NICOLAE TESTEMITANU STATE UNIVERSITY OF MEDICINE AND PHARMACY OF THE REPUBLIC OF MOLDOVA

Galina Obreja, Olga Penina, Elena Raevschi

Social Medicine and Health Management
(Textbook)

Chisinau
2025

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ABBREVIATIONS

CBA	cost-benefit analysis
CEA	cost-effectiveness analysis
DALY	disability adjusted life-years
DHS	Demography and Health Survey
DRG	diagnose related group
ECHI	European Core Health Indicators
EPHO	essential public health operation
GBD	global burden of disease
GDP	gross domestic product
HALE	healthy life expectancy
HRQOL	health-related quality of life
ICD	International Statistical Classification of Diseases and Health-related Conditions
ICF	International Classification of Functioning, Disability and Health
IT	information technology
LE	life expectancy
MHCI	mandatory healthcare insurance
MICS	multiple indicator cluster survey
MTBF	mid-term budgetary framework
NCD	noncommunicable disease
NGO	nongovernmental organization
NCHI	National Company for Health Insurance
NPV	negative predictive value
OOP	out-of-pocket payments
PHC	primary health care
PPV	positive predictive value
QALY	quality adjusted life year
QOL	quality of life
SDG	sustainable development goal
SF-36	Short Form Health Survey
Se	sensitivity
SP	specificity
USA	United States of America
VAT	value added tax
WHO	World Health Organization
WHOQOL	World Health Organization Quality of Life Questionnaire
WHOQOL-BREF	World Health Organization Quality of Life Questionnaire-BREF
YLD	years lived with disability
YPLL	years of potential life lost

INTRODUCTION

Social medicine is a branch of medicine concerned with the study of population health in a broad social context. Social medicine studies health and disease in a population or defined population groups to determine their health needs and to plan, implement, monitor and evaluate health strategies and programmes to respond effectively to those needs. Health management is the study of contemporary forms and methods of organizing, planning, financing, delivering, analysing and evaluating health services within health systems. The discipline encompasses a wide range of demographic, epidemiological, statistical, social and other methods used to analyze the population health status and its determinants, and to monitor and evaluate health systems and policies. The textbook for the course "Social Medicine and Health Management" is in accordance with the discipline curriculum for the integrated higher education programme in Medicine and for the licentiate programmes in the area of Health within the SUMPh "Nicolae Testemitanu".

The content of this textbook is divided into six chapters. The aspects of social medicine cover analysis of health status, including demographic analysis of health status; analysis of morbidity, disability and quality of life; determinants of health and health inequities; and the use of summary measures of population health in the analysis of population health and burden of disease. The topics dedicated to health status analysis aim to provide students with knowledge that will facilitate the development of graduation / licentiate thesis and involvement in research.

The management aspects are structured in two chapters, dedicated to the organization, management and functioning of health systems and health policy, and to the monitoring and evaluation of public health policy and health systems.

Chapter 1 includes a brief history of the development of social medicine as an interdisciplinary branch of medicine and the evolution of the meaning of social medicine at different stages and in different social conditions. Students are informed about the main concepts of social medicine and the importance of recognising the link between social conditions and health, as reflected in the WHO definition of health. In addition to physical and mental health, this definition includes social wellbeing. Study of this chapter will help students to appreciate the influence of health determinants and the importance of addressing them, as well as the role of health professionals in disease prevention and health promotion, health advocacy and intersectoral collaboration.

As the importance of the social aspects of health has been increasingly recognised and the field of public health has developed, the social aspects have become part of public health. To this end, the definition and functions (essential operations) of public health and their link to the functions of the health system are presented. The differences and similarities between the algorithm of population health assessment and the diagnosis of an individual's health are described. The contribution of public health to ensuring universal health coverage is specified. The purpose of presenting this information is to help future physicians and other health professionals acquire the relevant skills they need to provide the highest quality of care. Information on public health surveillance and its role in measuring the health status of the population is presented. Measuring health status and informing disease prevention and control interventions at population level involves the use of indicators. To this end, health indicators are defined and their areas of use are described. Students are introduced to the importance of disaggregating health indicators, identifying population groups with priority health needs, and determining the existence of health inequities, including as a result of implemented interventions. The content of this chapter is complemented

by the main data sources and health indicator systems at national, regional and international levels.

Chapter 2 discusses the importance of demography in measuring the health status of the population and in determining health service needs. Basic demographic concepts are presented and the main sources of demographic data are described. A description of the population structure and the main demographic processes, such as fertility, mortality and migration, is essential for analysing the health needs of different population groups and for allocating resources. Knowledge of these characteristics is of interest to future physicians and other health professionals. The demographic, medical and social aspects of population ageing and their implications for health and well-being and health service delivery are presented using the life course approach. Fertility and mortality are two of the main demographic processes that determine the health status of a population and in which physicians and other health professionals are directly involved. The definition, classification and description of mortality indicators completes the range of knowledge that students will acquire in order to analyse the health status of the population, which can be used in both practical and scientific activities.

Chapter 3 describes morbidity, disability and quality of life and approaches to their measurement. Types of morbidity and methods of analysis are presented. Students are familiarised with the International Classification of Diseases, 10th and 11th revisions, and their relevance to medical and public health activity. It also describes disability and its main concepts in the light of the International Classification of Functioning, Disability and Health (2001), the main approaches to measuring disability and the advantages and disadvantages of each approach. Students are informed about the directions of use of disability indicators, emphasising their importance in assessing the achievement of the Sustainable Development Goals and ensuring inclusive development. Most

noncommunicable diseases are not directly life-threatening, but have a serious impact on patients' health and quality of life. In this context, students are introduced to summary measures of population health, which combine information on deaths and non-fatal outcomes to produce a single number representing the health of the population. Students are introduced to the concepts of "burden of disease" and "health-related quality of life" and how they are measured. Guidance on the use of health-related quality of life measurement tools in clinical practice and public health is provided.

The main types of noncommunicable diseases and their risk factors are presented in **Chapter 4**. The three levels of prevention, as well as WHO approaches to primary prevention are described. Screening is a preventive intervention widely used in medical practice for the early detection of disease or risk factors. Students are familiarised with the basic principles for establishing a screening programme and the criteria for evaluating screening tests. Indicators for monitoring and surveillance of noncommunicable diseases and strategies for their prevention and control, including in the Republic of Moldova, are presented. The epidemiological transition stages are also described.

Chapter 5 describes aspects of the management, organization and functioning of health systems. Students are familiarized with the concept of a health system and the difference between it and a healthcare system. Common characteristics, functions and objectives of health systems are presented. The description of each health system function enriches the students' knowledge with general information about the system they will enter as health service providers. Governance is described in terms of subfunctions, actors and principles. Resource generation is described in terms of its three constituent components: human and physical resources, health information system and pharmaceuticals, vaccines and other consumables. The subchapter on financing informs students about the context of health expenditure and the components of financing, with

descriptions of each. The main types of health systems and their advantages and disadvantages are described too. A major function of the health system is service delivery, and this textbook defines, classifies and characterizes health services. A subchapter is devoted to the quality of health services and aspects of their measurement.

Chapter 6 is devoted to health policy and health monitoring and evaluation. It defines the main concepts related to health policy and outlines the concept of health policy formulation. In addition, the chapter introduces topics related to health policy, including stakeholders, the main types of health policy, and the importance of studying health policy. This chapter provides students with a basic knowledge of how health policy is developed in general, and in the Republic of Moldova in particular. Studying this chapter will help students to understand the analytical methods used in planning, such as SWOT analysis; the importance of correctly formulating specific objectives based on SMART criteria; and the analytical techniques used in option appraisal and decision making. One of the subchapters is dedicated to monitoring and evaluation of health policies and health systems. The two processes are presented in a logical framework with a description of indicator domains, data sources and tools for data collection, analysis and synthesis, communication and use of data. Important aspects of data quality are presented too.

The textual content is supplemented by information presented in tables and figures to help students understand the topics covered. The examples presented in the chapters, and the review exercises and questions at the end of each chapter, are designed to develop skills in calculating and interpreting health indicators, health service quality indicators and health system performance indicators, as well as skills in using information for evidence-based decision making in future medical careers.

1. POPULATION HEALTH AND ITS DETERMINANTS

1.1. Social Medicine: Brief History

Medicine is the science and practice concerned with the diagnosis, treatment, and prevention of disease. **Social medicine** is an interdisciplinary branch of medicine concerned with the study of population health and health systems in a broad social context. Social medicine contributes to understanding the factors that determine health status and the ways in which knowledge of these factors can be used to improve the population health.

The term "social medicine" has had different meanings over time and has been adapted to different societies and different social conditions. However, the basic principles regarding the academic and practical aspects of social medicine formulated by Rudolf Virchow (1821-1902) and his colleagues (14) in the 19th century and summarized later by George Rosen (1910-1977) (35) are the foundation of the term:

- Population health is an issue of direct social concern;
- Social and economic conditions have important effects on health, disease, and medical practice, and the relationships between them should be subject of a scientific research;
- Society should promote health and fight diseases, and the measures taken should be both social and medical.

The task of teaching social medicine is to provide students with a set of concepts and skills that will enable them to ask the right questions and address the health problems of the populations they serve. However, physicians cannot practice social medicine alone; they must be part of a large team of health professionals and community groups. Professor William Hobson, in his article "What is Social Medicine?" published in the "British Medical Journal" in 1949, stated that "In teaching medicine, the aim was to accumulate facts, by neglecting the study of man in his environment. The humanism of medicine is often

lost in the noise of technical detail. Social medicine is a branch of medicine that provides a point of contact with the broader humanities. Its philosophy should permeate all branches of medicine, because its implications cannot be separated from any branch of medical education", matters that are still relevant today (7).

At the end of the 18th century, German physician Johann Peter Frank (1745-1821) called "poverty the mother of disease" and described the system of "medical policy", the precursor of public health (36). The systematic study of the relationship between disease, medicine, and society began in the mid-19th century.

Poor working and living conditions, unemployment, homelessness, and poverty created an environment that had a significant impact on people's health. The study of the relationship between these and medical practice became known as "social medicine". At that time, the term signified the extension of medicine's perspective to social problems.

The term "social medicine" was first introduced in the mid-19th century by the French physician Jules Guérin (1801-1886), who described the relationship between social conditions and health (47). Guérin argued that the goal of creating a new, healthier society after the Revolution (1848) could be effectively achieved if knowledge and information about the relationships between *medical problems, social factors, and public affairs* were systematically integrated into social medicine.

The founder of social medicine is considered the German physician Rudolf Virchow, one of the great pathologists of the 19th century. He was aware of the social origins of disease. In 1848, he investigated a typhus epidemic in the Prussian province of Upper Silesia and identified social factors such as poverty and lack of education and democracy as key elements in the development of the epidemics. His report (1848) on this epidemic is considered a classic work in the history of social medicine.

According to Virchow, "Medicine is a social science, and politics is nothing but medicine on a large scale" and "If medicine really wants to

fulfil its great task, it must intervene in political and social life" (14). Virchow proposed the creation of a "public health service," an integrated system of publicly owned and operated health facilities staffed by health professionals employed by the state.

Since then, the definition of social medicine has evolved to be synonymous with public health, social hygiene, community medicine, and social pathology. The practice of social medicine has also evolved globally and nationally over the decades.

The interwar period witnessed a variety of international developments in social medicine as an academic discipline. In the period between the two world wars, advocates of social medicine as an academic discipline within international health organizations worked to break the exclusive focus on clinical medicine and to enable a move toward broader social agendas.

Since its inception, the World Health Organization (WHO) has prioritized the development of social medicine. The international social medicine movement prior to the Second World War sought to create a new social role for medicine to address the epidemiological transition from infectious to chronic diseases brought about by the economic and social developments of the 20th century.

Social medicine has been institutionalized as an academic discipline since the early 20th century. This institutionalization accelerated after the Second World War.

Human beings are both biological and social organisms, and therefore human health is influenced by both social and biological factors that lead to the development of disease. The interdisciplinary programme between medicine and the social sciences provides medicine with the knowledge and skills necessary to analyze the social causes of health and disease, just as the alliance between medicine and the laboratory sciences has provided new insights into the biological, chemical, and physical bases of disease.

Leon Eisenberg (1922-2009) argued more specifically, that the distribution of health and disease in human populations reflects the place where people live, what they eat, the work they do, the air and water they consume, their activities, their interconnectivity with others, and their social status (4).

The 1978 WHO Alma Ata Declaration on Primary Health Care also embraced the basic principles of social medicine (54).

Social medicine as a science and practice has evolved differently in different countries. As awareness of the importance of non-medical aspects of health grew and the field of public health developed, social aspects became part of it.

1.2. Health and Disease

1.2.1. Health

Health is usually perceived in terms of physical or biological health. But health is also a social issue, as many of the causes of disease are affected by social factors. The social aspects of disease are part of the definition of health as formulated by WHO (1946): "**Health** is a state of complete physical, mental and **social** well-being and not merely the absence of disease or infirmity". This definition was later supplemented with "and the person's ability to lead a socially and economically productive life" (69).

The World Health Organization defines health using **a positive approach** to health "complete well-being". But health, as defined by the WHO, cannot be measured by exact measurable methods. Therefore, the measurement of health status is based on **a negative approach**. This means that health is measured in terms of disease (lack of health), consequences of disease (disability, death) and determinants of health (social, behavioural, etc.). Social well-being is measured in terms of socioeconomic status, health-related quality of life, social contacts and social resources.

The Declaration of Alma-Ata (1978) stated that health is a fundamental human right and that governments are responsible for ensuring this right for their citizens and developing appropriate strategies to fulfil this promise (54). In 1986, the WHO Ottawa Charter on Health Promotion defined health as "the ability of individuals or groups of people to realize their aspirations, to meet their needs and to change or cope with their environment" (55).

Health is a more comprehensive phenomenon because it emphasizes the importance of the **social well-being** of individuals and populations and not just the medicalization of disease. It takes into account the complex range of cultural, social, political and environmental factors, as well as the biological and genetic components, that influence the health and well-being of populations. As health is a state of complete physical, mental and social well-being of an individual, it is important for the development of society. Among the components of good health that are essential for development are: peace, absence of violence, pain, discomfort, boredom and stress, absence of disease and infirmity, balanced diet, adequate housing, water supply, good working and living conditions, access to educational resources.

Good health strengthens development by increasing productivity. It also strengthens people's capabilities, contributes to economic growth and investment, and promotes positive behaviour.

Health is not the sole responsibility of the health sector, but a responsibility shared by other sectors. This vision is supported by the integrated system of Sustainable Development Goals (SDGs) and targets, which can facilitate the integration of public policies across sectors.

1.2.2. Disease

Disease represents functional and structural disturbances of the human body that produce signs and symptoms that are considered as deviations from the norm. Diseases appear as a manifestation of the

failure to adapt to the environment and to combat biological, physical and chemical aggressions. The extent of disease plays an important role in defining health.

In relation to health, disease is as a particular form of human existence. It is characterized by a process that disturbs the balance between parts of the body and the body in relation to the environment, leading either to the restriction or disappearance of freedom and the ability to work (disability) or to the death of the sick person.

With regard to the concept of disease, a distinction should be made between the feeling of being ill – the subjective perception of illness (when the person defines him/herself as ill) and the scientific concept of disease, which is objectively defined based on medical assessments.

Illness as a subjective perception refers to the subjective perception of feeling bad; this feeling does not define a specific disease, but refers to a person's subjective experience of discomfort, fatigue, or general malaise. The way in which patient reports symptoms is influenced by his or her cultural background, and the word "*sickness*" refers to the expression of illness *in relation to social and cultural norms* about health condition (e.g., fear of cancer or stigma in the case of HIV/AIDS or tuberculosis).

For disease, what is expressed is suffering. Meanwhile, disease means living with a diagnosis mediated by a set of health system interventions. Another term used to define disease is *disability*, which will be addressed in Chapter 3.

1.3. Health Determinants

The health status of a population is determined by the circumstances and environment in which it lives. **Determinants of health** represent a range of personal, social, economic and environmental factors that influence the health status of a population. The term "determinants" is generally used to explain patterns of health or disease in populations or groups of people.

Health determinants can be grouped into the following categories:

- Biological determinants;
- Behavioural determinants;
- Social or socioeconomic determinants;
- Health system determinants.

1.3.1. Biological Determinants

Some biological factors, such as age and sex, influence the health of the population. For example, older people are biologically predisposed to poorer health than younger people. This is due to the physical and cognitive effects of ageing. Men and women suffer from different diseases at different ages. Genetic inheritance and family history also play a role in determining life expectancy and the likelihood of developing certain diseases. Examples of genetic determinants: sickle cell disease, haemophilia, cystic fibrosis. Biological determinants cannot be changed by public health interventions.

1.3.2. Behavioural Determinants

Behavioural determinants are also known as behavioural risk factors. *Risk factors* are attributes, characteristics, or exposures that increase a person's likelihood of developing a disease or disorder. The ways in which social determinants influence health include the effects that lack of control, stress, and reduced capacity have on health-related behaviours, including

tobacco and alcohol use, unhealthy diet, physical inactivity, drug use, and unsafe sexual behaviour. Individual behaviours are sometimes described as freely chosen and therefore as social differences in lifestyle resulting from unhealthy individual choices. The obvious strategy to reduce these lifestyle behaviours is to inform people about the negative health consequences of these behaviours and to motivate them to change their lifestyles, i.e., to make healthier choices. However, it is wrong to assume that the lifestyles of different social groups are freely chosen, because the social and economic environment in which people live shapes their lifestyles. Recognizing these lifestyles as structurally determined highlights the importance of structural interventions to reduce social inequities in lifestyle related diseases. Such interventions include:

- Fiscal policies that increase the price of harmful goods and legally restrict access to them;
- Promoting healthier lifestyles by making it easier to choose healthy alternatives, for example through public subsidies and improved access to healthy food and recreational facilities.

This does not mean that interventions at the individual level are not important. For example, the quality of life of patients with diabetes can be improved through changes in their health behaviour, and individual health education of patients by health professionals should be used to achieve this.

1.3.3. Social Determinants

The distribution of health and disease in human populations can only be understood in its social context: "Social processes determine the social shaping of the distribution of health and disease within and between societies". As noted above, this concept is diametrically opposed to the individualistic biomedical and lifestyle assumptions that the distribution of disease results from the intrinsic characteristics of individuals, either biological or behavioural.

Social determinants, also known as socioeconomic determinants of health arise from a "social environment", structured by government policies and status hierarchies. The social determinants of health reflect the factors and conditions in which people are born, live, learn, work and age, as well as people's access to power, money and resources.

These factors influence health, functioning and quality of life. Examples of social determinants of health are: the availability of resources to meet daily needs, such as education, work, housing or food; social norms and attitudes, such as discrimination, exposure to crime and violence, poverty, public safety, and residential segregation.

Education is generally a prerequisite for a better job, which ensures a higher income. Education provides knowledge, problem-solving skills, and a sense of control over life circumstances. The relationship between better education and better health can be direct or indirect:

- *Direct* – more health knowledge can help people to promote their own health and avoid health hazards, including risky behaviours;
- *Indirect* – by influencing the types of work open to an educated person, the higher incomes they can earn and the lower levels of stress they experience as a result of their privileged position.

The education system plays a fundamental role in preparing children for life, giving them the knowledge and skills, they need to reach their full health potential – socially, emotionally and physically. These psychosocial factors are closely linked to health behaviours. For example, there is an inverse relationship between the level of education and the frequency of tobacco use. Parental education is associated with children's health behaviours.

Higher **income** and higher social status are associated with better health. The greater the discrepancy between the rich and the poor, the greater the difference in their health status. Lower levels of education

and unemployment are associated with poorer health compared to higher levels of education and employment.

Occupation is an important determinant of social status and social identity, and threats to social status through job instability or job loss affect health and well-being. Job loss, unemployment, and economic contraction have been associated with poorer health and higher mortality due to psychosocial and economic consequences.

Psychosocial factors such as stress at work are increasingly recognised as a major health hazard. Mortality rates tend to be higher among people who have little control over their work. Reduced opportunities to use skills and low decision-making authority affect health.

The social aspect of the work environment is a positive determinant of health. For many people, the sense of doing something useful with their peers is one of the most important dimensions of positive life and health.

Exposure to physical, ergonomic and chemical hazards at work, physically demanding or dangerous work, long or irregular working hours, temporary and shift work and prolonged sedentary work can all affect people's health.

Unemployment leads to health problems and premature death, including poor mental health and an increased risk of suicide. Work plays an essential role in society, providing a source of income, prestige, a sense of worth and a way to participate and be a full member of the community. Unemployment effectively excludes people from this participation and from the benefits of employment. Particularly vulnerable groups include the unskilled, the poorly educated, low-income families, single mothers and ethnic minorities. The main mechanisms by which unemployment affects the health of these groups include:

- Increase in poverty due to loss of income;
- The resulting social exclusion and isolation from social support;

- Changes in health-related behaviours, such as tobacco and alcohol use and physical inactivity, caused by stress or boredom;
- Life course effects, as a period of unemployment increases the risk of future unemployment and damages long-term career prospects.

Unemployment is high in the Republic of Moldova and varies considerably by age, sex and educational level.

Education, income and occupation are components of the socioeconomic status index used to measure individual and population well-being, which is part of the WHO definition of health.

Housing has a major impact on health and well-being. The quality of housing is closely linked to income. Overcrowding, lack of privacy, lack of safe playgrounds, damp and inadequate food storage and preparation areas have a particular impact on health.

1.3.4. Health System Determinants

Access to and **quality of health care** also affect health status. For example, uninsured people are more likely to delay medical treatment. Barriers to access to health care include: unavailability of services, high costs, lack of health insurance, (rural) area of residence. The health system is also relevant through the intersectoral actions it should lead.

Social inequities in health systems are determined by reduced access to health services for people with low incomes. The burden of disease is usually higher among these groups and should therefore reflect a higher use of essential health services. In addition, the burden of out-of-pocket, direct and indirect (unofficial) payments, as well as payments to commercial health services that sell their services at market prices, is higher for people with low incomes.

1.3.5. Health Determinants Model

The determinants of health act in interconnection with each other. The ecological approach to public health provides an understanding of how

their interactions can be modelled. In the ecological model, which explains the health status (good or bad), the determinants are divided into **distal** (upstream) determinants, which include the environment, physical or social, and **proximal** (downstream) determinants, which are related to the person, in particular behavioural. Distal determinants determine the overall risk to the population and refer to the circumstances that produce proximal causes, often called "causes of causes" of disease.

The ecological approach to public health, developed in the 1960s, views people as embedded in the physical and social environments that they influence and are influenced by. Within the ecological model, both the person and the context are potential sites for public health interventions. The Ottawa Charter, adopted at the First International Conference on Health Promotion in 1986, contributed to a reorientation of public policy and practice towards risk factors from the distal social environment (power, wealth, social status), as the main causes of health problems (55).

From a population health perspective, more complex public health models integrate distal and proximal determinants of health to predict disease, disability, and premature death. Health behaviours are not "inherent", they are shaped by the social environment, and social determinants are at the root of health inequities.

The most commonly used model of health determinants that analyzes the pathways through which they operate is the health determinants model of Dahlgren and Whitehead (1993) (1). The model illustrates the "stratified rainbow" vision of health determinants as causes of health inequity at the individual level (*Figure 1*).

In the centre of the figure are the individual biological factors that influence the health of individuals, but which cannot be changed by public health interventions. Around them, in four layers, are the theoretically modifiable determinants through public policy: individual

lifestyle/behavioural factors; social and community networks; living and working conditions and health services; socioeconomic, cultural and environmental conditions.

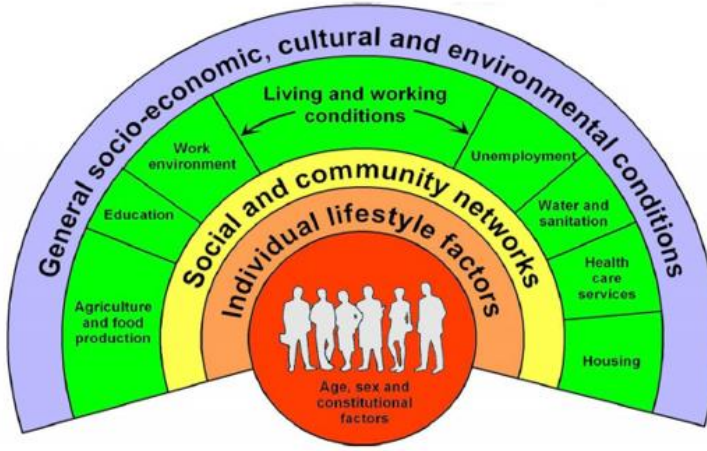


Figure 1. **The Dahlgren-Whitehead Model of Health Determinants**

Source: (1)

The international human rights framework is the appropriate conceptual framework for achieving health equity through action on the social determinants of health. This framework is based on the Universal Declaration of Human Rights adopted in 1948, which states that "everyone has the right to a standard of living adequate for the health and well-being of himself and his family, including food, clothing, housing and the necessary health care and social services" (43). The realization of the human right to health requires the empowerment of disadvantaged communities to maximize their control over the factors that determine their health.

1.4. Public Health

1.4.1. Definition, Purpose and Functions

The notion of "public health" became distinct in the 20th century succeeding sanitation. Charles-Edward Amory Winslow (1877-1957) defined public health as "the science and art of preventing disease, prolonging life and promoting health through the organized efforts of society" (51). Complementing this definition, the WHO emphasized that "Public health focuses on the entire spectrum of health and well-being, from health promotion and disease prevention, to early identification and management of disease, rehabilitation and end-of-life care" (71).

Thus, public health is defined in a broad sense, recognizing that the efforts of the health system alone are not sufficient to ensure the highest possible level of health. These efforts must be complemented by an understanding of how decisions in other sectors affect the health of the population. For example, agricultural subsidies, fiscal policy, urban planning, education, and transportation.

Public health is the process of mobilizing local, regional, national and international resources to ensure the conditions in which the population can be healthy. It reflects the commitment of the government to invest in the health and well-being of its citizens. Public health does not guarantee optimal health, but it creates the conditions in which society can achieve it.

The overall vision of public health is to promote better health and well-being in a sustainable manner, while strengthening integrated public health services and reducing inequities. To achieve this vision, public health efforts include:

- Support through public health instruments, such as health policy (including laws and regulations, prevention and control programs), health and social institutions and services;

- Working with other sectors to address the broader determinants of health and to implement the government's "health in all policies" policy;
- Community participation.

The object of public health is population groups or the population as a whole.

The **primary goal** of public health is to ensure the biological, physical, and mental well-being of all members of society, regardless of gender, wealth, ethnicity, sexual orientation, country, or political beliefs (2).

To achieve this goal, public health has ten functions, **called essential public health operations (EPHOs)** (*Figure 2*) (65).

1) Surveillance of population health and well-being;

2) Monitoring and response to public health threats and emergencies;

3) Health protection, including in relation to the environment, occupational safety, food safety, patient safety, and others;

4) Health promotion, including action to address social determinants and health inequities;

5) Disease prevention, including early detection;

6) Ensuring governance for health and well-being;

7) Ensuring a competent public health workforce;

8) Ensuring organizational structures and sustainable financing;

9) Information, communication and social mobilization for health;

10) Promoting public health research to inform policy and practice.

Defining and grouping EPHOs into core and supporting operations links essential public health operations to the health system functions and its building blocks. For example, core EPHOs include the traditional public health functions provided by modern health systems: health protection, health promotion and disease prevention.

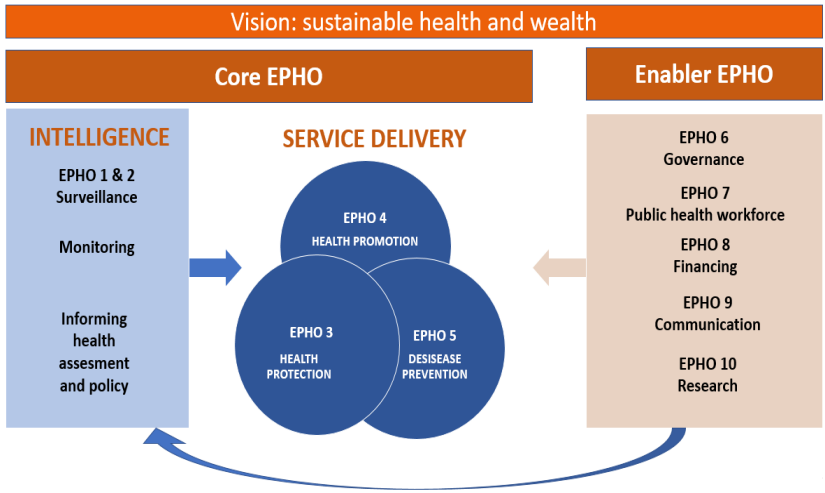


Figure 2. **Interaction between Essential Public Health Operations**
Source: (65)

Health protection (EPHO 3) encompasses various areas of action (e.g., environment, occupational health, patient safety, consumer safety and road safety) and refers to the legal framework and enforcement capacity.

Health promotion (EPHO 4) is the process of empowering people to increase their control over their own health and its determining factors, thereby improving health. This process includes community and social participation, intersectoral collaboration, interventions to address behavioural risk factors (tobacco and alcohol use, unhealthy nutrition and physical inactivity) and social determinants of health, and health education.

Disease prevention (EPHO 5) is the operation that facilitates the transformation of health service delivery to a person- and community-centered model of care. Prevention is considered as an action that usually comes from the health sector. Disease prevention focuses on access to health care in general and includes individual health services

provided through population health programs (e.g., immunization, screening).

The two EPHOs in the "Intelligence" block inform and shape service delivery operations and monitor their effectiveness. They provide the necessary information support for evidence-based decision making. Surveillance (EPHO 1) and monitoring (EPHO 2) of population health are components of the health information system (see subchapter 5.3.2).

Surveillance (EPHO 1) includes the establishment and operation of health surveillance, monitoring and information systems. These systems monitor and map disease incidence and prevalence, risk factors, health determinants, population health status, use of health services and health system performance.

Monitoring (EPHO 2) includes the monitoring and identification of occupational and environmental biological, chemical and physical hazards and preparedness for health emergencies.

Enabler operations include: governance, human resources, financing, communication and research. These EPHOs, embedded in the health system building blocks, are responsible for generating the resources (human, material, knowledge) and financing needed to implement the EPHOs and for overseeing their effective implementation.

Governance (EPHO 6) encompasses health policy development, a process that informs decision-making on public health issues. The development of health policy is a strategic planning process that involves all internal and external stakeholders and defines the vision, mission, measurable health objectives, and public health activities. Governance also includes monitoring and evaluation of the implementation of health programs, as well as the regulation and implementation of laws and regulations (see subchapter 5.2).

The **Human resources** operation (EPHO 7) encompasses planning, management, training, and development of human resources, including

recruitment and retention, educational and licensing characteristics, and performance evaluation.

Financing (EPHO 8) refers to the mobilization, accumulation and allocation of resources to meet the health needs of the population at the individual and collective levels.

Communication (EPHO 9) is the art and technique of informing, influencing and motivating individuals, institutions and the general public on important health issues and its determinants. It aims to increase the health literacy of the population and to improve the health status of the population. Communication includes social participation, community engagement and the use of new communication technologies and social media platforms for health, as well as the design of public health services according to people's needs. Communication should improve the ability to access, understand, and use information to reduce risk, prevent disease, promote health, navigate and use health services, advocate for health policies, and improve well-being, quality of life, and population health.

Research (EPHO 10) includes the following specific components: development of the national research agenda in the area of public health; generation and allocation of research resources; ethical aspects of research; integration of research activities in public health; strengthening capacity for innovation; and disseminating and brokering knowledge to translate research findings into policy and practice - to support evidence-based decision-making.

Strengthening the EPHOs is essential to achieving universal health coverage, a health system goal, and the commitments of the 2030 Sustainable Development Agenda.

Universal health coverage refers to access by the entire population to the full range of health services of good quality that the population needs, at the right time, in the right place and without financial hardship, including disease prevention and health promotion. The full spectrum includes essential health services, beginning with

health promotion and disease prevention and continuing through treatment, rehabilitation and palliative care.

An effective and comprehensive public health system supports universal health coverage by:

- Strengthening resilience through prevention and detection of health emergencies ((EPHOs: health protection, surveillance, monitoring (emergency preparedness));
- Facilitating effective governance, management and planning of the workforce (EPHOs: Governance and Human Resources);
- Promoting the development of health care based on context-specific evidence (EPHO: Research);
- Strengthening the financing of health services by upstream placing of public health interventions (EPHOs: Health Promotion and Health Protection).

1.4.2. Public Health versus Medicine

There is an important difference between public health and medicine. Whereas medicine is concerned with the health of the individual, public health approach is concerned with the whole population or specific population groups, and emphasizes disease prevention, health protection, and health promotion. This does not mean that public health neglects individual health, but that individual health is considered within the broader health of the community of which the person is a part.

Similarly, while medicine typically attempts to solve health problems (intervention after a problem has occurred), public health works to prevent such problems from occurring. This is easier said than done, and most public health interventions produce tangible results over many years (often decades). In contrast, the outcome of treatment for individual patients is usually known within days or weeks. Naturally, medicine is more attractive and profitable.

Public health reflects the commitment of governments to invest in the health and well-being of their citizens. Unlike medicine, however, public health is multidisciplinary and intersectoral, involving disciplines such as epidemiology, demography, biostatistics, informatics, biology, sociology, psychology, education, public policy, law, engineering, and medicine.

"In carrying out its functions, public health – like a physician with a patient, assesses the health of a population, diagnoses its problems, seeks the causes of those problems, and develops strategies to cure them" (37). When a physician diagnoses a disease in a patient and recommends treatment, it is up to the patient to accept or reject the physician's recommendation. If the patient is a "community" or an entire country, it is usually the government that should make the decision to accept or reject the recommendations of public health experts (37). Thus, the reasoning algorithm for assessing (diagnosing) the health status of a population is similar to the algorithm for diagnosing the health status that a physician applies to a patient, but with some specific aspects (*Table 1*).

The standards on qualification in *Medicine* and *General nursing* define the relevant skills that the physician and licenced general nurse should master in order to provide best quality health services (38,39). In addition to the fact that the physician and licenced general nurse are medical experts, the standards state that future health professionals should be communicators, researchers, health advocates, competent professionals with adequate knowledge, including knowledge of the existing relationships between the health status and social environment. Today, health professionals are actors of the health system, working in a team to treat patients, advocating for better health policy, preserving health resources, continuing education and engaging in research.

Table 1. **Algorithm of Population Health Assessment versus Individual Health Diagnosis**

Diagnosis of the health status of an individual	Assessment of the health status of a population
– Identification of the individual (name, sex, age, occupation, blood pressure measurement, etc.).	– Identification of the population group (distribution by age, sex, occupation, level of education with determination of the proportion; distribution by blood pressure values with determination of the mean blood pressure and the frequency of hypertension, etc.).
– Collection of anamnestic data; – Clinical and paraclinical examination; – Comparison of results with known "models" (e.g., maximum values established in the clinical protocol) for various diseases, disorders, and injuries.	– Data collection under standardized conditions, analysis with calculation of relative measures or means, statistical inference and comparison of results with certain reference models.
– Diagnosis of the individual's health (disease).	– Assessment (diagnosis) of the health status of the population group.
– Determination of the aetiology of the established disease.	– Identification of the causal/risk factors likely to be involved.
– Aetiological or symptomatic treatment.	– "Treatment" in the form of an intervention programme applied to the population, targeting the "causal"/risk factors or the disease whose frequency has been determined.
– Monitoring of the patient's compliance with the prescribed treatment and checking the evolution of the health status/disease.	– Monitoring the health status of the population group; – Evaluation of the effectiveness of the intervention.

1.4.3. Public Health Surveillance

One of the essential public health operations and an important component of the health information system is the surveillance and identification of the population health needs. Surveillance thus plays a fundamental role in public health. Surveillance is performed to track changes in disease frequency or health determinants (risk factor levels).

Public health surveillance is defined as "the continuous, systematic collection, analysis, and interpretation of health data necessary for the planning, implementation, and evaluation of public health practice, closely integrated with timely dissemination of these data to those responsible for prevention and control" (22). According to this definition, public health surveillance involves the collection, analysis, and dissemination of health information to those responsible for prevention and control to orient public health policy.

