.6 | 5.1 |
| 10-19 | 67.8 | 9.2 | 5.1 | 3.7 | 2.0 | 0.0 | 0.0 | 0.0 | 12.1 | 0.0 |
| 20-39 | 79.4 | 6.1 | 3.3 | 2.7 | 1.1 | 0.7 | 0.4 | 0.0 | 6.3 | 0.0 |
| 40-59 | 73.1 | 11.1 | 4.5 | 1.6 | 0.9 | 0.1 | 0.6 | 0.0 | 8.2 | 0.0 |
| 60+ | 60.3 | 13.1 | 6.4 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 17.6 | 1.4 |
| Total | 71.8 | 9.7 | 5.1 | 2.4 | 1.2 | 0.3 | 0.3 | 0.0 | 8.6 | 0.6 |

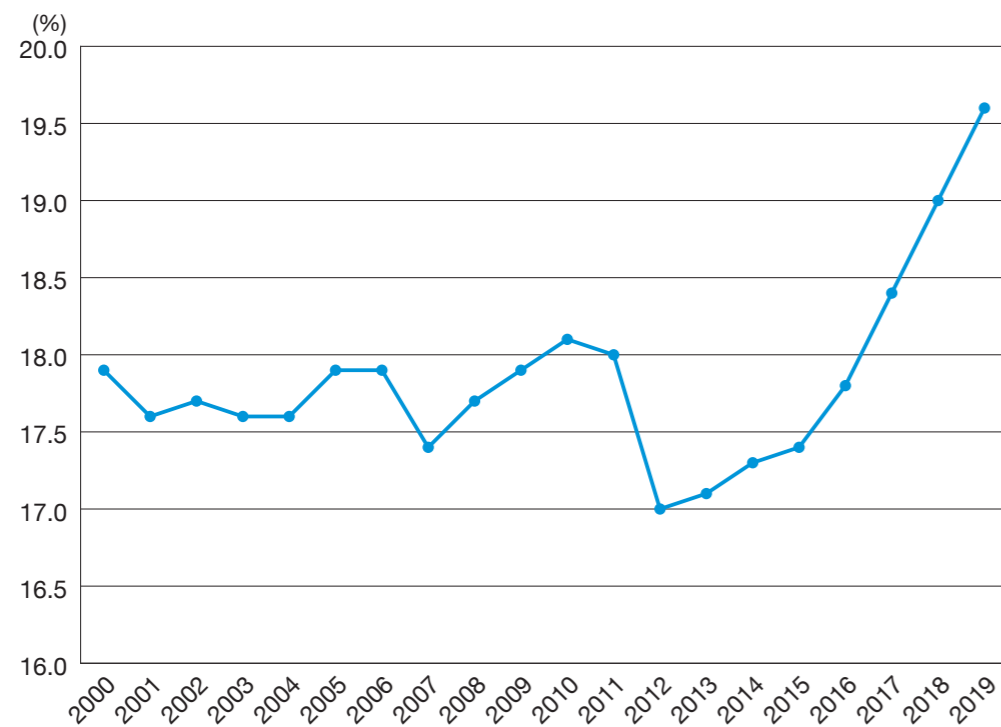
Percentage of the population injured in an accident in the past 12 months by type of accident according to age, Cambodia 2014
Source: Adapted from Reference⁴

4. Traffic safety and the prevention of traffic accidents

Traffic accidents are problems that we all face. In Cambodia, the mortality rate associated with traffic accidents is increasing every year (Figure 14.1).⁵ It is characterized by a large number of deaths associated with **motorcycles and tricycles**. The prevention of traffic accidents requires the establishment of relevant laws and regulations, the creation of a safe traffic environment (i.e., building road networks and improving the quality of existing roads), the inspection and maintenance of vehicles, and activities to educate people through traffic safety education.

The challenges in Cambodia include drivers' low awareness of the safety of **vulnerable road users** (i.e., children, elderly people, and pedestrians) and low awareness of compliance with laws (e.g., compliance with traffic regulations, helmet use, and particularly, not committing speed violations or driving under the influence of alcohol).

The contents of **traffic safety education** (Table 14.3) in schools include understanding dangers in various traffic situations as well as learning safe walking practice and the safe use of bicycles, motorcycles, and tricycles. In addition, it is important to be able to practice safe behavior by learning to **predict and avoid danger**. The major goals of traffic safety education are for children to behave in accordance with traffic rules and to take proper actions to protect themselves on their own, that is, “**stop**,” “**watch**,” and “**check**.”⁶ At the same time, these goals serve as the basis for **the creation of a safe traffic society**.



Source: Adapted from Reference⁵

Figure 14.1 Mortality rate caused by road traffic injury (per 100,000 population)

Table 14.3 Contents of traffic safety education

- i) Understanding dangers associated with walking on a road and crossing a road, and how to behave safely
- ii) Inspection/maintenance of bicycles and proper ways of riding them
- iii) Understanding the characteristics of motorcycles and tricycles, and their safe use
- iv) Understanding the characteristics of cars and how to behave safely in a driving car
- v) Correctly understanding and complying with traffic regulations
- vi) Understanding drivers' obligations and responsibilities, including cases where a bicycle is used
- vii) Understanding and considering the traffic safety of children, elderly people, disabled people, the sick and wounded, and pedestrians
- viii) Understanding the importance of creating a safe traffic society through active participation/cooperation
- ix) Functions of related organizations such as police and firefighters

Source: Created using Reference⁶

Column: School commuters' situations and the challenge of helmet use in Cambodia⁷

In Cambodia, the most common means of transportation is motorcycles. They account for more than 80% of the officially registered motor vehicles, with deaths caused by motorcycle accidents making up 67% of annual traffic fatalities. On top of that, the death toll is rising. Cambodia's law requires drivers to wear helmets but does not require passengers to do so. When both the driver and the passenger use a helmet, deaths can be avoided. The prevention of motorcycle accidents is an important challenge in Cambodia's traffic safety education.

Moreover, although the law allows people aged 16 years and older to drive motorcycles, this regulation is not strictly enforced. For example, we see students who live in areas far from their schools and who have difficulty commuting on foot or by bicycle, driving motorcycles to commute to school every day. There are often two or three students, sometimes even more, on a motorcycle, and they rarely wear helmets. This is a challenge for school attendance and safe commutes.

5. Prevention of criminal damage

With rapid urbanization and computerization, protecting against **criminal damage**, such as **abduction and injury**, has become an important challenge in school safety. The number of criminal damage cases through the use of the internet, which is related to the spread of smartphones and SNSs (social networking services), has increased, and the prevention of criminal damage involving schoolchildren has become an extremely important global challenge (see “Column: Children living in the digital age”). However, this challenge cannot be solved only through measures taken by schools; it should be addressed by the whole society.

This section explains how to respond to the presence of suspicious persons, which schools in Cambodia will also need to address in the future.²

1) Hardware aspect of crime prevention measures (facilities/installations)

As a crime prevention measure from the aspect of facilities/installations, the principles of “Securing visibility and territorial reinforcement/maintenance” and “Controlling access and entry” are important. These mean eliminating blind spots by improving visibility (Securing visibility and territorial reinforcement/maintenance) and preventing those attempting to commit crimes from accessing/entering the school premises and school building (Controlling access and entry). To this end, what can be done first in Cambodia is to place a fence around the premises and post a security guard. With a fence, it will also be possible to prevent entry by stray dogs and domestic animals, such as goats, and to prevent damage to the premises caused by unsanitary excretions as well as damage caused by wild dog bites.

Moreover, as the national and local economies develop, it may become possible to introduce security installations one by one, including security cameras and interphones, automatic lock systems at gates, and emergency alarm systems.

These installations are not expected to be highly effective without the software aspect of crisis management, which is mentioned later. Even with security cameras, if the system for intentionally monitoring them is inadequate, or the notification system has been cancelled, suspicious persons may easily gain entrance. It must be noted that hardware will be effective only when there is software enhancement.

2) Software aspect of crime prevention measures

It is important to establish a crisis management system in schools, and to devise and apply effective measures based on the system, and to devise and apply a crisis management manual. The points to achieve this are described below.

- i) Create a **crisis management system** by clarifying the roles of managers and the persons in charge of safety.
- ii) Collect information on suspicious persons around the school while collaborating with families and related organizations in the community.
- iii) Take feasible and effective measures depending on the various situations.
- iv) Collaborate with related organizations/institutions in the community, and seek cooperation from guardians and community residents.
- v) Create a **crisis management manual** suited to the situations of the school and the community. In this process, clarify the priority of responses in case of an incident/accident.
- vi) Conduct training to effectively apply the crisis management manual.
- vii) On the basis of challenges obtained through training, improve the crisis management manual to make it more functional.
- viii) Actively provide crisis management training for school personnel to enhance and maintain their awareness of crisis management.

Items that should be included in the crisis management manual for coping with the entry of suspicious

persons into the school are shown in chronological order (Table 14.4). It is important to give **the highest priority to the lives of people** in all items.

Table 14.4 Crisis management flow in case of entry by a suspicious person

| Item | Response |
|---|---|
| Early detection and checking of a suspicious person | <ul style="list-style-type: none"> • As a rule, ask the purpose of the visit before allowing a person into the school premises. • When there is a suspicious person in the school premises, say something to the person. • Ask a person without a proper reason to exit. |
| Prevention of human damage | <ul style="list-style-type: none"> • When school personnel sense danger or suspicion, promptly contact other staff of the school as well as police and related organizations. • If the person tries to use violence, take appropriate protective measures while promptly evacuating and guiding schoolchildren. • If someone is injured, give first-aid to the person and promptly check the safety of all people. |
| Appropriate subsequent response | <ul style="list-style-type: none"> • Promptly build an organization for post-incident response. • Grasp the situation of the incident and organize information. • Contact guardians. • Take measures to prevent recurrence. • Create a system for providing post-incident mental health care to schoolchildren, school personnel, and guardians. |
| Common matters | <ul style="list-style-type: none"> • Gather information at one place (e.g., the principal) and record it accurately. • Check one by one whether the critical situation was appropriately addressed and that nothing has been overlooked. |

Column: Children living in the digital age⁸

The United Nations International Children’s Emergency Fund (UNICEF) states in its report “Children in a digital world (2017)”⁸ that digital technology has already significantly changed the lives and life chances of children. It points out the advantage of this technology by saying that if the technology becomes equally accessible all over the world in the right way, children will be able to connect to life chances around the world and gain skills and knowledge from a variety of learning resources by overcoming disadvantages due to poverty, race, ethnicity, gender, and geographical conditions.

Meanwhile, digital technology has negative aspects as well as positive prospects. One example is the digital divide, by which poorer countries and remote areas within those countries are left behind in terms of “global” information because of their underdeveloped internet infrastructure. In addition, there is harm that can be caused to children’s online lives, such as the amplification of existing harm like cyber bullying, the occurrence of new forms of sexual abuse and exploitation, and websites containing information that could induce children to commit suicide and crimes. There has been damage that is serious and less visible from people who are around children. UNICEF cautions that particularly in areas in which the internet has recently spread, such as Africa and Southeast

Asia, inadequate safeguards are exposing children to major risks on the internet.

As a matter of course, guardians are concerned about children's health issues, including effects on eye health, internet addiction disorder, depression, and obesity.

Column: Natural disasters that frequently occur around the world²

Natural disasters frequently occur and cause heavy damage around the world. Flooding alone accounted for 47% of all weather-related disasters (1995-2015), affecting 2.3 billion people, the majority of whom (95%) live in Asia. It has been reported that about 90% of the people who lost their lives lived in low-income countries.⁹

In the international community, the 1990s was designated as the "International Decade for Natural Disaster Reduction," and since then, the United Nations Office for Disaster Risk Reduction (UNDRR) has taken the initiative to promote international cooperation aimed at reducing damage caused by natural disasters.

It is necessary to provide disaster prevention education in schools and communities, and consider what schools can do to protect the lives of children and community residents in case of a natural disaster.

Column: Response to lightning¹⁰

Lightning occurs as follows: Static electricity is generated when light air warmed by sunlight during the day ascends while the upper cool air descends. This static electricity is built up in clouds, and electricity that the clouds cannot hold any longer is discharged as lightning. The effects of lightning on the human body are **the direct lightning stroke** and **the side flash**. The direct lightning stroke is lightning that strikes the human body directly from the cloud. In this case, 80% of victims lose their lives. Areas surrounded by open space, such as flat areas and mountaintops, are dangerous. The side flash is lightning that rebounds off a tree or other tall object struck by the lightning to a person staying near the tree; or receiving an electric shock through the ground from a tree struck by lightning.

Evacuating to a safe place before lightning is generated is important. When you notice signs of lightning, such as black clouds approaching or the sound of thunder, shelter in a house, building, or car. Removing metals from the body or wearing an insulator like rubber boots will not protect a person from a lightning strike.