Areas of public health surveillance use are as follow:

- Identifying health problems and assessing their magnitude;
- Measuring trends in health problems;
- Identifying public health emergencies;
- Assessing changes in risk factors;
- Defining public health priorities (to guide disease prevention and control, health protection, and health promotion activities);
- Monitoring and evaluation of health policies effectiveness;
- Stimulating research.

The surveillance system can **measure:**

- Frequency of diseases, disorders, and health risk factors (e.g., incidence, prevalence);
- Disease severity (e.g., case-fatality, hospitalization rate);
- Health impact (e.g., cost);
- Can serve as an early warning system.

There are two main types of surveillance systems: passive surveillance and active surveillance.

Passive surveillance is a system that uses available data on notifiable diseases, the list of which is established by the Ministry of Health. In this case, the reporting of the disease to the competent authority is usually the responsibility of the health care provider. The completeness and quality of the reported data are highly dependent on healthcare workers. Therefore, underreporting of data is a common problem. However, the passive surveillance system is relatively inexpensive. In the Republic of Moldova, this type of surveillance is used for the surveillance of infectious diseases, occupational diseases and injuries.

Active surveillance is a system in which project staff are recruited specifically to carry out the surveillance program. They make regular visits to health facilities (day-care centers, hospitals, etc.) to identify new cases of disease or deaths from the disease that have occurred or to households to collect data on diseases and risk factors. Although the active surveillance system is more expensive, it provides more accurate information because it is carried out by specially employed personnel for this purpose. Based on this system, several studies on population health status and the risk factors have been conducted in the Republic of Moldova (i.e., the Multiple Indicators Cluster Survey, MICS, 2000 and 2012; Prevalence of risk factors for noncommunicable diseases in the Republic of Moldova, STEPS 2013 and 2021; Survey on salt consumption in the Republic of Moldova, 2016).

The surveillance system can use different **data sources**:

- Vital statistics;
- Notification of diseases and injuries;
- Registries;
- Surveys of target groups, households, etc.

1.5. Health Indicators

1.5.1. Definition

A health indicator is a quantifiable characteristic used to describe the health status of a population, its determinants, or the performance of the health system. Health indicators are often used by governments to guide health policy. As mentioned above, health status is influenced by health determinants. Health status and health determinants can be changed through health policy (interventions) (*Figure 3*).

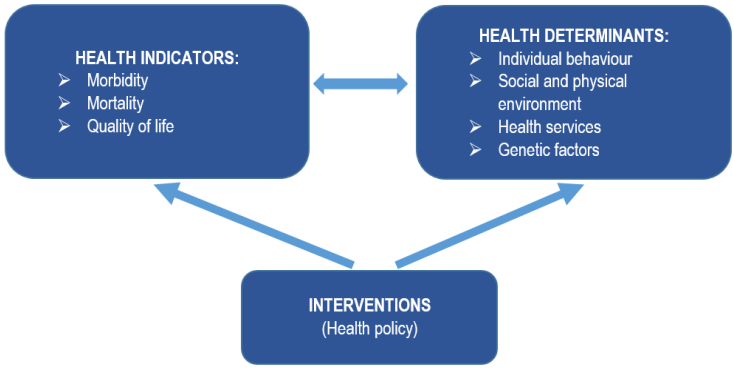


Figure 3. **The Relationship between Health Status Indicators, Health Determinants and Health Interventions**

1.5.2. Classification

Health indicators can be classified according to various criteria. Depending on their relationship to health, indicators can be favourable or positive and unfavourable or negative. A health indicator is **favourable** if there is a direct (positive) relationship between it and health, i.e., a higher indicator value is considered better. Examples include indicators that measure the use of essential services (immunization coverage, adherence to antihypertensive treatment), healthy behaviours and attitudes (fruit and vegetable consumption, physical activity), family and community connectedness, and positive

health outcomes (e.g., being alive; functioning well mentally, physically, and socially; and having a sense of wellbeing).

A health indicator is **unfavourable** if there is an inverse (negative) relationship between it and health, i.e., lower values of the indicator are considered better. Examples include indicators that measure the burden of disease (mortality, morbidity), non-use of essential services, lack of knowledge, and unhealthy behaviours and attitudes (tobacco and alcohol use).

Conceptual frameworks are most commonly used to categorize health indicators. The World Health Organization uses two frameworks for classification of the 100 indicators in *the Global Reference List of the Core Health Indicators* (66). One of the frameworks divides the indicators into four domains: a) health status (e.g., morbidity, mortality, fertility); b) risk factors (e.g., raised blood pressure, tobacco use, salt intake); c) service coverage (e.g., reproductive, maternal, children and adolescent health, immunization, screening and preventive health services, and mental health); and d) health systems (e.g., health care quality and safety, access, health workforce, health information, health financing and health security). Each domain is further divided into sub-domains. For example, the sub-domain "Age- and gender-specific mortality", included in the "Health status" domain, covers such mortality indicators as life expectancy at birth, infant mortality rate, neonatal mortality rate, etc. This list also includes health indicators related to the Sustainable Development Goals (SDGs).

The second, the result-chain framework, classifies indicators into input and process indicators, output indicators, outcome indicators and impact indicators. This classification will be discussed in Chapter 6.

The short list of the European Core Health Indicators (ECHI) is a list of 88 health indicators grouped in 5 chapters: a) demographic and socio-economic situation; b) health status; c) health determinants; d) health services; and e) health promotion (5).

Demographic and socio-economic indicators refer to the basic characteristics of the population, such as age, sex, geographical distribution and population processes (fertility, mortality, migration), distribution of the population by level of education, occupation and unemployment.

Health determinants indicators include indicators of the determinants described above. For example, breastfeeding, tobacco use, salt consumption, fruit consumption, body mass index).

Health status indicators include indicators on:

- life expectancy;
- mortality, including by cause of death;
- morbidity, including incidence and prevalence;
- functioning or disability and quality of life;
- summary measures of population health (combining information on mortality, morbidity and disability), such as healthy life expectancy, disability-adjusted life years.

Health service indicators include access (physical, financial and psychological) to health services, costs (health expenditure), quality and use of health services (e.g., children vaccine coverage rate, screening rate for cervical cancer).

Health promotion indicators include public health policies (i.e., healthy nutrition, tobacco control programs).

1.5.3. Data Disaggregation: Health Inequities

Advances in the treatment, prevention and control of diseases and their risk factors, and changes in health policies in recent decades have contributed to increases in the life expectancy and quality of life. At the same time, these advances raise concerns and challenges, particularly in terms of equity. Improvements in health have not been evenly spread across the population, and certain subgroups of the population continue to have poorer than average health. **Health inequities** refer to systematic

and avoidable or remediable differences in health between socially, economically, demographically or geographically defined subgroups of the population.

National health indicators can mask differences in their health problems and health needs of different population groups. In order to identify groups with priority health needs and determine the existence of health inequities, indicators need to be disaggregated. In addition, monitoring the changes in the distribution patterns of a type of events over time helps to formulate hypotheses about health phenomena, such as the impact of public health policies on population health, changes in patterns of population susceptibility to disease and the introduction of new serogroups or viral serotypes exhibiting novel behaviours (i.e., COVID-19), etc.

Disaggregation should follow the principle of "leaving no one behind" in order to highlight possible health inequities, including as a result of interventions implemented. This principle is an essential part of the commitments of the signatory countries to the 2030 Agenda for Sustainable Development, including the Republic of Moldova, to eradicate poverty, eliminate discrimination and exclusion of vulnerable individuals and groups, and reduce inequities, including health inequities.

Indicators can be disaggregated by geographical level (national, regional, district/municipal) and by different population subgroups (by age, sex, socioeconomic status, ethnicity, etc.). Indicators can be sensitive to changes over time, driven by changes in other areas of society (such as economic, environmental or public policy transformations).

According to WHO, the most commonly used disaggregation criteria to monitor health inequities are represented by the acronym PROGRESS: **P**lace, **R**ace or ethnicity, **O**ccupation, **G**ender, **R**eligion, **E**ducation, **S**ocio-economic status and **S**ocial capital or resources (29).

In every society there are differences in health (health inequalities or disparities), either between individuals, or between population groups, or between administrative-territorial units, regions or countries.

For example, in the Republic of Moldova there are differences in all-cause and cause-specific mortality between Chisinau municipality and the northern districts on the one hand and the central districts on the other. Overall mortality is higher in south-central districts compared to municipality of Chisinau and northern districts. Mortality from diseases of the circulatory system and digestive diseases is higher in the northern and central districts. At the same time, mortality from neoplasms, especially among women, is higher in the southern region and municipality of Chisinau (31).

Figure 4 shows the life expectancy at birth in the Republic of Moldova by gender. The data presented show worrying health inequities: men are expected to live about 8 years less than women.

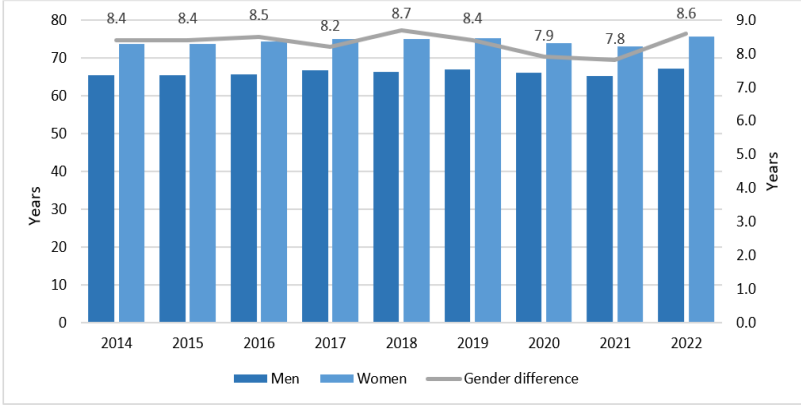


Figure 4. **Life expectancy at birth and gender inequity Republic of Moldova, 2014-2022**

Source: National Bureau of Statistics of the Republic of Moldova

The gap in the awareness, treatment and control of hypertension among adults in the Republic of Moldova shows important inequities by the level of education (*Figure 5*). The lower the level of education, the more prevalent is hypertension and the lower the share of those who take treatment for hypertension control (20).

Such patterns are attributed to the "social determinants" of health, defined as "the circumstances in which people are born, grow, live, work and age", reflecting socioeconomic status as a social determinant of health.

Systematic differences such as those shown in *Figure 4* and *Figure* 5 should, in principle, be remediable. A remediable disadvantage that can be corrected is called **health inequity**. Social inequities are often addressed by public policies that prioritize services for disadvantaged groups.

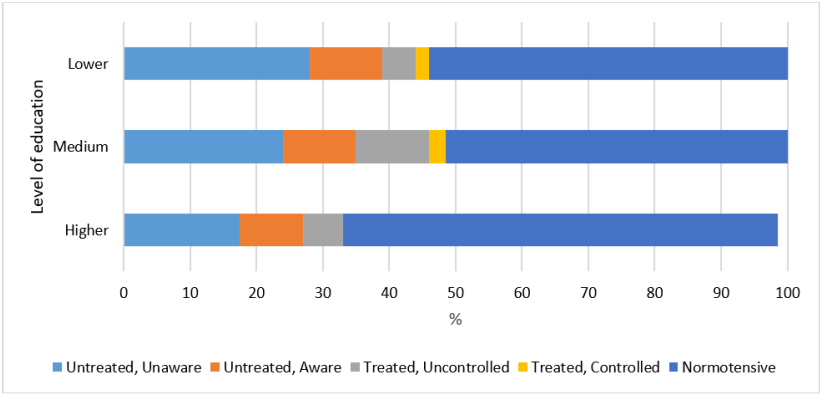


Figure 5. **Gap in Awareness, Treatment and Control of Hypertension by Level of Education*, Republic of Moldova, 2013**

Source: adapted from Maximova et al. (20)
Note:* lower level of education = gymnasium completed or less; medium = lyceum/vocational school/college; higher = higher education.

1.5.4. Health Indicators Use

Measuring health is essential to improving it. Knowledge and skills in measuring and interpreting health indicators are needed to assess the health needs of the population. Assessing the health status of populations is necessary for planning and evaluating health services and for evidence-based decision making. The main directions of the use of health indicators are the following: description and explanation, prognosis, health system management and health services quality improvement, evaluation,

advocacy, accountability, research, evaluation of social/health inequities and measurement of gender gap (29).

Description and explanation. Health indicators can be used to describe the burden of disease and health service needs of specific population groups. They can facilitate an understanding of health differences and inequities between populations or subpopulations. The description and explanation of the indicators underpins decisions about the extent and nature of unmet needs, the groups most affected, and the resources needed to address the problem.

Prognosis. Health indicators can be used to predict the health status of a population or a group of patients. They can also be used to predict the risk of outbreaks, thereby helping to prevent epidemics or stop the territorial spread of a particular health problem.

Health system management and quality improvement. Regular production and monitoring of health indicators provides feedback to improve decision-making at different levels. For example, significant improvements in the quality of data and indicator are largely due to improved processes for collecting, analysing and monitoring priority health indicators within national health information systems.

Evaluation. Health indicators can measure the outcomes of health interventions and evaluate the impact of public policies and health services. For example, health service performance and quality indicators are essential for institutional and social monitoring and evaluation.

Advocacy. Health indicators can be used as tools to support or oppose particular ideas and ideologies. The use of health indicators for advocacy is an important strategy for progress, as it can guide policy decisions to improve population health.

Accountability. Health indicators can provide information (e.g., on risk, disease and mortality patterns and health trends over time) to a wide range of users, including governments, health professionals, civil society and the community at large. Providing population health

monitoring information and trends to these groups is essential for social control, evaluation and institutional monitoring.

Research. Simple observation of the temporal and spatial distribution of health indicators in populations can facilitate analysis and lead to a hypothesis to explain observed trends and discrepancies.

Assessment of social inequities. Health indicators can be used to assess social inequities in health. Measures of central tendency (e.g., mean, median) or proportion may mask major internal inequalities within a particular geographic area, population subgroup, or at a particular point in time. It is therefore important to look at the internal dispersion of an indicator, either through deviations from the mean, quartiles, or minimum/maximum values, to identify any internal heterogeneity that may be present.

Measuring the gender gap. Gender-sensitive indicators measure gaps between men and women that result from differences or inequities in gender roles, norms and relationships. They also provide evidence on whether differences between men and women, as revealed by a health indicator (mortality, morbidity, risk factors, attitudes towards seeking health services), are the result of gender inequities.

1.5.5. Data Sources

The main sources of health data are: civil registration and vital statistics systems, population and household censuses, disease surveillance systems, household surveys, health facility information systems, health system data and non-health system data sources, as shown in *Table 2*.

In the Republic of Moldova, the National Agency for Public Health (https://ansp.md/) collects, compiles, analyzes and holds databases on the population health status, health facilities, national health accounts, human resources in health, health services and the health system. Health facilities are required by law to report data to the National Agency for Public Health. The National Agency for Public Health carries out periodic surveys on health risk factors.

Table 2. **Health Data Sources and Type of Information Generated**

Data sources	Type of information generated
Civil registration system and vital statistics	Registration of births, deaths and other vital events and producing statistical indicators on fertility and mortality to understand the burden of disease on the population.
Disease surveillance systems	Basic surveillance and response capacity with standardized case definitions, regular updating of responsibilities for notification and investigation, and supporting laboratory infrastructure (requirement of the International Health Regulations, 2005).
Census	The population and housing census is carried out periodically, every 10 years, based on international principles and standards.
Household surveys	The multi-year program of national surveys that defines the strategic priorities, frequency and scope of data collection on: population health status, service coverage, equity, financial risk protection, responsiveness of the health system to non-medical expectancies of the population (e.g., Demographic and Health Survey, Household Budget Survey, Generations and Gender Survey, STEPS survey on prevalence of risk factors for noncommunicable diseases).
Health facilities information systems	Timely and reliable statistics from public and private health facilities using standardized data, processes, and registration and reporting platforms with periodic data quality assessment. For example, disease reporting: notification of infectious and occupational diseases, chronic disease registries (e.g., cancer registry), medical statistics.
Health system data	Databases on health facilities and services, health service financing, supply chain and logistics. For example, the National System of Health Accounts, the Register of Human Resources in Health to track health workforce statistics.
Sources from outside the health sector	Data sources and reporting frequency: National Bureau of Statistics and ministries responsible for monitoring water and sanitation, indoor and outdoor air quality, education, agriculture and food security, transport and other relevant sectors.

The National Bureau of Statistics (https://statistica.gov.md/ro) collects, compiles, analyzes and maintains databases on population and housing censuses, vital statistics and household surveys. For example, the Household Budget Survey, which collects, compiles, analyzes, and disseminates information on the health status of the population and the health system, and the Generations and Gender Survey.

International health statistics databases are: WHO Global Health Observatory, https://www.who.int/data/gho; European Health Information Gateway (https://gateway.euro.who.int/en/); Eurostat statistics of the European Union (https://ec.europa.eu/eurostat); World Bank open data; United Nations (UNSD) databases.

1.6. Basic Concepts of Calculating Relative Measures

To measure the level and distribution of disease, health status, risk factor or death in a population, the number of people with a particular disorder/disease/risk factor should be reported to a reference population. The size and source of the population from which the patients are drawn (e.g., hospital patients, general population samples, census enumeration areas) and the time period over which the information was collected should also be known. By combining these components in the form of a rate, proportion, or ratio, we can compare the frequency of disease in 2 or more groups of people.

A rate is an indicator of the frequency of an event in a defined population. A rate is composed of a numerator (the number of events), a denominator (the average population at risk of the event), a defined period of time during which the event occurs, and a coefficient (10^n: n≥1) that transforms a fraction or a decimal number in an integer.

$$Rate = \frac{a}{a+b} \times 10^n$$

A rate measures the frequency of an event (e.g., disease or death) in a defined population over a specified period of time, like a year. For

example: the number of deaths per 100,000 population in the Republic of Moldova in a given year.

Rate has the dimension of time, while proportion does not.

Most rates are **proportions** – the numerator is a subset of the denominator. For example, the number of men with lung cancer in the Republic of Moldova divided by the total number of men in the Republic of Moldova. The numerator and denominator must reflect a similar population. If the numerator refers to a specific age, sex, or ethnicity, the denominator must have the same limitations.

The proportion can be expressed as a decimal fraction (between 0 and 1) or, more commonly, as a percentage (multiplied by 100). Percentages are easy to read and interpret.

$$Proportion = \frac{a}{a+b}$$

For example, to calculate the proportion of children in the population, we divide the number of children (0-17 years) by the total number of the population.

The **ratio** expresses the relationship between the numerator and the denominator without considering the population from which the numerator and denominator are derived. A ratio is a number divided by another number. The entities represented by the two numbers are unrelated. In other words, the people in the numerator are different from the people in the denominator. For example: 'sex ratio' is a ratio of two independent numbers: the number of males divided by the number of females, usually expressed as the number of males per 100 females.

$$Ratio = \frac{a}{b}$$

Figure 6 shows the distinctive attributes of the three types of relative measures.

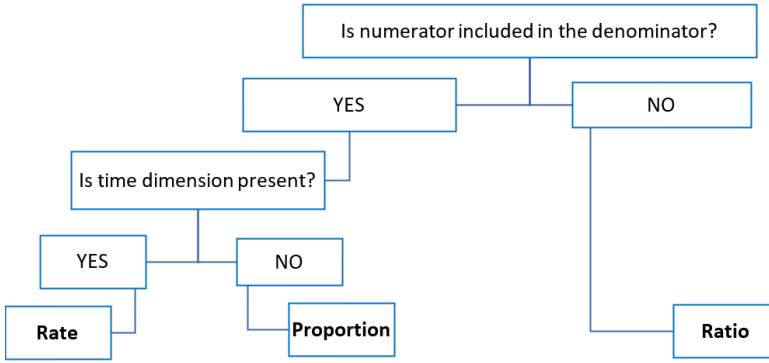


Figure 6. **Distinction between Ratio, Proportion and Rate**

The **probability** is the ratio of the number of events (births, deaths, etc.) to the number of the population at the beginning of the year. Rate and probability differ in the denominator. If the denominator used to calculate the rate is the estimated mid-year population, then the denominator used to calculate the probability is the population at the beginning of the year (January 1).

$$Probability = \frac{Number\ of\ events\ in\ the\ population\ in\ a\ year}{Population\ at\ the\ start\ of\ the\ year}\ x\ 10^n$$

Review Exercises

1. Select the essential public health operations related to service delivery:

a) Surveillance
b) Health promotion
c) Research
d) Financing
e) Disease prevention

2. Define the categories of health determinants and give examples of each category.

Category	Examples

3. The statistical yearbook of a country's health system provides data on morbidity and mortality disaggregated by region and cause. What further disaggregation of data would you suggest and for what purpose?

4. Fill in the table below with the required information.

Indicator	Area according to WHO	Chapter according to ECHI	Disaggregation options	Data sources
Maternal mortality				
General mortality				
Prevalence of tobacco use				
Access to health services				
Life expectancy at birth				
Adherence to treatment for tuberculosis				

Indicator	Area according to WHO	Chapter according to ECHI	Disaggregation options	Data sources
Prevalence of diabetes				
Essential drug coverage				
Cervical cancer screening				

Review Questions

1. What are the principles of social medicine formulated by Virchow?
2. Define public health.
3. What are the essential public health operations? Characterize each operation.
4. What are the concepts that distinguish public health from medicine?
5. What are the specific aspects of the algorithm for the assessment of the health status of the population and the diagnosis of the health status of the individual?
6. What is the difference between the WHO's "positive" and "negative" approaches to defining health?
7. What are the categories of health determinants? What characterizes each category?
8. What are the social determinants of health? What are they and how do they influence health?
9. What are the health system determinants related and how do they influence the health of the population?
10. Characterise the Dahlgren and Whitehead model of health determinants.

11. What are the different types of health indicators? Give examples of each type.
12. What is health inequity and what causes health inequity?
13. Describe the relationship between data disaggregation and the "no one left behind" principle.
14. What are the main sources of health data?
15. What are the directions for the use of health indicators?
16. What is public health surveillance?
17. What is the difference between passive and active surveillance?
18. Explain how to calculate rates, proportions, ratios and probabilities.

2. DEMOGRAPHIC ANALYZIS OF POPULATION HEALTH

2.1. Demography: Definition, Public Health Importance

The health and health service needs of a population cannot be measured or met without knowing the size of the population and its characteristics. Defining the population of interest is crucial. Translated from the Greek, the term "demography" means "description of the population". **Demography** is the science that studies the number, spatial distribution and structure of the population, changes within the population and the components of these changes (fertility, mortality and migration).

Demography is the social science that studies human populations in terms of:

- The number of the population, the structure of the population according to various social characteristics (e.g., age, sex, race/ethnicity, marital status) and the territorial distribution (or spatial distribution due to the dispersion of the population, the formation of agglomerations, e.g., according to place of residence, rural/urban) of the human population in a given geographical area at a given point in time;
- The processes taking place in the population (changes in the number and structure of the population), also generically referred as **demographic dynamics**; the components of these changes (fertility, mortality and migration); the factors influencing these components and the consequences of changes in the number, structure and distribution of the population.

"**Population**" means:

- All persons who are alive at a given point in time and who meet certain criteria, e.g.:
    - ✓ The population of the Republic of Moldova on 1 January 2024;

- ✓ The population of children in the municipality of Chisinau on 1 July 2024;

- A type of collectivity that persists over time, even though its members are constantly changing through attrition or accession. Thus, the phrase "population of the Republic of Moldova" can refer to all the people who have ever lived on the territory we define as the Republic of Moldova, and possibly even to those who have just been born here. The collectivity continues to exist even if, at least once a century, there is a possible complete turnover of its members.

Health demography is a subdiscipline of demography that applies the content and methods of demography to the study of population health and health services. Health demography is concerned with how demographic characteristics affect both the health status and health behaviour of populations, and how health phenomena in turn affect demographic characteristics. Health demography shares an interest in individual health problems with clinical medicine and an interest in population health problems with social medicine. Demographic characteristics of the population serve as both determinants and consequences of the relationship between the population and the health system. For example, if the population is in good health, low mortality rates and a relatively old age structure can be expected, because attrition through death will be minimal. At the same time, the demographic characteristics of the population will affect its health status and the need for health services. For example, the age composition of the population will be reflected in the types of health problems that are common.

The study of demography is of interest to public health because:

- Public health is concerned with the population health;
- The state of population health is influenced by a number of factors, the determinants of health, including the structure of the population by age group, sex, occupation, level of wealth, etc;

- The indicators used to measure the health status of the population have as their denominator the population from different perspectives (male or female population, employed or unemployed population, etc.);
- Interventions aimed at improving health must take account of the characteristics of the population;
- The primary source of information for the main demographic events (births, deaths) is the physician who fills in the birth or death certificate.

2.2. Demographic states, events and processes

Demography operates with 3 basic concepts: demographic state, demographic / vital event, and demographic process.

Demographic state is a particular characteristic that describes the people in a population. For example, being alive, being married or divorced, living alone or with a partner, being employed or unemployed, etc.

Demographic (vital) event is a transition from one demographic state to another. For example, death, birth, marriage, divorce, migration, etc. The concept of "event" presumes the existence of a specific moment in time when the event occurs (for example, the exact day, month and year of birth or death is known).

Demographic events may be repeatable (occurring several times) or non-repeatable (occurring only once).

Examples of *non-repeatable demographic events*: death (occurs only once); birth according to the birth rank (rank—hierarchical level) of the child (first born, second born); marriage according to the rank of the event (first marriage, second marriage).

Examples of *repeatable demographic events*: birth without mentioning the rank of the birth (the number of births a woman has had in her lifetime); divorce without mentioning the rank of the event (the number of divorces a woman or man has had in her/his lifetime).

The **demographic process** is the sequence of the same demographic events. For example, fertility, mortality, migration, nuptiality and divorce (*Table 3*).

Table 3. **Demographic Processes with the Corresponding Demographic Events**

Demographic event	Demographic process
Birth	Fertility
Death	Mortality
In-migration Out-migration	Migration
Marriage	Nuptiality
Divorce	Divorce

Thus, fertility as a demographic process consists of a sequence of demographic events called births.

In demography, three demographic processes are considered to be the main: mortality, fertility and migration, because they can all directly influence the size of the population.

2.3. The Basic Demographic Equation

Birth, death and migration are the three events that can influence the number of the population of a country. These three events are called the components of **population growth**. Thus, the population growth includes the following two components:

- **migration** (in-migration and out-migration) that can be generated by socioeconomic, political or other factors;
- **natural increase** (fertility and mortality).

The number of the population in a country is usually determined by a census. Between censuses, the population is estimated using **the basic demographic equation** or **the balancing equation**. There are two ways of entering a population: birth (B) and in-migration (I), and two

ways of leaving a population: death (D) and out-migration (E). Therefore, using the balancing equation, we can calculate the size of the population at a moment in time P_t:

$$P_t = P_0 + (B - D) + (I - E)$$

where P_0 = is the initial number of the population.

Natural increase is the difference between the number of live births and the number of deaths during the year. Natural increase can be:

- positive (the number of live births exceeds the number of deaths);
- negative (the number of deaths exceeds the number of live births).

Net migration is the difference between the number of in-migrations and the number of out-migrations in a region during a year.

Population growth has two components: natural increase and net migration.

Thus, the population size at a given point in time can be defined as the sum of the initial population size plus natural increase plus net migration.

Since the sum of natural increase and net migration is equal to population growth, the population size at a given point in time (P_t) can be calculated as the sum of the initial population size (P_0) and population growth.

Population on 1 January 2024 (P_t) = population on 1 January 2023 (P_0) + population growth in 2023.

Population growth can only occur if the natural increase is positive and/or net migration is positive.

Historically, natural increase is more important for understanding the impressive population growth.

2.4. Basic Demographic Rates

The rate is the most widely used indicator of population change. Ideally, demographic rates show the relationship between the number of demographic events (the numerator) and the population at risk (the denominator) in a given period of time.

$$Rate = \frac{Number\ of\ events\ in\ a\ given\ period\ of\ time}{Population\ at\ risk\ during\ the\ same\ period\ of\ time}\ x\ 10^n$$

Each component of population change (fertility, mortality and migration) can be expressed as an absolute number or, more commonly, as an annual rate. A rate has a numerator, a denominator and a multiplier.

The numerator is the number of a particular type of demographic event (births, deaths, migration, divorces, etc.) over a given period of time (e.g., a calendar year). The denominator is the number of people at risk of this type of event in the same period of time. The denominator of the annual rate is the estimated mid-year population. This estimated mid-year population can be calculated as the average of the population at the beginning of one year and the beginning of the next year (usually the beginning of the year is 1 January).

For example, to calculate the mid-year population for the year 2023, we need to calculate the average of the population on January 1, 2023 and the population on January 1, 2024:

$$Mid\text{-}year\ population,\ 2023 = \frac{Population\ on\ January\ 1,2023 + Population\ on\ January\ 1,\ 2024}{2}$$

Demographic rates are usually calculated per 1 000 of population, i.e., the multiplier is 1 000. However, for some types of demographic rate, the multiplier may be 100 000 or even 1 million. Using the multiplier makes the demographic rate easier to read.

There are four basic demographic rates:

Crude birth rate (CBR)

$$CBR = \frac{Number\ of\ life\ births\ in\ the\ population\ in\ a\ year}{Mid-year\ population}\ x\ 1\ 000$$

Crude death rate (CDR)

$$CDR = \frac{Number\ of\ death\ in\ the\ population\ in\ a\ year}{Mid-year\ population}\ x\ 1\ 000$$

Crude rate of in-migration (CRIM)

$$CRIM = \frac{Number\ of\ in-migrations\ in\ the\ population\ in\ a\ year}{Mid-year\ population}\ x\ 1\ 000$$

Crude rate of out-migration (CROM)

$$CROM = \frac{Number\ of\ out-migrations\ in\ the\ population\ in\ a\ year}{Mid-year\ population}\ x\ 1\ 000$$

Natural increase, net migration and population growth can be expressed in absolute numbers or as rates. Each component can be defined in two ways, as follows.

Crude rate of natural increase (CRNI):

$$CRNI = \frac{Natural\ increase\ in\ the\ population\ in\ a\ year}{Mid-year\ population}\ x\ 1\ 000$$

CRNI = Crude birth rate – Crude death rate

Crude rate of net migration (CRNM):

$$CRNM = \frac{Net\ migration\ in\ the\ population\ in\ a\ year}{Mid-year\ population}\ x\ 1\ 000$$

CRNM = Crude rate of in-migration – Crude rate of out-migration

Population growth rate (PGR)

$$PGR = \frac{Population\ growth\ in\ the\ population\ in\ a\ year}{Mid-year\ population}\ x\ 1\ 000$$

PGR = Crude rate of natural increase + Crude rate of net migration

Besides rates, demographers can also use other measures such as ratio, proportion and probability (*Figure 6*).

2.5. Data Sources in Demography

To calculate rates, data are needed both on the number of events occurring over a period of time and on the population at risk of experiencing these events. There are three main sources of demographic data: population census, civil registration system and vital statistics and surveys.

Other sources of data may be the population register and the demographic surveillance system.

2.5.1. Census

A census is an enumeration of the population that records the identity of everyone in each dwelling at a given point in time (Census Day). The census provides vital information about all household members. According to the United Nations (2008), **census** is "The process of total collection, compilation, evaluation, analysis and publication or otherwise dissemination of demographic, economic and social data relating to the entire population of a country or a well-defined territory of a country at a point in time" (44).

The main objective of a census is to obtain data on the number, structure and distribution of the population. A typical census thus includes information on:

- The number of the population and its social and geographical population subgroups, as well as data on their structure by age, sex and level of education;
- Data on the occupational structure of the active population (labour force), as well as economic data (salaries and incomes);
- Information on place (country or area) of birth, citizenship, language, recent experience of migration, religion and ethnic origin, which refers to group distinctions based on common cultural origins.

Characteristics of the Census:

- The census is the oldest, most sophisticated and most important source of demographic information;
- The census is a total process involving the collection and compilation of information, analysis, publication and dissemination of data;
- The census involves the collection of several types of data, such as demographic, economic and social data, and not just the simple counting of the population;
- The census is universal, covering the whole country and counting all individuals belonging to a population;
- The census is a simultaneous process and is designed to provide a snapshot of the population at a given point in time;
- The census involves the mobilization and training of an army of censors, a massive information campaign, the enumeration of all households, the collection of individual information, the compilation of large numbers of completed questionnaires, and the analysis and dissemination of the data.

The advantages and disadvantages of the census are shown in *Table 4*.

Table 4. **Census Advantages and Disadvantages**

Advantages	Disadvantages
Universal coverage.	Limited efforts to control the content and quality of data due to the volume and complexity of the exercise.
It provides the sampling frame for subsequent surveys and studies.	Due to the high cost, the census is conducted every ten years.

It can be a useful tool for "nation building" by involving the whole population.	There can be a time lag between data collection and the provision of results (typically 18 months to 2 years), which means that the census only provides a snapshot of the population at a point in time in the past.
It avoids sampling errors.	There is a risk that the census will be politicized, either by groups who feel that they are being systematically undercounted, or by vested interests trying to ensure that the population of their group is larger than that of other groups.
It provides data for small areas, such as neighbourhoods and administrative-territorial units, which are essential for planning services.	

The United Nations recommends that the census be carried out every 10 years. In the Republic of Moldova, after the Second World War, the population census took place in 1959, 1971, 1979, 1989, 2004, 2014 and 2024.

2.5.2. Civil Registration System and Vital Statistics

Civil registration and vital statistics refer to the continuous, permanent, compulsory and universal recording of the occurrence and characteristics of the population demographic/vital events with the generation of data and statistics on these events and their dissemination. Thus, the civil registration system and vital statistics measures demographic vital events as they occur and is dynamic and continuous. The vital registration system applies mainly to births and deaths, although many countries, including the Republic of Moldova, also keep records of marriages, divorces, adoptions etc.

Civil registration system and vital statistics:

- It is the second most important source of information for demographers;
- It collects information on people at the time of, or shortly after, their demographic/life events ((birth, marriage, death, migration (sometimes));
- Registration of births, deaths and marriages is compulsory in most developed countries, as well as in the Republic of Moldova;
- The demographic/vital data collected are tables of totals from individual records;
- Recorded data are collected, compiled and disseminated;
- Sometimes the information collected is more detailed (i.e., birth statistics may include information on sex, birth weight, place of birth);
- Despite the progress made, civil registration systems and vital statistics are still deficient in many countries.

2.5.3. Sample-based Surveys

Sample-based surveys are an important complement to, or sometimes an alternative to, routine demographic data sources. Most developed countries conduct surveys that provide much more detailed information on certain demographic and health aspects than could be collected in a census. For example, data on health behaviours, family formation strategies or reasons for migration. The quality of data collected in a survey is expected to be better than in a census, as interviewers may be better trained. At the same time, potential systematic errors, such as recall bias regarding age or other past events, need to be taken into account.

Sample-based surveys:

- Become increasingly important, as statistical science develops;

- Collect vital statistical data when the official civil registration system is inadequate or non-existent and in the periods between censuses;
- Collect additional demographic data and other data, if the collection of this data within the population census is not possible;
- Coordinated demographic surveys have been conducted worldwide since the 1970s (e.g., World Fertility Survey (WFS), Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS), Generations and Gender surveys and other types of surveys).

In the Republic of Moldova, a Demographic and Health Study (DHS, 2005), two Multiple Indicator Cluster Surveys (MICS, 2000 and MICS, 2012) were carried out, as well as a Generations and Gender Survey (2020) as part of the Longitudinal Demographic Survey of the same name.

2.5.4. Other Sources of Demographic Information

Population register. In countries where there is a system of continuous registration, each individual has a separate card from birth (or in-migration) to death (or out-migration), which is constantly updated by the recording of additional data such as marriage, divorce, birth of children, etc. Some industrialized countries, such as Germany and the Netherlands, have abandoned the census and use the population register (people are obliged to register with the local authorities when they change residence).

The demographic surveillance system monitors the demographic and health characteristics of a population living in a well-defined geographical area. A baseline census is followed by regular updates of basic demographic events (e.g., birth, death, migration, marriage) and key health events.

2.6. Population Size and Structure

Population size is the number of people living in a given geographical area at a given point in time. The size of the population determines the need for different services. Knowing the size of a population provides information about the amount of health services needed (although not necessarily the type of health services). The most complete count of a population is the census.

Population structure represents the distribution of a population in a geographical area according to various criteria. Knowledge of population structure and distribution is essential for analyzing health service needs and allocating resources.

2.6.1. Population Structure by Place of Residence

The structure or distribution of the population by place of residence depends on the economic structure of a country and its economic development policy. The place of residence influences morbidity and mortality patterns, as well as the structure of health services, since the organization of health service delivery differs between rural and urban areas. In the Republic of Moldova, 56.6% of the population lived in rural areas and another 43.4% in urban areas on 1 January 2024.

2.6.2. Population Structure by Sex

The main characteristics of the population structure are *age* and *sex*. The structure of the population by age and sex is an important factor in determining the number and type of health problems, the pattern of health service use and health behaviour. According to world demographic statistics, the number of males in the population is higher than the number of females, and the male birth rate is also higher than the female birth rate. In developed countries, the female population exceeds the male population. In most countries, the ratio of male to female population at birth is 105-106%. However, in the older age

groups, the male groups are inferior to the female groups. There are many reasons for these differences: higher male infant mortality than female infant mortality, higher cancer mortality in men, longer life expectancy in women.

The structure by sex is of interest to know the risks and the frequency of diseases in the male population compared to the female population.

In the Republic of Moldova, the ratio of male to female population at birth is 103-104%. The larger proportion of men predominates until about the age of 30. From the age of 40, the proportion of men decreases progressively, so that the ratio of male to female population also decreases progressively with age, reaching 72-73% at the age of 70 and only 50% at the age of 80.

2.6.3. Population Structure by Age Groups

It is largely determined by fertility and mortality, the phenomenon of population migration, wars and other factors. The unstable balance between fertility and mortality produces, at the level of a population, a certain structure by age group and sex. This has consequences not only for the rate of rejuvenation of the generations, but also for the consumption needs, the educational infrastructure or the health and social services, for the ability of society to offer jobs to the working age population. For example, a higher proportion of young people in the population means that the country in question will be a strong source of labour, especially young people, in the near future. An overpopulated and underdeveloped country is a potential source of out-migration.

The structure by age group is an expression of the division of the total population of a country into three major categories corresponding to the young, the adult and the elderly. The United Nations Population Commission identifies the following age groups:

- *The youth group* – population aged 0-14 years;

- *The adult group* – the population aged 15 and 64 years;
- *The elderly group* – the population aged 65 and over.

In turn, the adult group is divided into *young adults* aged 20-40 and *older adults* aged 40-64 years.

A country is considered demographically young if the youth group (0-14 years) exceeds 35% of the total population and the elderly do not exceed 12%. When young people make up less than 20% of the population, demographic ageing of the population begins.

Measuring and describing the population by age group is of interest to the health system because the morbidity and mortality picture varies from one age group to another.

2.6.4. Population Pyramid: Types and Characteristics

The typical graphical representation of the population structure by age group and sex is the population pyramid. The population pyramid can have different aspects.

A population pyramid is a horizontal bar graph (two back-to-back histograms) showing the number or proportion of people in each age and sex group for a given population. The horizontal axis shows the population in absolute numbers or percentages. The vertical axis shows the age groups. Men are shown on the left side of the pyramid and women on the right (*Figure 7*).

The population pyramid summarizes the past and announces the demographic future; the numerically reduced segments reflect the effects of wars and natural disasters over time, while the well-represented segments reflect periods of peace and economic development.

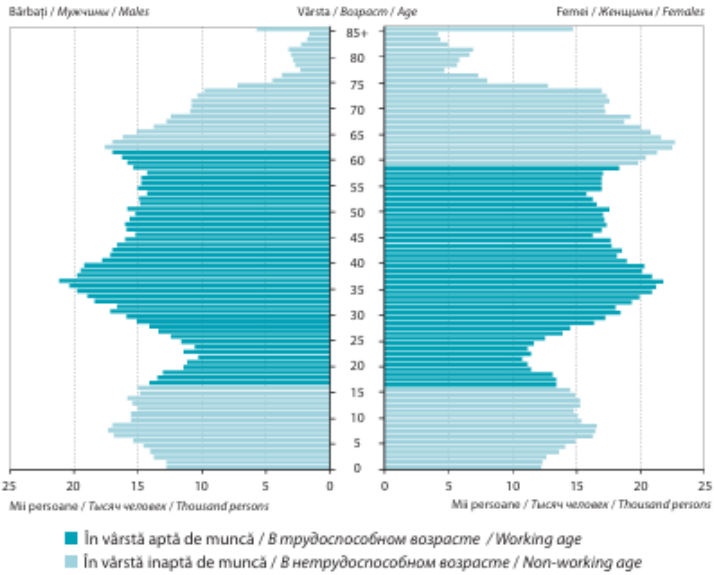


Figure 7. **Population pyramid, Republic of Moldova, 2024**

Source: National Bureau of Statistics of the Republic of Moldova

The population pyramid shows the demographic structure of society. **The shape of the pyramid** can provide information on:

- Crude birth rate and crude death rate;
- Life expectancy at birth;
- The dependency ratio;
- The specific events that have occurred in the population of a country.

The base of the population pyramid tells us about the crude birth rate of the population.

A wide base indicates a larger number of children in the population and thus a higher crude birth rate. A narrow base indicates fewer children and a lower crude birth rate.

The top of the population pyramid informs us about the life expectancy at birth, i.e., the number of years a new born is expected to

live. A narrow top of the population pyramid shows that few people survive to old age and life expectancy is low. A wider top reflects a larger number of older people in the population and a longer life expectancy, and, respectively, higher needs for social and health services.

The shape of the sides of the population pyramid informs us about the crude death rate of the population. Concave sides indicate a high crude death rate, and convex sides indicate a low crude death rate.

Irregularities in the sides of the population pyramid inform us about specific events that have occurred in the population of a country. The well-represented segments of the population pyramid (bumps or bulges) indicate either a period of immigration or an earlier population explosion/baby boom (the unexpected increase in the number of births). Numerically reduced segments (indents) of the population pyramid indicate either a higher death rate (due to war, famine) or a period of emigration.

The shape of the pyramid is expressive and varied. In general, there are three main types of pyramids (*Figure 8*):

The **expansive** type has a triangular form, with a wide base, characterizes a country with a rapidly growing population. Each successive group of older people is represented by a smaller bar. Crude birth and death rates are high and life expectancy is low. This type of pyramid is characteristic of developing countries (Latin America, Africa, Asia, Bangladesh).

The **stationary** type of population pyramid has a form of a "box". This type of population pyramid has a relatively wide base and a relatively equal population for almost all age groups. As a result of the increase in the standard of living, the average length of life also increases, accumulating more elderly people. It is a transitional type, characteristic of rapidly industrializing countries (France, USA, Scandinavian countries).

The **constrictive** type has a form of a "cup", with a narrow base. It is characteristic of developed countries with low birth rates and high longevity. This model expresses an aging population with a low share of young people and an increased share of adults and the elderly. It is the consequence of a low birth rate, with an obvious maturation and ageing of the population. This type of pyramid is characteristic of developed countries (Belgium, Germany, Italy).

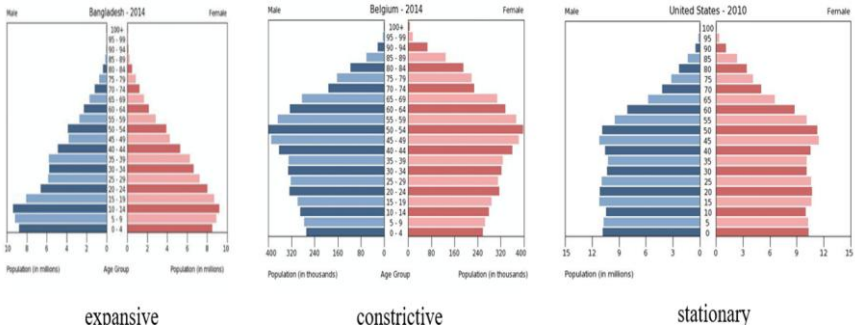


Figure 8. **Types of population pyramid**

The median age of the population is an indicator that summarizes the age structure of a population. The median age is the age that divides a population into two numerically equal groups, with half the people being younger than this age and half being older. The differences in median age reflect the obvious differences in the shape of the age distribution between less developed and more developed countries. A more developed country will have a higher median age than a less developed country.

2.7. Population Ageing

2.7.1. Demographic Issues

Population ageing is a term used to describe changes in the age distribution (age structure) of the population that contribute to an increase in the proportion of older people. This phenomenon will be one of the most significant social changes of the 21st century. Population ageing is an irreversible phenomenon that is progressing rapidly in both developed and developing countries and will eventually affect the entire population.

The increase in the absolute number of older people and their proportion of the total population is a consequence of the decline in the birth rate on the one hand and the increase in life expectancy on the other. It is the result of the decline in infant mortality, general mortality and mortality among the elderly, as well as the success of medicine and public health in preventing and controlling diseases, especially acute infectious diseases.

The growth rate of the elderly population has increased significantly in recent years and will accelerate in the coming decades. It is estimated that between 2015 and 2030 the number of people in the world aged 60 and over will increase by 56%, and by 2050 the number of older people will double. In Europe, the number of older people will increase by 23% by 2030.

The elderly population itself will continue to age. At present, the fastest growing age group is those aged 80 and over (3.8% per year), accounting for more than 10% of the total elderly population. By 2050, a fifth of the elderly population will be over 80.

The ageing of the population is much more pronounced in developing countries than in developed countries, as the former have much less time to adapt to the consequences of this phenomenon. Moreover, the population of developing countries is ageing in an

unfavourable socioeconomic context, which is not the case for the population of developed countries. For example, the countries of Eastern Europe and the former Soviet Union, including the Republic of Moldova, are facing the problem of rapid population ageing. By 2025, many countries in these regions will have populations that are among the oldest in the world. This can pose a threat to the economy and strain social and health systems, putting new pressure on public spending, including on health services.

With the ageing of the population in many countries, due to low birth rates and increasing longevity, the concepts of "dependent" population groups, i.e., the under-15s and the over-65s as a percentage of the total population, are becoming increasingly relevant for social and economic planning.

Two indicators are used to measure the ageing of the population: the ageing coefficient and the dependency ratio.

The ageing coefficient represents the number of persons aged 65 and over per 100 of population.

$$\textit{Ageing coefficient} = \frac{Number\ of\ people\ aged\ 65+\ years\ \ pe\ an}{Mid{-}year\ population\ with\ usual\ residence}\ x\ 100$$

According to the J. Beaujeu-Garnier - E. Rosset scale, the value of the ageing coefficient ≥ 12% is considered as "demographic ageing".

The ageing of the population has numerous socioeconomic consequences and implications for all sectors of society, including the economic sector through the increase in the dependency ratio, the health sector and the social security sector.

The dependency ratio is the ratio of the number of young (under 15) and old (65 and over) people to the number of people of working age (15-64), expressed per 100 people.

$$\textit{Dependency ratio} = \frac{Number\ of\ people\ under\ 15 + Number\ of\ people\ over\ 65}{Number\ of\ people\ between\ 15\ and\ 64}\ x\ 100$$

The dependency ratio is usually used as a measure of the economic burden borne by the working-age population. The higher the dependency ratio, the greater the burden on working-age people who have to pay for social security and health services for those who are not working.

High dependency ratios may be associated with higher birth rates or higher life expectancy at birth.

The change in the ratio between the active and passive population leads to an increase in the dependent population due to non-productive adults. This phenomenon creates difficult medical and socioeconomic problems for the family, the community and society.

In the Republic of Moldova, the dependency ratio, calculated as the number of dependents per 100 people of working age, was 51.7% in 2023.

2.7.2. Medical and Social Issues

With age, the health status of older people deteriorates, leading to increased demands on and costs of health and social services.

Ageing is associated with significant increases in morbidity, disability and mortality. Chronic and degenerative diseases are prevalent in the elderly, partly as a consequence of exposure to modifiable risk factors at a younger age (e.g., unhealthy and unbalanced diet, sedentary lifestyle, tobacco and alcohol use).

The older population is predominantly female in almost every country in the world. Gender differences in health status and risk of death make an important contribution to the quality of life of men and women. As health declines, the probability of death increases faster for men than for women. As a result, the male population is healthier, while women, who live longer, often suffer from severe diseases, often leading to several chronic conditions at the same time (co-morbidity or multimorbidity). Older women experience more disability than older

men. This reflects women's higher risk of disability due to musculoskeletal disorders and their longer survival after the onset of disability than men.

The elderly population is a major consumer of health services. In terms of health and health services, women are more active users of health services than men. They live longer but have more disabilities. Women bear much of the burden of making health care decisions, not only for themselves but also for their families. They are also more likely to influence the health behaviour of their peers.

However, health systems are poorly adapted to the needs of older people. Population ageing poses challenges both to public health (in particular the increasing burden of health care costs on national budgets) and to economic development (such as the shrinking and ageing workforce and the unsustainability of social security systems).

Most health problems in older people can be prevented or delayed by adopting healthy behaviours, or can be effectively managed, especially if detected early.

The population ageing requires a comprehensive public health response. It should be based on the principle of health promotion and disease prevention throughout life course and at different stages, and include the promotion of healthy habits and lifestyles, the improvement of health care and preventive measures, and the improvement of education and living conditions (socioeconomic).

The World Health Organisation promotes active ageing and healthy ageing.

Active ageing is the process of optimizing opportunities for health, participation and security to improve quality of life as the population ages.

Healthy ageing refers to the process of developing and maintaining functional capacities that enable well-being in old age.

2.7.3. Characteristics of the Population Ageing in the Republic of Moldova

The proportion of elderly people has increased rapidly in recent years, from 13.2% in 2006 to 25.2% in 2024 (*Figure 9*), representing a high level of demographic ageing. Ageing is more pronounced in women than in men.

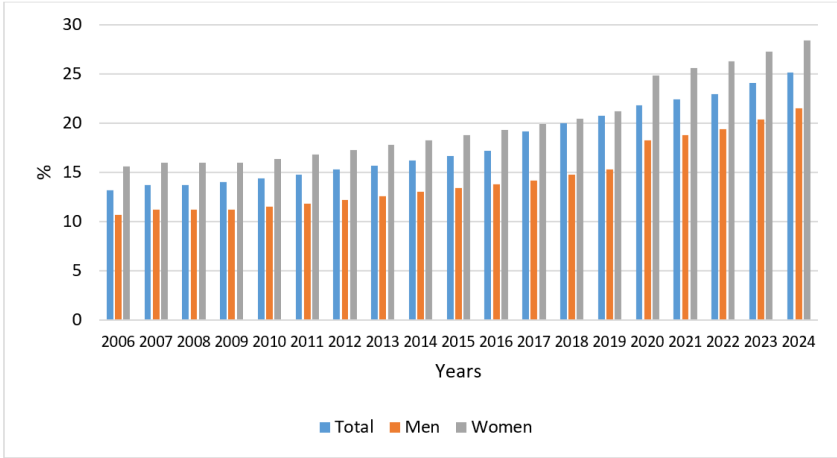


Figure 9. **Evolution of the Ageing Coefficient, Republic of Moldova, 2006-2024**

Source: National Bureau of Statistics of the Republic of Moldova

According to the latest available data (2023), 10.0% of all older people are over 80. The ageing process is more advanced in rural areas (57%). The proportion of older people is higher among women (60%).

Life expectancy is higher for older people in urban areas and for older women. Average life expectancy at 60 is 19.6 years for women and 15.0 years for men, with a difference of 4.6 years (2022). The life expectancy of older people living in urban areas is 2.6 years higher than that of people living in rural areas.

Mortality among older people has been stable in recent years. Mortality is higher in rural areas and among older men. Diseases of the

circulatory system predominate in the mortality structure of elderly (65.5%), followed by malignant neoplasms (17.0%) and diseases of the digestive system (6.3%) (the structure of the causes of death shown is for the year 2023 and does not differ significantly from previous years). Cause-specific mortality differs significantly between men and women. "Male s*upra-mortality*" is recorded for all major causes of death.

The incidence of malignant neoplasms is increasing. About 72.7% of the new cases of malignant neoplasms registered in 2023 was in people aged 60 and over. The incidence of neoplasms (per 100,000 elderly people) was 1268 cases in 2023, with little fluctuation over the last five years.

The rate of primary disability among the elderly (per 1 000 population) is higher in urban areas (1.3 cases) than in rural areas (1.1 cases). Circulatory system diseases are the main cause of primary disability (31.4%), followed by neoplasms (16.0%), and mental and behavioural disorders (12.1%).

The loss of autonomy of the elderly and the emergence of partial or total functional incapacity require appropriate medical and social support services.

2.8. Demographic Processes

2.8.1. Fertility

Population reproduction is the central domain of demography and of great interest to both medicine and public health. Fertility is declining in most countries of the world.

Factors contributing to the decline in fertility include:

- Improved educational opportunities for women (which contribute to women's social empowerment, greater use of contraception, better child health and women's participation in the labour force);

- Reduced infant and child mortality, which reduces the pressure to have more children to ensure survival;
- Improved access to contraception and family planning advice;
- Economic development, increased income, wealth and standard of living.

In the Republic of Moldova, the birth rate halved between 1988 and 1997, falling from 20.6 live births per 1000 of population in 1988 to 10.6 live births per 1000 of population in 1997. It has remained at this level for the last 25 years, with some small fluctuations.

Live birth

According to the WHO, a **live birth** is a product of conception completely ejected or extracted from the mother's body, regardless of the pregnancy duration who after this separation gives a sign of life: breathing, heartbeat, pulsation of the umbilical cord or voluntary contraction of a muscle, whether or not the placenta has been removed and the umbilical cord has been cut.

In the Republic of Moldova, the definition of a live birth has evolved from the definition used until 2008 to the one used since then. Until 2008, a live birth was defined as baby born after the 28th week of gestation or weighing more than 1000 g or longer than 35 cm. Since 2008, a live birth has been defined as a baby born after 22 weeks' gestation or with a birth weight of more than 500 grams.

Stillbirth is the product of conception resulting from a pregnancy of more than 22 weeks' gestation, weighing at least 500 grams and showing no signs of life after complete separation from the mother's body.

Abortion (miscarriage) is the product of conception resulting from a pregnancy of less than 22 weeks' duration, weighing less than 500 grams and showing no signs of life after complete removal from the mother's body.

Birth rank refers to the child's order among children born to the same mother. Children who died shortly after birth are also counted.

The rank of the newborn expresses how many births, living or dead, the child is considered in the series of births given by the mother**.**

Protogenesic interval refers to the time elapsed between the date of marriage and the birth of the first live-born child.

Intergenesic interval is the time elapsed between two consecutive live births.

2.8.2. Mortality

Mortality, as a demographic process, refers to the frequency of deaths in a given population and over a defined period of time (usually one year). Unlike fertility, mortality is the negative component of natural increase of the population.

Death registration is mandatory in the Republic of Moldova, and data collected through civil registration can be used by health authorities to monitor health status and plan health services.

Death certificate is mandatory in the Republic of Moldova and should be signed by a licensed physician before the body can be buried. The content of the death certificate is important because the medically certified cause of death is the basis for mortality statistics. It is not easy to standardize the reporting of causes of death. Causes of death recorded on the death certificate include:

- direct cause of death (line a);
- the antecedent causes: the intermediate (line b and c) and the underlying (line c) cause of death.

Medical diagnoses are coded according to the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) adopted by the WHO in the 1990s (67). Physicians completing the certificate may have different perceptions of the diagnosis and the difference between the direct cause of death and the

intermediate one. The quality of the data extracted from the death certificate is influenced by the completeness of the reporting, the accuracy of the diagnosis, the accuracy of coding of causes of death and the extent to which autopsies are used.

Mortality is influenced by multiple demographic characteristics and other factors, such as age, sex, race/ethnicity, occupation, and social class.

Avoidable (**preventable and treatable**) **mortality** refers to the frequency of deaths from diseases that are entirely or largely preventable through public health interventions and clinical care, such as measles, diphtheria, lung cancer caused by smoking or liver cirrhosis caused by alcohol.

Avoidable mortality indicators are used to assess the effectiveness of public health interventions and health systems in reducing premature mortality from various diseases and injuries. **Premature mortality** is defined as deaths before the age of 70 or another predetermined age.

Preventable mortality is defined as the causes of death that are mainly avoidable through effective public health and primary prevention interventions (i.e., before the onset of the disease/injury, to reduce incidence). For example, COVID-19, cervical cancer, suicide, road accidents or drowning.

Treatable mortality is defined as the causes of death that are primarily preventable through timely and effective healthcare interventions, including secondary prevention and treatment (i.e., after disease onset, to reduce case-fatality) (6). For example, acute pancreatitis, stroke or myocardial infarction.

Avoidable mortality measures the effectiveness of public health interventions and health care. It is used as a performance indicator for the health system and as a quality measure for health service delivery.

In the Republic of Moldova, the general mortality rate increased in the period 1966-1979, followed by a relative stabilization with some increases during periods of socio-economic crisis.

Mortality is a phenomenon that is highly dependent on the socioeconomic development of a country. Socioeconomic development has led to a decrease in mortality and an increase in life expectancy and quality of life. The relationship between socioeconomic development and health status can be summarized by the direct link that exists between the gross domestic product (GDP) per capita and the average life expectancy as a summary measure of mortality and health status: as GDP increases, so does average life expectancy.

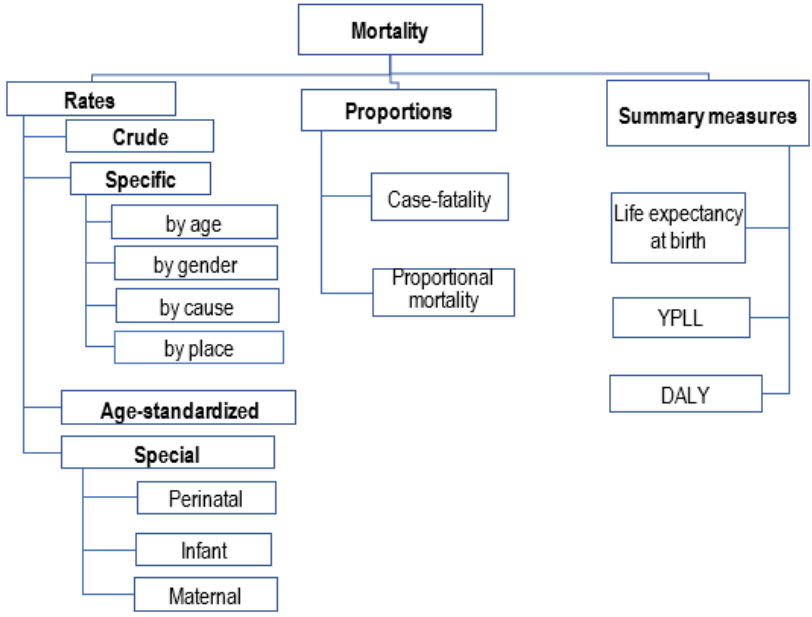


Figure 10. **Mortality Indicators**

There are several ways of measuring the mortality of a population (*Figure 10*). Mortality can be measured by calculating different types of

rates (crude, specific and age-standardized) or proportions (case-fatality, proportional mortality). Moreover, it is possible to use different types of summary measures of population health, such as life expectancy at birth, potential years of life lost (PYLL) and disability-adjusted life years (DALY) (see subchapter 3.5).

2.8.2.A. Mortality Rates

Crude death rate (CDR) measures the frequency of all deaths (all causes of death, all age groups and both sexes) occurring in the population during a given period of time.

$$\textit{Annual crude death rate} = \frac{Total\ number\ of\ death\ in\ a\ year}{Mid-year\ population}\ \textit{x 1 000}$$

The crude death rate is a frequently used measure due to its simplicity of calculation and availability of data.

Its main disadvantage is that it does not take into account the significant variations in the risk of death by age, sex, race, socio-professional category, etc.

The crude death rate is called crude because its denominator is the whole population, whose members are not equally exposed to the risk of death. The risk of death varies by age, sex, race/ethnicity, socioeconomic status, and many other characteristics. Thus, although all persons in the denominator of the crude death rate will experience death at some point, they are not all equally exposed to the risk of death.

Specific death rates measure the frequency of deaths in different subgroups of the population. Calculating this type of rate allows a more nuanced analysis of the phenomenon for different subpopulations. These rates can be calculated by gender, age group, place of residence (rural/urban), cause of death, ethnicity, income, level of education, etc. For example, to calculate the specific death rate from cancer for women, we divide the number of deaths from cancer in women during the year to the number of women in the population:

$$\textit{Annual death rate from cancer in a year among women} = \frac{Number\ of\ death\ from\ cancer\ in\ a\ year\ among\ women}{Number\ of\ women\ at\ midyear}\ x\ 1\ 000$$

The number of the specific population in which the events occurred is given in the denominator of the specific rates.

A general description of the mortality indicators is given in *Table 5* at the end of this chapter.

The analysis of deaths by sex shows a male supra-mortality. This goes hand in hand with female supra-morbidity, with more cases of the disease diagnosed and reported in women.

Death rates vary with age. They are high in the first year of life, then fall sharply and rise again around the age of 40.

In terms of age-specific mortality rates, infant mortality is the most common measure of child deaths.

Infant mortality is the demographic phenomenon of the deaths of children aged 0-1 years registered in the population of live births in a given region and in a given time interval, usually a year.

$$\textit{Infant mortality} = \frac{Number\ of\ death\ in\ infants\ less\ 1\ year\ of\ age\ in\ a\ year}{Number\ of\ life\ birth\ in\ a\ year}\ x\ 1\ 000$$

The study of infant mortality is of particular interest because, together with life expectancy, it is the most sensitive and widely used measure of the population health status and the level of socioeconomic development. Infant mortality reflects the impact of socioeconomic and environmental conditions on maternal and child health and the effectiveness of health systems. Factors such as maternal education, quality of antenatal and delivery care, preterm birth and birth weight, new-born care and infant feeding practices are important determinants of child mortality. Infant and child mortality continues to affect life expectancy in many countries. Infant mortality rates are decreasing in the Republic of Moldova, but are higher than in the European Region.

Perinatal mortality. The perinatal period begins after 22 full weeks of pregnancy and ends 7 full days after birth. Perinatal deaths are therefore deaths recorded in the perinatal period.

$$\textit{Perinatal mortality} = \frac{Number\ of\ stillbirths + number\ of\ deaths\ among\ children\ less\ than\ 7\ days}{Number\ of\ stillbirths + Number\ of\ life\ births\ in\ a\ year} \times 1\,000$$

Figure 11 shows schematically different periods of perinatal and infant mortality.

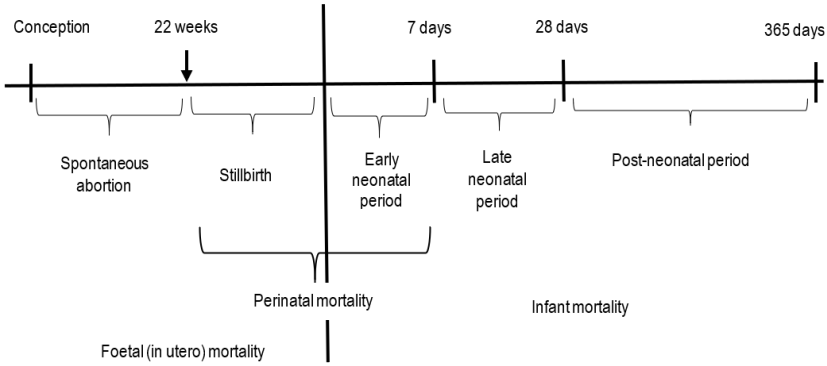


Figure 11. **Foetal and Infant Mortality**

The main causes of infant mortality and of children under 5 years of age in the Republic of Moldova are some conditions in the perinatal period, followed by congenital malformations. These two types of causes account for more than 60% of all deaths recorded in these two age groups. In third place are diseases of the respiratory system accounting for just over 10% in both age groups. This is followed by trauma and poisoning, the proportion of which doubles as the child begins to move. Infectious and parasitic diseases come fifth.

Understanding the causes of mortality is important for targeting interventions to prevent avoidable deaths and for promoting health among parents and educators.

Maternal mortality. **Maternal death** is defined as the death of a woman during pregnancy or within 42 days of giving birth, regardless of its duration or location, from any cause related to, or aggravated by, pregnancy or its circumstances, excluding cases of accidental or unintentional death.

In theory, the population at risk (the denominator) should include all pregnant women in a given period of time. However, because it is difficult to identify foetal deaths and intentional abortions, the denominator is usually the number of live births. Therefore, the calculated indicator is actually a ratio and not a rate.

$$\text{Maternal mortality rate} = \frac{Number\ of\ deaths\ assigned\ to\ pregnancy{-}related\ causes\ in\ a\ year}{Number\ of\ life\ births\ in\ a\ year} \text{ x } 1\,000$$

Maternal mortality is an important indicator of women's health status and for assessing health system performance. The risk of maternal death can be reduced through family planning, improved access to high quality antenatal and delivery care, and postnatal care by skilled health personnel. Addressing inequalities in the provision of essential reproductive health services must be part of any strategy. Health system strengthening and the universal health coverage agenda together with multisectoral actions (including women's education and addressing violence) are crucial efforts to reduce maternal mortality. Because of their importance, infant, perinatal and maternal mortality rates are considered to be special mortality rates.

Standardized mortality rate. The use of crude mortality rates to compare mortality in the same time period between 2 populations (i.e., between the Republic of Moldova and Romania in 2023), 2 subpopulations (i.e., between men and women in the Republic of Moldova in 2023) or 2 different points in time (i.e., in the Republic of Moldova, in 2022 and 2023) leads to inaccurate results. This inaccuracy is explained by the fact that the

crude mortality rate is influenced by the different age structure (confounder) of the populations being compared.

Standardization is the way to eliminate the influence of the different age group structure of the population on mortality. It allows the correct comparison of mortality rates recorded in two or more structurally different populations. The direct method of standardization is described in the *Compendium on Basic Biostatistics and Research Methodology*.

For example, *figure 12* shows the population pyramids of two countries: Bangladesh and Belgium. The population pyramid of Bangladesh is expansive characterized by a higher proportion of the young people and a lower proportion of the older people. Belgium's pyramid is constrictive, with a higher proportion of the older people and a lower proportion of the young people.

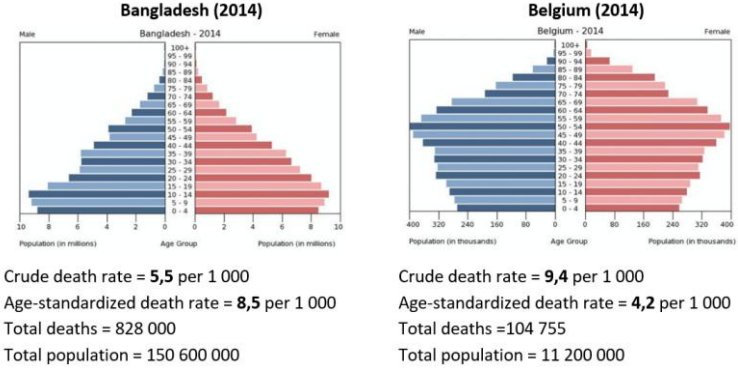


Figure 12. **Comparison of Crude and Standardised Death Rates in Bangladesh and Belgium**

However, a comparison of the crude death rate in the two countries shows that the crude death rate in Bangladesh (5.5 per 1000 population) is much lower than that in Belgium (9.2 per 1000 population). This paradoxical situation is explained by the fact that the

age structure of the two countries is different. Mortality rates are higher at older ages and the number of elderly people is higher in Belgium than in Bangladesh.

In order to compare mortality between the two countries, the difference in age structure must be eliminated. This can be done by standardizing death rates by age. Standardized death rates are hypothetical (unreal) rates that show what the death rates would be in the two countries compared if the age structure of the population were the same. For example, the age-standardized mortality rate in Bangladesh (8.5 per 1 000 population) is twice as high as in Belgium (4.2 per 1 000 population).

A number of factors contribute to **the reduction in mortality.** These include:

- Improving family well-being and living standards;
- Improving food and nutrition, including supply, distribution, quality and nutrition knowledge;
- Control of infectious diseases;
- Reducing mortality from noncommunicable diseases;
- Improving water and sanitation services and living conditions;
- Disease prevention, reduction of risk factors, promotion of healthy lifestyles;
- Improving access to and quality of health services;
- Health promotion and education for health at the societal, community and individual levels;
- Improving social security systems, e.g., child benefits, pensions, national health insurance;
- Improving working and leisure conditions, increasing economic and social well-being.

2.8.2.B. Case-fatality and Proportionate Mortality

Case-fatality is a well-known term in specialized medical literature. It is the ratio between the number of deaths from a particular cause (disease) and the number of diseases from the same cause, expressed as a percentage. Case-fatality rate for disease "x" shows the frequency of deaths due to a particular disease among all those suffering from that disease. Case-fatality is calculated as follows:

$$\textit{Case-fatality} = \frac{\textit{Number of individuals dying during a specified period of time after disease onset or diagnosis}}{\textit{Number of individuals with the specified disease}} \textit{ x 100}$$

It is important to distinguish between case-fatality and the death rate. In the case of death rate, the denominator represents the total population at risk of dying from a particular disease, including both people with the disease and those without the disease. For case-fatality, the denominator includes only people who have contracted the disease. Case-fatality is a proportion.

Case-fatality is a measure of the *severity of the disease*. It is also an indicator of the benefit of a new therapy. As therapy improves, case-fatality is expected to decrease.

Case-fatality is a more appropriate measure of the clinical significance of disease than mortality. For example, meningoencephalitis caused by *Naegleria fowleri* has a higher case-fatality (*N. fowleri* causes a fatal, rapidly progressive, fulminant acute infection) than heart attacks, which have a higher mortality rate, i.e., more people die from heart attack (due to the much higher prevalence of heart disease) than from *N. fowleri* infection (with a very low prevalence).

Proportionate mortality is the proportion of deaths from a given cause in the total number of deaths. It is a proportion.

$$Proportionate\ mortality = \frac{Number\ of\ death\ from\ cause\ X\ in\ a\ year}{Total\ number\ of\ deaths\ from\ all\ causes\ in\ a\ year}\ x\ 100$$

Cardiovascular diseases are responsible for the highest share of death in the Republic of Moldova, accounting for more than 50% of annual deaths. Neoplasms are in the second place and are on the increase. Digestive diseases are the third most common cause of death, accounting for about 10% of all deaths. More than three quarters of these deaths are caused by chronic hepatitis and liver cirrhosis. Trauma and poisoning are fourth, at 6%-7% and falling.

2.8.3. Migration

Migration is the movement of people from one place to another as a result of economic, social, political or natural factors. Migration is the movement of a person or group of people, either across an international border (international migration) or within a country (internal migration). Migration implies territorial mobility, a change of place of origin or even residence, which at the same time leads to a change in the social status of the migrants.

In many countries, migration is the main demographic process influencing the spatial distribution of the population.

Migration can be involuntary (refugees, asylum seekers), where people migrate because of persecution, threats of violence or extreme deprivation, or voluntary (economic migrants), where people are motivated by economic aspirations. International migrants are often categorized as legal or illegal.

The Republic of Moldova is currently facing the problem of population emigration, especially international emigration for work and study.

Implication of Migration on Health and Health Services

Migration, in its various forms, has a number of implications for the health status, health behaviour and health service utilization of both communities of origin and destination. The volume and type of health services used depend primarily on the size and structure of the population. As the population grows or shrinks, so does the demand for health services. Many destination communities struggle to meet the demand for health care because the local infrastructure and the pool of medical personnel cannot expand quickly enough. On the other hand, areas that are losing population cannot easily reduce their infrastructure to adapt services to the needs of the remaining population.

As the structure of the population changes, so do the overall demand and the types of services needed. Changes in the age structure have a significant impact on the demand for health services, both in terms of volume and type. Changes in the distribution of education or income levels also have a significant impact on health services. Education plays an important role in the use of certain services, and income and the ability to pay for health services are important factors in the use of health services. Occupational characteristics may determine the type of insurance available.

Research has shown that migrants are more likely than non-migrants to experience physical and mental disorders. The migration process is stressful and causes psychiatric symptoms. Displacement, with the loss of family, friends and colleagues, poses significant risks.

Another problem associated with migration is the introduction of indigenous diseases not found in the host/destination country, or the reintroduction of diseases that have been eradicated.