If there is no building that can serve as a shelter, shelter under a tall object that is at least five meters high (i.e., a utility pole, chimney, or steel tower). In doing so, keep a distance of four meters or more from the object while staying within a zone that allows you to look up at the top of the object at an angle of 45 degrees or greater. Staying close to the object will increase the risk of receiving a side flash. Facing down or lying on the ground will also increase the risk of receiving a side flash. It is advisable to **crouch and keep your head as low as possible** (Figure 14.2).

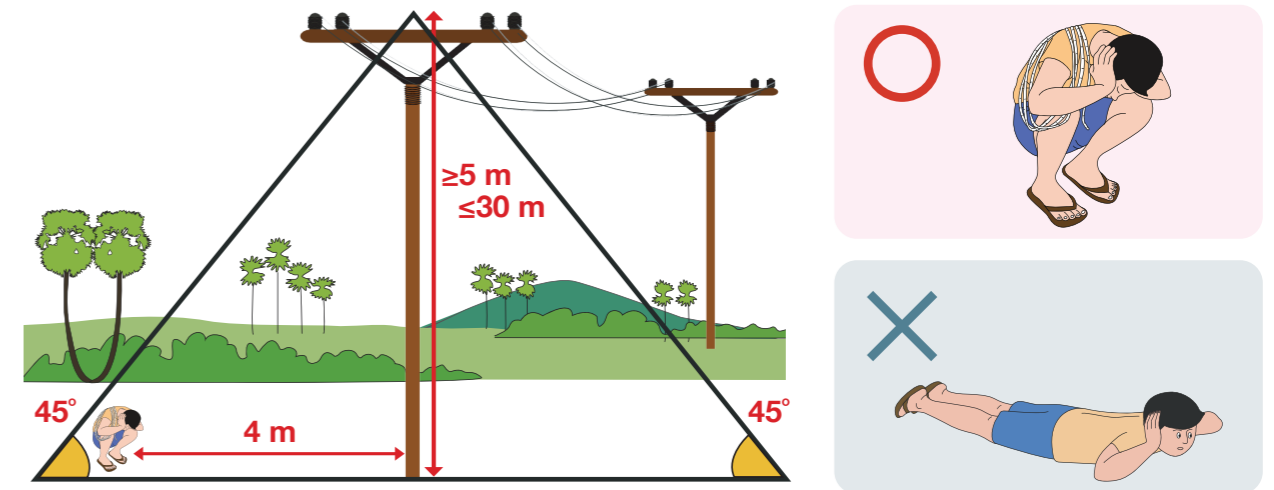


Figure 14.2 Response to lightning¹⁰

6. School safety

This section explains the concept of safety at school.⁶ **School safety** should be addressed with school health in an integrated manner in order to ensure the health and safety of schoolchildren, and to develop the basic knowledge that enables them to nurture mental and physical health and remain safe throughout their lives. **School safety is aimed at** developing schoolchildren's qualifications/skills to behave safely on their own and contribute to the safety of others and society on the basis of respect for their own lives and those of others, as well as at creating an environment to ensure the safety of schoolchildren.

School safety has three fields: **Daily Life Safety**, **Traffic Safety**, and **Disaster Safety (disaster prevention)** (Table 14.5).

Accidents that can occur during school time include accidental falls from stairs, a landing, a veranda, or a balcony, which require sufficient attention in safety management in schools. In addition, accidents caused by the deterioration or lack of proper maintenance of building structures and facilities/installations in schools cannot be overlooked.

In recent years, there has been concern about critical events that take advantage of changes in the environment surrounding schoolchildren, such as the spread of smartphones and SNSs, and which target schools (see Column: Children living in the digital age). Since critical events surrounding schools change as the times and society change, the way school safety operates needs to be flexibly reviewed to respond to the emergence of new critical events that were not considered in the past.

Activities for school safety consist of three major activities, namely, **safety education**, which is aimed at developing schoolchildren's abilities to safely behave on their own and contribute to the safety of others and society by predicting various dangers latent in their own behavior and environment, **safety management**, which is aimed at making the environment surrounding schoolchildren safe, and **organizational activities**, which facilitate both activities.

Table 14.5 Major contents of school safety

| Field | Contents |
|---------------------------------------|---|
| Daily Life Safety | <ul style="list-style-type: none"> • Injuries and accidents while studying or during school time • Incidents and accidents in family life • Prevention of crime damage (e.g., abduction, bodily harm, theft, and abuse of the network) • Dangers in school routes, safe way to commute to school • Safety of the school environment (facilities/installations), creation of a safe environment |
| Traffic Safety | <ul style="list-style-type: none"> • Danger, safety, and the prevention of accidents in various traffic situations • Inspection/maintenance of bicycles, understanding the characters of motorcycles, tricycles, and cars, and safety while riding them • Correct understanding of , and compliance with, traffic regulations • Creation of a safe traffic society based on new scientific technology |
| Disaster Safety (Disaster prevention) | <ul style="list-style-type: none"> • Understanding the dangers of natural disasters (i.e., wind and flood damage, drought and famine, lightning, earthquakes, tsunamis, forest fire, and volcanos) • Understanding dangers in case of a fire or disaster, and how to behave safely • Use of information on disasters and preparedness for disasters • Mental health care during and after a disaster |

Source: Created using references^{1,2,11,12}

7. Crisis management in schools

1) Concept of crisis management in schools⁶

Crisis management in schools must reflect the realities of schools, families, communities, and related organizations. In addition, it needs to assume various situations, including learning time both in and out of school, during commutes, breaks, lunch time, school events, and during the absence of a principal, vice-principal, or person in charge of safety, and requires drawing up a plan that can cope adequately with a variety of incidents/accidents. The most important aspect is to give the highest priority to the security of schoolchildren. The document that states these matters for the purpose of their implementation is called a **school safety plan**.

To conduct proper crisis management, it is necessary to prepare a detailed school safety plan in advance. In considering a school safety plan, the three activities, that is, activities related to safety education, activities related to safety management, and organizational activities related to safety, need to

be correlated. The document that specifically provides necessary matters and procedures to properly respond to the process from the occurrence of the accident to emerging from the crisis and restoring safety is called a **crisis management manual**. On the basis of these matters, schools need to create their own crisis management manuals and share a common understanding among all school personnel so that they can properly respond every day as well as in emergencies. In addition, it requires continuous verification and improvement.

2) Actual practice of crisis management in schools¹⁰

Crisis management in schools is divided into preventing incidents/accidents through early detection of danger (risk prevention), ensuring the safety of children and school personnel (risk management), and preventing the spread of damage through a prompt and proper response to incidents/accidents as well as subsequent measures (crisis management). Crisis management in schools is chronologically classified into the four phases below (**Table 14.6**). The content and flow of these phases are specifically explained below.

Table 14.6 Crisis management in school

| Phase | Crisis management item | Specific activity |
|---------------|--|---|
| 1 Prevention | Prevent incidents/accidents from occurring | Safety inspection, development of children's ability to predict and avoid danger |
| 2 Preparation | Prepare for the occurrence of incidents/accidents | Creation of a crisis management system, collaboration with related organizations/institutions, support from guardians and community residents, creation of the crisis management manual, carrying out training |
| 3 Response | Promptly respond to incidents/accidents | Security of children and school personnel, grasping the situation, emergency medical care, prevention/mitigation of the spread of damage |
| 4 Restoration | Subsequent response to incidents/accidents and restoration | Communication/explanation to guardians and related people, preparation to resume education, measures for preventing the recurrence of incidents/accidents, mental health care, review of the crisis management system |

Source: Created using reference¹⁰

(1) Prevent incidents/accidents from occurring [Prevention]

Inspecting facilities/installations and apparatuses in school as well as the safety of school routes is one of the important aspects of crisis management to prevent schoolchildren from getting involved in incidents/accidents. Efforts to “isolate,” “analyze,” and “manage” dangerous spots in the environment of school life, including going to and from school, need to be systematically made based on the **Plan-Do-Check-Act/Action (PDCA) cycle**.

a) Isolating dangerous spots

Use the three types of information below for reference to isolate spots where accidents are likely to occur.

- i) Information provided by school personnel, schoolchildren, guardians, and communities
Collect information from all the stakeholders, including school personnel, schoolchildren, guardians, and communities, about places where they were injured at school or where they experienced a danger on their way to or from school, and mark them on a local map. Identify places where many schoolchildren were injured and where a danger could have led to a major accident, and narrow down the spots to which priority should be given in taking measures.
- ii) Information about the occurrence of past accidents
For example, places where abductions or a suspicious approach incident occurred in the past, places where schoolchildren were injured, and spots where a waterway overflowed should be recorded as objective facts and included in priority dangerous spots.
- iii) Information about accident occurrence conditions
The occurrence of accidents involves typical environmental conditions. Use the viewpoints of a **hazard map** and an inspection list for reference to find the environmental conditions that can be linked to accidents in school or in the commuting environment, and inspect them on a regular/irregular/daily basis. Conducting daily inspections for suspicious objects is also important.

For your information, a hazard map is a map that indicates potentially dangerous places and evacuation sites in case of a certain disaster. The map may differ depending on the type of disaster.

b) Analyzing dangerous spots

Analyze isolated dangerous spots to obtain concrete images of possible accidents and identify environmental conditions that can cause a problem.

- i) Objective analysis through the eyes of multiple persons
Carry out joint inspections with stakeholders, and observe and analyze dangerous spots through the eyes of multiple persons. As needed, seek cooperation from experts to conduct a more detailed, objective analysis. In regard to the situation of damage when an accident occurred and the place of occurrence, identify the environmental conditions that served as factors of

occurrence.

- ii) Analysis of schoolchildren’s behavior
The occurrence of multiple accidents is linked to schoolchildren’s behavioral characteristics. Observe how schoolchildren behave in dangerous spots in school and on school routes, and obtain concrete images of possible accidents. After that, determine the environmental conditions and challenges in guidance that should be improved.
- iii) Survey by schoolchildren
The analysis of dangerous spots conducted by schoolchildren is useful because it can lead to the identification of problems from the perspective of schoolchildren as well as the safety education of schoolchildren themselves. It is also effective to collect information from schoolchildren about their dangerous experiences and create a **local safety map**, then exchange opinions with guardians and community stakeholders.

c) Managing dangerous spots and the organizational structure

Through the isolation and analysis of dangerous spots, consider concrete improvement plans to take measures. It is desirable that schools, families, and communities come together as one to systematically promote discussions on activities including regular inspections.

(2) Prepare for the occurrence of incidents/accidents [Preparation]

a) Evacuation drills

Evacuation drills are held in order to confirm the roles of school personnel stipulated in the crisis management manual and to nurture schoolchildren’s practical attitudes and ability to evacuate safely in case of an emergency.

Evacuation activities are “activities to protect life” from dangers that may occur in the next several seconds, minutes, and hours. The matters below need to be clarified before an evacuation drill wherever possible, by considering what kinds of dangers can threaten schoolchildren’s lives and physical health from the standpoint of protecting them.

- i) What kinds of dangers can be posed? Evacuation from what?
- ii) What kinds of evacuation activities should be taken for each danger?
- iii) When should evacuation activities be initiated?

b) Evacuation plans in case of danger

Evacuation activities in case of danger vary depending on the type and scale of the danger as well as each individual’s characteristics and situation. Assuming that evacuation activities are “security activities to escape danger,” they can be classified into “Wait (stay at the site),” “Move vertically (e.g., move to a secure place on the 2nd or higher floor),” and “Move horizontally (e.g., move to an evacuation site temporarily or for a longer time)” in terms of space. Therefore, it is important to take this into account and consider in advance what activities should be carried out in case of danger. In addition, evacuation activities assuming **secondary disasters** (i.e., a series of disasters triggered by the primary disaster) also need to be considered in advance.

In case of danger, the school must protect the lives and physical health of schoolchildren by establishing a countermeasures headquarters to help all school personnel fulfill their roles, such as information gathering, evacuation guidance, and relief activities. To ensure the fulfillment of these roles, it is necessary to create a crisis management manual in advance and to share a common understanding among all school personnel.

It is necessary to prepare evacuation plans and include them in the crisis management manual by designating evacuations sites and evacuation routes individually and specifically on the basis of the topographical and geological characteristics of the school environment and its surrounding areas, as well as hazard maps created by local governments and organizations.

(3) Promptly respond to incidents/accidents [Response]

In the case of an accident in school, it is essential for the body that established the school (principal) to take prompt and proper action by giving the highest priority to the lives and health of schoolchildren (Figure 14.3). To achieve this, it is important for the school to have a flexible system in place as an organization, and for all school personnel to always understand and master procedures for treating sick (wounded) persons promptly and properly without hesitation (see Chapter 15).

When a sick (wounded) schoolchild is found, it is important for the first person on the scene to check the injured or ill schoolchild's symptoms and ask nearby staff and schoolchildren to help while preventing the symptoms from becoming serious by providing first aid, such as immediately stopping bleeding and providing cardiopulmonary resuscitation (CPR), depending on the condition of the schoolchild. In case of an accident, it is required to simultaneously perform many tasks, including contacting the guardian of the affected schoolchildren and caring for other schoolchildren, in addition to providing first aid. All school personnel must have a common understanding of what should be done promptly so that they can respond systematically. In contacting the guardian of the affected schoolchild, make contact as early as possible after organizing minimum information required about the general situation of the accident and the degree of injury (i.e., minor, moderate, and severe).

In cases requiring emergency response, such as those in which the life of the affected schoolchild is being threatened, take prompt action by giving a higher priority to lifesaving treatment than to reporting to the manager. School personnel need to work to reduce other schoolchildren's anxieties without being emotionally disturbed by the situation of the accident or the condition of the affected schoolchild. Try to leave notes as needed regarding the occurrence of the accident, measures taken after occurrence, and the results of those measures while giving priority to first aid, and organize the contents of records once the situation settles down temporarily.

(4) Subsequent response to incidents/accidents and restoration [Restoration]

Concerning accidents in school, the body that established the school (principal) is required to devise and implement recurrence prevention measures by investigating the cause and verifying the previous safety measures, and to provide a sufficient explanation and continued support to the guardian of the affected schoolchild.

Specifically, organize background information about the occurrence of the accident once the response that was needed immediately after the accident is completed. Collect a broad range of information on

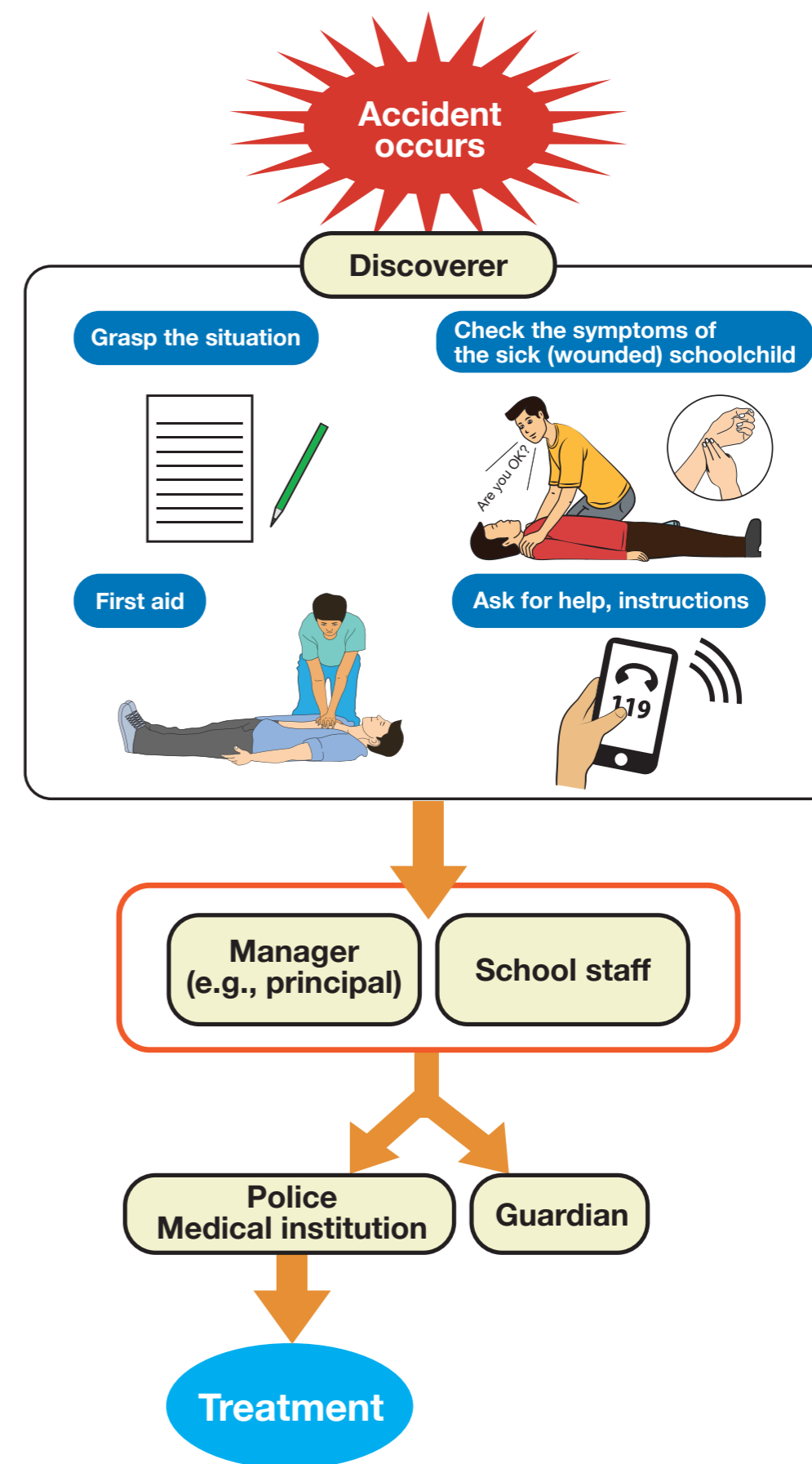


Figure 14.3 Example of response in case of an incident/accident in school (first aid/emergency contact system)

possible causes of the accident, conduct research/verification aimed at preventing accidents in the future, and make use of the results of research to prevent recurrence.

3) Experience of an incident/accident and mental health care^{2,10}

Encountering an incident/accident can traumatize schoolchildren because of fear or loss; they may develop symptoms, such as repeatedly remembering the event or reproducing the event in their play, as well as emotional instability and sleep disorder, causing serious problems in their daily lives. These reactions can happen to everyone, and in most cases, subside over time. If this condition persists for three days to one month after the encounter with the incident/accident, it is called **Acute Stress Disorder (ASD)**, and if it persists for one month or longer, it is called **Post-Traumatic Stress Disorder (PTSD)**. Therefore, it is important to provide support for schoolchildren and their guardians immediately after the incident/accident for the prevention and early detection of PTSD. It should be noted there are cases in which schoolchildren develop symptoms of ASD soon after the encounter with the incident/accident, which then become chronic and lead to PTSD, as well as cases in which symptoms are not noticeable at first and cases in which symptoms are reduced once but recur a few months later; thus, it is important to provide mental health care for as long as possible (see Chapter 12).

In addition, the guardians of affected schoolchildren and school personnel may ignore these signs or become insensitive to their own physical and mental disorders, and therefore, they may require mental health care for themselves. For the affected schoolchildren, it is important for their guardians and the school personnel around them to be mentally stable. This is why it is important for all the people involved in the incident/accident to understand that they need mental health care, which includes noticing their own physical and mental disorders as early as possible and take a break or have consultations proactively.

(1) Mental health care provided immediately after the occurrence of a crisis

Like bodily injury, mental trauma requires first aid. **Psychological First Aid (PFA)** is globally accepted as a basic method of mental health care provided immediately after the occurrence of a crisis. PFA provides the specific contents and overall procedures of mental health care that is necessary immediately after the occurrence of a crisis.

The framework of the **Psychological First Aid School Edition (PFA-S)**¹³ consists of eight major activities (Table 14.7). The PFA-S considers it natural that schoolchildren and school personnel show various early responses (i.e., physical, cognitive, behavioral, and spiritual problems) after an emergency situation. Care provided by experts in disaster relief assistance and mental health can help schoolchildren and school personnel recover from these early responses, and leading such care to assistance tailored to each person's needs will be able to prevent symptoms from becoming severe or persisting for a long time.

Table 14.7 Framework of PFA-S

| Activity | Objective |
|--|---|
| i) Approach sufferers and start activities | Reach out to sufferers (schoolchildren and the staff of the school) in an empathic manner without placing a burden on them, and respond to their requests. |
| ii) Safety and a sense of security | Ensure immediate security so that sufferers can rest their body and mind. |
| iii) Stabilization | Quell the disorder of sufferers who are overwhelmed by the situation, and give them a perspective. |
| iv) Collect information | Collect related information and identify sufferers' present needs and problems. |
| v) Help solve actual problems | Help sufferers address their present needs and problems in a realistic way. |
| vi) Promote interactions with surrounding people | Promote sufferers' interactions with their families/friends/teachers/other school officials who stay close to them and with supporting organizations in the community, and provide assistance to make these relationships last for a long time. |
| vii) Information helpful to respond to the situation | Provide sufferers with information on stress reaction and a coping method in order to alleviate their suffering and enhance their adaptive function. |
| viii) Introduction and transfer | Introduce services that sufferers presently need or will need in the future, and transfer support. |

Source: Created using references^{2,14}

Column: Anniversary reaction²

People who were traumatized by a disaster or incident/accident may reexperience their trauma, though since healed, on the date when they experienced it first. This is called an **anniversary reaction**.

One method to cope with this is to inform guardians and children beforehand that the previous reaction may recur as the date of the disaster or incident/accident approaches, but they don't have to worry even if it recurs because this reaction can happen to everyone. By doing this, it will be possible to prevent children's anxiety from increasing as well as enable guardians to respond calmly.

8. Roles of school personnel in creating safe schools

This section explains the roles of school personnel required to make schools a safe and secure place/environment.^{8,15} School personnel are required to appropriately make decisions and take action according to circumstances to protect the safety of schoolchildren's lives and physical health from danger. They are also required to fully understand the organizational structure in school as well as the importance and urgency of school safety, and to further enhance their safety awareness and safety response skills as well as their safety education skills. To achieve this, it is necessary to provide school personnel with practical training that meets the needs of the school and the community.

Making full use of the latest safety information provided by, for example, the government, international organizations, and international aid organizations, all school personnel must be firmly determined to ensure the safety of schoolchildren, understand matters necessary to protect the health and safety of schoolchildren, and have the basic knowledge and skills on the contents and methods of teaching. This requires the improvement of school safety training provided for school personnel. In doing this, structures within schools also need to be improved to enable all school personnel to share the latest information.

Examples of training include the items below. Concerning forms of training, simulation exercises, in which discussion is held as to what kind of action should be taken by assuming a case that can occur in school, and training by external personnel with expertise are effective, in addition to lectures/classes.

- i) Evacuation drills for disaster/crime prevention based on the crisis management manual
- ii) Drills to respond to disasters/incidents (including responses to affected or injured schoolchildren and guardians)
- iii) Cardiopulmonary resuscitation including AED, and first aid
- iv) Matters related to the creation of a safe environment using statistics of disasters and accidents that occurred in school as well as information on specific cases
- v) Matters related to the safety education of schoolchildren
(e.g.) Qualifications/skills related to safety that need to be developed, positioning of safety education, common understanding of teaching contents/materials
- vi) Mental health care of schoolchildren, school personnel, and guardians

9. Safety education of schoolchildren¹⁰

To ensure the safety of schoolchildren, it is very important to provide safety education that enables schoolchildren to predict and avoid danger for themselves, in addition to conducting thorough safety management of facilities/installations such as safety inspections. Thus, safety education throughout all educational activities (all subjects and school events) is required.

1) Development of the ability to predict and avoid danger

Schoolchildren may encounter danger in a situation in which there are only schoolchildren, such as on their way to or from school or on holiday. In such a situation, schoolchildren need to predict and avoid danger for themselves by noticing potential dangers they may face, predicting what kinds of accidents can be caused by those dangers, and deciding what to do to avoid the dangers. Safety education must be provided so that schoolchildren can develop their ability to think and decide on their own in all circumstances.

For example, it is important to **nurture** schoolchildren's **ability to predict and avoid danger** in natural disasters specific to the region, such as typhoons, tropical storms, floods, and drought, while making use of materials prepared in each region and involving activities to make schoolchildren think in light of specific situations as well as experimental activities.

2) Use of human resources/resources in communities

In order to ensure more effective practice in the safety education of schoolchildren, it is necessary to obtain cooperation from lecturers of external organizations, including NGOs, and to actively request that homes and communities provide teaching materials and learning opportunities. It is important to choose and consider the contents and methods according to the actual situation of the school and the community. Particularly in school, where learning is pursued according to the curriculum of each subject, it is important to effectively use external human resources by linking curriculums across different subjects instead of providing an isolated, independent learning opportunity. This is one method of curriculum management.

Examples of collaboration with communities include the items below.

- i) Utilize guidance from police and disaster prevention/safety experts in safety training provided at school.
- ii) Use community facilities and organizations related to safety (e.g., the Commune Committee for Disaster Management, the Village Disaster Management Group¹⁶) as teaching materials.
- iii) Use the region's topography, geology, environment, and past disasters¹⁶ as teaching materials.
- iv) Study and experience the contents of work of people who protect safety in communities.
- v) Participate in safety events in communities to develop skills to ensure one's own safety (self-help) and the spirit of cooperation (mutual assistance).