One type of migration that has particular implications for health systems is the international migration of physicians and other health professionals. Physicians trained in one country may perceive limited

opportunities in their home country, and the shortage of health workers in another country may be perceived as more attractive. Emigration of health professionals is a major challenge for the health system in the Republic of Moldova.

2.9. Demographic Transition

Demographic transition describes changes in the structure of human populations over time. The basic idea is that with economic development and improved health care, populations tend to move from a situation of high birth and death rates, and hence shorter life spans (the pre-industrial stage), to one in which birth and death rates are lower, and hence life expectancy is higher (the stage of an industrialized economic system). This transition typically changes the age structure of the population from one dominated by children and young adults up to age 29 to one dominated by middle-aged and older adults aged 40 and over.

Demographic transition is a long-term trend of declining birth and death rates that results in significant changes in the age structure of a population. The demographic transition model describes the changes that occur as a country or population moves through stages of development from a population with high birth and death rates to one with low birth and death rates.

In the 1940s-1950s, Frank W. Notenstein (1902-1983) developed the theory of the demographic transition, showing the relationship between demographic changes and socioeconomic changes (46).

Currently, 4 stages of the demographic transition are distinguished.

The first stage, recorded in pre-industrial societies, is characterized by high death and birth rates. As a result, a state of relative equilibrium is recorded in the population. This relative equilibrium disappeared at the end of the 18th century, when industrialization began in Western Europe through the mechanization

of agriculture. At this stage, population growth is very low, and society faces food shortages and lack of sanitation, resulting in high mortality rates from malnutrition and infectious diseases. The population pyramid has a triangular form, showing a large number of children, few elderlies, and deaths at all ages (usually from infectious diseases).

In **the second stage**, mortality declines rapidly as improvements in food supply and sanitation contribute to increased life expectancy and reduced morbidity. Improvements in public health, such as food handling, water supply and sanitation, and personal hygiene, and increased literacy among women, help to reduce mortality, especially among children. Under these conditions, in which the birth rates remain high, the world's population is growing rapidly throughout the globe.

In **the third stage**, the birth rates gradually decline as a result of increasing access to contraception and limitation of family size, rising incomes, urbanization, reduction of subsistence agriculture, and increased social status, the level of education, and employment of women. At this stage, population growth declines and the population pyramid become more rectangular.

The fourth stage is characterized by low birth and death rates. Birth rates fall below replacement levels (e.g., in Germany, Italy, and Japan), leading to population decline, a challenge facing many developed and developing countries. The pyramid is squeezed at the top. As the population born in the second stage ages, it places an economic burden on the declining working-age population. Mortality rates may remain persistently low or increase slightly due to increasing of lifestyle-related diseases, low levels of physical activity, high rates of obesity, and ageing populations in developed and developing countries. By the end of the 20th century, birth and death rates had declined to low levels in developed countries.

Some researchers argue that the fourth stage is followed by a "**fifth stage**" of below-replacement birth rates. Others hypothesize a "fifth stage" of higher birth rates.

This version of the demographic transition is one of idealizing events, being generally applicable to different countries. It focuses on the natural growth of a population and does not take into account migration.

Table 5. **Commonly Used Mortality Indicators**

Measure	Numerator	Denominator	Multiplier
Crude death rate	Total number of deaths in a year	Mid-year population	1,000
Cause-specific death rate	Number of deaths from a specific cause in a year	Mid-year population	100,000
Sex-specific death rate (for females)	Number of deaths among women in a year	Mid-year female population	1,000
Proportionate mortality	Number of deaths from a specific cause in a year	Total number of deaths from all causes in a year	100
Case-fatality	Number of individuals dying during a specified period after disease onset/ diagnosis	Total number of individuals with the specified disease	100
Neonatal mortality rate	Number of deaths among infants less than 28 days of age in a year	Number of life births in a year	1,000
Early neonatal mortality rate	Number of deaths among infants less than 7 days of age in a year	Number of life births in a year	1,000
Late neonatal mortality rate	Number of deaths among infants at age 7-27 days in a year	Number of life births in a year	1,000
Post-neonatal mortality rate	Number of deaths among infants 28-364 days in a year	Number of life births in a year	1,000

Measure	Numerator	Denominator	Multiplier
Infant mortality rate	Number of deaths among infants less than 1 year of age in a year	Number of life births in a year	1,000
Perinatal mortality rate	Number of deaths among infants less than 7 days of age and number of stillbirths in a year	Number of life births and stillbirths in a year	1,000
Maternal mortality rate	Number of deaths assigned to pregnancy-related causes in a year	Number of life births in a year	100,000

Review Exercises

1. In a locality A, on 1 January 2024 there were 750,000 people, and on 1 January 2025 there were 765,000 people. In 2024 there were 2,600 live births and 2,450 deaths. In the same year, 1,400 people emigrated from this locality. Calculate the natural increase, net migration, population growth, crude birth rate, crude death rate, crude out-migration rate, crude in-migration rate and crude population growth rate.

2. The mid-year population in locality D in 2024, was 950,000 people, including 150,000 children under 15 years, 450,000 people aged between 15 and 64, and the rest of the population was aged 65 and over. Calculate the dependency ratio and the population ageing coefficient. Interpret the results.

3. The mid-year population aged 15-65 in locality B in 2024 was 63,500 people, including 31,600 men. In 2024, 340 cases of death were registered in this locality. Of the total number of deaths, 160 were registered among women, including 70 from cardiovascular diseases, 40 from cancer, 15 from liver cirrhosis and 35 from other causes. Calculate all possible indicators.

4. The mid-year population in locality C in 2024 is 130,000 people, including 62,700 men. This year, 2,150 deaths were registered, including 960 among women. In 2024, 1,200 live births and 40 stillbirths were registered. Of the total deaths, 20 were maternal deaths and 50 were among children under 1 year of age, including 15 deaths in the first week after birth. Calculate all possible indicators.
5. For the causes of death listed in the table below, please indicate whether the death can be avoided by prevention or treatment, or both, and the appropriate methods to avoid it.

Cause of death	Preventable mortality	Treatable mortality	Methods to avoid it
Diphtheria			
Measles			
Tuberculosis			
Lung cancer			
Melanoma			
Cervical cancer			
Colorectal cancer			
Breast cancer			
Diabetes mellitus			
Hypertension			
Ischemic heart disease			
Cerebrovascular disease			
Kidney failure			
Asthma			

6. A study by Rogado J et al (33) found that 9 out of 17 patients with lung cancer infected with COVID-19 died compared to 192 out of 1878 patients with COVID-19. Calculate the case-fatality rate. Comment on the results.

Review Questions

1. Define demography.
2. What is the relationship between demography and public health?
3. Characterize the main demographic concepts.
4. Name the three main demographic processes.
5. What are the components of the balancing equation?
6. What does it mean natural increase, net migration and population growth?
7. What are the basic demographic rates?
8. What are the main sources of demographic data?
9. What are the characteristics, advantages and disadvantages of the census?
10. What categories are used to describe the structure of the population?
11. What is the population pyramid?
12. What are the types of population pyramid and what are the characteristics of each type?
13. What are the characteristics of the population ageing?
14. What are the medical and social aspects of population ageing?
15. What is the demographic dependency ratio and what does it mean?
16. What are the characteristics of the ageing population in the Republic of Moldova?
17. What are the components of population growth?
18. What are the factors influencing the fertility?
19. What is the difference between "stillbirth" and "abortion/ miscarriage"?
20. Why is it important to study mortality?
21. What types of measures are used in studying mortality?
22. What are the three types of death rates?
23. Give examples of specific death rates.
24. What is the purpose of age standardization of crude death rates?

25. What are the components of neonatal mortality and infant mortality?
26. What is the difference between case-fatality and proportional mortality?
27. What does it mean demographic transition, what are the stages of this transition and what are the characteristics of each stage?

3. MEASURING MORBIDITY, DISABILITY AND QUALITY OF LIFE OF THE POPULATION

3.1. Morbidity: Definition, Types

Morbidity is defined as any departure, subjective or objective, from a state of physiological or psychological well-being (15). Morbidity can be measured in terms of the following characteristics: the people who are ill, the illnesses they suffer from and the duration of the illness.

Depending on data sources, three types of morbidity can be distinguished (*Figure 13*):

- Diagnosed;
- Measured;
- Self-reported.

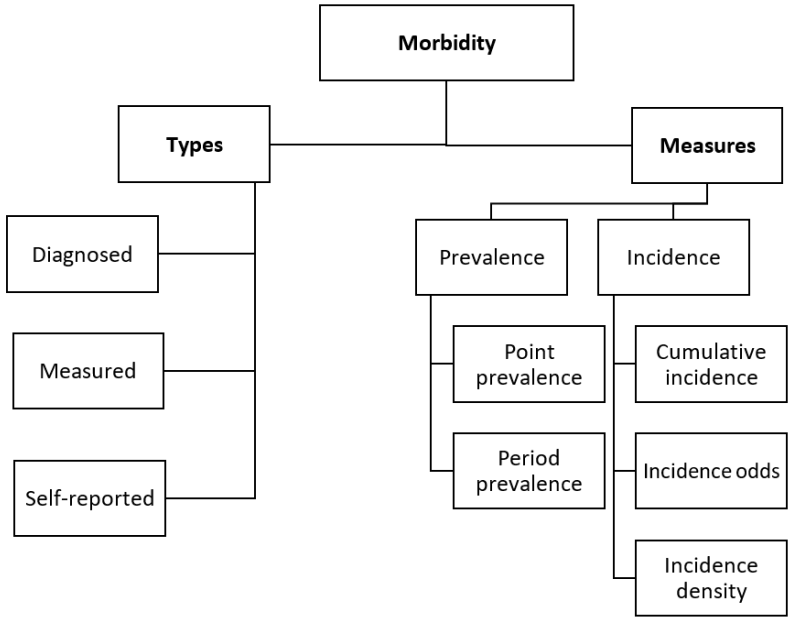


Figure 13. **Morbidity Types and Indicators**

3.1.1. Diagnosed Morbidity

Diagnosed morbidity is morbidity expressed in terms of the quality of available diagnostic knowledge and methods. This type of morbidity includes diseases that are diagnosed (and treated) by health professionals and that are currently recorded or confirmed by medical records. Diagnosed morbidity is recorded in many countries and includes mandatory reporting or notification of infectious diseases, chronic disease registers (e.g., cancer register), health statistics, statistics on occupational diseases and accidents at work.

In the Republic of Moldova, diagnosed morbidity is registered and reported monthly and annually, and the main nosologies are analyzed annually within the health information system. Priority infectious diseases, occupational diseases and accidents at work are notified.

The shortcomings of the diagnosed morbidity include: dependence on the availability of health care, individual attention to one's health, quality of morbidity registration.

3.1.2. Measured Morbidity

Measured morbidity (*actual, objective*) is morbidity about which information is collected by systematic investigation of the health problem in a population on the basis of standardized, objective criteria that are independent of multiple sources of error. Measured morbidity reports illnesses detected by doctors during routine medical examinations of the whole population or specific population groups, including biomedical measurements (e.g., medical examinations of children at school, of employees in enterprises). National health examination surveys are conducted regularly in many developed countries.

In the Republic of Moldova, information on measured morbidity is collected during mandatory medical examinations of pre-school and school-age children and some employees of enterprises, and is partially reported and analyzed at regional and national levels.

A disadvantage is that it is expensive and difficult to measure at the national level.

3.1.3. Self-reported Morbidity

Self-reported morbidity (*subjective*) refers to information about illness / disease collected directly from individuals in health surveys and is sometimes referred to as perceived or subjective morbidity. This type of morbidity is the expression of the individual personality in expressing the health status, which depends on: the level of culture, the social environment, the ability to express oneself, previous experiences with health care, etc. This different image of morbidity is subjective but important because it influences the behaviour of the population, including compliance with preventive measures. Standardized questionnaires are used to identify specific health problems. In this way, it is possible to learn about the existence of easily detectable health problems and diseases, and to assess the needs of the population and the demand for health services, which are generally measured in demographic surveys.

In the Republic of Moldova, information on this type of morbidity has been and is being collected in population studies (e.g., Demographic and Health Study 2005, Prevalence of risk factors for noncommunicable diseases STEPS 2013, 2021, Household Budget Survey).

The shortcoming of this type of morbidity is that it is influenced by several subjective factors, including age, sex and occupation.

3.2. Morbidity Measures

The occurrence of a disease in a population can be measured using rates and proportions. Rates show how quickly a disease occurs in the population, while proportions show what fraction of the population is affected by a disease. Incidence and prevalence are the most frequently used measures of disease frequency (*Figure 13, Table 8*).

3.2.1. Prevalence

Prevalence is the proportion of the population that has a specific health problem or characteristic at a given point in time or over a period of time. A distinction is made between point prevalence and period prevalence.

3.2.1.A. Point prevalence

Point prevalence is the proportion of the population that has a health problem at a given point in time.

$$\textit{Point prevalence} = \frac{Number\ of\ all\ cases\ with\ disease\ at\ specified\ point\ in\ time}{Total\ number\ of\ population\ at\ the\ same\ point\ in\ time}\ x\ 10^n$$

The numerator includes all people who have a particular health problem (e.g., disease, injury, risk factor) at a given point in time, without taking into account the period of time during which the people had that problem. The denominator includes the whole population, i.e., all people diagnosed with the problem and all people without the problem.

As prevalence is a proportion, it is dimensionless, meaning it has no unit of measurement.

This indicator is called point prevalence, because it refers to a specific point in time (at the time of data collection). Although prevalence has no time units, the point in time to which it refers should be always be specified.

3.2.1.B. Period prevalence

Period prevalence measures the frequency of all cases of a disease (new and old) in a given period of time. It accounts for the population that has the disease or characteristic being studied at any time during the period.

$$\textit{Period prevalence} = \frac{Number\ of\ all\ cases\ with\ disease\ in\ a\ given\ period}{Mid-year\ population}\ x\ 10^n$$

The factors that influence the prevalence are shown in *Table 6*.

Table 6. **Factors Influencing the Prevalence**

Factors contributing to the increase in prevalence	Factors contributing to the decrease in prevalence
Long duration of the disease	Short duration of the disease
Increase in average life expectancy	
Longer survival time, even in the absence of any treatment	High case-fatality rate associated with the disease
Occurrence of new cases of the disease (increasing incidence)	Decreasing incidence
In-migration of new cases of the disease	Out-migration of cases
Out-migration of healthy people	In-migration of healthy people
Improvement of diagnostic tools (improvement of registration)	
Improvement of treatment options (treatment can prevent death, but it does not cure the disease)	Improvement in the treatment rate of cases (cure of the disease)

Prevalence is a useful measure, particularly in the study of chronic diseases and their risk factors. Calculating prevalence is useful for determining health services and treatment needs, especially for health service planning, as well as for determining disease prevention and health promotion needs.

3.2.2. Incidence

Incidence refers to the frequency of new cases of the disease in the population during a given period of time. Unlike prevalence, which includes both new cases of the disease and pre-existing cases, incidence is limited to new cases of the disease only. Incidence depends on the accessibility of health services, the addressability of the population and

the quality of the diagnosis. The frequency of occurrence of new cases of the disease can be considered real only in populations where these three conditions are optimally met.

There are three types of incidence: cumulative incidence or incidence risk, incidence odds and incidence density (*Table 7*).

Table 7. **Types of Incidence**

	Numerator	**Denominator**
Cumulative incidence (incidence risk)	Number of **new cases** with the disease in the population at risk over a given period of time	Number of population at risk (disease-free people) **at the start** of the observation period
Incidence odds		Number of disease-free people **at the end** of the observation period
Incidence density		It is a more accurate indicator of the population at risk during the study period and is measured in **person-time**

3.2.2.A. Cumulative Incidence

The **cumulative incidence** (incidence risk) can be thought of as a probability and represents the risk of individuals in a given population developing the disease over a given period of time, assuming that the individuals exposed at the beginning of the period are healthy. The denominator includes the disease-free people at the beginning of the observation period from the population at risk.

$$\textit{Cumulative incidence} = \frac{Number\ of\ new\ cases\ with\ disease\ in\ a\ specified\ period\ of\ time}{Number\ of\ disease-free\ people\ at\ the\ start\ of\ the\ period} \times 10^n$$

Cumulative incidence is calculated only in cohort studies. Cumulative incidence is based on the assumption that the entire population at risk is followed from the beginning of the observation

period to the end of this period (*closed population*). Cumulative incidence is useful for comparing health risk in different populations.

Example of calculating point prevalence, period prevalence and cumulative incidence

Figure 14 shows 9 cases of disease that occurred between January 1 and December 31, 2023 in locality A with a population of 1,000.

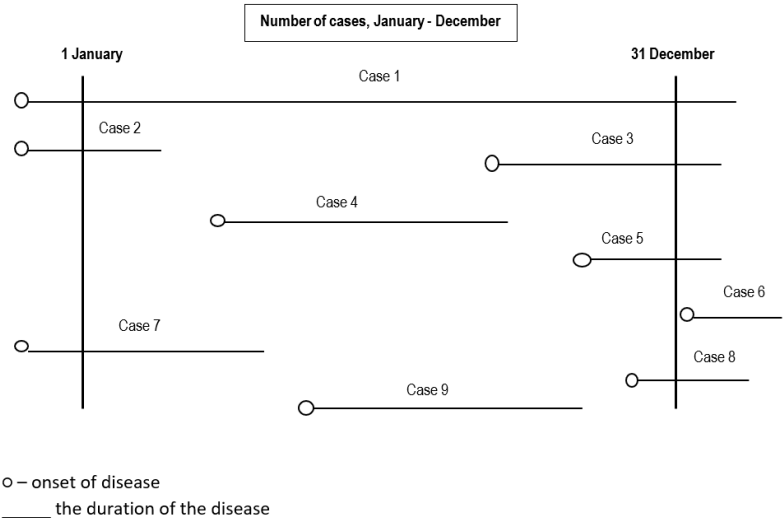


Figure 14. **Example of Calculating Point Prevalence, Period Prevalence and Cumulative Incidence**

a) Calculate point prevalence at 1 January 2023.

Numerator: Total number of existing cases at 1 January 2023 (cases 1, 2 and 7) = 3.

Denominator: Total population at 1 January 2023 = 1000

$$\textit{Point prevalence} = \frac{3}{1000}\ x\ 100 = 0{,}3$$

b) Calculate point prevalence at 31 December 2023.

Numerator: Total number of existing cases at 31 December 2023 (cases 1, 3, 5 and 8) = 4

Denominator: Total population at 31 December 2023 = 1000

$$\textit{Point prevalence} = \frac{4}{1000} \textit{ x 100 = 0,4}$$

c) Calculate the period prevalence for the period 1 January - 31 December 2023.

Numerator: Total number of existing cases of the disease between 1 January and 31 December 2017 (cases 1, 2, 3, 4, 5, 7, 8 and 9) = 8

Denominator: Total population in the period 1 January – 31 December 2023 = 1000

$$\textit{Period prevalence} = \frac{8}{1000} \textit{ x 100 = 0,8}$$

d) Calculate cumulative incidence in 2023.

Numerator: Number of new cases of the disease registered between 1 January and 31 December (cases 3, 4, 5, 8 and 9) = 5.

Denominator: Number of people at risk = 1000 – 3 = 997.

$$\text{Cumulative incidence} = \frac{5}{997} \text{ x } 100 = 0,5$$

The **attack rate** is a special type of a risk measure used in specific exposures (epidemic outbreaks, food poisoning, etc.). The attack rate is the number of new cases of disease that occur in the population at risk during the exposure period only.

$$\textit{Attack rate} = \frac{\textit{Number of new cases with disease in the exposure period}}{\textit{Number of people at risk}} \textit{ x } 10^n$$

Example

After a dinner attended by 150 people, 30 people who consumed pizza became ill.

The numerator: Number of people who became ill during the exposure period = 30 (new) cases of the disease.

Denominator: Number of people at risk during the exposure period = 150.

$$Attack\ rate = \frac{30}{150}\ x\ 100 = 20\%$$

3.2.2.B. Incidence odds

Another way to measure incidence is to calculate **incidence odds**. For incidence odds, the denominator is the number of people in the population that do not have the disease at the end of the observation period. Because the numerator is not a subset of the denominator, we cannot say that incidence odds is a rate. It is a ratio.

$$Incidence\ odds\ = \frac{Number\ of\ new\ cases\ with\ disease\ in\ a\ specified\ period\ of\ time}{Number\ of\ disease\ free\ people\ by\ the\ end\ of\ the\ period}\ x\ 10^n$$

Example

During a ten-year follow-up period (2015-2024), 50 people out of a total of 4,500 participants in a cohort study were diagnosed with diabetes.

The numerator: the number of people newly diagnosed with diabetes in the period 2020-2024 = 50.

Denominator: number of people free of the disease at the end of the observation period = 4500 – 50 = 4450.

$$Incidence\ odds = \frac{50}{4450}\ x\ 100 = 1{,}12\%$$

3.2.2.C. Incidence density

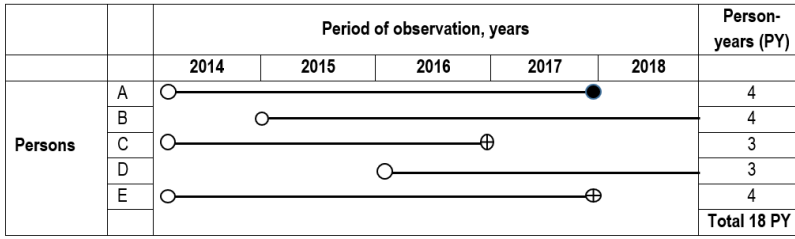
Both cumulative incidence and incidence odds assume that the population at risk is followed for the entire observation period, and that

those who were included under observation at the beginning of the observation period are counted at the end of the period. In other words, *cumulative incidence* and *incidence odds* are calculated for a *closed population* (people do not enter or leave the population at risk).

However, it is not always possible to record observations for a defined period of time. For example, participants may enter the study at different times, or some of them may not be available for observation for various reasons, including loss to follow-up or death from a cause other than the study disease. This population is called an *open* or *dynamic population* (individuals enter or leave the observation at different times). As a result, the duration of the observation period will not be the same for all participants and in such situations the **incidence density** (incidence rate) is calculated. It is calculated using the exact duration of observation for each participant. The denominator of the incidence density is the sum of the length of time that each person contributed to the observation period and did not develop the disease. Therefore, the denominator reflects time, expressed in *person-time at risk* (person-days, person-months, person-years). The numerator is made up of the number of new cases of the disease that occurred during the observation period.

$$\textit{Incidence density} = \frac{Number\ of\ new\ cases\ with\ disease\ in\ a\ specified\ period}{Total\ person{-}time\ at\ risk\ during\ that\ time\ period}\ x\ 10^n$$

Suppose we have a study that lasts 5 years and 5 people are followed during that time. Participants A, B and E were followed for 4 years each, and participants C and D for 3 years each. Total person-years = (3 x 4) + (2 x 3) = 18 person-years (*Figure 15*). One participant was lost to follow-up (●).



O – The beginning of observation

● - Follow-up stopped: the person studied died from causes other than the diseases studied or left the study area

⊕ - Detection of the disease being studied

PY – Person-year

Figure 15. **Example of Calculation of Incidence Density**

During the observation period, 2 new cases of the disease (x) were registered. Therefore,

$$Incidence\ density = \frac{2\ cases}{18\ person{-}years} \text{ x } 100 = 11.1 \text{ cases per } 100 \text{ person-years.}$$

In large studies, it is difficult to accurately measure the amount of time (person-time) that each participant contributed to the study. In this case, the mid-year population can be used for the total person-time at risk.

Factors that influence the incidence include:

- Changes in lifestyle;
- The emergence of new risk factors;
- The effectiveness of national programmes and interventions to prevent and control the disease and its risk factors;
- The temporal evolution of the disease;
- New diagnostic methods;
- Changes in the age structure of the population;
- Changes in the classification of diseases;
- Migration.

Characteristics of prevalence and incidence indicators are shown in *Table 8*.

Table 8. **Prevalence versus Incidence**

	Point Prevalence	**Period Prevalence**	**Cumulative Incidence**	**Incidence Density**
Numerator	All existing cases (new and pre-existing) at a point in time	All existing cases (new and pre-existing) during a period of time	New cases	New cases
Denominator	Population at the same point in time	Mid-year population	Disease-free people at the start of the period	Person-time
Time	At a moment in time	Period	Period	Period
Type	Proportion	Rate	Proportion	Rate
Example of questions	Do you currently have hypertension?	Have you had a hypertensive crisis in the last year?	Have you ever had a hypertensive crisis in the past year?	
Type of study design	Cross-sectional Surveillance		Closed cohort studies	Open cohort studies

3.3. International Classification of Diseases

3.3.1. Purpose and Destination

The International Statistical Classification of Diseases and Related Health Problems (ICD) is the foundation for identifying global health trends and statistics and is the international standard for reporting diseases and health conditions. It is a standard for classifying diagnoses for clinical and research purposes. The ICD defines the universe of

diseases, disorders, injuries and other health conditions, listed in a comprehensive, hierarchical manner that enables:

- Easy storage, retrieval, and analyzis of health information for evidence-based decision making;
- Exchange and comparison of health information between medical institutions, administrative-territorial units, countries and regions;
- Comparison of data in the same locality over different time periods.

ICD is used to monitor disease incidence and prevalence, observe trends in reimbursement and resource allocation, and track guidelines on health services safety and quality. ICD is also used to record deaths, injuries, symptoms and factors affecting health status, and external causes of illness and death.

The first classification of diseases and causes of death, known as the International Classification of Causes of Death, was adopted in 1893. WHO took over the ICD in 1948 and published the 6th version, ICD-6, which included morbidity for the first time. The ICD has been revised and published in a series of revisions to reflect advances in health and medical science over time and to take account of changing disease patterns.

The current version, the 10th revision of the ICD (ICD-10), was adopted by the 43th Assembly of the WHO in 1990 (67). Most countries, including the Republic of Moldova, adopted the 10th revision at the end of the 1990s.

3.3.2. International Classification of Diseases, 10th revision

The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, 2019 WHO version, comprises 22 chapters, with each disease assigned a unique four-digit alphanumeric code (*Table 9*). The alphanumeric classification uses all 26 letters of the alphabet.

One letter is used for each chapter and 2-3 letters are used for large chapters (e.g., neoplasms, infectious and parasitic diseases).

Each chapter contains 100 disease groups consisting of 3 characters, the first of which is alphabetical and two are numerical (A00-A99).

Each 3-character group is subdivided into 10 disease codes (0-9) or disease groups.

Each disease has an alphanumeric code of 4 characters.

Table 9. **International Statistical Classification of Diseases and Related Health Problems**

Chapter	Codes	Title
I	A00-B99	Certain infectious and parasitic diseases
II	C00-D48	Neoplasms
III	D50-D89	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism
IV	E00-E90	Endocrine, nutrition and metabolic diseases
V	F00-F99	Mental and behavioural disorders
VI	G00-G99	Diseases of the nervous system
VII	H00-H59	Diseases of the eye and adnexa
VIII	H60-H95	Diseases of the ear and mastoid process
IX	I00-I99	Diseases of the circulatory system
X	J00-J99	Diseases of the respiratory system
XI	K00-K93	Diseases of the digestive system
XII	L00-L99	Diseases of the skin and subcutaneous tissue
XIII	M00-M99	Diseases of the musculoskeletal system and connective tissue
XIV	N00-N99	Diseases of genitourinary system
XV	O00-O99	Pregnancy, childbirth and the puerperium
XVI	P00-P96	Certain conditions originating in the perinatal period
XVII	Q00-Q99	Congenital malformations, deformations and chromosomal abnormalities
XVIII	R00-R99	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified
XIX	S00-T98	Injury, poisoning and certain other consequences of external causes

Chapter	Codes	Title
XX	V01-Y89	External causes of morbidity and mortality
XXI	Z00-Z99	Factors influencing health status and contact with health care
XXII		Codes for special purposes
	U00-U49	Provisional assignment of new diseases of uncertain aetiology or emergency use
	U82-U85	Resistance to antimicrobial and antineoplastic drugs

3.3.3. International Classification of Diseases, 11th revision

In 2019, the 72nd WHO Assembly adopted the 11th revision of the ICD (ICD-11), which entered into force starting 2022 (68). WHO member states are at different stages of the implementation of the new classification system.

The 11th revision of ICD contains about 55,000 unique codes for injuries, diseases and causes of death. It uses a common language and enables the exchange of health information around the world. The 11th revision of ICD includes significant improvements over previous versions; for the first time, it is fully electronic and has a more user-friendly format.

The ICD is also used by health insurers, whose reimbursement depends on ICD coding; by national health programme coordinators or managers; by professionals involved in data collection; and by other people and institutions that monitor global health progress and determine the allocation of health resources.

The ICD-11 classification and terminology:

- Allows the systematic collection, analysis, interpretation and comparison of mortality and morbidity data collected in different countries or regions and at different times;
- Ensures semantic interoperability and reuse of recorded data for different use cases beyond simple health statistics, including

decision support, resource allocation, reimbursement, guidelines and more.

The ICD-11 revision also reflects advances in medicine and scientific understanding. For example, the codes for antimicrobial resistance are more in line with the Global Antimicrobial Resistance Surveillance System (GLASS).

The new 11th revision of the ICD can better capture data on healthcare safety, which means that unnecessary events that can harm health, such as unsafe flows in hospitals, can be identified and reduced.

This new revision also includes new chapters, one on traditional medicine: although millions of people worldwide use traditional medicine, it has never been classified in this system. Another new chapter on sexual health brings together conditions that were previously classified in other ways (i.e., gender incongruence was included under mental health conditions) or described differently. Gaming addiction has been included in the section on addictive disorders.

3.4. Disability

3.4.1. Key Concepts

Functioning refers to the **positive** or neutral aspects of the interaction between a person's health status and its contextual factors (environmental and personal factors). The pathological changes that occur in the body at the onset of the disease (during clinical course or the natural history of the disease) result in an impairment that may affect the usual functioning.

Impairment is a loss or deviation from the normal function and/or structure of an organ or system. A type of nerve injury that leads to multiple sclerosis, leg paralysis or the complete loss of a body part through amputation of a limb, are examples of *structural impairments*. Pain that cannot be relieved or joints that no longer move easily, loss of vision or memory are examples of *functional impairments*. Impairment

is usually not perceived by the patient, and *screening tests* can be used at this stage to identify impairment of which the person is unaware.

Impairment may also result in activity limitations and participation restrictions. **Activity limitations** are the difficulties a person may face in performing usual activities. For example, difficulty seeing, hearing, walking or solving a problem. **Participation restrictions** are the problems a person faces in engaging in normal daily life activities. For example, education, work, engaging in social and recreational activities, and accessing health care and preventive services.

Disability is the opposite of functioning. According to the WHO International Classification of Functioning, Disability and Health, (ICF 2001), **disability** is an umbrella term for impairments, activity limitations and participation restrictions, these forming the three dimensions of disability (58). Disability denotes the **negative** aspects of the interaction between a person's health status and that person's contextual factors (environmental and personal factors).

Activities and participation can be made easier or more difficult by environmental factors such as technologies, support and relationships, services, policies or the beliefs of others.

The WHO formulation of 2001 on activities and abilities is a more positive one. The WHO has thus provided a complete classification system of health conditions, covering the body structure and functioning as they affect the person's participation in society. Contextual factors such as housing, transport and work (social determinants of health) that may affect participation have been considered. ICF approaches work as an interaction between a person, their health condition (disease or injury) and the context in which the person lives, including the physical environment and cultural norms relevant to the condition. ICF addresses the issue of disability through an approach that recognizes the role of social, socio-demographic and behavioural factors in the analysis of disability.

Thus, according to the new scientific model, disability occurs as a result of the interaction between the health condition and contextual, environmental and personal factors (*Figure 16*) (64).

Contextual factors are the factors that make up a person's overall life context and include two components: environmental factors and personal factors.

Environmental factors are the physical, social and attitudinal environment in which people live and lead their lives (e.g., natural environment, architectural features, legal and social structures, climate, terrain, socio-economic system and policies). Environmental factors are either barriers to or facilitators of the person's functioning.

Personal factors are those related to the person as such and include: age, gender, social status and life experience.

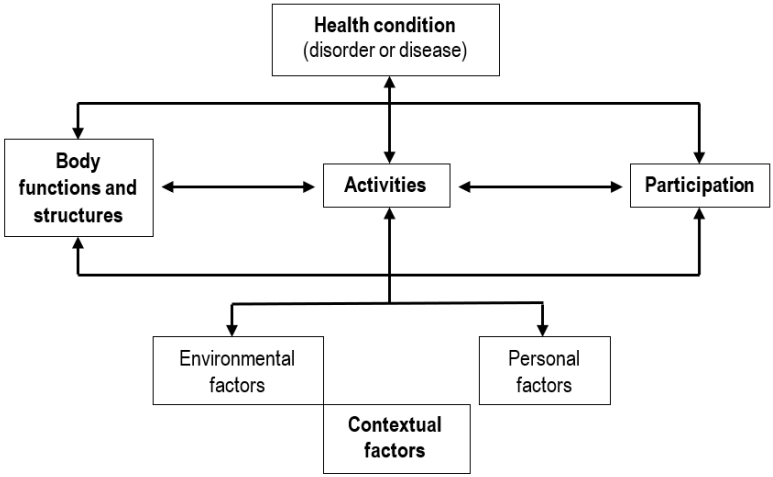


Figure 16. **Disability model as defined by the International Classification of Functioning, Disability and Health**

Source: (64)

Example

An 8-year-old child has a form of cerebral palsy called spastic diplegia. His legs are stiff, tight, and difficult to move. The child cannot stand, walk or climb stairs.

- *Impairment:* paralysis of the legs.
- *Activity limitations:* inability to move, walk, or climb stairs.
- *Participation restrictions:* the child cannot lead a normal life at home, at school and in the community because of environmental barriers.
- *Environmental factors:* barriers that make the child disabled and prevent (or limit) him from exercising his rights to participate fully in society. These barriers are not limited to physical barriers, but also include social and political barriers. Inaccessible buildings, inaccessible roads and transport systems and lack of assistive devices are barriers to participation in education and training and later in employment and family and community life. Barriers can also include negative attitudes, low expectations, and laws and institutions that do not support inclusion.

3.4.2. Approaches to Measuring Disability

There are three main approaches to measuring disability:

- Direct interview about disability;
- Self-reported functioning;
- Screening of impairment or health status.

Direct interviewing about disability involves asking people directly whether they think they have a disability. This approach is simple and quick, but can significantly underestimate the prevalence of disability. People may not consider themselves to be disabled or may fear stigma or discrimination if they are labelled as having a disability. Therefore, direct questioning to measure disability is not recommended.

Self-reported functioning is another approach, which consists of measuring disability through self-reported functioning, i.e., asking people whether they experience difficulties in different areas of functioning. For example, people are asked whether they experience difficulties in their main areas of activity in their daily lives, and how much difficulty they have.

The Washington Group on Disability Statistics (Washington Group on Disability Statistics), a United Nations working group, has developed a short questionnaire with questions that are limited to basic functioning (48). The six main areas of functioning that could limit their ability to fully participate in social life are: vision, hearing, walking or climbing stairs, memory or concentration, communication and personal care (dressing and washing).

Screening for impairments or health status. Impairment or health status are components of disability that can be measured directly using objective tests. For example, the use of a handheld otoscope with a built-in screening audiometer or tablet audiogram apps are designed to objectively measure hearing impairment in the population aged 50 years or more.

However, testing impairments and health status in isolation generally does not take into account how they affect a person's level of functioning or participation. This type of assessment requires more resources than collecting self-reported information. The advantages and disadvantages of each method are shown in *Table 10*.

Table 10. **Advantages and Disadvantages of Disability Measuring Approaches**

Type	Example	Advantage	Disadvantage
Direct interview	Do you have a disability?	Easy to administer.	Underreporting due to stigma, discrimination or lack of self-identification.

Self-reported functioning	Are you having trouble hearing?	Easy to administer; Absence of stigmatization; Experience/impact information.	It cannot be used for needs assessment and planning of health or rehabilitation services.
Clinical screening for deficiency	Measuring hearing loss.	Information about the type and severity of impairment.	Resource consuming; impairment is only one component of disability.

3.4.3. Disability Data Use Directions

Data on disability are needed to:

- Estimating the prevalence of disability;
- Identifying the needs of people with disabilities, planning and evaluating health services, including rehabilitation, that adequately respond to their needs (e.g., provision of cataract surgery, hearing aids, mobility equipment);
- Monitoring the integration of people with disabilities and advocacy to promote the social inclusion of people with disabilities;
- Assessing the level of achievement of each of the SDG for people with disabilities and ensuring that they are not left behind.