Column: Measures related to land mines in Cambodia

In Cambodia, as the result of its long civil war, several million **land mines** and **unexploded ordnances (UXO)** still remain uncleared, and thus the country is called a major land mine- and unexploded ordnance-contaminated country. These land mines and UXO have caused death and injury to a large number of civilians, most of whom were children, posing very serious humanitarian issues. In rural areas, they threaten safety in daily life and hinder regional development and economic recovery.

Anti-land mine measures in Cambodia are led by the Cambodia Mine Action Center (CMAC). The CMAC reports that the number of land mines it removed during the period from 1992 to January 2020 exceeded 540,000.¹⁷ It carries out activities by developing long-term plans and goals for various issues, including land mine removal plans, compensation for land mine victims, and risk education on land mines and UXO, while receiving support from United Nations agencies, other countries, and NGOs. The issues of land mines and UXO still have a great impact on the health and safety of children and Cambodia's economic development (see Chapter 13).

Exercises for further thought and research

- [14-1] What can you cite as characteristics of incidents/accidents involving children? Pick one example of an incident/accident in Cambodia, and discuss factors and the background of its occurrence as well as prevention measures.
- [14-2] Are there any dangerous places in and around school? Pick one elementary school nearby, and create danger prediction maps and safety check lists for (1) School premises and (2) Area around the school.
- [14-3] Investigate and report the actual situations at nearby elementary, junior high, and senior high schools, including whether a crisis management system is in place, whether safety education is provided, and whether evacuation drills and training of teaching staff are provided.

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First aid at school

Learning objectives

You will be able to gain proper understanding and explain:

- What vital signs mean, and assess them correctly.
- How to care for minor injuries and illnesses that may happen around you.
- Rest, Ice, Compression, and Elevation (RICE) method for injuries.
- The importance of cardiopulmonary resuscitation (CPR) and Automated external defibrillators (AEDs), and practice using them.

In this chapter, you will learn about injuries and illnesses that may happen around you, and how to observe and provide care. Here we will focus on minor injuries and illnesses for which children can provide care by themselves. Specifically, we will look at injuries such as those of limbs, and illnesses such as abdominal pain, diarrhea, headache, and fever. In addition, you will also learn about **vital signs** as an important measure of the level of urgency of a particular sickness.

Since teachers are not medical experts, this chapter covers **first aid for laypeople**. Understanding what is included in first aid can vary among different countries and regions. For the purpose of this chapter, **the International First Aid and Resuscitation Guidelines 2016¹** are used as a primary reference.

1. Necessities for learning first aid

First aid is the immediate assistance provided to a sick or injured person until professional help arrives. You never know when or where an injury or illness can happen. Some injuries and illnesses are **time sensitive**. In a time-sensitive situation, it may be too late if you wait until the ambulance arrives. If someone present (i.e., a bystander) happens to have knowledge and skills of first aid and is able to respond quickly, it may save a life.

Some injuries and illnesses are medical emergencies and require immediate care, while others are not so time sensitive. In Cambodia, there are situations where it takes time for one to reach a hospital. Even if a person is not in a life-threatening situation, providing proper care can help prevent an injury or illness from becoming worse and alleviate pain. It is therefore important to learn **first aid knowledge and skills**, even for the general public.

Teachers, besides being members of the general public, are in a position to keep children safe at school. School is a place where children of different ages learn in groups, a circumstance which can give rise to an unexpected injury. For these reasons, teachers need to learn first aid. In addition, school is one of the places best suited to learn about first aid, not only for teachers but for pupils/students and their

parents and guardians, as well as other members of the community at large.

2. Vital signs

Vital signs are basic indications (signs) of the human body's life-sustaining (vital) functions, indicating the maintenance of basic physiological functions that are necessary for a human body to survive. Specifically, vital signs refer to the **level of consciousness, respiratory rate, pulse rate, blood pressure, and body temperature**. Assessment of these signs, i.e., performing a **vital sign check**, provides a measure of a person's physical condition.

Vital signs are affected by factors such as age and gender. They also constantly fluctuate to some degree with daily activities such as exercise and food intake. Nevertheless, a sudden change in a vital sign may indicate the presence of a threat to life, and knowing the correct ways of measuring vital signs and their reference ranges is critical when you provide first aid. It is also useful to be familiar with your normal respiratory rate, pulse rate, blood pressure, and body temperature, for it helps detect any abnormalities in your body based on your vital signs.

1) Consciousness

Being medically **conscious** means that one is able to respond properly to stimuli from within one's body or from the outside world. One's state of consciousness is assessed based on both one's state of alertness and cognitive function.

To assess someone's consciousness, you talk to the person, saying, "Mr./Ms. ●●, are you OK?", gently shake their shoulder, or apply a mild pain stimulus (**Figure 15.1**). Because the brain is responsible for consciousness, a **decreased level of consciousness** is a sign that there is a problem with the brain, making it a medical emergency.



Figure 15.1 Assessing consciousness

There are many scales used to evaluate impairment of consciousness. Here we pick one that is commonly used globally, called the **Glasgow Coma Scale (GCS)**.² On the GCS, lower total scores indicate lower levels of consciousness. A GCS total score of 15 or higher indicates the person is fully

conscious, while scores of 13–14 indicate mild impairment of consciousness, and 12 or lower, semicomatose or coma (Table 15.1).

Table 15.1 Glasgow Coma Scale (GCS)²

| | | |
|--------------------------|------------------------------------|---|
| Eye opening response (E) | Opens spontaneously | 4 |
| | Opens to voice sound | 3 |
| | Opens to pain / pressure | 2 |
| | None | 1 |
| Best verbal response (V) | Oriented | 5 |
| | Confused | 4 |
| | Inappropriate words | 3 |
| | Incomprehensible sounds | 2 |
| | None | 1 |
| Best motor response (M) | Obeys commands | 6 |
| | Localizes pain | 5 |
| | Normal flexion / withdraws to pain | 4 |
| | Abnormal flexion | 3 |
| | Extension | 2 |
| | None | 1 |

Column: What is orientation?

Orientation is one's capability to grasp and understand the situation in which they are placed, such as the time now, and why they are there. In order for one to have good mental orientation, there should be no significant damage done to their function in terms of consciousness, perception, attention, memory, and thoughts, at the very least. If people have impaired consciousness or memory problems due to organic brain disorders, they have become "disorientated." They lose their sense of place and identity, or time and date.

2) Respiration

Respiration involves bringing oxygen, which is required to produce energy to sustain life and perform activities, into the body through inhalation, and flushing carbon dioxide, which is generated as a metabolic end product, out of the body through exhalation (see Chapter 2). Low respiratory rates and shallow respiration indicate inadequate oxygen intake. You assess respiration based on the measurement and rhythm of respiration, by looking at the movements of the chest and abdomen per minute. Poor respiration results in the face or lips turning dark purple. If one shows such symptoms (i.e., cyanosis), assess their respiration very carefully. Special attention is required in a case of very high (20, 30, 40, and

60 breaths per minute or more in adults and adolescents, children, infants, and neonates, respectively) or very low (10, 15, 25, and 40 breaths per minute or fewer in adults and adolescents, children, infants, and neonates, respectively) respiratory rates.¹

3) Pulse

A **Pulse** is a palpable wave of blood that is sent into the aorta by the pumping action of the heart as the left ventricle contracts, and which travels through the arterial system of the body (see Chapter 2). A slow pulse rate or an irregular pattern indicate abnormalities in the heart or the circulatory system. The pulse may be palpated through the walls of a peripheral artery. The pulse is typically taken at the **radial artery** (Figure 15.2). To take the pulse, you place the tips of your index, second, and third fingers on the artery of a subject and count the beats for a period of 1 minute. While doing so, you also assess the rhythm, amplitude, tension, and quality in addition to the number of beats. When one is in shock, it may be difficult to take the pulse at the radial artery. In such a case, you take the pulse at the **carotid artery** (Figure 15.2). If the pulse is not palpable, immediate **cardiopulmonary resuscitation (CPR)** is required. Reference ranges for pulse rate vary among different organizations and authorities, but they are typically **70–90 pulses per minute for children of school age**, and a rate of lower than 50 pulses per minute or 120 pulses per minute and higher should be considered a medical emergency.³

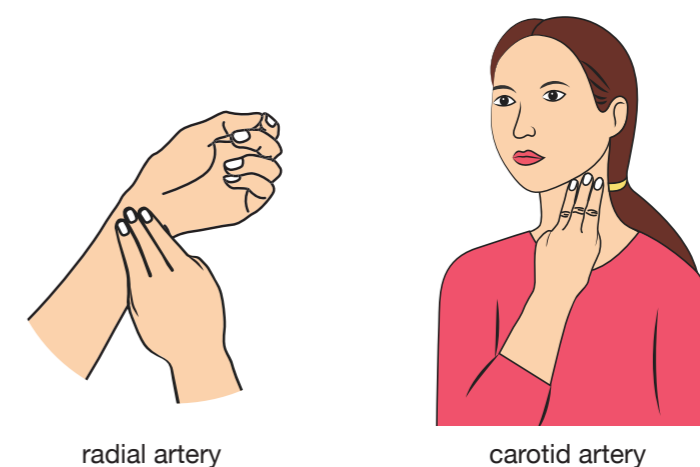


Figure 15.2 Points to take pulse

4) Blood pressure

Blood pressure is the pressure of circulating blood against the walls of arteries. The pressure of blood against the arterial walls as the heart contracts is called the **systolic pressure**, while that of blood as the heart relaxes is called the **diastolic pressure** (see Chapter 2). The higher the cardiac output is, and the higher the peripheral resistance is, the higher the blood pressure becomes. Decreased blood pressure indicates abnormalities in the blood circulation. Meanwhile, hypertension serves as an indicator of progression of arterial stiffness. As blood pressure varies depending on age, gender, ethnicity, and

measurement conditions, the **parameters of hypertension** are determined by individual organizations and authorities.

WHO defines hypertension as follows:

“Hypertension is diagnosed if, when it is measured on two different days, the systolic blood pressure readings on both days are ≥ 140 mmHg and/or the diastolic blood pressure readings on both days are ≥ 90 mmHg.”⁴

Blood pressure is measured using a sphygmomanometer. There are several types of sphygmomanometers; they may be aneroid or digital sphygmomanometers, and sites of placement may include an upper arm, wrist, or finger.



Figure 15.3 Examples of digital sphygmomanometers

5) Body temperature

Body temperature refers to **internal body temperature**, and values vary depending on the site used for measurement. While body temperature may be measured in the rectum, in the mouth, or at the tympanic membrane, it is commonly measured in the axilla. **Axillary temperature** is skin temperature, and is therefore lower than internal temperature by about 1°C . When taking measurements, wipe any sweat off first, then place the thermometer under the arm, angling it so that its tip is in the deepest crease of the armpit, as shown in the picture (Figure 15.4). Body temperature varies among individuals, and it is important to assess the temperature by taking one's normal temperature into account. A temperature of 38°C (100.4°F) or higher is considered a fever.¹

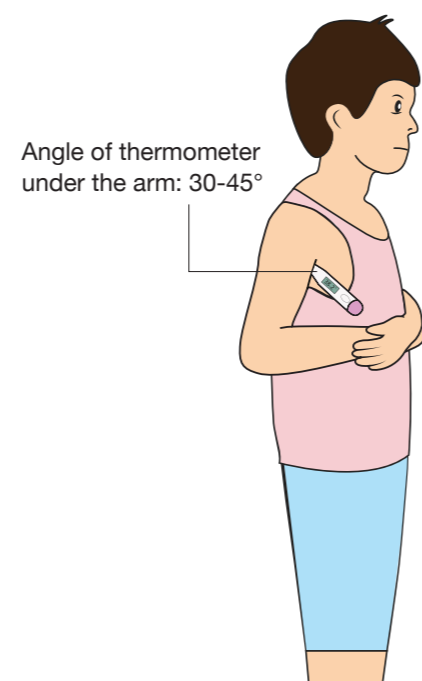


Figure 15.4 Taking body temperature

Column: Non-contact body thermometer

With the onset of the COVID-19 pandemic, “non-contact” body thermometers are becoming increasingly more common. Such thermometers measure the amount of infrared radiation emitted by a human body and convert it into a temperature. They offer great convenience, for you can use one to take the body temperature hygienically and quickly. However, due to the space between the sensor and the object of measurement, temperature readings may be affected by the air condition, and may not be accurate under measurement conditions. It is recommended that you follow manufacturer's instructions, and if the reading is not in agreement with the observed conditions (e.g., you feel hot but the temperature reading is low), you should take another measurement using an axillary thermometer.

3. First aid procedures

First aid procedures are as follows: **observation, assessment, and care**.

1) Observation

First aid begins with **observation**. You make an assessment by **listening (interview)**, **looking (visual examination)**, and **touching (palpation)**. Listening means that you ask about the circumstance in which an affected person's injury or illness occurred (when, where, why, what, how). Looking means observing the person's general condition and the state of injury or illness very closely. Touching means placing your hand over the affected area and assessing any skin swelling, heat sensation, or tension. Vital signs are also a critical part of observation.