3.5. Summary Measures of Population Health

The most commonly used measures of population health are morbidity and mortality and life expectancy.

Most chronic noncommunicable diseases have a serious impact on the health status and quality of life of patients, but are not directly life-threatening and do not cause death. **Summary measures of population health** are measures that combine information on different aspects of health such as mortality, health status, morbidity and functional status or quality of life, to give a single figure for the health of a population.

There are two groups of summary health indicators: health expectancies and health gaps (23).

Health expectancies, such as healthy life expectancy (HALE) and quality-adjusted life years (QALYs), represent the number of years of life lived in full health and the number of years lived free of certain diseases or disabilities, respectively. In calculating these indicators, years lived in full health are "worth" more than years lived in any state other than full health.

Health gap indicators, such as disability-adjusted life years (DALYs), quantify the difference between the actual health status of a population and a stated population health objective. They therefore represent the number of years of healthy life lost due to ill health and premature death.

The concept of summary measures of population health is described in *Figure 17* (23).

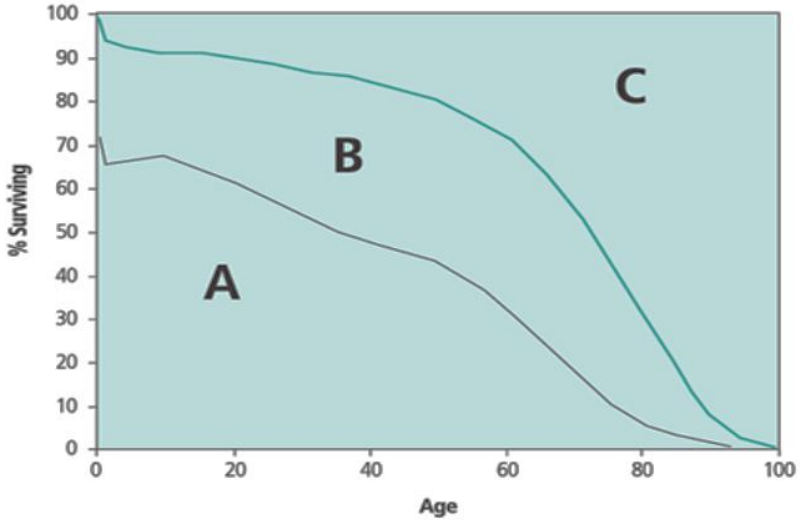


Figure 17. **Summary Measures of Population Health**

Source: (23)

The curve in the figure is an example of a survival curve for a hypothetical population. For each age along the X-axis, the curve shows the proportion of the original birth cohort that will be alive at that age.

Zone A represents the time lived/spent in full health.

Zone B represents time spent in less than full health, weighted for severity.

Zone C represents time lost due to premature mortality.

Life expectancy at birth is equal to the sum of areas A and B;

Healthy life expectancy (HALE) = A + *f* (B),

where *f* is a weighting factor reflecting the health status on a scale from 0 to 1, where 1 is equivalent to 1 year of full health;

Health gap (DALY) = C + *g* (B),

where *g* is a weighting factor reflecting less than full health on a scale of 0 to 1, where 1 is equivalent to 1 year of full health lost due to premature death.

3.5.1. Life Expectancy

Life expectancy (LE) is an estimate of the average number of years an individual can expect to live given the characteristics of the mortality pattern by age group of the population from which the person comes for a given year. Life expectancy is often reported as life expectancy at birth (or life expectancy, e0), but it can also be calculated at age 25 (e25) or another age. Life expectancy is calculated using the life tables, dividing the total number of person-years lived after a given age (0 or 25 years) by the number of survivors at the corresponding age of 0 or 25 years. Life tables are derived from age-specific death rates and show the probability of death (and survival) between given ages. The infant mortality rate has a strong influence on life expectancy at birth, as a very large number of potential years of life are lost due to an infant death.

Because of gender differences, life expectancy is calculated separately for men and women. Life expectancy is a hypothetical indicator of current health and mortality conditions.

Life expectancy at birth is a common indicator used to compare health status within a country and between countries. Life expectancy roughly, but comprehensively, measures the overall health of the population because it summarizes, in a standardized format, current information on the health status of all age and sex groups in the population. As such, it is a reliable measure of the overall performance of the health system at a given point in time.

This measure provides an indirect measure of a country's standard of living. Thus, a direct correlation was found between average life expectancy and gross domestic product (GDP) per capita. There is also a similar correlation with the percentage of national income allocated to health.

Currently, the life expectancy is higher for women than for men, but the difference varies considerably. Life expectancy for women is about 8 years higher than for men in the Republic of Moldova. In countries with low-mortality, the gender gap in life expectancy is generally larger than in countries with high-mortality, reflecting the association between declining mortality and the increasing advantage of women. This is the result of lower death rates from causes that specifically or predominantly affect women (such as maternal mortality and pulmonary tuberculosis), gender differences in health behaviour and exposure to occupational risks. The epidemic of tobacco use and tobacco-associated diseases is a major cause of gender differences in mortality. Alcohol is also a determinant of gender differences in mortality. In the Republic of Moldova, the prevalence of tobacco use is about seven times higher among men (52.0%) than among women (7.7%). Alcohol consumption is also more common among men (73.1%) than women (53.2%) (40). The unprecedented increase in life

expectancy in the Republic of Moldova during the 1985 anti-alcohol campaign and the rapid deterioration of the situation after the abolition of restrictive measures showed a strong dependence of mortality among both sexes on alcohol abuse (30).

3.5.2. Healthy Life Expectancy

Healthy life expectancy (HALE) is the average number of years people is expected to live in full health and without disability. Comparing trends in HALE and life expectancy shows whether the extra years of life are healthy years. Healthy life expectancy is calculated as the difference between life expectancy (LE) and years lived with disability (YLD).

$$HALE = LE – YLD$$

The HALE measure is used to determine: a) whether increases in longevity are accompanied by improvements in health; b) the average length of time people live in full health; and c) the proportion of time spent in less than full health. The overall increase in life expectancy also means an overall increase in healthy life years, and a decrease in the proportion of life spent in less than full health.

Although women live longer than men on average, they spend a smaller proportion of their lives in full health or without disability than men. Thus, towards the end of life, women accumulate a greater health burden than men, as a result of both greater longevity and multimorbidity.

3.6. Global Burden of Disease

Burden of disease is a measure of the difference between the current health status of a population and the optimal status, in which all people reach their full life expectancy without suffering from serious diseases.

The Global Burden of Disease (GBD) represents the impact of a health problem as measured by financial costs, mortality, morbidity and other measures. The concept of "burden of disease" was developed by the World Bank and WHO in the 1990s to describe deaths and health

losses due to diseases, injuries and risk factors in all regions of the world. *Figure 18* presents a simplified version of the GBD framework, showing the causal chain of events relevant to health outcomes and identifying key components and determinants of health that need to be quantified (19).

In addition to the summary measures of population health described above, there are other summary measures that are used to quantify the burden of disease on society.

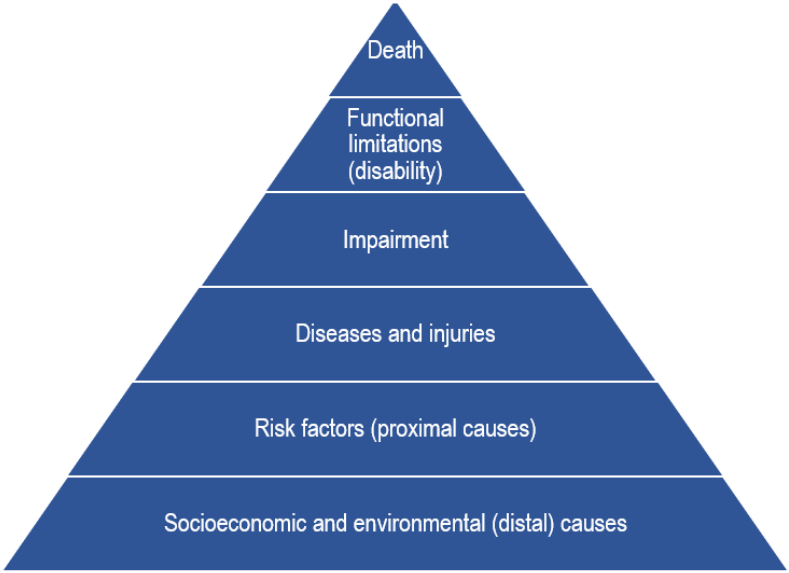


Figure 18. **Overview of the Burden of Disease Framework**

Source: adapted by Lopez et al, 2006 (19)

3.6.1. Potential Years of Life Lost

Potential years of life lost (PYLL) is a summary measure of premature mortality. PYLL is defined as the potential years of life lost (by society) due to premature death.

It is calculated in 2 steps. The first step is to calculate the difference between each person's age at death and a predetermined

age, usually 70. Thus, all deaths that occur before the age of 70 are considered premature. A child who dies at the age of 5 loses 65 potential years of life (70-5) and a person who dies at the age of 65 loses 5 potential years of life (70-65). YPLL takes into account age at death, giving more weight to deaths that occur at younger ages and less weight to deaths that occur at older ages.

In a second step, the years of life lost by each person are aggregated to calculate the total number of PYLL.

YPLL can also be calculated as the product of the number of deaths at each age and the estimated life expectancy at the age of death. These data are taken from the life tables.

YPLL = number of deaths x standard life expectancy (years) at the age of death.

YPLL can be calculated for different causes of death and is expressed per 10 000 or per 100 000 population.

$$\textit{Crude rate of YPLL} = \frac{YPLL}{N}\ x\ 10\ 000$$

where N = population.

Priority cardiovascular diseases were responsible for 38.9% of the total number of PYLL lost due to noncommunicable diseases and 21.8% - of all causes of death in 2015 in the Republic of Moldova (32).

The YPLL is used in public health planning to compare the relative importance of different causes of premature death within a population, to compare the state of premature mortality between populations, and to set priorities for prevention.

However, the YPLL assessment does not take into account the degree of disability of the person before death, so this indicator treats a person who dies suddenly the same as a person who dies at the same age after decades of illness.

3.6.2. Years Lived with Disability

Years lived with disability (YLD) quantifies non-fatal health losses and is an indicator of the impact of disease on quality of life before the disease resolves or leads to death. It is calculated for incident cases of the disease or health condition. To estimate the YLD for a given cause in a given period, the number of incident cases in that period is multiplied by the average duration of the disease and a weighting factor that reflects the severity of the disease on a scale from 0 (perfect health) to 1 (death).

$$YLD = I \times DW \times L$$

where:
I = number of incident cases
DW = weighting factor
L = mean case duration until remission or death (years).

3.6.3. Disability-adjusted Life Years

Disability-adjusted life years (DALY) is a measure of the health gap that extends the concept of years of potential life lost (YPLL) by including the equivalent of "healthy" life years lost due to poor health or disability. The burden of disease (the sum of DALYs for the whole population) is a measure of the gap between the current health status and an ideal situation in which the whole population reaches old age free from disease and disability. DALYs facilitate the comparison of different types of health conditions or health outcomes. DALYs can be used to compare the burden of diseases that cause premature death but little disability (e.g., drowning or measles) with the burden of diseases that do not cause death but cause disability (e.g., cataracts causing blindness).

The burden of a particular disease or health condition, as measured by summary measure DALY, is estimated by adding the number of years of life lost due to premature death caused by the disease (YPLL) and the number of years of life lived with the disability caused by the disease (YLD for incident cases of the disease).

DALY = YPLL + YLD

A DALY is usually one year of healthy life lost.

A disease with high morbidity but low mortality has a high DALY and a low YLD. Heart disease and stroke are responsible for the greatest loss of human lives, and neuropsychiatric conditions, such as major depressive disorder, accounts for the greatest number of years of healthy life lost due to the disease.

3.6.4. Quality-adjusted Life-Years

Quality-adjusted life years (QALYs) measure the extent to which different types of medical treatment prolong and/or improve patients' quality of life. When the evidence shows that a treatment helps to prolong life or improve quality of life, these benefits are added together to calculate the number of additional QALYs that the treatment provides. This additional health benefit is then compared with the additional health benefits of other treatments for the same patient population.

The QALY indicator uses a scale from 0 (death) to 1 (perfect health) for each health status. It is the product of life expectancy and an indicator of quality of life. For example, 4 years in perfect/full health = 4 QALYs. Therefore, 4 years in a state measured as 0.5 of perfect health followed by 4 years of perfect/full health = 6 QALYs.

Example

A patient suffering from a severe disease is currently taking drug X. If the patient continues to take this drug, the patient will live for 5 years and his quality of life will average 0.6 of perfect health. If the patient is given a new drug, Y, the patient will live for 6 years and the quality of life will be on average 0.7 of perfect health.

QALY for drug X = 5 x 0.6 = 3

QALY for drug Y = 6 x 0.7 = 4.2

Thus, taking drug Y will result in 1.2 additional QALYs compared to drug X.

The QALY measure is used to measure utility in cost-utility analyzes and effectiveness in cost-effectiveness analyzes.

Quality-adjusted life years (QALYs) are an adjustment or reduction of life expectancy to take account of chronic conditions and disability, derived from a study, hospital discharge or other data. The numerical weighting of disability severity is established based on the judgment of the patient and health professionals.

3.7. Directions of use of summary measures of population health

Summary measures of population health are used for:

- Measuring the global burden of disease and quantifying the burden of disease in terms of monetary costs;
- Comparing the health status of two or more populations (assessing the performance of health systems);
- Monitoring changes in the health status of populations (assessing health system performance and progress towards health system goals);
- Comparing the impact of different diseases and risk factors on the shortening and/or quality of life;
- Identifying and quantifying health inequalities;
- Informing public health policy on priorities for action;
- Appropriate allocation of resources to priority diseases with the highest burden;
- Informing the debate on research and development priorities;
- Improving public health training programs;
- Analyzing the benefits of health interventions for use in cost-effectiveness analysis;
- Monitoring and evaluating the impact of public health interventions;
- Developing new regulations/standards for diseases and risk factors.

3.8. Health and Quality of Life

The concepts of health and disease are closely related to the concept of quality of life. Quality of life is a broad multidimensional concept that encompasses all aspects of a person's life, including health. World Health Organization defines **quality of life** as "a person's perception of his/her position in life in the context of the culture and value systems in which he/she lives and in relation to his/her goals, expectations, cultural norms and concerns" (52). Quality of life is influenced in a complex way by a person's physical health and psychological status, autonomy, social relationships, personal beliefs and their relationship to the essential characteristics of the environment. The concept of quality of life encompasses both the objective and the subjective dimensions. The objective dimension refers to the satisfaction of needs related to social and material living conditions and physical health. The subjective dimension refers to emotional aspects and general satisfaction with life.

The quality of life considered in the context of health and disease is commonly referred to as **health-related quality of life** (HRQOL). Health-related quality of life focuses on the impact of health on a person's ability to lead a fulfilling life. It represents the overall perception of the patient or group of people about the impact of the disease and treatment on physical, emotional and social well-being. Therefore, health-related quality of life measures the quality of life in relation to the health and illness of the person or group of people (*Figure 19*).

In public health and medicine, the concept of health-related quality of life refers to the personal or group perceptions of physical and mental health over time. Physicians often use health-related quality of life to measure the impact of a chronic disease on their patients, to better understand how the disease affects the person's daily life. Similarly, public health professionals use health-related quality of life to measure the impact of different disorders, disabilities, and diseases on different populations. Tracking health-related quality of life in different

populations can identify subgroups with poor physical or mental health and help guide public policies or interventions to improve their health.

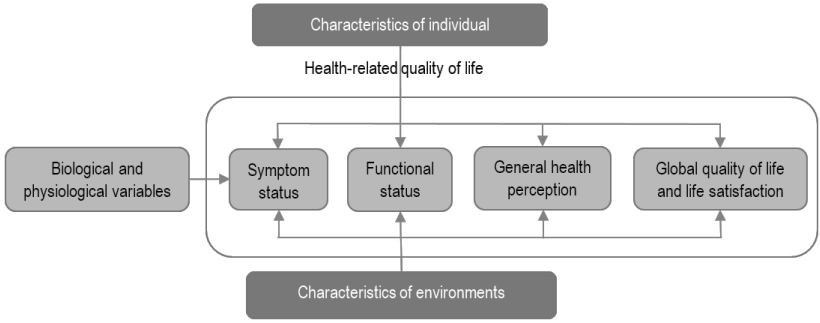


Figure 19. **Conceptual model for health-related quality of life**

Source: adapted from Wilson, 1995 (49)

The concept of health-related quality of life:

- Encompasses both positive and negative aspects of well-being and life;
- Is multidimensional, encompassing social, psychological and physical health;
- It is a personal and dynamic concept, since as health deteriorates, perspectives on life, roles, relationships and experiences also change;
- Includes some assessment of the patient's satisfaction with treatment, outcomes, health status, and future prospects;
- Differs from overall quality of life, which includes adequacy of housing, income and perceptions of the immediate environment.

3.8.1. Measuring Health-related Quality of Life

There are several tools for measuring quality of life (QOL) and health-related quality of life (HRQOL). They assess the quality of life and functioning of people with specific conditions in different domains and also provide information on patients' satisfaction with their functioning

and the health effects of treatment. These tools are used to identify subgroups of people with poorer health status and quality of life and to guide interventions to improve the situation and prevent more serious consequences.

They can be measured using generic instruments, such as the World Health Organization Quality of Life Questionnaire (WHOQOL), Short Form Health Survey (SF-36) or disease-specific instruments (e.g., 39-item Parkinson Disease Questionnaire, PDQ-39).

Generic tools:

- They aim to address the quality of life and include physical, mental and social health;
- Are best suited to studies of general populations;
- Allow comparison of results between different diseases or deficiencies;
- Do not allow the identification of specific aspects of a disease.

The most commonly used generic instrument is the WHO Quality of Life (WHOQOL) instrument. The WHOQOL group considers it important to know how satisfied or dissatisfied patients are with important aspects of their lives, and this interpretation is very individual. The WHOQOL-100 is a self-administered 100-item instrument covering 6 domains of quality of life: physical health, psychological status, autonomy, social relationships, environment and spirituality (53). Based on the WHOQOL-100, a shorter version, the WHOQOL-BREF instrument (questionnaire), has been developed, which contains 26 items and measures the following domains: physical health, psychological status, social relations and environment (72).

Another commonly used generic tool to measure perceived health status is the Short Form Health Questionnaire (SF-36). The SF-36 is a 36-item questionnaire covering 8 domains: physical functioning, social functioning, mental health, role limitations due to physical problems, role limitations due to emotional problems, vitality (energy

and fatigue), bodily pain and general health perceptions. Each domain is rated separately on a scale from 0 (worst) to 100 (best).

Disease-specific tools:

- Aim to identify the specific aspects of a disease;
- Are sensitive to small but clinically important changes;
- Can compare levels of severity in patients with the same disease or deficiency.

Examples of disease-specific QoL tools are those used for patients with Parkinson's disease and end-stage renal disease.

3.8.2. Directions for Using QOL and HRQOL Instruments

QOL and HRQOL instruments are used for:

In clinical practice*:*

- To identify the areas in which a patient is more affected and help make decisions about its care;
- To measure changes in quality of life during treatment;
- As a predictor of mortality in daily practice;
- To improve the patient-physician interaction by increasing the physician's understanding of how the disease affects the patient's quality of life;
- To measure the relationship between health care services and the patient's quality of life, and as an indicator of the patient's perception of the quality and availability of health care;
- To provide new insights into the nature of the disease by assessing how the disease affects a person's subjective well-being and daily functioning in a wide range of domains;
- To support the development and evaluation of new treatments and medical devices.

In public health*:*

- To identify problems related to the health of the population and planning public health policy;

- To decision analysis, economic evaluation of health interventions and evaluation of health policies;
- To estimate the burden of disease (HRQOL) and assess the impact of different diseases on quality of life (QOL).

Review Exercises

1. On 1 October 2023, 1,500 7-year-old children were examined as part of the childhood obesity surveillance program. 30 children had a BMI indicating obesity. The same complete group of children was also examined on 1 October, 2024; 65 of them, including the 30 identified in 2023, had a BMI indicating obesity. Calculate point prevalence, cumulative incidence and incidence odds.

2. After lunch, children at a summer camp developed symptoms of food outbreak, including nausea, vomiting and fever. Data on the number of children at the camp and the number of children who show signs of food outbreak by sex are shown in the table below.

Sex	Number of children	Number of cases
Girls	130	45
Boys	120	50
Total	350	95

a) What is the attack rate among all the children?
b) What is the attack rate among girls and boys?
c) What is the proportion of cases occurring among girls?

3. In a cohort study, 15 people were followed for 5 years. During this period, 5 people became ill and 2 people were lost to follow-up, the data of which are shown in the table below. The medical examination was performed annually on 1 January.

Years / persons	2020	2021	2022	2023	2024	Years at risk
1	------	------	------	---x		
2		------	------	------	------	
3	------	------	------	------	-------	
4	------	------	------	------	-------	
5	---	------	------	------	---●	
6	------	------x				
7	------	------	------	------	------	
8	------	------	------	---x		
9	------	------	------●			
10	------	------	------	------	------	
11	------	------	---x			
12	------	------	------	------	------	
13		------	------	------	------	
14	------	------	------	------	------x	
15	------	------	------	------	------	

--- = Time at risk: 1 year ------; 0.5 year ---

x = Disease

● = Lost to follow-up

a) Calculate point prevalence on 1 January 2022 and 1 January 2023.
b) Calculate cumulative incidence on 1 January 2022 and 1 January 2023.
c) Calculate incidence odds on 1 January 2022 and 1 January 2023.
d) Calculate the total number of person-years at risk of disease observed in the study.
e) Calculate incidence density.

4. A person lived with disability 5 years and died at age of 55. How many healthy life years were lost?

5. Complete the table below with the required information on category of problem.

Problem	Disease or a health condition	Deficiency	Activity limitation	Participation restriction
Cataract				
Paralysis				
Inability to use the computer				
Loss of a lower limb				
Unable to attend conferences without assistive hearing aids and sign language interpreters				
Anxiety disorders				
Inability to climb stairs				
Turning down a job because of a diagnosis of schizophrenia				
Inability to continue studies due to lack of materials in Braille				
Inability to understand the language used in TV news programs				
Autism				
Lack of fine motor skills				

6. A person suffering from a severe life-threatening disease is currently taking drug A. If she continues to take this drug, she will live for 10 years and her quality of life will average 0.5 of full health. If the person is given a new drug, B, for the same disease, she will live an average of 12 years and the quality of life will be 0.7 of full health. Compare the two drugs by QALY and state your conclusion.

Review Questions

1. What types of morbidity exist?
2. What are the data sources for each type of morbidity?
3. What are the main disadvantages of each type of morbidity?
4. Give the definition of point prevalence and period prevalence.
5. Give the definition of incidence. Give the denominator for cumulative incidence, incidence odds and incidence density.
6. When is the attack rate used?
7. What is the difference between cumulative incidence and incidence odds?
8. What is incidence density?
9. What does person-time at risk mean? What type of population is it calculated for?
10. What is the purpose of the International Statistical Classification of Diseases and Related Health Conditions?
11. How many chapters are in the 10th revision of ICD, WHO version 2019?
12. Describe the disease coding system used in the 10th revision of ICD, WHO version 2019.
13. Who are the ICD beneficiaries?
14. What are the improvements in the 11th revision of the ICD compared to the 10th revision?
15. Give the definition of disability.
16. What are the dimensions of disability and what characterizes each dimension?

17. What does the new paradigm of disability underpinning the International Classification of Functioning, Disability and Health (ICF, 2001) offer?
18. What is the meaning of ICF 2001?
19. What are the approaches to measuring disability? Characterize each one.
20. What are summary measures of population health?
21. What is the difference between life expectancy and healthy life expectancy?
22. What is the concept of burden of disease?
23. What does the DALY indicator measure?
24. What is the utility of the DALY indicator?
25. Give the definition of quality of life.
26. What tools are used to measure quality of life?

4. PREVENTION AND CONTROL OF NONCOMMUNICABLE DISEASES. SCREENING

4.1. Noncommunicable Diseases: Definition, Types and Risk Factors

4.1.1. Definition. The Major Types of Noncommunicable Diseases

Noncommunicable diseases (NCDs) are a group of diseases that do not result from an acute infectious process and have a complex aetiology with multiple risk factors. They have a long latency period and prolonged disease duration, leading to premature death and/or disability, reduced quality of life, and require long-term treatment and care. Noncommunicable diseases are rarely curable. This group of diseases is responsible for approximately 74% of all deaths worldwide each year. Of the total number of deaths registered annually in the Republic of Moldova, more than three quarters are caused by NCDs. Noncommunicable diseases are a major health and development challenge of the 21st century.

According to the WHO, the **4 major types of NCDs** are: cardiovascular diseases, cancer, diabetes and chronic obstructive pulmonary diseases. These 4 types of NCDs are responsible for more than 80% of all premature deaths caused by NCDs. Some definitions of NCDs also include chronic neurological disorders (Alzheimer's disease, dementia), arthritis/musculoskeletal diseases.

Although NCDs are often associated with older populations, evidence shows that the entire population is vulnerable to risk factors that contribute to NCDs, such as unhealthy diet, physical inactivity, exposure to tobacco smoke, use of alcohol and air pollution.

These diseases are driven by forces such as rapid, unplanned urbanization, the globalization of unhealthy lifestyles, and population ageing.

Risk factors (proximal determinants) are attributes, characteristics, or exposures/behaviours that increase a person's likelihood of developing a disease or disorder. Major risk factors for NCDs include:

- Modifiable behavioural risk factors that increase the likelihood of developing NCDs: unhealthy diet, tobacco use, alcohol consumption and physical inactivity;
- Metabolic risk factors, which contribute to four major metabolic changes that increase the risk of NCDs: high blood pressure, high total cholesterol, high blood glucose and overweight/obesity.

All of these risk factors, combined with socioeconomic determinants such as globalization and international trade, rapid unplanned urbanization, and population ageing, are leading to the emergence of NCDs (*Figure 20*).

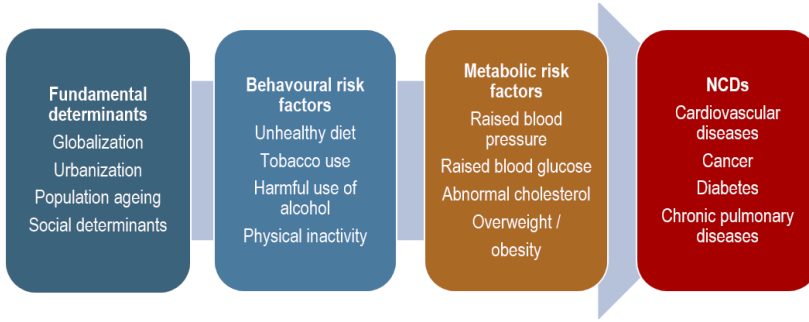


Figure 20. **Determinants of Noncommunicable Diseases**

4.1.2. Socio-economic Impact

Noncommunicable diseases threaten progress toward the 2030 Agenda for Sustainable Development, which includes a target to reduce by one-third, by 2030, the likelihood of dying between the ages of 30 and 70 from the four major NCDs.

There is a strong link between poverty and NCDs. Vulnerable and disadvantaged people fall ill and die earlier than those with higher social

status. This is mainly due to a higher risk of exposure to harmful products, such as tobacco, alcohol or unhealthy diets, and limited access to health services.

4.1.3. Prevention and Control of Noncommunicable Diseases

Noncommunicable diseases can be prevented and controlled by reducing associated risk factors. Cost-effective interventions are available to reduce common modifiable risk factors. Monitoring NCD risks and trends, as well as progress in their prevention and control, is important for setting priorities and guiding public policy.

To reduce the impact of NCDs on individuals and society, a comprehensive approach is needed, involving collaboration across all sectors, including health, finance, transport, education, agriculture and others, to reduce the risks associated with NCDs and promote interventions to prevent and control them.

Better management of NCDs is also essential. Management of noncommunicable diseases includes screening, detection and treatment of these diseases and ensuring access to palliative care for those in need. Key interventions for high-impact NCDs can be delivered through the primary health care approach, which strengthens early detection and timely treatment. Evidence shows that such interventions are excellent investments from an economic perspective, as early intervention can reduce the need for more expensive treatment. Interventions to manage NCDs are critical to achieving the SDG 3 target 3.4 "To reduce premature mortality from NCDs by one third by 2030 through prevention and treatment, and promote mental health and well-being" (45) and the nine global targets by 2030 (63).

4.2. Prevention: Levels of Prevention

4.2.1. Key Concepts

The changing patterns of mortality and morbidity over time and the geographical differences in morbidity between regions and countries show that the major causes of disease are modifiable and therefore preventable. The decline in mortality rates in the 19th century and the first half of the 20th century was mainly due to improvements in the quality of drinking water and sanitation, nutrition, living conditions and other environmental measures. Preventive measures are implemented with the aim of changing the distribution of risk factors in the population as a whole.

Prevention is one of the 3 essential public health operations. Disease prevention includes measures to prevent the onset of a disease, such as reducing risk factors, as well as measures to prevent its progression and reduce its consequences once it has occurred.

There are three levels of prevention, corresponding to different stages of disease development (*Table 11*): primary prevention, secondary prevention and tertiary prevention.

Primary prevention makes the greatest contribution to the health of the population as a whole.

Table 11. **Levels of Prevention**

Level of prevention	The stage of the disease	Goal	Actions	Target
Primary	Specific risk factors	Reduction of disease incidence	Protect health through personal and community efforts, such as improving nutrition (iron and folic acid supplementation), ensuring immunization, and eliminating environmental risks. It is achieved through public health programs.	The entire population / specific population groups at increased risk.
Secondary	Early stage of the disease	Reduction of disease prevalence through shortening of its duration	Measures available to individuals and communities for early detection and prompt intervention to control disease and minimize disability (e.g., screening programs)	Specific groups of the population.
Tertiary	Late stage of the disease (treatment, rehabilitation)	Reduction in number and/or impact of complications	Actions to mitigate the effects of long-term illness and disability. It is achieved through rehabilitation or drug control of the disease to prevent complications.	Patients.

4.2.2. Primary Prevention

Primary prevention aims to prevent the onset of a specific disease by reducing risk, modifying behaviours or exposures that may contribute to the onset of the disease, or increasing resistance to the effects of exposure to the causative factors. Primary prevention also aims to reduce the incidence of the disease, for example through vaccination or smoking cessation. Some approaches involve active participation, such as regular brushing and flossing to prevent tooth decay. Other approaches are passive: adding fluoride to municipal drinking water to strengthen tooth enamel and prevent tooth decay, or adding iodine to salt to prevent iodine deficiency disorders. Another goal of primary prevention is to promote safe environments that reduce the risk of disease in general, such as thorough sanitation of operating rooms to prevent postoperative infections.

Primary prevention targets the entire population or groups at high risk of exposure but without evidence of disease.

The World Health Organization recommends two approaches to primary prevention of disease once risk factors have been identified: the population strategy and the high-risk individual strategy.

The population strategy targets the entire population or population groups, regardless of individual risk levels. The main goal is to reduce the average level of a particular risk factor in the entire population or group of people. For example, studies have shown that even a small reduction in the average level of blood pressure or serum cholesterol in a population would result in a significant reduction in the incidence of cardiovascular disease.

The high-risk individual strategy focuses on individuals at greatest risk for a particular disease or disorder. This strategy involves actively identifying individuals at high risk, eliminating risk factors (e.g., encouraging patients to quit smoking or reduce salt intake), or increasing specific resistance to the causative factor (e.g., vaccination).

Each of these approaches has advantages and disadvantages (*Table 12*). In most cases, a combination of both strategies is more effective.

Table 12. **Advantages and Disadvantages of the WHO Approaches to Primary Prevention**

	Advantages	Disadvantages
Population Strategy The goal – to reduce the average level of risk factor in the population and change the distribution of risk.	- Attempts to eliminate the root causes; - Great potential for improvement at the population level; - Tries to change norms at the population level.	- Little benefit for most people (prevention paradox); - Low motivation to comply; - Possible low motivation of health professionals due to lower perceived effect; - The individual risk-benefit ratio may be a concern.
High-risk Individual Strategy The goal – to identify those most at risk and intervene to reduce individual risk.	- Appropriate intervention for the individual; - High motivation; - Health professionals' motivation is also high; - Can be cost-effective; - Higher risk-benefit ratio for the person.	- Difficulties and costs of intervention; - It is not radical; it does not address the causes; - Has limited potential to improve population health; - Does not address the social norms that structure health behaviours.

Prevention Paradox

The relationship between risk quantification and the targeting of health promotion and disease prevention interventions has been described by Geoffrey Rose (1985) as the prevention paradox: "A preventive intervention that is of great benefit to the population often provides little benefit to each individual participant" (34). The prevention

paradox arises because many interventions aimed at improving health have relatively little effect on the health of most people. Thus, for one person to benefit, many people must change their behaviour but not benefit from those changes.

4.2.3. Secondary Prevention

Secondary prevention is aimed at detecting and stopping preclinical pathological changes in order to control the progression of the disease. Secondary prevention is aimed at the period between the onset of the disease and its diagnosis.

Secondary prevention can only be applied to diseases whose natural history includes an early period when the disease can be easily detected and treated so that progression to more serious stages can be stopped. Thus, two requirements are essential for a useful secondary prevention program: a safe and accurate method of detecting the disease at an early stage, and cost-effective and efficient methods of intervention. The most commonly used secondary prevention measure is screening for the early detection of a disease or disorder. Examples include screening for cancer (cervical, breast, or colorectal), phenylketonuria, iodine deficiency in new-borns, visual acuity and scoliosis in school-age children, and screening for high blood pressure and high blood glucose in middle age.

4.2.4. Tertiary Prevention

Tertiary prevention aims to reduce the progression or complications of an existing disease and is an important aspect of clinical and rehabilitation medicine. It includes measures to reduce the impact of the disease on the patient's functioning, longevity and quality of life.

The main goal of tertiary prevention is to maintain the patient's quality of life. When a disease is irreversible, tertiary prevention focuses on rehabilitation to help the patient cope with the disability. For reversible diseases, such as heart disease, tertiary prevention will

reduce the prevalence in the population, while for incurable diseases it may increase the prevalence due to prolonged survival.

Rehabilitation of patients with stroke, injury, blindness and other chronic conditions is essential to their ability to participate in daily social life. Tertiary prevention can improve individual and family well-being and income. Examples of the three levels of prevention are presented in *Table 13*.

Quaternary prevention refers to avoiding the over-medicalization of patients, protecting them from unnecessary interventions, and suggesting ethical alternatives.

Table 13. **Examples of primary, secondary and tertiary prevention interventions at individual and population levels**

Disease	Level of intervention	Primary	Secondary	Tertiary
Type 2 Diabetes mellitus	Individual	Healthy lifestyle counselling: nutrition and physical activity counselling; advice on reducing body mass for people at high risk of diabetes etc.	Blood glucose testing for early detection of diabetes.	Follow-up examinations to detect complications: diabetic foot, diabetic retinopathy etc.
	Population	Public awareness campaigns on the benefits of lifestyle changes to prevent diabetes; promotion of maintaining a healthy body mass; promotion of healthy food choices throughout life; taxes on sugar-sweetened beverages; subsidies for physical activity programs.	Diabetes screening programs	Reorganization of health services to improve access to quality follow-up care

4.3. Screening

4.3.1. Key Concepts

Screening is the process of using large-scale tests to determine the likelihood of having a disease or being exposed to a risk factor for a disease in an apparently healthy population. *The screening test* therefore identifies asymptomatic people who **likely** have the disease.

Screening does not mean early diagnosis of disease. The screening test is not intended to be a diagnostic test. Screening involves testing people who have no symptoms, while early diagnosis aims to detect conditions as early as possible in people who do have symptoms.

A positive screening test result must be confirmed by specific diagnostic procedures. *Diagnostic tests* are used to determine the presence or absence of a disease when a person has signs or symptoms of the disease. The diagnostic test is performed after a positive screening test to establish a definitive diagnosis.

There are several types of screening:

- *Mass screening* aims to screen the entire population (or specific population groups);
- *Multiple* or *multistage* screening uses several screening tests at the same time;
- *Targeted screening* of groups with specific exposures;
- *Opportunistic* (*case-finding*) screening targets patients who present to the physician for other reasons.

4.3.2. Principles of Screening

The principles (criteria) for establishing a screening program include the characteristics of the disorder or disease, its treatment, and the screening test. A screening program for a disease, disorder, or risk factor should meet basic criteria that are fundamental to the integrity of the process (*Table 14*).

Table 14. **Basic Principles of Screening**

Category	Criteria
Disease:	- Should represent a *significant public health problem* in the target population in terms of *frequency* and/or *severity*; - Should have a detectable preclinical stage for early detection/a recognizable early or latent stage.
Target-population:	- Should be clearly defined. The participation rate of the eligible population in the screening program should be high.
Screening test:	- Should be valid, reliable, and feasible.
Diagnosis and treatment:	- Diagnostic procedures must be appropriate, safe, acceptable and available from a physical and financial point of view for all the target population; - Treatment for patients with a confirmed diagnosis must be available, accessible, acceptable and effective; - Early detection should improve the prognosis.
Screening and case finding costs:	- Should be economically balanced with total healthcare costs.

Examples of screening tests: pap smear for cervical cancer, mammography for breast cancer, fasting glucose for diabetes, intraocular pressure for glaucoma.

The validity of a screening test is the ability of the test to correctly identify what it is intended to identify (the frequency with which the test results are confirmed by more rigorous diagnostic procedures, called the gold standard).

The reliability (reproducibility) of the test is the consistency of the results when the screening test is repeated on the same individuals under the same conditions.

Feasibility refers to the acceptability (quick to use, easy to interpret, safe) and cost-effectiveness (reduction in mortality or number of DALYs saved / gained) of the test and is assessed prior to the screening program.

4.3.3. Evaluation of Screening Tests

Screening tests are used to determine the likelihood of the presence of disease in individuals, and diagnostic tests are used to determine the severity of disease in people. Therefore, it is important to evaluate the performance of both screening and diagnostic tests prior to their use in healthcare settings. The performance of a new screening or diagnostic test is evaluated by comparing the actual test results with the actual disease state of the patient (as determined by the gold standard). The four criteria used to evaluate a new test are sensitivity, specificity, positive predictive value and negative predictive value.

Gold standard is a term used to describe the most rigorous diagnostic method, such as microscopic examination of a tissue sample, or the best available laboratory test, such as serum antibodies to HIV, or a comprehensive clinical assessment, such as the clinical assessment of arthritis. Gold standard tests can often be expensive, invasive and/or uncomfortable. New tests that are less invasive and less expensive are compared to gold standards to assess the accuracy of the new test. A test that detects a breast cancer marker in the blood may be less sensitive than the breast biopsy itself, but the discomfort of the biopsy may make the blood test a better alternative.

Calculating test results. The contingency 2x2 table is used to group people into one of four disease test categories.

	Truth (gold standard)	
Test results	**Disease present**	**Disease absent**
Positive test	a = true positive	b = false positive
Negative test	c = false negative	d = true negative

Sensitivity vs. specificity. Sensitivity and specificity are criteria used to evaluate the validity of screening or diagnostic tests. These criteria reflect the accuracy of the test in detecting disease and classifying individuals into disease and non-disease groups.

Sensitivity (Se) is the ability of a test to correctly identify the disease among those who actually have the disease, or the percentage of people with positive test results among those with the disease.

Specificity (Sp) is the ability of a test to correctly identify individuals without the disease among those who actually do not have the disease, or the percentage of individuals with negative test results among those who do not have the disease.

$$Se = \frac{True\ positive}{True\ positive + False\ negative} \times 100 = \frac{a}{(a+c)} \times 100$$

$$Sp = \frac{True\ negative}{True\ negative + False\ positive} \times 100 = \frac{d}{(b+d)} \times 100$$

A highly sensitive test means that a large percentage of people with the disease are correctly classified as having the disease. A highly specific test means that a large percentage of people who do not have the disease are correctly classified as not having it. An ideal test would be both highly sensitive and highly specific, detecting the disease in 100% of those who truly have the disease (100% sensitivity) and excluding the disease in 100% of those who truly do not have the disease (100% specificity).

In reality, as sensitivity increases, specificity decreases, and conversely, as specificity increases, sensitivity decreases.

Example

If a test has a sensitivity of 90% and a specificity of 95%, then 10% of people with the disease will test negative (the test misclassifies 10% of people with the disease), and 5% of people without the disease tested will

have positive test results (the test misclassifies 5% of people without the disease).

False positives and false negatives

A false positive is a person who is falsely tested as a case when they do not have the disease. A false negative is a person falsely diagnosed as a non-case when in fact the person has the disease.

100% - % sensitivity = % false negatives.

100% - % specificity = % false positives.

Using the example above, we have:

100% - 90% = 10% false negatives

100% - 95% = 5% false positives.

Tests with high sensitivity led to the loss of a small number of patients (few false negatives). They are recommended for severe diseases and represent the optimal solution for public health interventions.

Tests with high specificity result in low costs for subsequent diagnosis (few false positives). They are recommended for diseases where diagnosis is costly and represent the optimal solution for the clinician.

Positive predictive value and negative predictive value

The positive predictive value (PPV) is the percentage of true positives among those who test positive. *Negative predictive value* (NPV) is the percentage of true negatives among those who test negative.

Like sensitivity and specificity, PPV and NPV show the ability of the test to classify people into disease and non-disease groups, but the denominator for PPV is the total number of people who test positive over time (a+b), whereas the denominator for NPV is the total number of people who test negative (c+d). A test with a high PPV indicates that there is only a small percentage of false positives among all individuals with positive test results. A test with a high PPV indicates the presence of only a small percentage of false negatives among all individuals with negative test results.

$$PPV = \frac{True\ positive}{Positive\ tests} \times 100 = \frac{a}{(a+b)} \times 100$$

$$NPV = \frac{True\ negative}{Negative\ tests} \times 100 = \frac{d}{(c+d)} \times 100$$

Example

A stress ECG test that has a PPV of 90% and an NPV of 95% is used to screen 10,000 people for coronary heart disease. Forty percent of the people (4,000 people) test positive and 60% (6,000 people) test negative. Using the gold standard for coronary heart disease found that 3,600 of those who tested positive (90% of 4,000) really had coronary heart disease, and 5,700 of those who tested negative (95% of 6,000) really had no coronary heart disease.

Disease prevalence affects the predictive values, PPV and NPV. In the case of a disease with a low prevalence and a test used to assess the disease in individuals that has a sensitivity and specificity of less than 100%, false-positive results may exceed positive test results.

4.4. Epidemiological Transition

Epidemiological transition theory describes changes in health patterns and types of disease, focusing on death and birth rates and the interaction of social, economic, demographic and health variables (25). The four stages of the epidemiological transition correspond to and influence the four stages of the demographic transition (*Table 15*).

Table 15. **The Stages of Epidemiological Transition**

Stage	Description	Typical life expectancy, years	% of deaths due to cardiovascular disease	Examples of contemporary countries
Plague and famine	Malnutrition and infectious diseases are prevalent.	35	5-20	Sub-Saharan Africa
Pandemics on the decline	Improved nutrition and public health measures reduce infectious diseases. People live long enough to develop chronic diseases.	50	15-35	South Asia; parts of Latin America and the Caribbean
Degenerative and man-made diseases	Due to the increase in tobacco and alcohol consumption and the subsequent increase in fat and energy consumption, the proportion of deaths due to chronic diseases exceeds that due to infectious diseases.	60	>50	Europe and Central Asia; Latin America; Middle East; North America; Urban India.
Delayed/slowed down degenerative diseases	The leading causes of death are cardiovascular disease and cancer. Prevention delays the onset of disease and treatment prolongs survival, reducing age-standardized death rates. It increases age-related morbidity, such as Alzheimer's disease.	>70	<50	High-income countries.

Stage of plague and famine. In this stage, endemic diseases are prevalent, nutrition is poor, and infectious diseases and starvation are widespread. Birth and death rates are high, and population growth is minimal. The main causes of death are infectious and parasitic diseases, accidents, animal and human attacks (e.g., the black plague. It is said to have started in Kyrgyzstan and was brought by a Tartar army when it attacked an Italian trading outpost, actually Ukraine. The retreating Italians took the infected rats with them on their ships to other coastal cities in Europe). Large, extended families, multi-generational households and sedentary lifestyles prevailed. The role of women was to be mothers, with no rights or responsibilities outside the household (25).

The stage of pandemics (diseases that occur in a wide geographical area and affect a large proportion of the population) is in decline. At this stage, disease and hunger decrease, death rates decrease, birth rates increase, and the number of people increases. Large, extended families predominate, especially in rural areas, but nuclear family units are becoming more common in urban centers. Women begin to engage in activities outside their household.

The stage of degenerative and man-made diseases. During this period, social, economic, and environmental conditions improve; infectious diseases and conditions related to poor nutrition decrease. Birth and death rates are low and population numbers are stable. Chronic diseases (e.g., cardiovascular disease, cancer, stroke, diseases caused by occupational exposure) are the leading causes of death. Small nuclear families are becoming the norm. Women are increasingly involved in the educational process and career-oriented.

This stage is characterized by a decrease in deaths from infectious diseases and an increase in chronic disorders associated with aging. Cardiovascular diseases and cancer are two of the most important types of diseases in this stage.

The stage of delayed/slow degenerative diseases is an extension of stage III. Delaying the onset of degenerative diseases is the result of improving the quality of medical care (technologies and interventions, new drugs), improving "healthy" nutrition, etc. Some researchers argue that infectious and parasitic diseases are re-emerging; others see it only as a relapse.

The causes of this emergence:

- Evolution: Microbes are immune to antibiotics, etc.
- Poverty: Diseases such as tuberculosis are largely controlled in countries such as the USA, but still cause many deaths in less developed countries, including the Republic of Moldova.
- Travel/movement: spread of diseases (e.g., SARS in China in the mid-2000s, COVID in the world in 2020-2023).

These patterns of epidemiological transition are evident at the international, regional and local levels, but it is recognized that they cannot be unidirectional. The epidemiological transition can have different "speeds" in different places, and sometimes reversals or mixed patterns can be observed.

4.5. Monitoring and Surveillance of Noncommunicable Diseases

There are currently several monitoring and surveillance systems in place around the world that cover different aspects of NCDs. The main indicator systems for NCDs are the following:

- The WHO NCD Global Monitoring Framework (73);
- The WHO global reference list of 100 core health indicators (66), which includes NCDs related indicators (see Chapter 1);
- The European Core Health Indicators, including 28 indicators on NCDs (5) (see Chapter 1);
- Health indicators of the Republic of Moldova.

The WHO NCD Global Monitoring Framework includes 25 indicators to track global progress in the prevention and control of major NCDs, such as cardiovascular disease, cancer, chronic obstructive pulmonary disease, and diabetes and their major risk factors (*Table 16*) (73).

The 25 indicators of the WHO NCD Global Monitoring Framework are grouped into 3 domains:

- Mortality and morbidity indicators;
- Risk factors indicators;
- National health system response indicators.

Table 16. **WHO NCDs Global Monitoring Framework (25 indicators)**

Mortality and morbidity	Risk factors	National health system response
– The unconditional probability of dying between the ages of 30 and 70 from cardiovascular disease, cancer, diabetes, and chronic obstructive pulmonary disease; – The incidence of cancer by type.	– Harmful use of alcohol (3); – Reduced consumption of fruits and vegetables; – Physical inactivity (2); – Salt consumption; – Consumption of saturated fats; – Tobacco use (2); – High blood glucose/diabetes; – High blood pressure; – Overweight/obesity (2).	– Cervical cancer screening; – Drug treatment and counselling; – Essential medicines and technologies for noncommunicable diseases; – Hepatitis B vaccination; – Vaccination against human papillomavirus; – Marketing targeted at children; – Access to palliative care; – Policies to limit saturated fats and virtually eliminate *trans* fats.

Note. The total number of related indicators is shown in brackets.

Source: (73)

4.6. Global Strategies for the Prevention and Control of Noncommunicable Diseases

In 2011, the United Nations General Assembly adopted the Political Declaration of the General Assembly High-level Meeting on the Prevention and Control of NCDs. Under the auspices of WHO, more than 190 countries have agreed on global mechanisms to reduce the avoidable burden of NCDs, including the *Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2030* (63). This plan aims to reduce premature deaths from NCDs by 25% by 2030 compared with 2010 levels. To measure progress, 9 voluntary targets have been agreed globally (*Table 17*). The 9 targets focus in part on addressing risk factors, such as tobacco use, harmful use of alcohol, unhealthy diet and physical inactivity, that increase the population's risk of developing NCDs.

Table 17. **Nine Global Voluntary Targets for the Prevention and Control of NCDs**

Framework element	Target
Mortality and morbidity	
Premature mortality from NCDs	1) A 25% relative reduction in overall mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases
Behavioural risk factors	
Harmful use of alcohol	2) At least 10% relative reduction in the harmful use of alcohol, as appropriate, within the national context
Physical inactivity	3) A 10% relative reduction in prevalence of insufficient physical activity
Salt/sodium consumption	4) A 30% relative reduction in mean population intake of salt/sodium
Tobacco use	5) A 30% relative reduction in prevalence of current tobacco use in persons aged 15+ years
Biological/metabolic risk factors	

Framework element	Target
Raised blood pressure	6) A 25% relative reduction in the prevalence of raised blood pressure or contain the prevalence of raised blood pressure, according to national circumstances
Diabetes and obesity	7) Halt the rise in diabetes and obesity
National health system response	
Drug therapy to prevent heart attack and stroke	8) At least 50% of eligible people receive drug therapy and counselling (including glycaemic control) to prevent heart attacks and strokes
Essential noncommunicable disease medicines and basic technologies to treat major noncommunicable diseases	9) An 80% availability of the affordable basic technologies and essential medicines, including generics, required to treat major noncommunicable diseases in both public and private facilities

Source: (63)

4.7. National Programs for the Prevention and Control of Noncommunicable Diseases

Monitoring and surveillance of NCDs and their risk factors in the Republic of Moldova is carried out through routine collection of data on incidence and prevalence of diseases, disability and mortality, as well as periodic surveys. Noncommunicable diseases represent a significant burden for the Republic of Moldova. The incidence and prevalence of cardiovascular diseases, cancer and diabetes are high and have been increasing over the last decade, resulting in significant costs to society.

To prevent and control the four major NCDs (CVD, cancer, diabetes and chronic obstructive pulmonary disease) and their major risk factors, several national prevention and control programs have been adopted. Their implementation involves multisectoral cooperation and health promotion and prevention activities at all three levels

(primary, secondary and tertiary). The Ministry of Health is the promoter of these interventions, which are implemented through specific national programs approved by the government. The following national programs are currently being implemented:

The National Program for the Prevention and Control of Priority Noncommunicable Diseases for 2023-2027 (10);

National Program for Cancer Prevention and Control 2016-2025 (8).

The Ministry of Health coordinates the implementation and monitoring of the programs at the national level and ensures their periodic evaluation in order to determine the degree of achievement of the goals and other objectives set.

Review Exercises

1. Complete the table below with examples of individual and population level interventions for the three levels of prevention.

Disease	Level of intervention	Primary prevention	Secondary prevention	Tertiary prevention
Hypertension	Individual			
	Population			

2. Fill in the blank cells and calculate the sensitivity and specificity for the given example.

Screening results	Real characteristics of the population		Total
	Disease present	Disease absent	
Positive	230		
Negative		600	
Total	300	700	1000

3. A test used for hepatitis B screening in the general population has a sensitivity of 96% and a specificity of 98%. The total number of people to be screened for hepatitis B is 100,000. The true prevalence of hepatitis B in the population is 150 per 100,000.

a) Complete the contingency 2x2 table.
b) Calculate the number of true positives.
c) Calculate the number of true negatives.

4. Read the WHO Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020 (https://iris.who.int/bitstream/handle/10665/94384/9789241506236_eng.pdf?sequence=1) and answer the following questions:

a) What global voluntary targets have been set for the prevention and control of noncommunicable diseases and their risk factors?
b) What policy options are proposed for member states under the objective 3 to reduce modifiable risk factors for noncommunicable diseases?

Review Questions

1. What are the four major types of noncommunicable diseases?
2. What are the main common risk factors for noncommunicable diseases?
3. What are the 4 metabolic risk factors for noncommunicable diseases?
4. What is prevention?
5. What are the three levels of prevention?
6. Who is the target population for primary prevention?
7. Who is the target population for secondary prevention?
8. Who is the target population for tertiary prevention?

9. What are the two WHO approaches to primary prevention? State the advantages and disadvantages of each.
10. What is the difference between primary and secondary, secondary and tertiary prevention?
11. Give examples of primary prevention, secondary prevention and tertiary prevention.
12. Define and present the types of screening.
13. What are the criteria for a screening programme?
14. What are the evaluation criteria for a screening programme?
15. What is the sensitivity and specificity of a screening test and what is their practical importance?
16. What do positive predictive value and negative predictive value mean?
17. What are the stages of the epidemiological transition and what are the characteristics of each stage?
18. What are the main indicator systems for monitoring noncommunicable diseases at international and EU level?
19. What are the nine global voluntary targets for the prevention and control of NCDs?

5. MANAGEMENT, ORGANIZATION AND FUNCTIONING OF HEALTH SYSTEMS

5.1. Health System

5.1.1. Key Concepts

In recent decades, there has been considerable scientific progress in treating and preventing disease. The range of interventions available to prevent and control the most common diseases has also increased. However, these diseases still persist, often with a high prevalence and a high incidence. We will try to explore this conundrum from the perspective of the **organization, management, and delivery of health services** that should be accessible to people in need. The delivery of health services is usually viewed from a "system" perspective. The health system, like any other system, is a set of interrelated parts that must work together to be effective.

In the World Health Report (2000), WHO defined **the health system** as "all the organizations, people and institutions that produce actions whose primary purpose is to promote, restore or maintain health" (57).

The concept of the health system is broader and different from that of the health care system. In the World Health Report (2003), WHO defined **the healthcare system** as "the institutions, people and resources involved in providing health care to people" (59).

The health system includes: formal health services, actions of traditional healers, use of medicines, whether prescribed by a health care provider or not, home care, and health education.

The boundaries of a health system are limited to those actors and actions whose primary intention is to improve health and which have a direct effect on health. Activities that have an indirect effect on people's health are not considered part of the health system (e.g., the general education system is outside the boundaries of the health system).

Health systems emerged at the end of the 19th century and developed particularly after the Second World War. The World Health Organization was founded in 1946. Its efforts to promote viable and effective health services culminated in the Alma Ata Declaration of 1978, which **endorsed the concept and strategy of primary health care** as a mean of **ensuring health for all and universal health coverage**. The aim was to provide all residents of a country with the health services they needed, without financial barriers.

A health system is a set of organizations, institutions, and resources that collectively finance and deliver health services to a defined population, with the primary goal of improving health. The health system is also an important public health issue.

The health system is an important **direct determinant** of health. It can reduce morbidity and mortality from major NCDs and contribute to the elimination and prevention of infectious diseases.

Health systems also have **indirect effects** on health, such as:

- Creating a sense of security, safety and well-being among people who have safe and convenient access to quality health services;
- Creating a market for goods and services;
- Creating jobs;
- Reducing health inequities:
  - ✓through health care and public health initiatives that improve health;
  - ✓through their organizational characteristics, which influence patterns of service use within social groups.

5.1.2. Characteristics of Health Systems

Health systems are open systems, being influenced by many external factors. Although health systems differ, they share common

characteristics such as complexity, external influence, pluralism and dynamic evolution.

The complexity of the health systems is determined by:

- The diversity of tasks in the delivery of health services;
- The interdependence of health service providers;
- The diversity of patients, physicians and other personnel;
- The multiplicity of relationships between patients, caregivers, health service providers, support staff, administrators, family and community members;
- The vulnerability of patients;
- Variations in the physical appearance of clinical environments;
- The variability or lack of the regulations;
- The introduction of new technologies;
- The diversity of the care pathways and the institutions involved;
- The increasing specialization of health professionals, which provides a wider range of treatments and services for patients, but also more opportunities for things to go wrong and for mistakes to be made.

The environment. Health systems are systems open to the influence of external factors, including poverty, education and infrastructure. A health system is also influenced by the economic, political, social, historical and cultural environment, local and national, and is open to international and global influences.

Pluralism. Most countries have a plurality of health systems.

Health systems are **dynamic** and evolve over time through reforms.

An effective health system should meet the following minimum requirements (57):

- Ensure *access* to quality services for acute and chronic health needs;

- Provide *effective health promotion* and *disease prevention services*;
- Ensure *an adequate response to new threats* as they emerge.

The poor state of health systems in many countries is one of the major barriers to access to essential health care. Unequitable social protection or increased costs due to inefficient use of resources are among the causes of health system fragility.

5.1.3. Health System Objectives and Functions

The aim of a health system is to improve the health of the population by providing efficient, high-quality and equitable services that meet the needs of the population.

According to WHO, a health system aims to achieve **three general objectives** (*Figure 21*) (57):

- Improvement of the population health;
- Responsiveness to the (legitimate) non-medical expectations of the population (people-centredness);
- Equity of financial contribution (protection against financial hardship);

and **two cross-cutting objectives**:

- Equity of the health system;
- Efficiency of the health system.

Population health is measured using the demographic, health status, health determinants, health system and health policy measures discussed in previous chapters.

A health system that **is responsive** to the non-medical expectations of the population and **people-centered** is one that meets both the health care needs of the population and the non-medical expectations of the population, such as:

- Ensure the acceptability of health services;

- Ensuring respect for the person, including dignity, autonomy and confidentiality;
- Customer orientation (patient satisfaction), including prompt attention to health needs, basic conditions and facilities, access to social support networks for people receiving care and choice of health service provider;
- Involvement of service users in decision making.

This objective reflects the product of the whole population's non-medical interactions with the system, including trust in the health system and perceptions of the quality of and access to health care, and does not focus solely on patient experience and/or satisfaction, although these are important products of patient-centered care.

Financial protection is measured in terms of direct payments or **out-of-pocket (OOP) payments**: catastrophic health spending and impoverishing health spending. *Catastrophic health spending* are out-of-pocket payments for health services that exceed a certain threshold (or proportion) of total household income. *Impoverishing health spending* are the out-of-pocket payments for health services that push the household below the poverty line.

Equity of health systems refers to the differences and inequities between different population groups in the achievement of health system objectives.

Health system **efficiency** refers to how resources are used to achieve health system objectives. Improving the efficiency of a health system allows the system to produce more with the same resources.

The health system has **four main functions**: governance (stewardship), resource generation, financing and service delivery (*Figure 21*).

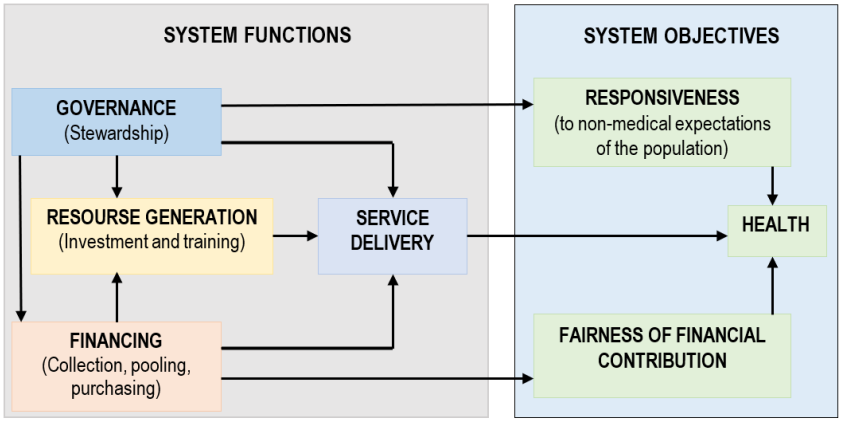


Figure 21. **Relationship Between Health System Functions and Objectives**

Source: (57)

The World Health Organization has structured the four functions into six constituent elements (pillars) that correspond to the functions, with the R*esource generation* function comprising three elements:

- Leadership and governance;
- Service delivery;
- Resource generation and its three elements:
  - ✓ Human resources for health;
  - ✓ Health information system;
  - ✓ Medicinal products, vaccines and technologies;
- Financing.

5.2. Governance

5.2.1. Definition

Governance (stewardship) refers to the role of government in health and its relationship with other actors whose activities have an impact on health. **Health systems governance** refers to the processes, structures

and institutions in place to oversee and manage a country's health system.

Health systems are currently facing a wide range of challenges, including:

- Demographic changes, in particular population ageing and migration;
- Epidemiological changes, such as the increasing frequency of chronic and noncommunicable diseases and the ever-present threat of infectious diseases outbreaks;
- Economic changes, such as the growth of part-time work and in the service sector, and changes in the development and wealth of different countries;
- Political changes, such as the need to comply with European Union legislation;
- Medical changes, such as the seemingly endless new technologies, many of which are very expensive, and the limitations of human resources;
- Social changes, including changes in how patients and professionals see their roles.

The governance of a health system **shapes its ability to respond** to the various challenges facing health systems and to deliver equitable, sustainable and high-quality health services.

5.2.2. Governance Components

The following components of governance are distinguished:

- Policy and vision;
- Collaboration and coalition building;
- Information and intelligence and oversight;
- Legislation and regulation.

The ***Policy and vision*** component refers to the capability and capacity of governance to:

- Ensure a strategic vision for the health sector that is clearly articulated in a set of public policies, laws and/or guidelines for which governments are accountable;
- Define objectives, directions and spending priorities between services;
- Define the roles of public, private and voluntary actors and the role of civil society.

Collaboration and coalition building. Stakeholder involvement in health policy and decision-making is a critical dimension of the governance function. This sub-function therefore refers to the involvement and input of key stakeholders such as academia, health service providers, civil society, vulnerable and marginalized communities and the general public in health policy decision-making. The contribution of the "stakeholder voice" leads to the adoption of people-centered public policies that reflect the needs of the population and make government more accountable.

Collaboration and coalition-building between government sectors and with non-governmental actors, including civil society, is important to:

- Proactively influence public policies in other sectors that affect health, action on key health determinants and access to health services;
- Build support for health policies;
- Keep different parts connected.

The ***Information and intelligence*** component provides for the collection, analysis and use of information on:

- Trends and differences in inputs, access to health services, coverage and safety of services;
- Sensitivity, financial protection and health outcomes (health status), especially for vulnerable groups;
- The impact of public policies and reforms;

- The political environment and opportunities for action;
- Policy options.

The collection and use of information is essential for improving health services and health system performance. This sub-function focuses on the governance culture and political will required to support an environment in which the generation and use of evidence is the norm, and in which changes within the health system and their impact on system performance are monitored, continuously learned from and acted upon. An effective information system, accessible to all stakeholders, is essential to achieve these goals.

The ***legislative and regulatory component*** includes the development of normative acts (laws, regulations) and incentives, and ensuring their fair enforcement.

5.2.3. Actors in Health Governance

There are three categories of **key actors** that determine the governance framework of the health system: the state, health service providers and citizens or the population.

By ***the state***, we mean politicians and decision-makers in government institutions at central/national and local levels. The second category is represented by ***health service providers***, which may be public or private, clinicians or non-clinicians, paramedics, professional associations or care or service networks. The category of ***citizens*** includes users of health services, such as the general population, patient associations, NGOs, etc. (see examples for the Republic of Moldova in *Table 18*).

Table 18. **Health Governance Actors**

State: Politicians and Decision-makers	Health Service Providers	Citizens
Parliament and Parliamentary Commissions	Public and private health facilities	Community groups

State: Politicians and Decision-makers	Health Service Providers	Citizens
Ministry of Health	Physicians and their associations	HIV/AIDS, TB support groups
Ministry of Finance	Nurses and other health workers and their associations	Advocacy organizations
National Company for Medical Insurance	Pharmaceutical manufacturers and suppliers	Civil society watchdogs
Agency for Medicines and Medical Devices	SUMPh „Nicolae Testemitanu", medical colleges	Human rights organizations
National Agency for Public Health	Community health workers	Political parties
Center for Centralized Public Acquisitions in Health (of Medicines, Consumables and Equipment)	Private insurance companies	Legal services NGOs
National Anti-Corruption Centre		
Courts of law		
Trade union of health workers		

The relationships between the actors in the health system. Each of the three categories of actors has specific responsibilities and there are interdependent relationships between them (*Figure 22*). For example, the **state** sets health goals, standards and procedures for the delivery of health services, provides the necessary resources and support to health service providers, and oversees them.

Providers, in turn, report to the state (for accountability) and provide data and information that is used to develop evidence-based public policy. Providers may lobby for particular services.

Citizens express their needs, preferences and demands for health services to the state, and the state should be sensitive to citizens' needs, preferences and demands.

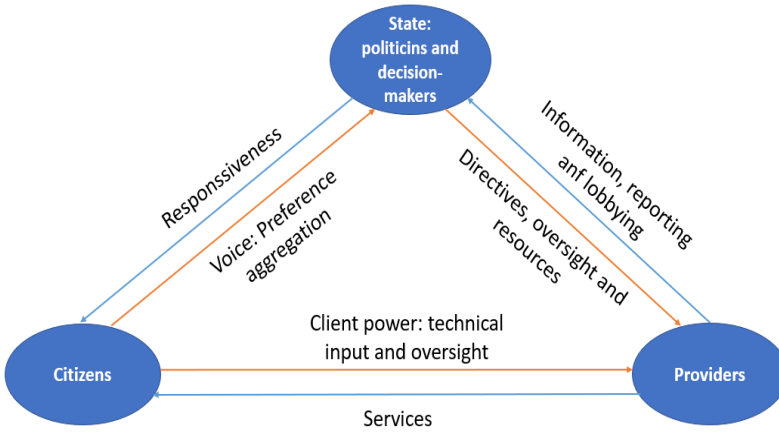


Figure 22. **Health Governance Framework**

5.2.4. Principles of Governance

There are five principles of governance: accountability, transparency, participation, integrity and capacity.

Accountability refers to the formal mechanisms by which each actor is accountable for its actions to other actors and can be rewarded or punished based on the outcome of the actions for which it is responsible. From the patients' perspective, we consider the formal mechanisms by which patients can hold key actors accountable for access to quality services, satisfaction and fair financing.

In a **transparent** governance, institutions approve clear decisions and inform the public about the reasons and decision-makers.

Participation means ensuring that people who are affected by proposed decisions can express their views on them in a way that ensures that they are at least heard.

Integrity means clear allocation of roles and responsibilities and a clear process for relating them.

Capacity is the ability of governance to develop health policies that are aligned with resources to achieve established objectives.

5.3. Resource Generation

Resource generation is the function that provides all the **inputs** necessary for the health system to function. This function involves producing, procuring and making available all the necessary resources at the right time and place. Resource generation enables the delivery of health services and influences the intermediate goals and overall performance of the health system.

This function has three components:

- Human resources for health, infrastructure and medical equipment;
- Health information system;
- Pharmaceuticals and other consumables.

5.3.1. Human Resources and Physical Resources (Infrastructure and Medical Equipment)

According to WHO, **health workers** are all those involved in activities whose main purpose is to protect and improve the health status of the population. The health workforce consists of health service providers, health service managers and support staff. It includes both public and private sector human resources, paid and unpaid, professional and lay (patients and communities are legitimate parts of health care).

Three main factors determine the performance of the health workforce: production, distribution and retention.

Health systems face many human resource challenges. These include understaffing and additional demands on human resources for health caused by: the increasing complexity and cost of health systems; the management of a much more socially diverse chronic patient

population; the teamwork required for patient management; and the explosion of knowledge and technology.

Strategies such as the recruitment of health professionals, the development of mid-level health staff, the use of community health workers and the modification of training programmes for physicians and nurses can be used to address these issues.

Health infrastructure and medical equipment are the physical resources needed to provide efficient and effective health services. The main components of health infrastructure are: buildings and equipment (physical infrastructure); utilities and water and electricity supply systems necessary for the proper functioning of the facilities and equipment; medical waste disposal systems; information and communication technology infrastructure; and transport/logistics infrastructure. Medical equipment are articles, instruments, apparatus or machines used to prevent, diagnose or treat disease or to detect, measure, restore, correct or modify the structure or function of the body for health purposes.

5.3.2. Health Information System

Safe and reliable information underpins decision-making at all levels of the health system. It is essential for: governance (development and implementation of health policies and regulations); health research; human resource development; health education and training; service delivery and financing.

The health information system (HIS) is one of the constitutive elements of the health system and includes two EPHOs (health surveillance and monitoring). It is used/intended to collect, standardize and codify data, process, report, manage and use relevant information to improve the efficiency and effectiveness of health services through better management at all levels of health services.

The health information system has three main characteristics:

- **Generation of individual, institutional and population-level data** from multiple sources: public health surveillance platforms, medical and other health records, civil registration data, household surveys, censuses, health service coverage and health system resource data (e.g., human resources, health infrastructure and financing).
- **Ability to detect, investigate, communicate and contain** events that threaten public health security where they occur and as they happen.
- **Ability to synthesize** information and promote demand and supply (availability) and use of data in clinical and public health management, financing, planning and implementation.

The health information system provides a sound basis for decision making and consists of four components:

- Data generation (data collection);
- Data collation;
- Analysis and synthesis (data processing);
- Communication (reporting) and use.

The health information system collects data from the health sector and other relevant sectors, analyzes the data and ensures the quality, relevance and timeliness of statistical indicators, and transforms data into information to support health decision-making.

The health information system is essential for:

- Monitoring and evaluation;
- Alerting and early warning;
- Management of patients and health facilities;
- Planning;
- Supporting and stimulating research to analyze the health situation and trends;

- Supporting reporting and communication on health challenges to different users.

Information should therefore be available in formats that meet the needs of different users, such as decision-makers, planners, managers, health care providers, communities and individuals. Dissemination and communication are therefore essential features of the health information system.

5.3.3. Pharmaceuticals, Vaccines and Other Supplies

Pharmaceuticals, vaccines and other supplies are the key inputs that need to be available simultaneously, in the right combination, at the right place and at the right time within the service delivery function, supported by governance and financing.

This component focuses on the manufacturing and procurement processes needed to ensure the continued availability of these products and supplies.

Pharmaceutical products must be safe, effective and of good quality and prescribed and used rationally.

The availability of pharmaceuticals is a fundamental element of quality health care within a human rights framework. Increasing the availability of medicines is essential to reduce the burden of disease and health inequalities.

SDG 3b3 "Proportion of health facilities that have a core set of relevant essential medicines available and sustainably accessible" (13) highlights the link between the availability of medicines, their accessibility and the existence of a core set of relevant essential medicines. **Essential medicines** are the most effective, safe and cost-effective medicines for priority diseases. In the Republic of Moldova, the national list of essential medicines was approved by Order of the Minister of Health no. 1033 of 11 November 2021 (26).

5.4. Health Systems Financing

5.4.1. The Context of Health Expenditure

Health systems need financial resources to achieve their objectives. Financing is essential to achieving the other functions of the health system: governance, resource generation and universal health coverage.

Health system financing affects the availability, accessibility and affordability of health services. A country's ability to achieve its health financing goals is influenced by external factors, particularly the fiscal context.

The **fiscal context** refers to the government's current and future ability to spend. One indicator of the current fiscal context is the ratio of public expenditure, including health expenditure, to gross domestic product (GDP). Fiscal capacity is affected by several factors, including demographic factors (e.g., dependency ratio) and the effectiveness of the fiscal system itself (e.g., enforcement capacity, revenue collection).

The government operates within its budgetary limits. Government spending cannot meet all the needs of its society, including the needs of the health system. The amount the government spends on health therefore depends on its overall fiscal context and decisions about priorities.

Health expenditure refers to expenditure from all sources for the whole health system, regardless of the provider. The allocation of financial resources involves a skilful planning process to balance expenditure on different components of the system and to ensure equity between administrative-territorial units and different socio-economic groups.

Current health expenditure measures the final annual consumption of health goods and services, including personal health care (e.g., treatment, recovery, long-term care, auxiliary services and

medical goods) and collective services provided at population level (e.g., preventive and other public health services) and health administration.

Current health expenditure and investment in health infrastructure (buildings, machinery, information technology) make up **total health expenditure**.

The following indicators are commonly used to compare the level of expenditure between countries or the evolution of expenditure within a country:

- Current health expenditure as a percentage of GDP;
- Current health expenditure per capita in US dollars (adjusted for differences in purchasing power of national currencies to compare expenditure levels).