2) Assessment

Based on the information obtained through listening, looking, and touching, as well as the vital sign values, you make an assessment. **Teachers are laypeople and not healthcare professionals**, and are not able to make a diagnosis. Nevertheless, you can infer the injury or illness, and take action accordingly. First, you **determine the level of urgency**. If the case is urgent, the affected person should seek medical attention immediately. If it is not very time sensitive, then you provide care according to the symptoms. Urgent conditions of sickness include a lack of consciousness, stab or gunshot wounds to the head, chest, neck, or abdomen, fractures of the pelvis or the femur, amputations of limbs, and burns covering a large area.³

3) Action

Based on the assessment that has been made, take action. How to provide care according to the symptoms will be discussed in the following section.

Column: What is shock?

Shock is an acute syndrome in which an attack to a living body or the response of body to the attack has caused a failure to maintain blood flow to vital organs, resulting in a disturbance in cellular metabolism or damage to organs, potentially threatening to the life of the person. If shock progresses, it can cause malfunctions and result in death; if any symptom of shock is observed, urgent action is needed in response. Symptoms of shock include pallor, writhing movements, cold sweat, impalpable pulse, and decreased blood pressure.

4. Appropriate first aid care for different situations

1) First aid for injuries

(1) Head trauma

Head traumas vary widely depending on the site and extent of injury, ranging from severe to mild. Examples of severe cases of head trauma include a fracture of the skull, and a concussion caused by a jolt to the head. Some symptoms, such as acute epidural hematoma, may appear several days later.

Common steps that should be taken are as follows. First, find out how the injury occurred. Since the injured person may not know everything that has occurred, seek information from other people who have been on the scene. Knowing how it occurred will help you determine the severity of the injury. Next, check the vital signs, especially the level of consciousness. If there is any vital sign abnormality, transfer the person to a healthcare facility as quickly as possible. If there is any wound, stop the bleeding and protect the affected area, as appropriate for the type of trauma. If there is swelling, cool the affected area. In cases of head contusion, symptoms may worsen gradually; the injured person should be placed at rest for 24 hours with their conditions monitored. Symptoms to look out for during this 24-hour period include vomiting, seizures, headache, numbness of the limbs, and vision problems. If any of these abnormalities is observed, seek medical attention immediately.

(2) Facial trauma

Features projecting from the face, such as the forehead, nose, mouth, and cheeks are more prone to facial trauma. One type of facial trauma that requires particular attention is **ocular contusion**. Cases of ocular contusion can become severe, as it can involve damage to the retina or a fracture of the bone under the eye, which is thin and prone to fracture. Assess the injured eye by comparing it to the other, uninjured eye, focusing on any bleeding, eye movement, and change in vision. If the injured person has anything wrong with eye movement, double or blurry vision, or constriction of visual fields, seek medical attention

immediately.

Column: Management of nosebleeds

Most nosebleeds are caused by picking of the nose or scratching it with fingernails. Bleeding often occurs in the 1-cm area at the front of the nose (i.e., **Kiesselbach's area**). To care for a nosebleed, have the injured person tilt their head down slightly, pinch the nose around Kiesselbach's area between the thumb and index finger, and press firmly towards the back of the nose (Figure 15.5). Bleeding should normally stop after around five minutes. Tipping the head up may cause blood to run down the throat; tilting the head down is preferable. A nosebleed as a result of trauma may indicate a potential fracture of the nasal bone; cool the nose with a wet towel and seek medical attention.

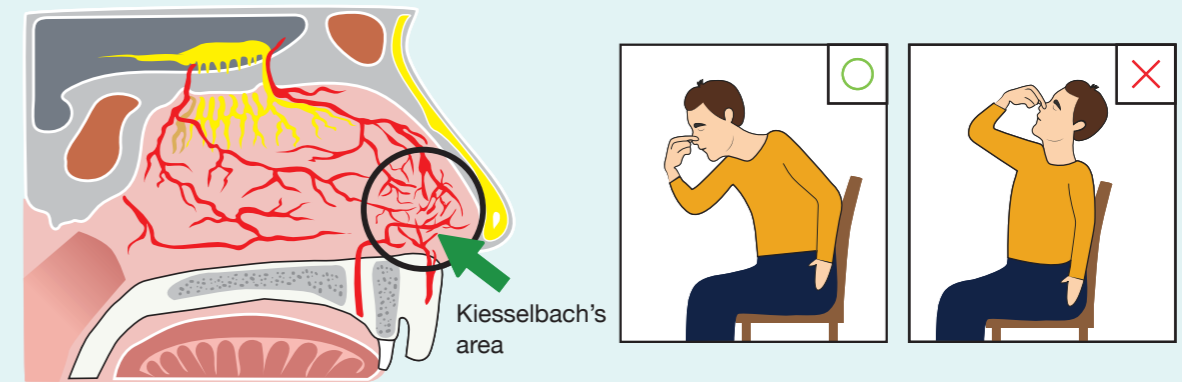


Figure 15.5 Points to apply pressure

(3) Chest or abdominal trauma

In the case of chest or abdominal trauma, it is possible that internal organs may be damaged. Assess the injured person's general condition, focusing on the vital signs. It is also helpful to ask about the cause of the contusion in making necessary decisions. If the injured person has any vital sign abnormality, complains of intense pain, or has symptoms of shock, seek medical attention immediately.

(4) Limb trauma

a) Wounds

Wounds include **abrasions, cuts, puncture wounds, and bites**. An abrasion is a wound where an area of the epidermis is damaged due to external friction. A cut is a line of damage to the skin caused as a result of a sharp object moving on the body surface. A puncture wound is a puncture caused by the stab of a sharp object into the skin. A bite is a wound caused by the teeth of an animal or a human (**Figure 15.6**).

The basics of care are: **rinse** the wound, **stop the bleeding**, and **protect** the wound (**Figure 15.7**).

First, rinse the wound with clean water. As any foreign matter remaining in the wound can make it susceptible to suppuration, rinse the wound carefully with clean water to wash off any foreign matter or

bacteria around the wound. This may also help stop bleeding more quickly, as the cold water cause the capillaries to constrict. It is preferable to use tap water to rinse the wound; if you have no access to clean water, however, bottled water or tea with no sugar added may be used in its stead. In the absence of clean water, using an antiseptic may be beneficial. Do not use pooled water to rinse a wound as it may potentially be contaminated with pathogens.

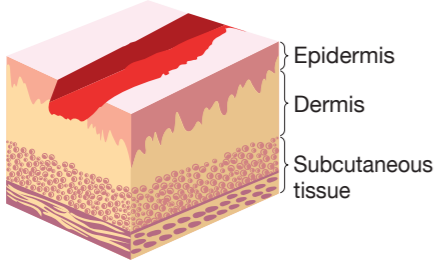
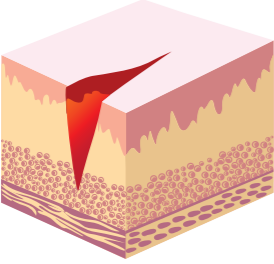
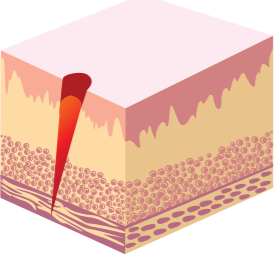
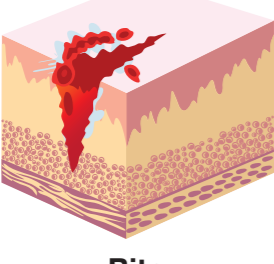
| Type | Characteristics / keys to treatment |
|--|---|
|  <p>Abrasion</p> | <p>An abrasion is a wound where an area of the epidermis is damaged due to external friction. The surface of the wound is scraped off, leaving it irregular; this often causes foreign matter to remain in the wound, making it susceptible to infection. It is important to rinse any foreign matter off thoroughly.</p> |
|  <p>Cut</p> | <p>A cut is a line of damage to the skin caused as the result of a sharp object moving on the body surface. A cut left open is susceptible to infection. It is advisable to cover the wound by holding the skin on either side of the cut so that the cut is closed, and securing it with a strip of surgical tape.</p> |
|  <p>Puncture wound</p> | <p>A puncture is caused by the stab of a sharp object into the skin. A wound may be small in area, but if it is deep, it may have caused internal damage. A wound caused by a rusty or contaminated object can result in tetanus infection, which is caused by anaerobic bacteria; check the vaccination status and seek medical attention.</p> |
|  <p>Bite</p> | <p>Caused by an animal or a human. A bite with sharp teeth in particular can cause deep tissue destruction. In addition, animals may harbor various bacteria and viruses in their mouth, which may result in not only wound infection but animal-borne infection as well. Provide first aid, and make sure the injured person seeks medical attention without fail.</p> |

Figure 15.6 Major types of wounds, their characteristics and treatment

Stop the bleeding, if any. Cover the wound with a clean cloth (preferably gauze), and apply pressure directly over the dressing. Blood has a **coagulation mechanism** (i.e., platelets form a plug the rupture of the blood vessel, followed by the action of coagulation factors, which forms a fibrin clot). Most injuries are bleeding from capillaries or small veins (i.e., blood oozing out), and this can be stopped by simply applying pressure. In the case of bleeding from an artery, however, blood spurts out and thus cannot be stopped by direct compression alone; seek medical attention as soon as possible.

Once the wound has been rinsed clean and the bleeding stopped, apply a clean cloth (preferably gauze) over the wound and secure it with a strip of surgical tape to keep the wound clean and prevent it from drying out. Change the gauze as appropriate if it is contaminated by blood or effusion.



Figure 15.7 Keys to caring for wounds

Column: Special considerations when treating bleeding

Some infectious diseases, such as hepatitis B and AIDS, are transmitted through blood. When caring for a person who is bleeding, wear vinyl gloves or use plastic bags, taking care not to come in direct contact with the injured person's blood. In the event of having contact with blood, wash it off with water immediately.

There is no problem for a victim to touch one's own blood; it may be advisable to occasionally have an injured child try to stop the bleeding, so long as the injury is minor.

Column: Management of outdoor injuries caused by animals or insects

• **Snake bites**

Squeeze out effusion (blood) from the snake bite wound, rinse it thoroughly, and cover it with a clean cloth. Keep the wound location at a level below the heart, and keep the person still. If one is bitten by a venomous snake, one will experience intense pain and a burning sensation immediately following the bite, and the site of the bite will start swelling. When you are unsure if the bite has been made by a venomous snake, yet the injured person suffers from intense pain and significant swelling, seek medical attention without delay in case it was indeed a venomous snake bite. If you know what kind of snake it was that made the bite, inform the staff at the hospital.

• Animal bites

Animals harbor various bacteria in their mouths, and their bites may potentially cause the wound to become suppurative or lead to **tetanus**. A bite by a stray dog or cat can result in **rabies**. In Cambodia, there are approximately 800 deaths a year from rabies, and 40% of the victims are those under the age of 14.⁵ In the case of an animal bite, it is important that the wound be rinsed with clean water and protected with clean cloth (gauze), and that the injured person seek medical attention without delay.

• Bee stings

Pinch the sting site firmly and rinse the wound, squeezing out effusion (blood). Remove the bee stinger, if it is left behind. When doing so, exercise caution and avoid grabbing the stinger, as it may cause the venom to be released into the body of the person stung. It is advisable to cool the sting site with a wet towel.

With a person who has in the past received a bee sting and experienced symptoms such as rash and nausea, another sting may trigger **anaphylactic shock**. Anaphylactic shock is a medical emergency, and a stung person should be monitored for about 30 minutes following the sting (see Chapter 5).

Outdoor injuries caused by animals and insects are preventable. Familiarize yourself regularly with information concerning areas infested with snakes, bees, etc., and avoid places where one may potentially encounter them. Give children guidance on clothing and precautions to take when going outdoors. It is also important to take public health measures such as wild dog control and canine rabies vaccination.⁵

b) Contusions, sprains, fractures, and dislocations (Figure 15.8)

A **contusion** is a condition in which a strong impact due to a fall, collision, etc., inflicts damage to the tissues beneath the skin even without a wound on the surface of the skin, causing **internal bleeding**. As it can occur in any area of the human body, it is necessary to have an accurate understanding of the level of risk and its characteristics.

A **sprain** is a condition in which force is applied to a joint, causing damage to periarticular tissues such as tendons, ligaments, or cartilages. A sprain often occurs in the ankle. In particular, a form of sprain where the foot turns inward, causing the damage to the outside of the ankle, called an **inversion sprain**, is quite common.

A **fracture** is a broken bone caused by the application of force greater than the bone strength. In cases of growing children, an incomplete fracture in which the bone is bent or cracked is quite common, in addition to a complete fracture in which the bone is broken completely.

A **dislocation** is a condition in which the articular surface of the head of a bone and that of the socket of another have shifted from their normal locations due to external force and become stuck in abnormal locations. A dislocation commonly occurs in the shoulder, elbow, finger, and jaw joints.

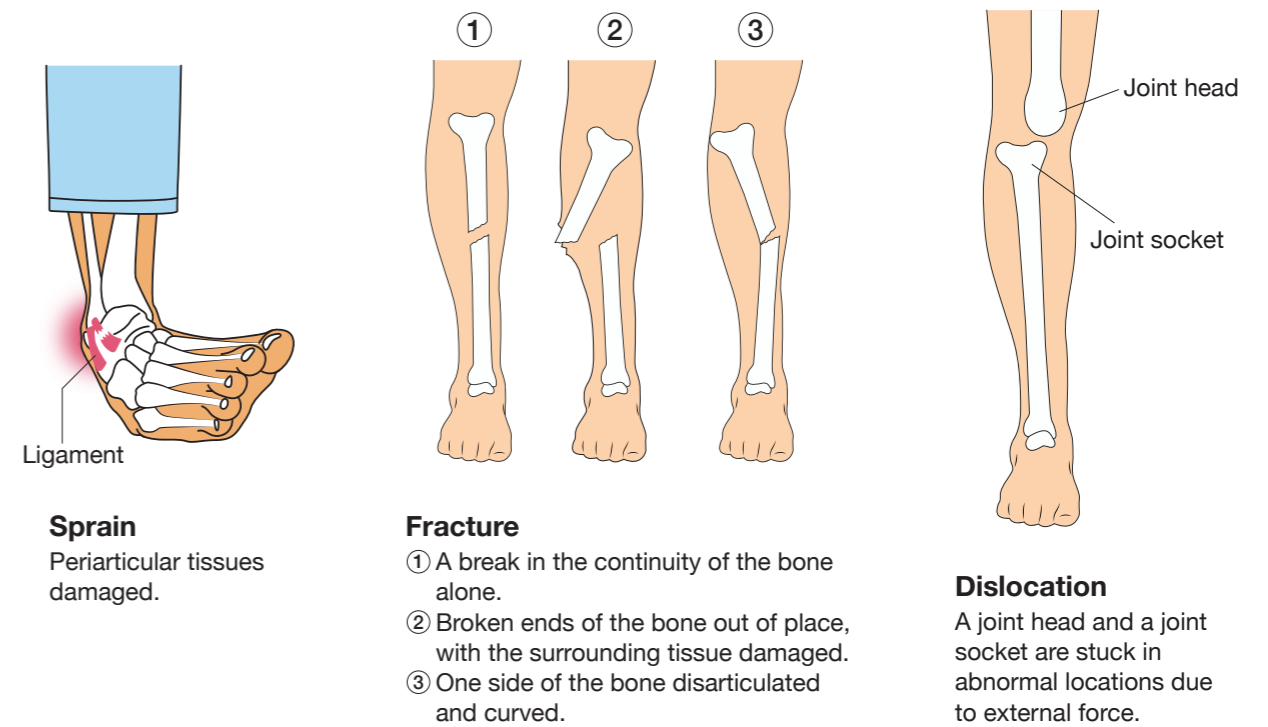


Figure 15.8 Differences between sprains, fractures, and dislocations

c) The RICE method for treating injuries

The basics of care for these conditions are: **Rest, Ice, Compression, and Elevation (RICE)** (Figure 15.9).

Rest refers to resting the affected area. It helps to reduce the movement of the injured site and relieve pain, as well as reducing bleeding (internal bleeding) and swelling. Make sure the injured person moves or rests in a position that prevents any weight from being put on the injured site.

Ice refers to cooling the affected area. It promotes the constriction of the blood vessels in tissues of the affected area, minimizing the progression of bleeding (internal bleeding) and reducing swelling. It also helps reduce pain from the injury. It is advisable to use iced water at 0°C or so to cool deeper parts efficiently. Place ice cubes and water in a plastic bag, and apply it to the affected area. Ice the area for around 15–20 minutes; stop when the injured person experiences a loss of sensation on the skin, and resume the icing when they regain the sensation. Repeat this process for the first 72 hours after injury, which is considered the acute stage.

Compression involves application of an appropriate level of pressure over the affected area, which prevents cellular fluid in tissues from flowing into other areas, thus reducing bleeding (internal bleeding) and swelling. Pay attention to the degree of pressure applied, as overly tight compression can compromise blood circulation. Check the color of the tips of the digits and measure their temperature as appropriate to ensure that blood circulation is not compromised.

Elevation refers to keeping the injured area above the level of the heart. This facilitates the return of blood flow to the heart, helping to reduce bleeding (internal bleeding) and swelling.

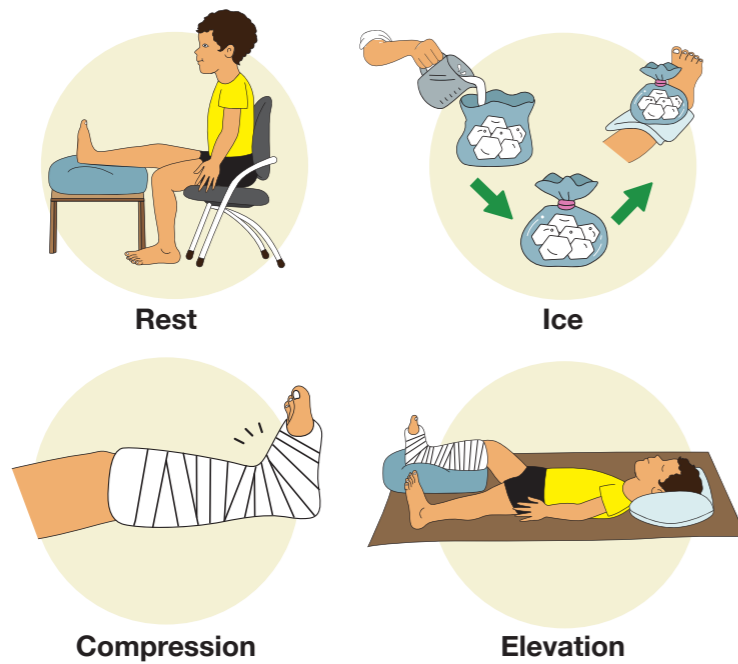


Figure 15.9 RICE method for treating injuries

Column: Preparedness for injuries at school

Children can get injured at school. To avoid panicking in such eventualities, it is important that schools have a response system in place in advance. Specifically, arrangements for emergencies should be made, including who will provide care, who will contact parents, and what to do when an injured child needs to be transported to hospital. Individual communities may or may not have a healthcare institution, and may have different approaches to care (e.g., schools with only male teachers may not provide care to girls, parents or guardians of children cannot afford medical fees); it is recommended that schools work together with parents/guardians and local specialist organizations to build such a system.

Column: First aid in school

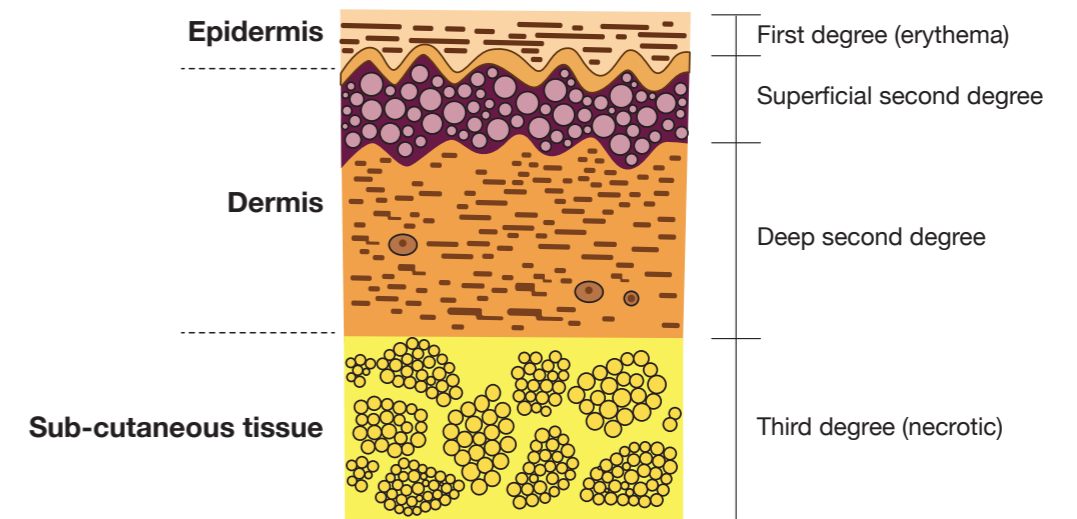
You are advised to have a first-aid kit of basic items including thermometers, nail clippers, adhesive bandages, face masks, gauze, surgical dressing, and antiseptics, so that you can respond to injuries or other health problems. That being said, first aid provided at school is a procedure to temporarily keep an injury or illness from worsening and relieve pain, and is not medical treatment. As a matter of principle, **a teacher, who is not a healthcare provider, should not use pharmaceutical products.**

One of the pillars of the National School Health Policy 2019 is the establishment of “health rooms” to provide first aid. This suggests that schools in Cambodia are slowly starting to implement school nurse’s offices (see Chapter 1). It is advisable that a health room or its equivalent be equipped with what they need to provide first aid, including first-aid kits, treatment tables, chairs, and cots. In addition to providing first aid, a health room serves as a school health center as they keep a record of health room visits and identify when, where, and what types of injuries and health problems have

occurred, as well as assessing children’s growth on an ongoing basis (through health check-ups) and sharing health-related information.

(5) Burns

A **burn** is damage to skin tissues caused by heat. Pain may persist and worsen with time. Burns are classified as first-, second-, and third-degree burns (I, II, III), depending on the depth of tissue damage (Figure 15.10). That said, the severity of a burn is determined not only based on how deep the skin damage is alone but in combination with how large the area affected is. The larger the affected area is, and the deeper the damage penetrates, the severer a burn is.



| | |
|--------------------|--|
| First degree (I) | <u>Damage to the epidermis.</u> The site appears red on the surface; symptoms include stinging pains and burning sensation. Sunburn is an example of first-degree burns. |
| Second degree (II) | <u>Damage extends into the dermis.</u> Includes two subcategories: superficial dermal burns and deep dermal burns. The site appears red on the surface, with the presence of blisters. With a superficial second-degree burn, the affected person will experience the same subjective symptoms as those with first-degree burns, while a deep second-degree burn is less painful due to the damage caused to the sensory nerves. |
| Third degree (III) | <u>Damage to all skin layers,</u> involving the subcutaneous tissues. The site appears white, and painless. |

Figure 15.10 Classification of burns

To care for a burn, cool the affected area with water as soon as possible. For a site that cannot be cooled with water, apply a cool, wet towel. Do not use ice directly on the site, as it can cause damage to the skin. Cool the site until the pain eases. After cooling, protect the wounds with gauze or other dressing. Do not break any blisters, as they serve to protect the wounds. A burst blister can lead to bacterial infection. Seek medical attention for a second-degree or severer burn that covers a wide area, or a third-degree burn. If a person sustains a burn with clothes on, taking the clothes off may cause damage to skin tissues; do not remove the clothes but cool the affected area over the clothes, and seek medical attention promptly.

Column: Care for injuries provides an opportunity for health education

According to the International first aid and resuscitation guidelines 2016,¹ we need to teach children how to provide first aid not only in school health classes but also in other classes, and using a variety of other opportunities as well. Teachers may find themselves in a position to provide care for a child who was injured at school. Rather than stopping at simply providing care, you can instead take it as an opportunity for children to think about prevention of and response to injuries. For children, doing so when they have just gotten injured will drive the point home to them, giving them a chance to learn something they will be able to use in years to come.

2) First aid for illnesses

(1) Abdominal pain / diarrhea

Abdominal pain or diarrhea is often caused by a digestive problem. However, some may complain of abdominal pain caused by a urinary or gynecological problem. For these reasons, it is necessary to perform thorough assessment and vital sign checks to determine the level of severity.

First, observe the characteristics of the abdominal pain a person experiences, and ask whether or not he/she has symptoms such as vomiting and diarrhea. Ask the person about his/her experience with meals, urination, and for females, menstruation. If the person suffers from frequent vomiting or diarrhea in addition to abdominal pain, suspect infectious gastroenteritis (see Chapter 7). If it is not an urgent case, keep the sick person at rest and monitor their conditions. If he/she is experiencing diarrhea, have him/her replace lost water and salts (electrolytes) in small, frequent amounts to avoid dehydration.

Column: Disposal of bodily waste / vomit

School is a place where people live their lives in groups, and it is necessary to properly dispose of human bodily waste or vomit as a source of infection. Failure to dispose properly of bodily waste or vomit may potentially lead to widespread infection (such as norovirus infection). It is therefore necessary for teachers to be able to dispose of them properly. The disposal procedures are as follows (Figure 15.11).