The USA is the country with the highest current health expenditure, both per capita and as a percentage of GDP, followed by Western European countries.

Health spending, either per capita or as a share of GDP, does not reflect the efficiency of resource use. However, regardless of the efficiency of resource allocation, countries that spend less than 4% of GDP on health have poorly developed health services. Countries spending between 4 and 5 percent of GDP may be able to achieve universal health coverage, but often do so by underpaying staff, providing inadequate equipment and spreading scarce resources. Countries that spend between 8 and 16 percent of GDP on health services place health care among the top priorities of their societies.

Strengthening health financing is one of the targets of Sustainable Development Goal 3 (SDG target 3.c). Levels and trends in health expenditure data highlight key issues, such as weaknesses and strengths, and areas where investment is needed, such as additional health facilities, better health information systems or better trained human resources. Health financing is also key to achieving universal health coverage (UHC), defined as everyone getting the quality health

services they need without financial hardship (SDG 3.8). Data on out-of-pocket expenditure is a key indicator of financial protection, and therefore progress towards UHC.

In the Republic of Moldova, there is a general trend of increasing health expenditure in US dollars per capita, except for the year 2015-2016, when a decrease was recorded. However, spending as a percentage of GDP is on a downward trend, ranging from 6 to 7 per cent (*Figure 23*) (70).

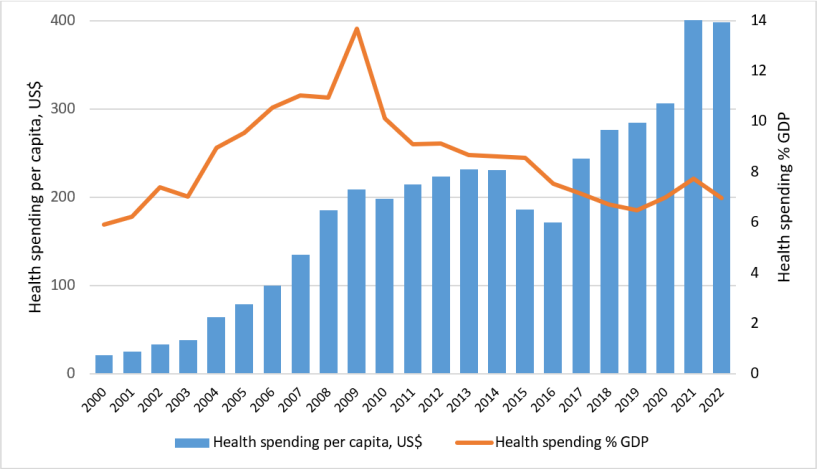


Figure 23. **Health Spending, Republic of Moldova, % GDP and US$ per capita, 2000-2022**

Source: WHO Global Health Expenditure Database, 2024 (70).

5.4.2. Health System Financing Components

Health financing consists of the following components (*Figure 24*):

- Revenue collection;
- Pooling of resources (funds);
- Purchase of services.

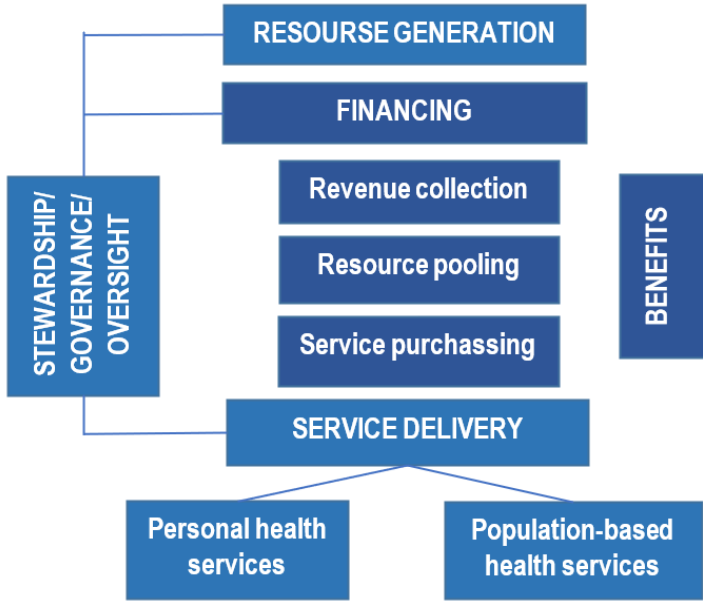


Figure 24. **Health Financing Sub-functions**

Financing also includes policies on service coverage, benefit packages (in the Republic of Moldova - Unique Program of Compulsory Health Care Insurance) and cost-sharing (user fees). How each of these components and policies is met or applied can have a significant impact on the achievement of health financing policy objectives. The objectives of health financing policy in the Republic of Moldova are: universal coverage; solidarity in financing; equity of access; provision of high-quality medical care.

5.4.2.A. Revenue Collection

Revenue collection is the process by which health systems collect money from individuals, households, businesses and other external sources.

The revenue collection process includes the following three elements: sources of funding, mechanisms for collecting revenue (contribution mechanisms) and organizations responsible for collecting revenue (*Table 19*).

Table 19. **Revenue Collection Process**

Sources of funding	Mechanisms for collecting revenue	Revenue collection institutions
- Individuals, households and employees. - Enterprises and employers. - NGOs. - Foreign governments and multilateral agencies (donors).	**Public** - Direct and indirect taxes. - Compulsory health insurance contributions. **Private** - Private health insurance. - Out-of-pocket payments (direct payments or cost sharing/user fees).	- Government, at central or local level. - Independent public body or social security agency. - Public insurance funds or non-profit or profit-making private insurance funds.

Sources of Funding. Individuals and businesses are the main sources of funding for health services, although some funds may be channelled through non-governmental organizations and multilateral agencies such as the World Bank and external donors.

Collection Mechanisms. Depending on the sources of financing for health services, a distinction is made between publicly financed health systems and privately financed health systems.

Revenue is raised through four main financial contribution mechanisms (*Figure 25*):

- Taxation (direct and indirect);
- Compulsory social health insurance contributions;
- Voluntary insurance premiums (private health insurance);
- Out-of-pocket payments.

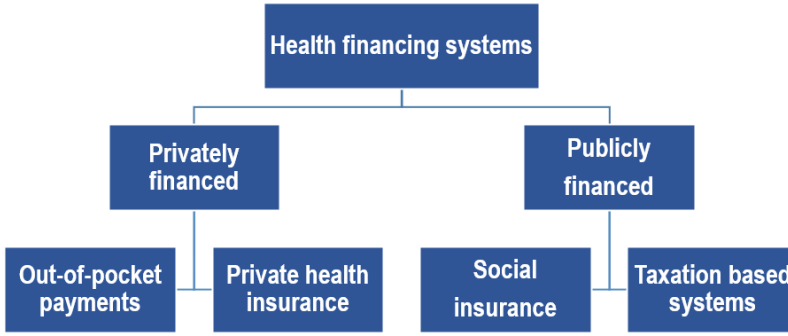


Figure 25. **Health System Financing**

Direct and Indirect Taxation

Direct taxes are levied on individuals, households or companies (e.g., income tax, property tax, profit tax). Direct, income-based taxes are **progressive** because the wealthiest people contribute a larger share of their income than the poorest. In low-income countries, the tax-based option may not be feasible.

Indirect taxes are taxes levied on the consumption of goods and services (e.g., VAT, sales taxes, export and import duties). Indirect taxes are **regressive** because the rich pay a relatively smaller share of their income than the poor. But taxing harmful goods (e.g., tobacco, alcohol, sugary soft drinks) can reduce consumption and improve health.

In countries that are mainly financed by central taxation (e.g., UK, Ireland, Portugal), the tax collecting authority transfers the revenue to the Ministry of Finance, which in turn allocates funds for health services to the Ministry of Health. The size of the budget therefore depends on political considerations and the ability of the Ministry of Health to negotiate with the Ministry of Finance.

Social health insurance

Social health insurance contributions are usually compulsory and shared between the employee and the employer. They are usually set as a fixed

percentage of the salary. For example, if the total social security contribution is 9%, this may be made up of a 4.5% contribution from the employee and a 4.5% contribution from the employer (as it is currently in the Republic of Moldova).

The collecting body can vary from country to country, from a single national fund (such as in the Republic of Moldova) to local branches of the national fund (such as in Romania) to smaller independent funds (such as in France).

Private health insurance

Private health insurance is defined as a set of health services financed by a third party through private payments, called *premiums*, which are independent of income. Enrolment in private health insurance is *voluntary*. Private health insurance is one of the most important health financing mechanisms, but in practice it plays a limited role in most countries.

Out-of-pocket payments

Out-of-pocket payments are payments made by an individual directly to the health service provider at the time of service use. The following forms of out-of-pocket payments (OOP) can be distinguished:

- Direct payments for services not covered by the statutory benefit package (formal payments);
- Cost-sharing (user fees) for services covered by the benefit package;
- Informal direct payments.

Out-of-pocket payments are part of the health financing landscape in all countries. They rely on user payments and co-payments to mobilize revenue, rationalize the use of health services, contain health system costs or improve health system efficiency and service quality.

Unregulated out-of-pocket payments are often a major barrier to accessing needed health care and contribute to high out-of-pocket spending, leading to financial protection problems.

Disadvantages of out-of-pocket payments include:

- Expensive, causing financial difficulties for households;
- Unmet needs due to the financial barrier to accessing health services;
- Reduced continuity of care.

5.4.2.B. Pooling of Resources

Pooling refers to the accumulation of revenues or prepaid funds from the population. Pooling and managing income allow group members to share collective health risks and protects individual group members from large, unpredictable health expenditures. Prepayment allows group members to pay expected **average costs in advance**, reducing uncertainty and ensuring compensation in the event of a loss.

Pooling together with prepayment makes it possible to create insurance and redistribute health expenditure between people with high and low health risks and between people with high and low incomes (*Figure 26, Figure 27*).

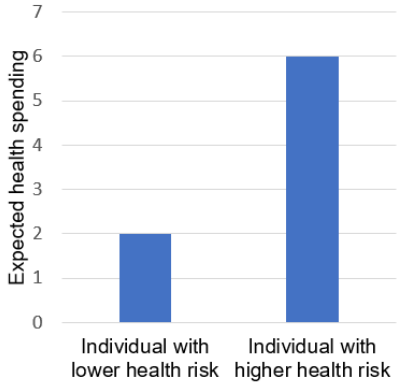


Figure 26. **Health Spending without Risk Pooling**

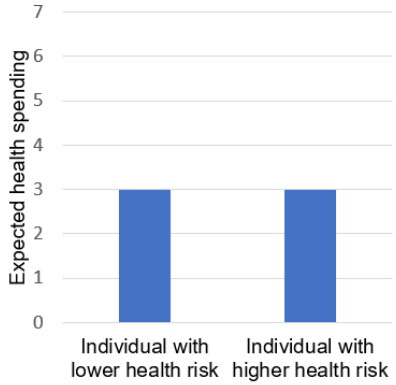


Figure 27. **Health Spending with Risk Pooling**

5.4.2.C. The Purchasing and Delivery of Health Services

There are two basic ways of paying for health services: out-of-pocket payments, the simplest and earliest form of transaction between patient and provider, and third-party payments, where providers are paid by an insurance company or government.

In most countries, people choose to finance health services through payments to a third party who plays the role of purchaser (*Figure 28*). The reasons for this choice are the high cost of health services and equity. The third party may be public or private.

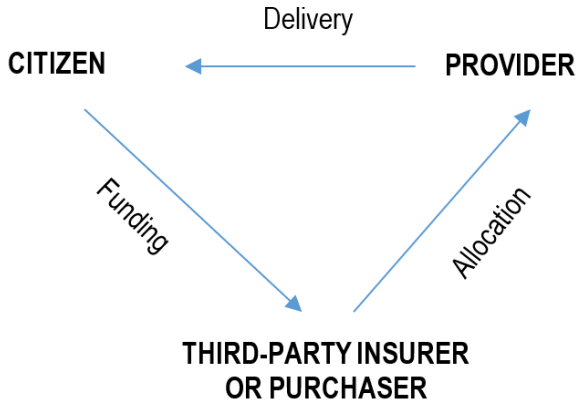


Figure 28. **The Health Care Triangle**

Source: adapted from Reinhardt, 1990 (21).

Purchasing services refers to the transfer of accumulated resources to service providers on behalf of the population, thus enabling people to be "covered by health services". The way in which health services are purchased is critical to the delivery of services, ensuring efficiency and quality of care. Purchasing involves three types of decisions:

- Identifying the interventions or health services to be purchased, taking into account the population needs, national health priorities and cost-effectiveness;

- Choosing service providers based on criteria such as service quality, efficiency and fairness;
- Determining how services will be purchased, including contractual arrangements and mechanisms for paying providers.

Health insurance funds or the government (the purchaser) are responsible for purchasing health services from public or private providers. The relationship between purchaser and provider is traditionally contractual. In the Republic of Moldova, the National Company for Health Insurance (NCHI) purchases health services from providers (public and private) on a contractual basis, setting the terms and conditions (27).

Purchasing should not be confused with procurement, which generally refers only to the procurement of drugs and other medical supplies.

Coverage policies determine the categories of people covered (who), the range of services and goods (for what) that will be paid from the collected revenues, and any restrictions or conditions on access. All countries restrict entitlements to health services in one way or another. Coverage policy decisions determine the specifics of how benefits are rationalized and thus influence health system performance and progress towards universal health coverage goals. Some may consider coverage policies to be part of purchasing because they reflect decisions about entitlements to health services, but these decisions are made not by the purchaser but by the ministry of health, which is directly accountable to citizens and may be less concerned about cost implications.

To illustrate the inextricable links between financing and coverage policies, the coverage cube (*Figure 29*) breaks down health service coverage into three dimensions: population coverage (breadth), type and number of services covered (depth) and financial protection or proportion of total health services costs that are publicly funded

(height), with the yellow box representing pooled funds (50). Health system performance ultimately reflects myriad coverage policy options within these dimensions, which are closely related to and dependent on other aspects of the financing function.

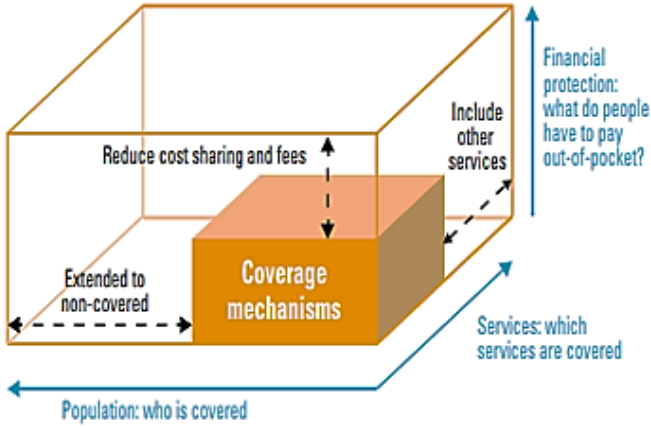


Figure 29. **Universal Health Coverage Cube**

Source: (50)

Universal health coverage means ensuring that all people have access to the necessary health promoting, preventive, curative and rehabilitative services of sufficient quality to be effective, while ensuring that people do not suffer financial hardship in paying for these services. In other words, it is about reducing the gap between access, need and use of services, improving quality and enhancing financial protection (*Figure 29*).

Benefit package. The entitlement or eligibility of people to health services refers to the normative act on the basis of which beneficiaries have the right to access health services. The core set of health services usually includes medical consultations, tests, examinations and hospital care. The package of services offered to the population of the Republic

of Moldova is regulated by the Unique Programme of Compulsory Health Care Insurance, approved by the Government (12) and joint order of the Ministry of Health and the National Company for Medical Insurance (28). Coverage takes into account the number or proportion of the population covered by health services.

5.4.3. Payment for Service Delivery: Main Payment Methods

Payment for the delivery of health services in health systems can be either **prospective** or **retrospective**. **Prospective payment** refers to the allocation of funds to providers in advance of the delivery of health services, based on predefined levels of activity and expected costs. Prospective payment methods take the following forms:

- *Budget lines*, the allocation of a fixed amount of funds to the provider to cover specific input costs;
- *Global budget*, the allocation of a fixed amount of funds to the provider for a specified period of time to cover total expenditure;
- *Capitation/per capita*, the allocation in advance of a fixed amount per person registered on the provider's list to provide a defined set of services.

Retrospective payment refers to the payment of providers after services have been provided. Retrospective payment methods take the following forms:

- *Payment per service* or service element. It refers to the full retrospective reimbursement of all costs incurred. Providers are paid for each individual service provided. Payments are fixed in advance for each service or group of services;
- *Payment for performance.* It refers to the payment of providers for each service or individual case or for a defined target (outcome). Payment is fixed in advance;

- *Payment per case treated or "DRG".* It refers to the payment to hospitals of a fixed amount per admission, depending on patient and hospital characteristics. "DRG" (Diagnosis Related Group) is a classification system that assigns patients to categories based on the expected cost of their episode of hospital care;
- *Per diem payment.* It refers to the payment of hospitals with a fixed amount per day.

The methods of payment for medical services provided by public health facilities in the Republic of Moldova are established by a joint order of the Ministry of Health and the National Company of Medical Insurance (27).

5.4.4. Typology of Health Systems: Characteristics, Advantages and Disadvantages

Health systems vary widely from country to country. Three models of health systems can be distinguished according to the extent of coverage, financing and delivery of health services, and regulation (*Table 20*):

- *The tax-based* or national health system (Beveridge model), which is characterized by universal coverage, financing through general taxation, public service providers, and regulation by the government;
- *The social health insurance* model (Bismarck model), characterized by universal coverage, financing through (compulsory) social insurance contributions, public and/or private providers, and regulation by the government;
- *The private insurance* model, based only on private health insurance, which is the main source of financing, and private providers.

This classification does not take into account the fact that most health systems are mixed.

Table 20. **Health System Typology**

Type	Financing and Regulation	Service Providers
Tax-based system	Financed by taxes levied by the government; regulated by the government	Public providers
Social health insurance model	Financed by compulsory contributions on wages and salaries, shared between the employee and the employer; regulated by the government.	Public and/or private providers
Private health insurance model	Financed by voluntary private health insurance.	Private providers

5.4.4.A. Tax-based Health System (Beveridge model)

The British National Health Service was established in 1948 as a key part of the social reforms recommended by William Beveridge, with the aim of providing health services for the whole population (universal health coverage).

It is financed by taxation, which means that taxpayers' money is used to finance the delivery of health services to the population. Funds may flow directly to health service providers or through an intermediary who purchases services on behalf of the population (ensuring a separation between purchaser and provider). Health services are mainly provided by public providers.

Countries with such a system include the UK, Ireland, the Nordic countries (Norway, Finland, Denmark, Sweden, Iceland), Spain, Portugal, Italy, Canada, Australia and New Zealand.

The **advantages** of the tax-based system include the following:

- It is progressive, i.e., the rich pay a higher contribution from their income than the poor;
- Has the ability to create a large accumulation of risk through the anticipated payment of funds;

- Mobilizes funds from everyone, regardless of health status, income or occupation;
- Efficiently pools health risks across a large contributing population;
- Has no theoretical limits to the coverage of the population;
- Tax-based financing is the only safe method of providing health services to hard-to-reach groups;
- Relatively simple to administer.

The tax-based system also has certain **disadvantages**, including:

- The health budget has to compete with other government needs, such as defence, education, and internal affairs;
- Political pressure to serve privileged groups;
- Problems of poor accountability and instability.

5.4.4.B. Social Health Insurance Model (Bismarck model)

Social health insurance was introduced in Germany in 1883 by Chancellor Otto von Bismarck. Financing is based on compulsory payroll contributions, usually shared between the employee and the employer. Social health insurance is administered by public bodies, either single (a single central government agency that collects social contributions and pays for services) or multiple (health insurance companies that pay for services on a contractual basis). Providers can be either public or private.

The social health insurance model can be found in most European countries. They include Germany, France, the Netherlands, Belgium, Austria, Switzerland, Luxembourg, Israel, Japan, central and south-eastern European countries, including the Republic of Moldova.

The **advantages** of the social health insurance model are as follows:

- The ability to create a large accumulation of risk through the early payment of funds (as in the case of tax-based financing);

- Resources for health care are clearly identified and have not to compete with other government needs such as defence, public order, social security;
- The model is more socially acceptable to the public.

This model also has certain **disadvantages**, such as:

- The system is complex and expensive to administer;
- The health system does not have a guaranteed income, the amount collected varies according to the number of employees;
- Involves the cost of collecting funds from employees and employers (an additional cost that does not arise in tax-based systems);
- The financing burden is concentrated on employees in the formal sector, which may be a relatively small proportion of the total population, especially in developing countries;
- Social health insurance is a form of labour taxation (i.e., paid by those in employment), which can discourage employers from creating new jobs and lead to underreporting of wages.

5.4.4.C. The Private Health Insurance Model

The private health insurance model uses private insurance in combination with private service providers. The system is financed by premiums paid to private insurance companies. In the US, health care is predominantly privately financed, with the exception of health care for the poor and the elderly, which is provided through the government-funded programmes "Medicare" and "Medicaid".

The **advantages** of this model include:

- Provides multiple options and the ability to choose the best plan to meet individual health needs;
- Provides greater flexibility and access to care than public health insurance;
- Can cover expensive medical costs that may arise unexpectedly.

The **disadvantages** of this model include the following:

- It is expensive and insurance premiums increase every year;
- Does not guarantee full access to healthcare;
- Inequitable access to care for the poor and elderly.

A well-functioning health system is essential for improving the health status of the population and should demonstrate good performance. Improved health contributes to social well-being through its strong impact on economic development, competitiveness and productivity. A well-functioning health system therefore contributes to economic development and well-being, and each country should ensure that its health system:

- Fairly distributes the burden of financing according to people's ability to pay, so that individuals and families are not impoverished as a result of poor health or use of health services;
- Is responsive to people's needs and preferences, and treats them with dignity and respect when they come into contact with the system.

Therefore, public financing of health is superior to private financing.

In most developing countries, health is financed by a combination of government expenditure, private expenditure (mostly out-of-pocket) and external aid (from donors).

Figure 30 shows the sources of health expenditure in the Republic of Moldova over the period 2000-2021 (70). The main sources of financing are compulsory health insurance and the state budget, whose share is increasing. Out-of-pocket payments represent an important share of health expenditure, although a downward trend has been observed in recent years.

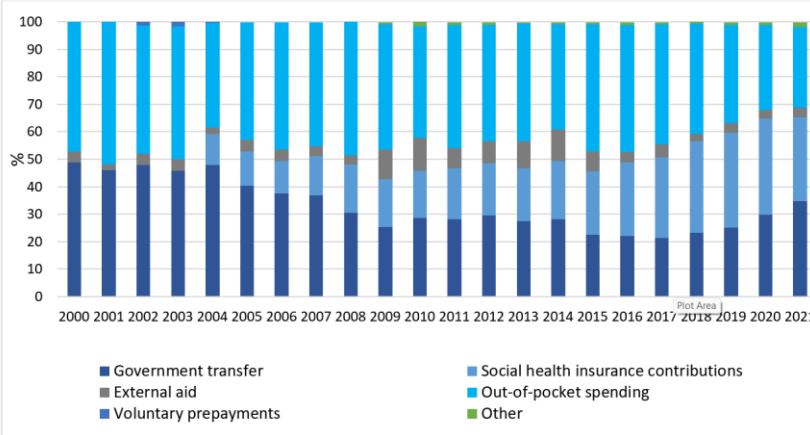


Figure 30. **Sources of Health Expenditure, Republic of Moldova, 2000-2021, % of total expenditure**

Source: (70)

5.5. Health Services

5.5.1. Key Concepts

Service delivery is a core function of health systems, and it is influenced by and affects governance, financing and resource generation. Service delivery has a direct impact on intermediate and overall health system objectives. Murray and Frenk (2000) defined service delivery as "the combination of inputs to a production process that takes place in a particular organizational setting and results in the delivery of a set of interventions" (22).

A **health service** is any service (not limited to health care) that is intended to contribute to the improvement of health or to the diagnosis, treatment and rehabilitation of sick persons.

Health services are the full range of activities undertaken primarily for health reasons. Health services are undertaken to have a direct effect on people's health. Activities that have an indirect effect on human health are not considered health services. Examples of these

types of services are water supply and sanitation, education and the use of seat belts.

5.5.2. Classification

The World Health Organization distinguishes between two types of health services: personal health services and population health services.

Personal health services are services provided to individuals on an individual basis. They include individual health education, disease prevention, diagnosis and treatment, rehabilitation, palliative care, acute care and long-term care services.

Population health services are services provided to a group or an entire population (e.g., vaccination campaigns, wearing masks, physical distancing, oral hygiene education, food fortification to prevent micronutrient deficiencies, tobacco and alcohol control interventions, physical activity interventions).

Health services can be classified by the following criteria:

- by primary purpose of consumption (e.g., preventive, curative, rehabilitative, long-term care);
- by delivery platform (e.g., primary care facility, hospital);
- by level of care (e.g., primary, secondary, tertiary);
- by mode of delivery (e.g., hospital care, outpatient care, day care, home care).

5.5.3. Components of Service Delivery

Within the service delivery function, the following components are distinguished:

- Public health;
- Primary health care;
- Specialized health care, which includes secondary health care and tertiary health care.

5.5.3.A. Public Health Services

Public health is a social and political concept that aims to improve health, prolong life and enhance the quality of life of the whole population. **Public health services** therefore focus on health promotion, disease prevention, health protection and other forms of intervention and are delivered through public health (including screening) and community programmes. Public health covers the whole spectrum of health and well-being, from the eradication of specific diseases to the growing recognition of political, commercial, economic, social and environmental factors as determinants of health and social inequalities (see chapter 1).

Both public health and clinical medicine seek to integrate preventive behaviours into people's lifestyles. Preventive services are generally more cost-effective than the provision of specialized (secondary and tertiary) health services.

5.5.3.B. Primary health care

The definition of primary health care, as articulated in the Alma Ata Declaration of 1978, was a first attempt at the international level to unify thinking about health in a single policy framework. The approach developed in the Declaration is based on the principles of equity, participation, intersectoral action, appropriate technology and the central role of the health system "in providing **universally accessible services to individuals and families in the community**, with their full participation and at a cost that the community and country can afford and sustain at every stage of their development, in a spirit of self-reliance and self-determination" (54).

Primary health care is the first point of contact (gatekeeper) of the population with the health system for unspecified and common health problems. They comprise three interdependent components: integrated primary health care services and essential public health

operations; multisectoral policies and actions; and individual empowerment and community involvement. Primary health care involves comprehensive and coordinated health care provided to individuals regardless of sex, disease or organ system affected, along a continuum from health promotion and disease prevention to diagnosis, treatment, rehabilitation and palliative care.

Different types of services are provided within primary health care. For example, general health care, diagnostic services, minor surgery, rehabilitation, family planning, perinatal care, first aid, prescription of medicines, certification, 24/7 availability, home visits, acute and chronic care, palliative care, specific services for mental health problems, preventive services (e.g., immunization, screening), health promotion services (e.g., health education).

5.5.3.C. Specialised Health Care

Specialized health care goes beyond first contact triage and involves specialist skills. It includes both outpatient and inpatient care. In many countries, including the Republic of Moldova, it is divided into two levels – secondary and tertiary health care.

Secondary health care includes specialist care, which is often only available by referral from a primary care health worker, and is usually provided in local "polyclinics" or hospitals. However, people can refer themselves to a hospital (*secondary care*) if they are injured and need emergency care.

Tertiary health care refers to highly specialized care, often only accessible by referral from secondary health care. This is usually provided in highly specialized health care facilities at regional or national level. Tertiary health care is characterized by the use of advanced technology and a high volume of procedures. Tertiary health care facilities are an important resource for medical education and serve as training facilities for various health professions.

5.5.3.D. Challenges to health service delivery

The challenges currently facing health systems include the ageing of the population and the increase in the burden of noncommunicable diseases; the increasing prevalence of comorbidity, multimorbidity and chronicity; the low availability of essential medicines; the high prevalence of risk factors such as tobacco and alcohol use, obesity and physical inactivity, which remain major public health problems; the high burden of out-of-pocket health expenditure; the inadequacy or even shortage of health workers; and globalization with the very rapid spread of new diseases (infectious diseases, e.g., COVID-19).

These new challenges place new demands on the delivery of health services. Health systems are increasingly faced with demands for **proactive, comprehensive and continuous care** (as opposed to the more reactive and episodic services of the past) that is disease-specific and based on an **ongoing patient-provider relationship**.

Integrated health services refer to the management and delivery of health services so that people benefit from a continuum of health promotion, disease prevention, diagnosis, treatment, disease management, rehabilitation and palliative care services across different functions, activities and settings within the health system.

5.6. Quality of health services

5.6.1. Definition

The quality is measured by comparing a set of inherent characteristics of a product or service with a set of requirements. If the inherent characteristics meet all the requirements, the quality is high, and if these characteristics do not meet all the requirements, the level of quality is low.

Quality is essential to the performance of health service delivery. Quality of health services has been defined in various ways. *Table 21* shows the most commonly used definitions of health care quality.

Table 21. **Defining the Quality of Health Care**

Author/organization	Definition
Donabedian (1980)	Quality of health care – that care which is expected to maximize the dimension of patient well-being, taking into account the balance of expected gains and losses that occur at all stages of the health care process (3).
Institute of Medicine (IOM, 1990)	Quality of care is the degree to which individual and population-based health services increase the likelihood of desired health outcomes and are consistent with current professional knowledge (17).
WHO (2000)	The quality of health care is „the extent to which health services provided to individuals and patient populations improve desired health outcomes. To achieve this, health services must be safe, effective, timely, efficient, equitable and person-centered" (74).

5.6.2. Measuring Health Service Quality

Quality measurement should take into account the components of health services. Donabedian's model is usually regarded as the basic model for assessing the quality of health care. Donabedian argued that health care should be evaluated in terms of structure, process and outcome because "good structure increases the likelihood of good process, and good process increases the likelihood of good outcome" (3).

Structure, process and outcome are not attributes of quality. They are just types of information that can be obtained and from which it is possible to infer whether quality is good or not (*Figure 31*). Ideally, any evaluation system will include structure, process and outcome indicators because they examine different aspects of the care provided in health systems.

The structure (inputs) represents the conditions of the health service provider and the resources needed to provide these services. The structure includes: material resources (e.g., buildings, capital, equipment, drugs, etc.), intellectual resources (e.g., medical knowledge,

information systems) and human resources (e.g., number, diversity, qualifications of health professionals).

The structural indicators represent the necessary conditions for the provision of health services of a certain quality. However, they are not sufficient. Their presence does not guarantee the proper development of processes and the achievement of satisfactory results by the health system.

Examples of structural indicators: number of health facilities, number of hospital beds, number of physicians ((total and by specialty, by sector (hospital, PHC) and mid-level medical staff)).

Processes are the use of resources to provide and receive care. Processes can be divided into patient-related processes (e.g., prevention, diagnosis, treatment interventions, education) and organizational processes: (a) support and logistics (e.g., administration, technology, drug supply) and (b) managerial processes (e.g., marketing, quality management, financing).

Process indicators are closest to the health services actually provided and, from a clinical point of view, are the most specific of the three types of indicators. Process indicators are often more sensitive quality indicators than outcome indicators, because a poor outcome is not necessarily due to a failure in the provision of health services. Process indicators tend to be the dominant quality indicators for health services.

Examples of process indicators:

- *Patient-related*: intervention rates, referral rates, number of births, average number of visits per individual per year, average number of bed days per year, average length of stay in hospital, hospital bed occupancy rate, hospitalization rate per 100 population;
- *Organizational*: supply of medicines, management of waiting lists, payment of staff.

Outcomes are the effects of health services on the health status of patients and the population. Outcomes can be intermediate (outcomes) or final (impact).

Examples of outcome indicators include: changes in the knowledge of patients and family members that may influence future care; changes in the behaviour of patients or their family members that may influence future health status.

Impact indicators measure changes in health status (e.g., mortality, morbidity, disability and quality of life) and patient and family satisfaction with care and outcomes.

Outcomes and impacts are generally considered to be weaker indicators of quality of care because they are only partly attributable to health services and may be more influenced by other factors such as diet, environment, lifestyle or socio-economic conditions.

5.6.3. Health Service Quality Dimensions

Dimensions of health care quality are definable, preferably measurable and actionable attributes of the health system related to its functioning to maintain, restore or improve health. The Law on Health Protection No. 411/1995 provides for in the art. 20(1) "...the right of citizens of the Republic of Moldova to receive timely and quality medical care..." (16).

The Institute of Medicine has identified 6 dimensions for assessing the quality of health care: safety, effectiveness, patient-centredness, timeliness, efficiency and equity (17). Other dimensions are: access, acceptability and continuity, although there is some overlap between the dimensions.

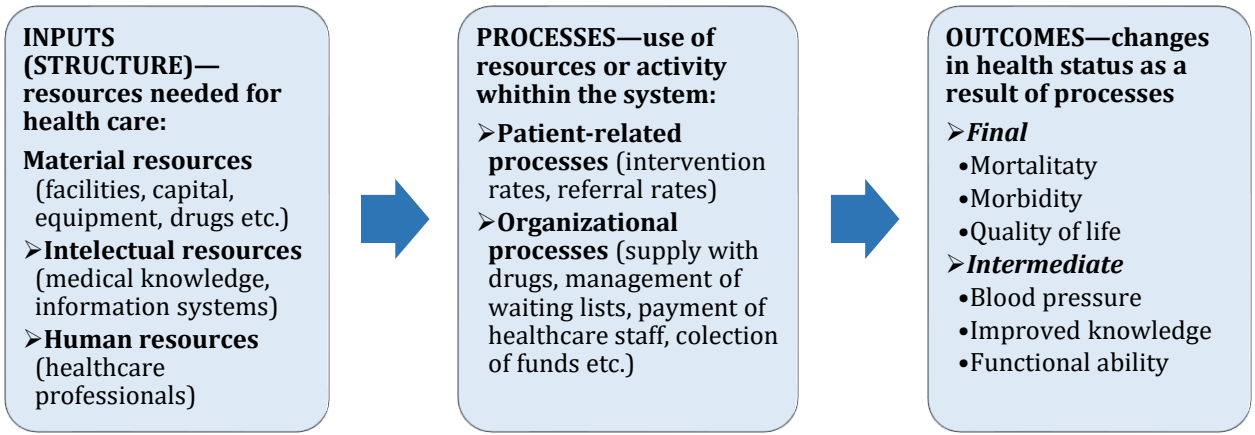


Figure 31. **Donabedian's Health Care Triad**

Source: (3)

Safety is the delivery of health care that minimizes risk and harm to service users. Overuse, underuse and misuse of antibiotics and other prescription medicines contribute to increased antimicrobial resistance and unnecessary costs.

Examples of indicators: mean volume of antibiotics, opioids and long-term prescriptions of anticoagulants.

Effectiveness is the extent to which a health service achieves desired outcomes or effects at the patient or population level. Effectiveness is about providing evidence-based health services.

Examples of indicators:

- *Effectiveness of the primary health care*: avoidable hospital admissions due to asthma, COPD, congestive heart failure and diabetes. Hospital admissions for such conditions may indicate quality problems in primary health care.
- *Effectiveness of the preventive care*: screening for cervical cancer. Cervical cancer is the most common cancer in women and one of the leading causes of cancer death in women. Early screening is essential to identify cases, allowing treatment to start at an early stage of the disease.
- *Effectiveness of acute health care/secondary/hospital*: 30-day mortality rates after a heart attack or stroke.

Patient-centredness is the delivery of health care that takes into account the preferences and aspirations of patients and their families.

Examples of indicators: percentage of hospitalized patients who said they were sufficiently involved in decisions about their care, level of satisfaction with the health worker.

Timeliness refers to the extent to which patients receive the care they need in a timely manner. Timely means reducing waiting times and sometimes damaging delays.

Examples of indicators: waiting time for general practitioner consultation, waiting time for cataract surgery.

Efficiency means providing health care in a way that maximizes the use of resources and avoids waste.

Examples of indicators: average length of hospital stay, mean number of bed-days per year.

Equity is the extent to which the delivery of health care does not vary in quality because of the personal characteristics of the recipient, such as gender, race, ethnicity, geographic location or socioeconomic status.