- i) Put on protective equipment (wear a mask and vinyl gloves at minimum; single-use masks and gloves are preferable). In the case of a closed space, ventilate the space.
- ii) Wipe up bodily waste / vomit with paper towels, working inward to prevent spreading.
- iii) Put the collected bodily waste / vomit, as well as the paper towels used, immediately in a plastic bag, seal tightly, and dispose of it.
- iv) Disinfect the areas that have been soiled with bodily waste or vomit, using a disinfectant. Vomit tends to spread over a wide area; disinfect a 2-meter circle from its center, working inward. Dispose of the paper towels, mask, and gloves used in a plastic bag.
- v) After completing the process, wash your hands with soap and gargle.

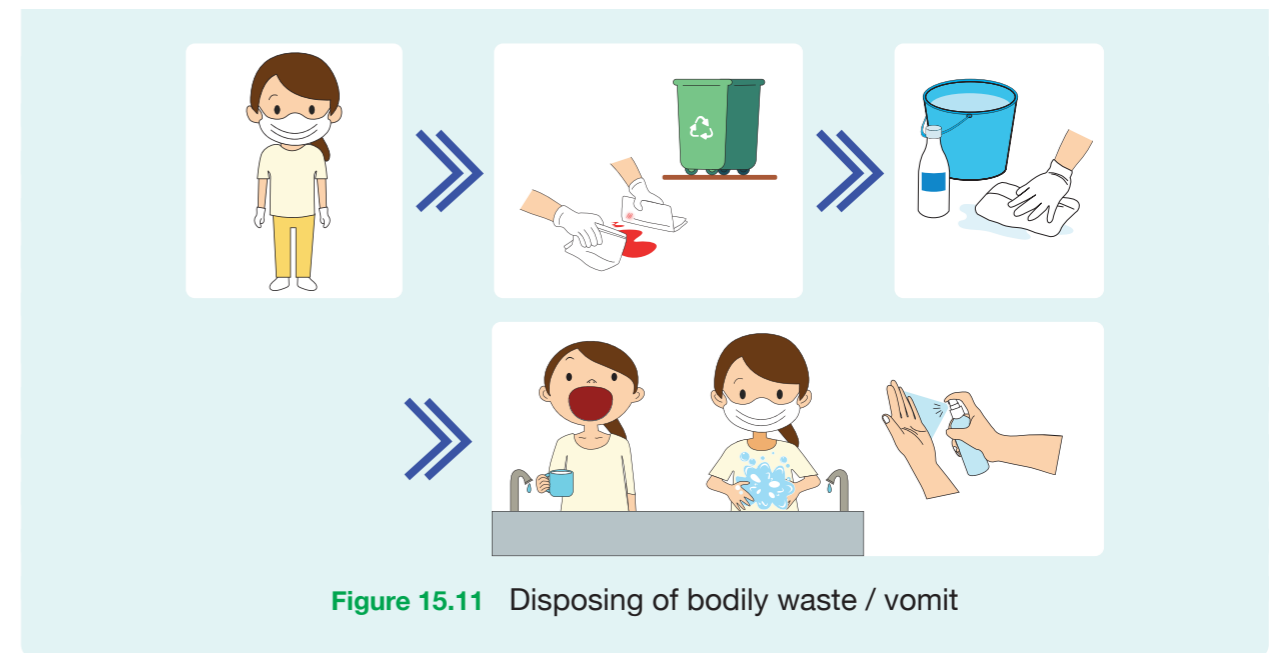


Figure 15.11 Disposing of bodily waste / vomit

(2) Headache

Headache may occur due to a variety of factors. Check the vital signs of the sick person, and ask about the characteristics of the headache in detail (i.e., when did it start? What kind of headache? How long has it been going on?).

First of all, check for any trauma. If the person has trauma, and experiences vomiting and impaired consciousness, it is a medical emergency. Headache accompanied by high fever and seizures also requires particular attention. Check for a runny nose and assess the condition of the throat, too, for ear, nose, and throat problems can also be a cause of headache.

If the sick person has normal vital signs and only mild symptoms, keep him/her at rest and monitor their conditions. Since headache may be caused by irregular lifestyle habits, including lack of sleep and eyestrain, it is also important to review his/her daily life.

(3) Fever

Fever is an inflammatory response to various virus or bacterial infections. Check the vital signs and observe the general condition of the sick person. In general, a fever of 38°C or higher is considered to be high. One has the chills as their body temperature goes up. During fever, have the sick person lie quietly and replace water and salts (electrolytes) to prevent dehydration. If he/she has the chills, keep him/her warm with blankets and towels. If sweating, have him/her change clothes. If a person has a fever accompanied by severe headache/abdominal pain or vomiting, seek medical attention promptly as he/she may be at a risk of falling into a critical condition.

Column: Responsible self-medication, self-care and self-healing mechanisms

WHO, in its guidelines on the use of pharmaceutical products (the Guidelines for the Regulatory Assessment of Medicinal Products for Use in Self-Medication), recommends the practice of **self-care** and **responsible self-medication**, in which individuals take responsibility for their own health

and care for “minor ailments” of body and mind that do not require medical attention, by means of making adjustments in their everyday lives and using non-prescription medicinal products.^{6,7} The human body has innate defense and other systems, which give our body the ability to heal illness (**self-healing mechanisms**) (see Chapter 7). For instance, having a fever or inflammation means that our body’s defensive response is at work, trying to rid the body of viruses and other invaders. And in addition to using healthcare services, we can also use our wisdom to adopt everyday lifestyle behaviors that are effective in helping our body restore its health, such as eating well-balanced meals and getting adequate sleep, all based on particular symptoms we may be experiencing.

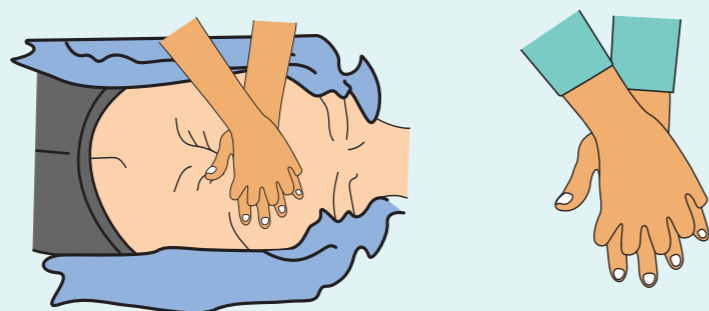
In some cases, however, self-care or self-medication may have a negative impact. In order to promote self-care and self-medication successfully, it is necessary to promote social empowerment as well, with an aim to advance people’s health education, general knowledge, and socioeconomic status.^{6,7}

Column: Cardiopulmonary resuscitation and AED

• Why is cardiopulmonary resuscitation (CPR) necessary?

If you find yourself in the presence of a sick person who requires immediate emergency medical care, such as one who is unconscious, in cardiac arrest, or in respiratory arrest, you may be able to save the sick person’s life if you can perform cardiopulmonary resuscitation (CPR). Even if you are a member of the general public who is not a healthcare provider, if you have received training and are able to give CPR, the chance of the person’s life being saved will increase if you perform **chest compression** while waiting for an ambulance to arrive after contacting medical services.

- i) Place the heel of one hand on the center of the person’s chest, and place the heel of the other hand over the first.



- ii) Push straight down on the chest, keeping your elbows straight and positioning your shoulders over the point of compression.



**100 compressions per minute
Push down by 5 cm**

Figure 15.12 Keys to chest compression

CPR is a technique to restore spontaneous blood flow and the respiration of a sick person who is in cardiopulmonary arrest. Chest compression promotes the flow of blood to the brain and the heart by applying pressure to the area around the heart (Figure 15.12). If the person who finds a sick person performs CPR at once, the person’s chance of survival will increase.^{8,9}

• Increased access to AEDs

AED stands for **automated external defibrillator**. An AED is a medical device that can analyze the electrocardiogram and deliver **defibrillation** (i.e., sending an electrical shock to the heart to reset a normal rhythm), and a layperson can operate one (Figure 15.13). When you turn on the AED, it will give voice prompts. When you attach a pair of pads to the chest area, automated analysis of the electrocardiogram will be performed. If defibrillation is required, instructions to do so will be given in voice prompts. Press the defibrillation button to start defibrillation. Once a person falls into cardiopulmonary arrest, their survival rate decreases by 7–10% for every minute without defibrillation.^{8,9} It is therefore critical to use an AED at the first possible moment to save their life.

In Cambodia, AED awareness is not very high yet, and there are not many AED locations, although it is gradually becoming more common. In Phnom Penh, a Japanese soccer player has donated an AED to the KMH Stadium, while another has been placed at Aeon Mall, as well. It is anticipated that there will be more AEDs accessible, primarily at locations where large crowds of people gather and accidents are prone to happen. At the same time, it is necessary to create more opportunities for as many people as possible to learn how to use an AED first-hand.

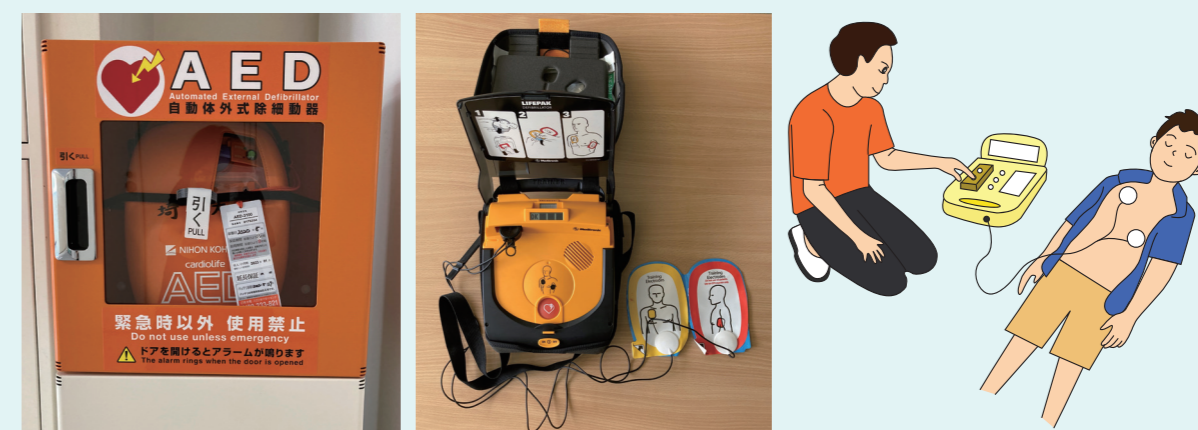


Figure 15.13 Example of AED use

• Special considerations when performing CPR

- (1) If the sick person is an infant, you may need to adjust the point and depth of compression, taking into account the smaller body.
- (2) Recommended CPR steps are subject to update. You will need to check the most current information.

Exercises for further thought and research

- [15-1] Find out about injuries common among children in Cambodia, and discuss what to do to prevent them.
- [15-2] Assuming an injury that is likely to happen to children, such as an abrasion or cut, discuss possible ways to teach children how to treat it.
- [15-3] Concerning first aid procedures that are actually performed in daily life, discuss what kinds of scientific evidence form a basis for the procedures, and whether there is anything that can be done to improve on them.
- [15-4] Look back on experiences of your own or someone close to you of injuries or illnesses in the past, and reflect on what care was given, what action was taken in response, and what you/they were and were not able to do. Discuss what issues Cambodia has.

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Chapter 16

Disability and special education needs

Learning objectives

You will be able to gain a proper understanding and explain:

- The definition of disease, impairment, disability, and handicap using specific examples.
- The medical model of disability, the social model of disability, and the integrated model of disability (International Classification of Functioning, Disability and Health: ICF).
- Challenges in education of children with disabilities in Cambodia.

This chapter first provides basic knowledge necessary to understand disease, impairment, disability, and handicap. Secondly, we explain the medical model of disability, the social model of disability, and the International Classification of Functioning, Disability and Health (ICF) as an integrated model of disability. Finally, we describe the present situation of special education needs for children with disabilities in Cambodia.

Note that in this chapter health is mainly treated as a factor of disability; that is, in terms of health conditions such as disease or injury. This differs from the broad meaning ascribed to health in the previous chapter (e.g. Chapter 1).

1. Aspects of disease, impairment, disability, and handicap

1) Disease

Disease results from abnormalities in all or part of the physiological state of living creatures. Someone suffering from a disease is incapable of fulfilling normal functions, and generally experiences various types of pain. However, some diseases such as diabetes produce no sense of pain before growing severe. A disease can be defined as a condition in which cells suffer damage for some reason and fail to function normally.

Diseases recognized as resulting from morphological abnormalities in cells are referred to as “**organic diseases.**” They contrast with “**functional diseases,**” in which current medical knowledge cannot identify any cellular abnormalities. Cancer, diabetes, cerebrovascular disease, and heart disease are considered organic diseases, while mental illnesses are placed in the functional disease category.

2) Impairment, disability, and handicap

(1) Definition of impairment, disability, and handicap

The WHO (1980) provided definitions of impairment, disability, and handicap as follows:^{1,2,3} **Impairment** is physical or mental dysfunction, which may be either permanent or temporary, due to a loss of mental or physical structure or function. **Disability**, meanwhile, is any restriction or lack of ability (resulting from an impairment) to perform an activity in the manner or within the range considered normal for a human being. **Handicap** is a disadvantage for a given individual that limits or prevents the fulfillment of a role that is normal.

Views on disability, however, are more complicated and can broadly be divided into two basic models: **the medical model** and **the social model**.

2. Models of disability

1) The medical model of disability

Under **the medical model**, disability is defined as conditions in which the body fails to function normally due to disease or injury (Figure 16.1). This causes a decline in the capacities necessary for everyday life, placing afflicted persons in socially disadvantageous circumstances. Suffering a stroke, for example, may cause brain damage (i.e., disease) that permanently impairs numerous physical functions. This can include paralysis in the hands and feet, speech disorders, and other problems (i.e., impairment). Numbness in the hands and feet can adversely affect mobility, the ability to grasp objects, and other everyday life skills (i.e., disability). Victims can lose the ability to work, perform housework, and fulfill other social roles (i.e., suffer social disadvantage or handicap).

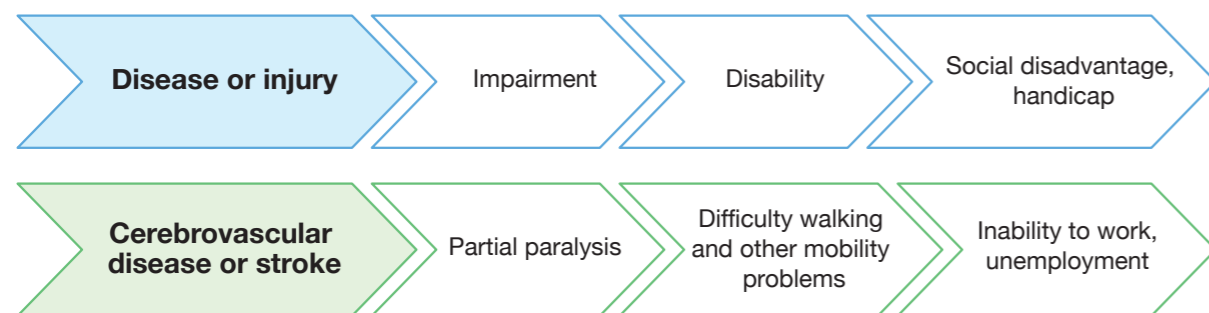


Figure 16.1 The medical model of disability

2) The social model of disability

In contrast, under **the social model**, the causes of disability are considered to lie in the social environment. For example, even if people lose legs after stepping on unexploded land mines, they may regain mobility

by wearing artificial limbs or using a wheelchair. In such cases, the physical loss of a leg cannot be directly linked to a decline in capacity or suffering social disadvantage.

What happens, however, if Cambodian society is unable to supply artificial legs or wheelchairs? Or if roads, homes, and workplace environments are not altered to provide proper wheelchair access? In such cases, the view is that the social environment is the cause of the disability. That is the basic idea of the social model.

Look at the following illustration and consider where the disability exists (Figure 16.2).

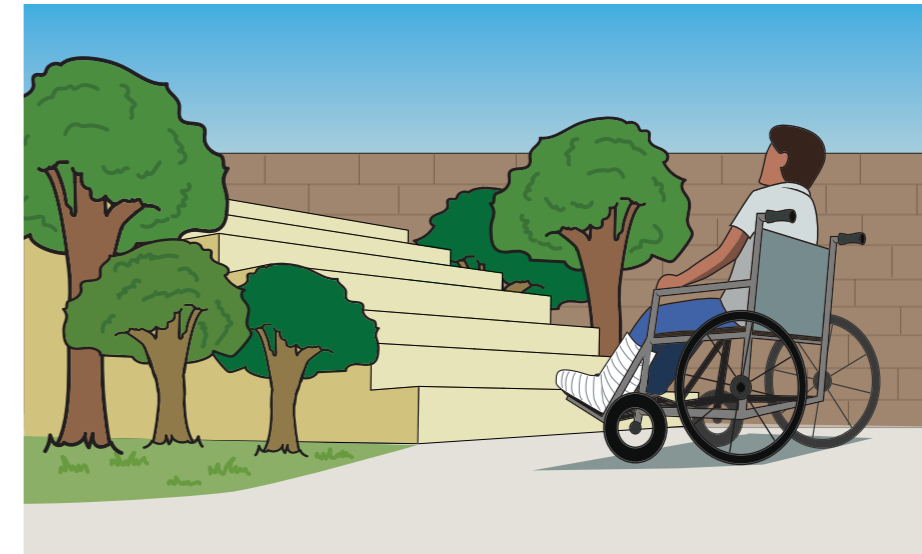


Figure 16.2 A person with a disability in a wheelchair faces stairs. Where is the disability?

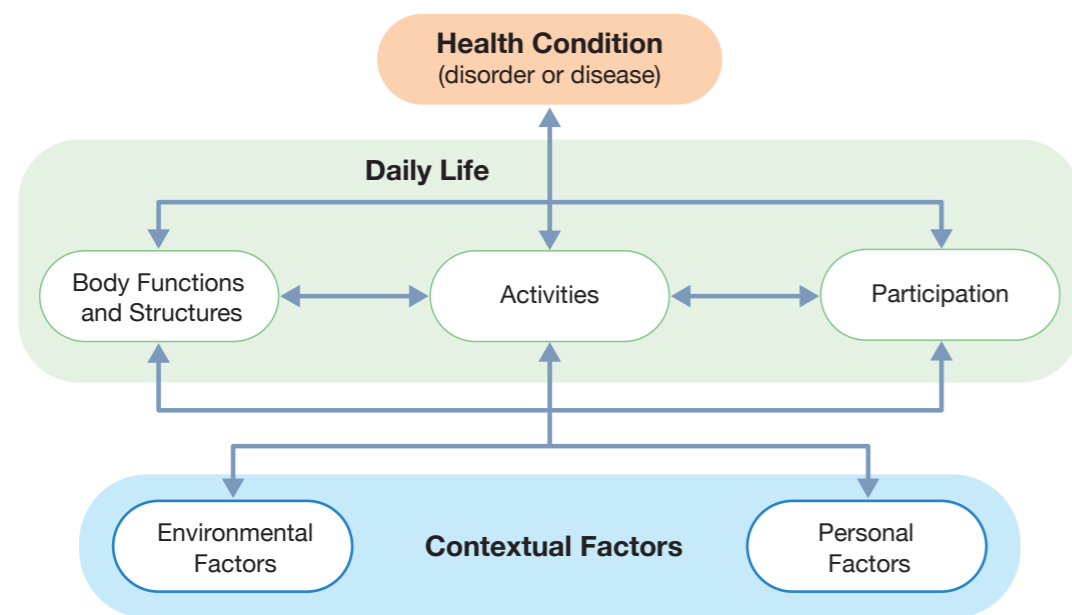
3) International Classification of Functioning, Disability, and Health (ICF) as an integrated model of disability

The ICF is a classification of health and health-related conditions for children and adults that was developed by the WHO and published in 2001. **The integrated model of disability** is an attempt to merge, or at least bring together, the medical and social perspectives.⁴ This model allows for people with disabilities to fill a number of different roles “including citizen and patient, among many others.”^{4,5} An important point to note is that this model was created to be applicable to all people under any conditions, not just persons with disabilities.

As shown in Figure 16.3, the ICF model regards disability as a state of dysfunction or disturbance of daily human life. **Daily life** is categorized into three parts: **physical and mental function and structure**, **activity**, and **social participation**. For example, dysfunction or disturbance of physical and mental function and structure means **impairment**, indicating abnormality of mental function, motor nerve function, sensory functions such as vision and hearing, vocal organs, digestive and circulatory systems, immune system, endocrine system, or reproductive system. Limitation of activity refers to difficulty in performing activities such as walking, eating, taking transport, or counting money. Restriction of social participation refers to limitation or lack of involvement in any area of life such as education, gainful

employment, or leisure pursuits. Relationships between health conditions, daily activity, and environmental and personal factors are indicated by double arrows, denoting interaction.⁶

The three types of dysfunction of daily life are influenced and affected in turn by **environmental factors** (e.g., products and technology, the natural environment and human-made changes to the environment, services, systems, and policies), and by **personal factors** (e.g., age, gender, ethnicity, outlook on life, and lifestyle). Moreover, this figure shows that these functions of daily life interact with **health conditions** such as disease and injury.



Source: World Health Organization. How to use the ICF: A practical manual for using the International Classification of Functioning, Disability and Health (ICF). Exposure draft for comment. October 2013. Geneva: WHO.³

Figure 16.3 The ICF Model: Interaction between ICF components

3. How does Cambodian society view disease and disability?

Disease and disability can lead to **prejudice, stigma, and discrimination**. In Cambodia, however, a recent report based on a survey of **people living with HIV** reveals interesting results. For example, instances of job discrimination or income loss due to AIDS declined from 46% in 2010 to 2% in 2019. Those experiencing verbal harassment fell from 14% to 3% during the same period.⁷ The report also notes, however, that despite the decreases in such stigmas and discrimination from others, **“self-stigma”** (resulting from personal shame, guilt, and self-blame) had declined only slightly.

How and why have such changes occurred in Cambodia, and what types of prejudice, stigmas, and discrimination are directed toward other types of diseases and disabilities, for example, mental illness, blindness, or hearing loss?

4. Special education needs for disabled children in Cambodia

According to the Policy on Education for Children with Disabilities of the Cambodian Ministry of Education, Youth and Sport, 68% of all children with disabilities suffer from vision-, hearing-, or mobility-related issues.⁸ In the 5-17 age group, 2.6% of boys and 2.9% of girls do not attend school due to their disabilities. Unfortunately, Cambodia has a shortage of experts that specialize in educating disabled children. As a result, the introduction of **inclusive education** has not progressed smoothly.

This creates challenges to guaranteeing education for children with disabilities through **the framework of the child-friendly school** adopted in the policy. One objective of this policy is to raise awareness of the situations of persons with disabilities throughout the community, and to promote acceptance of such individuals into society among all concerned parties.

Column: Inclusive education for children

All children have the right to access and benefit from quality education, based on the principle of “Education for All.” Guaranteeing education is the key to sustainable development, peace, and stability among countries; thus it is an urgent issue. However, due to various conditions there are children who have difficulty accessing education, and are excluded from education. What kinds of children are hampered in their right to education? For example, children with disabilities, girls, children living in remote areas, street children, child laborers, children in poor families, and children of minorities. These children have special needs for education. Inclusive education not only includes children with these special needs in school education, but also transforms the whole school so that children with diverse traits can learn equally.

Resources: Disability Action Council. Inclusive education training in Cambodia. <https://www.eenet.org.uk/resources/docs/cambodia.pdf>, Education World Forum. The Dakar Framework For Action. UNESCO 2000. <https://sustainabledevelopment.un.org/content/documents/1681Dakar%20Framework%20for%20Action.pdf>

Column: Child-friendly schools

All social systems and agencies that affect children should be based on the principles of the Convention on the Rights of the Child. Based on this principle, **UNICEF** developed the framework of the child-friendly school, which is characterized as “inclusive, healthy and protective for all children, effective with children, and involved with families and communities - and children.”

Cited from https://www.unicef.org/french/lifeskills/index_7260.html

Column: What is UNICEF?

The United Nations Children's Fund (UNICEF) is an international organization established in 1946 to provide emergency assistance to children suffering in the aftermath of World War II. UNICEF's missions are to save children's lives, to defend their rights, and to help them fulfil their potential, from early childhood through adolescence. UNICEF staff work in over 190 countries and territories.

Cited from <https://www.unicef.org/> and <https://www.unicef.org/eca/press-releases/unicef-commemorates-70-years>

Exercises for further thought and research

- [16-1] Think about what disability and the conditions of being disabled mean to you.
- [16-2] Consider why special education programs need to teach children with disabilities, reflecting on your own experiences.
- [16-3] Examine how Cambodian society views disabilities.

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School Health for All — A Step to a Better World [English edition]

Acknowledgements

We would like to express our sincere gratitude to all the people involved in the publication of the textbook, including the School Health Department of the Ministry of Education, Youth and Sport of the Kingdom of Cambodia, Phnom Penh Teacher Education College, Battambang Teacher Education College, The Nippon Foundation, Social Compass, and Education Support Center “KIZUNA”.

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Illustration production

Social Compass

Grant

The Nippon Foundation

Publisher

Tokyo Shoseki Co., Ltd.

2-17-1 Horifune, Kita-ku, Tokyo, Japan

Printer

Livretech Co., Ltd.

1-28-1 Horifune, Kita-ku, Tokyo, Japan

The date of issue 4/1/2022

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Printed in Japan