Access is the extent to which services are available and accessible in a timely manner without compromising financial protection (affordable). Access can be physical, financial or psychological and includes the a priori availability of health services (e.g., distance to health facility, transport, organizational factors such as work schedule, ethnic and religious preferences).

Examples of indicators: Population coverage with health services. The share of the population receiving a basic set of health services provides a first measure of access to health services and financial protection.

Continuity refers to the extent to which a patient's health care is coordinated over time between providers and institutions.

5.7. Health System Performance

Health system performance has often been defined as the extent to which health systems meet their overall objectives. The performance frameworks divide the overall objectives of the health system into two broad categories: final objectives and intermediate objectives, which are essential for achieving the final objectives and link the functioning of the health system to outcomes (*Figure 32*) (61).

The following intermediate objectives of the health system are distinguished: access, coverage, efficiency, equity, quality and sustainability, which are used to evaluate the performance of the health system. These objectives also represent the performance criteria of the service delivery function and therefore coincide with the areas of service delivery evaluation.

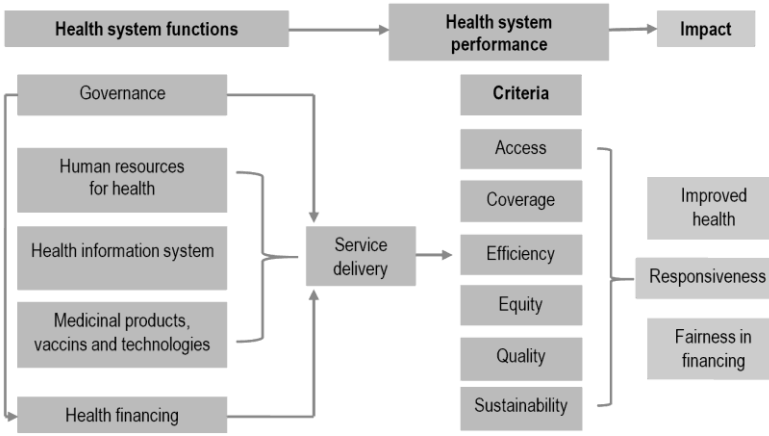


Figure 32. **Health System Performance Criteria**

Source: (61)

Sustainability. A sustainable health system is an organized health system that ensures that the health needs of the current population are met without compromising the environmental, economic and social resources of future generations. Sustainable health care means understanding that our health and the health of the environment around us are inextricably linked, and acting in ways that support the health of both people and the planet.

Review Exercises

1. Select the characteristics of health systems:
   a) Pluralistic
   b) Responsive to the expectations of the population
   c) Dynamic
   d) Standardised
   e) Complex

2. Select the objectives of the health system:
   a) Service delivery
   b) Equity of financial contribution
   c) Financing

d) Responsiveness to population expectations
e) Dynamic development

3. Select the main actors in the health system:
a) Ministry of Health
b) Private drug distributors
c) Patients' association
d) Association of biology teachers
e) NGOs protecting the interests of tenants

4. Choose the principles of health policy:
a) Equity
b) Transparency
c) Efficiency
d) Accountability
e) Participation

5. Select the main mechanisms for financing health systems:
a) Taxation
b) Purchasing
c) Compulsory social insurance
d) Revenue collection
e) Contracting

6. Select payment methods for health services:
a) Per hospital
b) Per capita
c) Per service provider
d) Per case treated
e) Per health worker

7. Select the components of health care according to Donabedian:
a) Management
b) Processes
c) Patients
d) Outcomes
e) Inputs

8. Complete the table below, indicating the type of health care quality indicators.

No.	Name of the indicator	Input	Process	Outcome (intermediate)	Outcome (final)
1.	Use of electronic medical records				
2.	Physician/patient ratio				
3.	Percentage of exclusively breastfeed infants until the age of six months				
4.	Prevalence of current tobacco users				
5.	Percentage of children vaccinated against measles				
6.	Managing the waiting list of patients registered for cataract surgery				
7.	Percentage of women screened for cervical cancer				
8.	Percentage of people with hypertension who had their blood pressure controlled				
9.	The percentage of patient who died as a result of surgery				
10.	The rate of hospital-acquired infections				

Review Questions

1. Give the WHO definition of a health system.
2. What are the common characteristics of health systems?
3. What are the objectives of a health system?
4. What are the functions of a health system?
5. What does health system governance mean?
6. What are the components of health system governance?
7. Name the three categories of health system actors. Give examples of each category.
8. What are the principles of health system governance?
9. What characterizes the "resource generation" function of the health system?
10. What are the characteristics of the health information system?
11. What is health expenditure?
12. What indicators are used to measure health expenditure?
13. What are the components of the health system financing function?
14. What is revenue collection? Give examples of sources of financing, collection mechanisms and institutions responsible for revenue collection.
15. Give the characteristic of financing health systems through taxation.
16. What is the difference between direct and indirect taxation?
17. Give the characteristics of social health insurance.
18. Give the characteristics of private health insurance.
19. Give the characteristic of out-of-pocket payments for health services.
20. What does pooling of resources mean?
21. What are the characteristics of purchasing health services?
22. What is universal health coverage?
23. What are the payment mechanisms for services? Characterize each mechanism.

24. Give the characteristics, advantages and disadvantages of the tax-based health system.
25. Give the characteristics, advantages and disadvantages of the social health insurance model.
26. Give the characteristics, advantages and disadvantages of the private health insurance model.
27. Define health services.
28. How are health services classified by the WHO?
29. What are the components of the "service delivery" function?
30. What is primary health care?
31. What is specialized healthcare?
32. Define the quality of health services.
33. Characterize the quality of health services using Donabedian's triad.
34. What are the dimensions of health care quality?
35. What does health system performance mean?

6. HEALTH POLICY. MONITORING AND EVALUATION

6.1. Health Policy

6.1.1. Defining Public Policy

Public policy is a set of actions the government takes to approach a problem that affects the society. Longest (2006) defined public policy as "officially adopted legislative, executive or judicial decisions that are intended to direct or influence the actions, behaviour or decisions of others" (18). Health policy includes the decisions made by the government in the area of health.

The World Health Organization has defined **health policy** as "an agreement or consensus on health problems, the priority goals and objectives to be addressed, and the main directions for achieving them" (56). Health policy aims to improve the health status of the population. Policy decisions in one sector interact with those in other sectors. For example, "Environment and health" or "Road safety and health".

6.1.2. Public Health versus Health Policy

Health policy and public health are related concepts, but they differ in focus and scope (*Table 22*).

Public health is the science and practice of preventing disease, promoting and protecting the health of populations. It encompasses a wide range of activities aimed at improving the health of the population.

Health policy encompasses decisions and actions taken to achieve specific health goals within a society.

Health policy focuses on the development, implementation, and evaluation of public policies, such as strategies, laws, and regulations, funding priorities and guidelines that govern health systems, health service delivery, and influence population health and health equity.

Table 22. **Public Health versus Health Policy**

Criteria	Public Health	Health policy
Definition:	Uses evidence-based interventions to help people live safer and healthier lives.	Includes policies, laws and regulations to promote health and prevent disease.
Focus:	Population health improvement.	Specific health objectives.
Scope:	Health promotion, health protection and disease prevention.	Development, implementation and evaluation of health policy.
Relationship between them:	Public health activities inform and drive health policy.	Health policy provides the structure and resources needed to implement public health initiatives.
Examples:	Vaccination or screening programmes, health education campaigns, disease surveillance, initiatives to promote fruit and vegetable consumption, initiatives to reduce salt consumption.	Coverage of the population by health insurance, regulation of health service providers, health financing, access to health services, quality of health services, tobacco and alcohol control legislation.

In fact, public health is a broader field and includes health policy as one of its components. Public health and health policy work together to achieve similar objectives: to protect and improve the health and well-being of the population. Public health activities inform and drive health policy, while health policy provides the structure and resources necessary to implement public health initiatives. This collaboration is essential to address current public health challenges and to promote the health and well-being of the population.

6.2. Health Planning

6.2.1. Key Concepts

The purpose of health policy is to facilitate governance. The **policy process**, or **health planning**, is described as the process of assessing the overall health needs of the population and determining how these needs can be effectively met by allocating the necessary resources.

Planning is a method of ensuring the efficient use of current and anticipated future resources to achieve explicit objectives. It also involves organizing and preparing the interventions needed to achieve these objectives.

Health policy goes beyond "health care" and covers the broad public health agenda, including disaster preparedness, risk management and the International Health Regulations (60), action on the social determinants of health, and the interaction between the health sector and other sectors of society.

Planning is a management function aimed at managers at different levels and at all health workers.

6.2.2. Types of Planning

Three types of planning are commonly used in the health sector:

- Medium or long-term planning, mainly used for strategic orientation and called **strategic planning**;
- Short-term planning, used to guide the implementation of strategic documents, called **operational planning**;
- **Ad hoc or contingency planning**, which is necessary in situations with unpredictable developments (e.g., COVID-19).

Strategic planning is the process of determining the actions to be taken by the health sector in the future and how these actions will be carried out to achieve the desired results. Strategic planning differs from operational planning in the following ways:

- Focuses on the medium term (3-5 years, the programme) or long term (5-10 years, the strategy);
- Aims at a comprehensive "whole system" perspective (strategy) or a sub-domain (programme);
- Addresses the integration of the health system into the external environment that may affect the system in the long term.

Strategic planning aims to comprehensively identify, sequence and synchronize medium- to long-term interventions for the health sector. This planning must guide the activities and investments needed to achieve the desired results and impact.

Strategic planning in the health sector is complex and covers the following areas:

- Delivery of comprehensive health services, including personal and population-based, clinical and non-clinical services;
- Financing and generating resources to enable the delivery of health services;
- Governance of health systems;
- Health research;
- The overall development of the health system;
- Health reforms (institutional, organizational and administrative, including decentralization);
- Cooperation with other sectors.

Strategic planning includes:

- Sequencing and synchronizing interventions;
- Assignment of overall responsibilities;
- Linking interventions to resource allocation (for activities and investments);
- The establishment of a sectoral monitoring and evaluation system to measure the implementation of public policies, their effectiveness, outcomes and impact;

- Adjustments to the strategic document during its implementation, if appropriate.

Strategic planning focuses on priority areas and interventions and is directly linked to situation analysis, costing and budgeting. The strategy is the reference document against which all subsequent activities in the health sector are assessed, guided and reviewed.

In the Republic of Moldova, the strategy and the programme are considered strategic planning documents (9). **The strategy** defines the vision and general objectives or development directions of the health system and is a long-term public policy document (5-10 years). For example, the National Health Strategy "Health 2030" (11). **The programme** defines the general and specific objectives in a sub-domain and is a medium-term document (3-5 years). For example, the National Programme for the Prevention and Control of Priority Noncommunicable Diseases in the Republic of Moldova 2023-2027 (10).

The three categories of health governance actors have specific roles in the strategic planning process.

The Ministry of Health centrally coordinates and leads the development of the national health strategic planning document and is responsible for informing, training and guiding stakeholders through all stages of the planning process.

The essential role of the population is to provide feedback and evidence on the pressing health priorities addressed in the strategic planning process.

Health service providers have an important role to play in providing information and evidence for agenda setting, implementation and monitoring of the health strategic planning document. Their contribution, together with that of the population, is therefore crucial.

The issues highlighted in the strategic planning document will be central to the policy dialogue at all stages of the planning process.

Policy dialogue is the set of formal and informal exchanges and consultations aimed at facilitating policy change, influencing policy development and promoting subsequent decision-making processes. It uses "whole of government" and "whole of society" approaches and aims to ensure the participation of all three categories of health system stakeholders, including service providers and the population, in decision making, monitoring and evaluation.

Strategic planning follows the priority setting phase and precedes operational planning. A strategy defines the vision and development directions of the health sector, while an operational plan describes in detail how the strategy will be achieved (*Table 23*).

Operational planning (strategy or programme implementation plan) is the link between the objectives of the strategic document and the implementation of activities. This type of planning is done after the strategic document has been developed, budgeted and approved. Operational planning translates the strategic document into actionable tasks; it identifies the activities that need to be carried out to achieve the objectives of the strategic document.

The operational plan is a short-term plan covering periods of up to one year, usually referred to as the annual operational plan. It determines the day-to-day activities of the institution for which it has been developed.

An operational plan includes:

- A sequential description of the activities for each of the objectives of the strategy or programme;
- Deadlines for each activity;
- The persons responsible for implementation;
- The resources required, including financial resources and sources;
- Monitoring indicators.

Table 23. **Strategic Planning versus Operational Planning**

	Strategic planning	Operational planning
Perspective:	Medium or long-term development.	Short-term interventions.
Focus:	Heath sector strategic directions.	Implementation of concrete activities.
Time frame:	Medium-term (3-5 years) or long-term (6-10 years) documents.	One year or shorter time intervals.
Flexibility:	Changes during implementation are less likely.	It can be easily adapted and modified as circumstances change.

6.2.3. Stages of the Strategic Planning Process

Strategic planning is a cyclical process and consists essentially of four stages: agenda setting, policy formulation, implementation, and monitoring and evaluation (*Figure 33*). This cycle is a continuous process.

Stage 1. Agenda Setting

Phase 1. Situation Analysis and Problem Identification

This phase involves situational analysis activities to identify and define the problems that need to be addressed by a public policy. **A problem** is a perceived gap between the existing situation and the ideal situation in relation to an issue. A public policy problem can be a condition (e.g., disease) or a situation (e.g., inadequate human resources) that creates a need or dissatisfaction that requires government intervention to correct.

Defining the problem correctly and identifying its causes are fundamental elements of successful public policy, and the whole subsequent course of the policy process invariably depends on this moment. Understanding the problem is important for defining options for solving it. Defining the problem incorrectly reduces the chances of solving it.

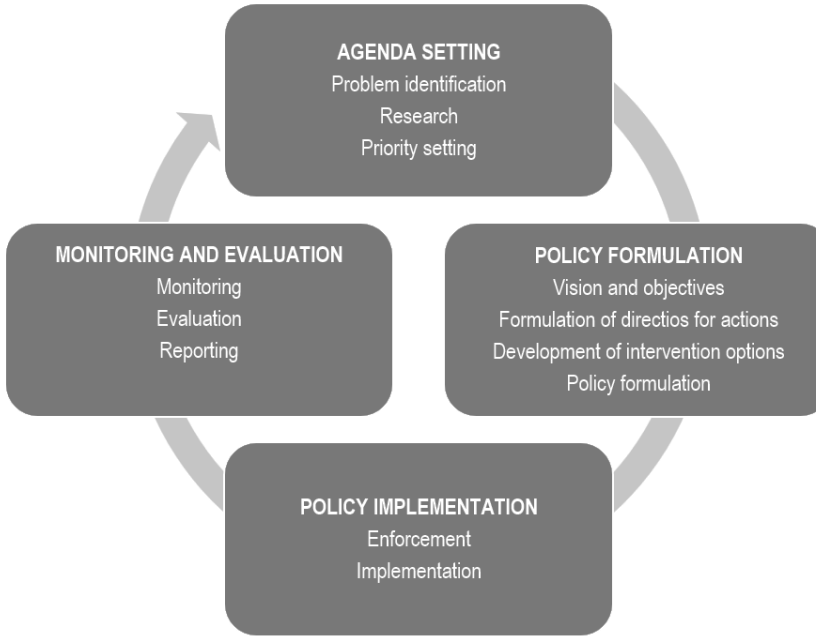


Figure 33. **Stages of Policy Cycle**

A thorough understanding of the situation is essential in order to define strategic development directions/general objectives and specific objectives. Situational analysis has the following objectives:

- To provide a realistic assessment of the current situation of the health sector or sub-sector, with all its strengths and weaknesses, opportunities and threats, including the main causes of problems and their impact;
- To provide an evidence-based basis for responding to the health needs and expectations of the population;
- To provide an evidence-based basis for formulating future strategic directions/general objectives for the health sector and specific objectives for a sub-sector.

The situation analysis usually brings together the three categories of governance actors: government, service providers and the population.

Analysis of the situation includes:

- Analysis of data on the population health status and the performance of the health system;
- Analysis of the implementation of activities, budgets and finances in the health sector;
- Analysis of the effectiveness of the areas of action in the strategic document.

Research plays an important role in analyzing the situation and defining the problem. This involves collecting and analyzing existing data and evidence on the problem, its causes and effects, and making the case for intervention. For this purpose, relevant data from the health information system, other statistical data, the results of research on the problem, its causes and context, carried out at international, regional, national or local level, can be analyzed.

The situation analysis includes a description of the population's health problems in terms of: groups of the population affected, disaggregated according to various characteristics of interest (gender, age, ethnicity, socioeconomic status, area of residence, geographical area, etc.); causes or factors influencing the health problem; possible risks and consequences of not addressing the health problem and the impact on the affected groups; costs of addressing and not addressing the problem; potential stakeholders, etc. An effective situation analysis realistically assesses the current status of the health sector and provides an evidence-based basis for formulating strategic directions for health sector development that better meet the real needs of the population.

An effective situation analysis realistically assesses the current situation of the health sector and provides an evidence-based basis for formulating strategic directions for health sector development to better

meet the real needs of the population. The situation analysis should be published, promoted and widely disseminated to guide stakeholders in the strategic planning process.

Policy dialogue is an effective method of analyzing internal capacities (of the health system, health policy), in the form of strengths and weaknesses, and external developments, in the form of opportunities and threats, their causes and effects. SWOT analysis (*S – strengths, W – weaknesses, O – opportunities, T – threats*) is a popular method used for this purpose (*Table 24*).

Table 24. **SWOT Analysis**

	Definitions	**Examples**
Strengths (*S*)	Factors stimulating health sector performance.	Modern medical equipment, improved drug reimbursement system.
Weaknesses (*W*)	Factors that increase health service costs or reduce quality.	Old buildings of healthcare facilities, fragmentation of the health information system, high proportion of out-of-pocket payments, vulnerability to corruption.
Opportunities (*O*)	New initiatives and growth areas available to the health sector.	New development partners for health programmes, introduction of standard clinical protocols, increased funding for the health sector.
Threats (*T*)	Factors negatively affecting sector performance.	Political or economic instability, funding shortfalls, increase in uninsured population, COVID-19 pandemic.

Phase 2. Priority Setting

Recommendations and findings from the situation analysis need to be prioritized. Prioritization examines the extent to which an important issue identified in the situation analysis can be addressed. In fact, prioritization is used in two different stages of strategic planning:

- *Prioritizing health problems* or health system challenges (stage 1);
- *Prioritizing interventions* to address these problems or challenges (stage 2).

The two types of prioritizations are closely related, but there may be more than one possible solution to a problem. For example, identifying hypertension as a priority health problem is a different decision from examining the different prevention, health promotion and treatment interventions available to control hypertension.

The prioritization or ranking of problems and solutions/ interventions is carried out based on certain *criteria* (data presenting evidence) and involves the participation of the three types of actors of the health system governance. The prioritization process consists of three steps (3 D: data, dialogue, decisions):

Data. By data, we mean the criteria used for prioritization of:

- Problems: burden and equity; and
- Solutions or interventions: effectiveness, cost, acceptability and equity.

Burden: the extent, severity and urgency of the problem are the most relevant criteria for the Ministry of Health and service providers, and the perception of health burden is the most relevant criterion for the population.

The effectiveness of the intervention considers how well, from a clinical or practical point of view, the health problem can be solved in terms of outcome and impact.

The cost of the intervention refers to costs in terms of affordability (How much does the National Health Strategy cost? Can we afford to pay for it?) and efficiency (an assessment of value for money, which must include both cost minimisation and cost-effectiveness).

Acceptability refers to the social and/or cultural acceptability of the intervention.

Fairness refers to the absence of injustice in the setting of priorities.

Policy dialogue (transparency) involves the examination of the list of priorities and the options for joint actions by the three categories of health system actors.

Decision-making involves "hearing the voice" of the population.

Stage 2. Policy Formulation

Phase 1. Setting the Vision and Objectives

Once the agenda has been set, the strategic planning document is prepared. The development of the national health strategy involves establishing the vision and objectives, formulating the directions for action, and disseminating the strategy.

The **vision** is a description of the desired state in the future. For example, the vision of the National Health Strategy "Moldova 2030" is "The population of the Republic of Moldova is healthier as a result of the active contribution of a modern and efficient health system that meets the needs of each individual".

Objectives can be general or specific. The strategy sets general objectives, also called strategic directions. An overall objective is a general statement about an overall outcome that the health system is expected to achieve. For example, an overall objective of the National Health Strategy "Health-2030" is "to reduce the burden of communicable and noncommunicable diseases through disease prevention, health protection and promotion".

The specific objectives are part of the programmes, the medium-term planning documents that ensure the implementation of the strategies. World Health Organization defines the *specific objective* as a statement of a desired future state, condition or goal that a programme aims to achieve (75). For example, if the general objective is to "reduce the burden of communicable and noncommunicable diseases through action to prevent, protect and promote health", a specific objective might be "to reduce the mortality rate from cardiovascular disease in people aged 30-70 years by 30% by 2030".

Like the general objectives, the specific objectives describe the intended results as a result of the implementation of the interventions. The setting of specific objectives is essential for three main reasons:

- The objectives define clearly and precisely what the strategy or programme is intended to achieve;
- The objectives largely determine the main activities to be carried out in the implementation of the strategic planning document;
- The objectives provide the necessary guidance to stakeholders and implementers for the use of appropriate monitoring and evaluation tools.

A specific objective should meet the SMART criteria. Adapted to the context of the programme, a specific objective should be:

- *Specific:* the objective should be precisely formulated and leave no room for interpretation;
- *Measurable:* the objective must quantify the change to be achieved (in the example above, the quantification is "reduction by 30%") in order to demonstrate whether or not the objective has been achieved;
- *Achievable* (*feasible or realistic*): the objective can be achieved with the available resources and implementation capacity and any obstacle can be overcome (the result can be achieved);

- *Relevant:* the objective fits into the general health policy or logically refers to the general objective/strategic direction ("reducing the mortality rate from cardiovascular diseases" is directly related to "reducing the burden of communicable and noncommunicable diseases through actions to prevent diseases, protection and promotion of health, improvement of maternal health");
- *Time-bound:* the objective should be achieved within the estimated timeframe ("by 2030").

Therefore, general objectives and specific objectives set the standards against which the current state of the problem will be compared to evaluate the performance of the strategic planning document. Without clear overall objectives and specific objectives, the strategic planning document cannot be effectively implemented and will result in messy and unnecessary activities.

Phase 2. Formulation of the Directions for Action

Directions for action are defined for each general and specific objective. For example, for the general objective of the National Health Strategy "Moldova 2030" "to reduce the burden of communicable and non-communicable diseases through disease prevention, health protection and health promotion", a direction of actions is "to consolidate the normative framework and implement effective programmes for the control of behavioural risk factors (tobacco use, alcohol use, unhealthy diet, physical inactivity) and measures for the prevention of noncommunicable diseases, including screening and early detection, especially among men and adolescents".

Phase 3. Development of Intervention Options

Once the objectives and directions for action have been established, the existing scientific evidence (at international, regional, national or local

level) on intervention options (possible solutions) is analyzed and evaluated. **An option** is an identified set of possible actions that, if taken, will solve the problem and achieve the policy objective. The identified intervention options are prioritized according to the criteria mentioned above.

Cost-benefit analysis and cost-effectiveness analysis can be used as analytical techniques for evaluating options and making decisions. They assess the justification of the cost of an option (action) to achieve the expected results and impacts.

Cost-benefit analysis (CBA) estimates the impact of implementing options. The aim of CBA is to identify and quantify (in monetary terms) all the possible impacts (positive and negative) of the option in order to determine the corresponding costs and benefits.

$$\text{CBA} = \text{Benefits} - \text{Costs}$$

Cost-effectiveness analysis (CEA) compares the costs per unit of benefit for different options and answers the question of which option should be pursued to maximize outcomes. Cost-effectiveness analysis estimates inputs in monetary terms and outputs in quantitative non-monetary terms (e.g., DALYs saved).

$$\text{CEA} = \frac{Costs}{Effects\ (lives\ saved)}$$

Figure 34 shows the cost-effectiveness of tobacco control interventions in the Republic of Moldova, expressed in MDL per year of healthy life year saved (DALY averted) (42). Tax increase is the most cost-effective intervention among the options analysed, with one year of healthy life saved costing 863 MDL.

Cost-benefit analysis and cost-effectiveness analysis are used to:

- Inform decisions about the most efficient allocation of resources;
- Identify the most cost-effective interventions.

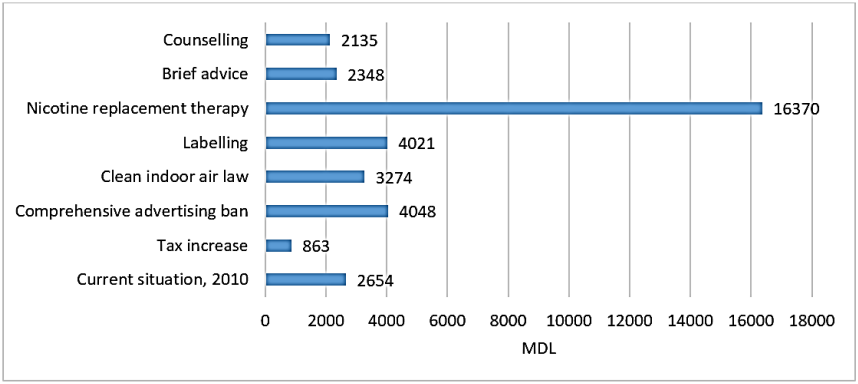


Figure 34. **Cost-effectiveness of Tobacco Control Interventions, Republic of Moldova, 2011 (MDL per DALY saved)**

Source: (42)

The decision is made based on the evaluation of alternative options. **A decision** is usually understood as the outcome of the process of choosing between two or more alternative options (courses of action) that can lead to the same objective. The whole process of reaching this conclusion is known as the "**decision-making process**".

The prioritization of intervention options is followed by a SWOT analysis of their implementation.

Phase 4. Cost Estimation

The cost estimate of the strategic planning document serves to determine the financial resource needs for the planned activities. Estimated costs should be compared with projected available financial resources to assess affordability and possible resource shortfalls. "**Costing**" is the process of identifying the resources, in monetary terms, required for the realization of an option (action).

Connection with MTBF. The medium-term budgetary framework (MTBF) is a comprehensive government-wide expenditure plan that links public policy priorities and the allocation of financial

resources/spending within a fiscal framework (linked to macroeconomic and revenue forecasts), usually for a three-year advance planning period. Medium-term budgeting helps to link revenue forecasts, sectoral allocations and health policy priorities and to strengthen the overall quality and credibility of annual budget packages.

Phase 5. Stakeholder Consultation

Selected intervention options should be consulted with stakeholders, including at cross-sectoral level. Consultation facilitates the subsequent implementation of interventions as well as monitoring and evaluation.

Phase 6. Public Policy Formulation

Once the options have been selected and decisions have been made, the public policy document is formulated.

The strategy defines the vision, the directions of development of the health system and the impact of public policy, and identifies monitoring and evaluation indicators, implementation risks, responsible institutions and reporting procedures. A strategy describes principles, addresses the problem and its causes, and is broadly applicable. It rarely changes in response to the emergence of new problems, changes in relationships, or changes in institutional mission or philosophy.

The programme addresses the problem and the causes of the problem, but has a narrower application, a subfield. It defines the general and specific objectives, expected results and impacts, monitoring targets and indicators, implementation costs, risks in the implementation process, responsible institutions and reporting, monitoring and evaluation procedures.

The finalized strategic planning document follows the approval and dissemination procedure. In the Republic of Moldova, national strategic planning documents are published in the Official Monitor of the Republic of Moldova and placed on the website of the State Register of Legal Documents: www.legis.md.

Stage 3. Implementation

Implementation is the stage of the public policy process during which:

- The options identified as most appropriate are legislated;
- The necessary resources are mobilized and action plans are put into practice, leading to the achievement of the objectives set and, ultimately, to the resolution of the problem;
- Monitoring and evaluation activities are carried out throughout the implementation process, using a set of defined indicators.

Operational planning is a tool for implementing strategic planning documents.

The plan sets out the actions to be taken to implement the strategy or program and is called an action plan. It addresses the way of creating the public policy document. The plan establishes the actions to be carried out for each of the objectives, the deadlines, the responsible institutions, the necessary budget and the monitoring indicators.

Actions in the action plan involving regulation are developed and adopted in the form of laws or other types of normative acts, after which they are enforced. Carrying out other types of actions than those involving regulation, requires the development of appropriate procedures to guide the routine performance of activities.

Procedures are designed to facilitate the day-to-day implementation of the plan. A procedure describes the process in detail, giving details of the persons responsible for implementation, the deadlines and the method of implementation. The procedure has a narrow application and changes frequently in response to the operational needs of the institution.

Stakeholders may be involved in implementation or enforcement.

Stage 4. Monitoring and Evaluation

Monitoring and evaluation are essential management tools to ensure that health interventions are implemented as planned and to assess the

achievement of set objectives. Monitoring and evaluation run simultaneously with the implementation of public policies. Monitoring assesses progress in the implementation of activities and evaluation measures the achievement of objectives.

6.3. Monitoring and Evaluation in the Health Sector

6.3.1. Key Concepts

Monitoring and evaluation are essential components of:

- Public policy documents;
- Health systems.

They provide the framework for informing decision-making and for improving the quality, efficiency and effectiveness of public policies, health services and their responsiveness to the health needs of the population. Monitoring and evaluation provide the three categories of health system actors with the opportunity to learn from past experience, to improve service delivery, planning and resource allocation, and to demonstrate results as part of accountability to stakeholders.

Monitoring refers to the continuous tracking of the implementation of planned actions, the systematic and routine collection of information to measure progress towards objectives (targets) over a given period of time and to identify deviations. Monitoring uses a set of indicators and targets linked to the strategic directions and main objectives of the health sector. Monitoring involves comparing the activities actually carried out and the results actually achieved with those planned. For example, monitoring may show that the number of people being screened for cervical cancer is decreasing or increasing compared to what was planned. Monitoring may also provide information on the reporting of unusual or increased events, such as increased cases of a particular disease, which require action. The monitoring plan is part of the action plan.

Monitoring determines the efficiency of the programme. Efficiency is usually measured by the ratio of activities to inputs (maximization of outputs, outputs in relation to resources invested).

Evaluation periodically determines the degree of achievement of objectives and the impact of the public policy document or health system. It determines the effectiveness of the public policy or health system. Effectiveness is measured by the relationship between outputs and inputs (the relationship between the objective of the result obtained and the objective to be achieved). Evaluation is usually carried out by external evaluators (*Table 25*).

Evaluation quantifies the results achieved after the implementation of interventions and provides the basis for the next cycle of public health policy.

Table 25. **Monitoring versus Evaluation**

Monitoring	Evaluation
Ongoing: daily.	Periodic: at the end of the milestones (usually at the end of a funding cycle).
Produces progress reports.	Provides an in-depth analysis of the achievement of objectives.
Focuses on actions and outputs.	Focuses on outcomes and impact.
Alerts management to identified problems.	Provides management with policy options.
Measures programme efficiency (ratio of activities to inputs).	Measures programme effectiveness (ratio of output to inputs).
Self-assessment.	Self-assessment and external analysis.

6.3.2. The Importance of Monitoring and Evaluation

Monitoring and evaluation are essential to:

- Track the progress and performance of strategic planning documents and the national health system;
- Country monitoring provides data and information for regional and global monitoring of priority health issues. For example, WHO Member States have agreed on a global *100 Core Health Indicators* (20) and hundreds of other indicators covering a wide range of health and disease programmes, which have

been prioritized to monitor progress. The Republic of Moldova monitors the achievement of these indicators and reports on progress at the regional and global levels;

- Reporting on progress towards achieving the 13 targets related to Sustainable Development Goal (SDG) 3.8 "*Ensuring healthy lives and promoting well-being for all at all ages"*;
- Monitoring health inequities (according to various characterristics, including demographics (age, gender), socioeconomic status (wealth, education), geographical distribution and other characteristics (migration, minorities, etc.);
- Ensuring the functioning of surveillance mechanisms for the detection, reporting and response to specific events (e.g., COVID-19);
- Monitoring, evaluation and review are necessary for accountability, and accountability is necessary for policy dialogue.

6.3.3. Logical Framework for the Monitoring and Evaluation Process

The logical framework of the monitoring and evaluation process is shown in *Figure 35*. It includes: the areas for which data are collected; data sources and tools used for data collection; data analysis and synthesis procedures; and procedures for communicating and using data for evidence-based decision making. Monitoring and evaluation cover *four domains of indicators*: (a) input and processes; (b) outputs; (c) outcomes; and (d) impact (62).

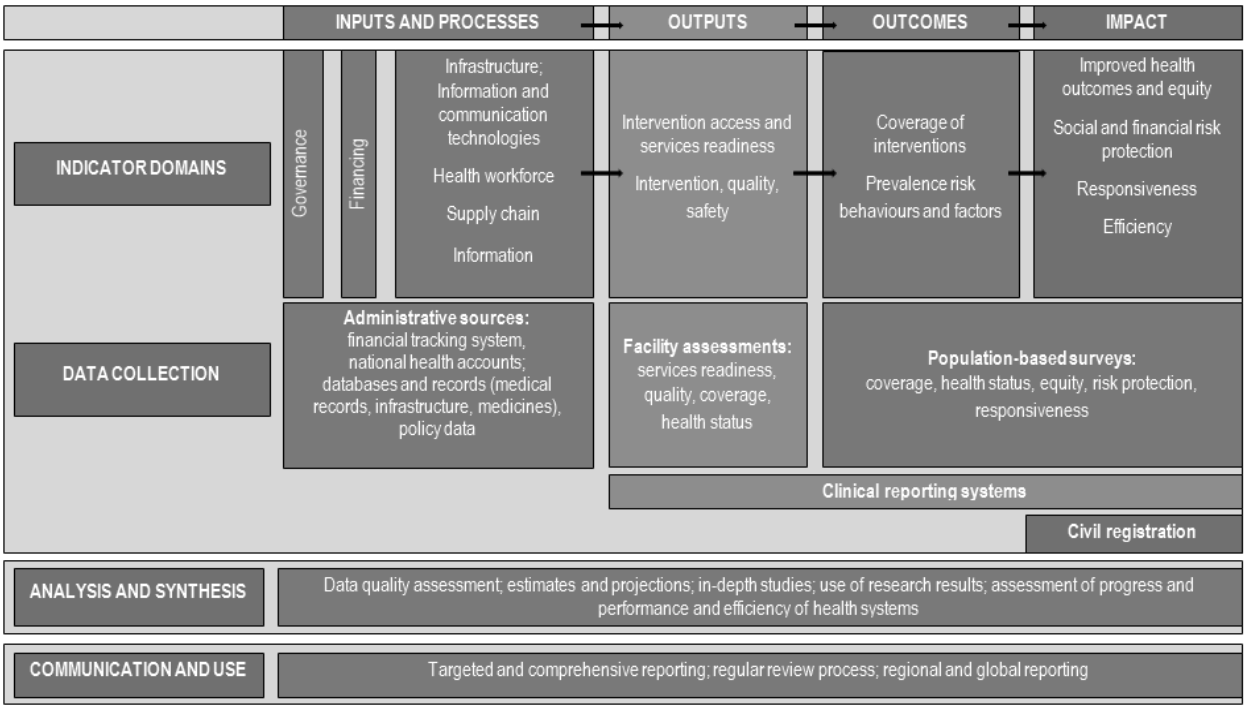


Figure 35. **Health System Monitoring and Evaluation Logical Framework**

Source: (62)

6.3.3.A. Domains of Indicators

a) **Input indicators** (resource) relate to infrastructure, information and communication technology, health workforce, medicines, supplies, utilities, financing and governance.

Examples: health workforce density and distribution (SDG 3.c.1), current health expenditure as a percentage of GDP, hospital bed density, existence of a national health strategy.

Process indicators measure a programme's activities and outputs (direct products or deliverables/results of activities). Together, measures of activities and outputs indicate whether the programme is being implemented as planned.

Examples: training health workers, building a health facility, registering births and deaths.

b) **Output indicators** relate to access to and availability of services, quality of services and patient safety.

Examples: access to essential drugs (SDG 3.b.3), perioperative mortality rate, in-hospital maternal mortality rate, tuberculosis notification rate, antiretroviral treatment retention rate.

c) **Outcome indicators** measure the results (effects or changes) expected in the short and medium term as a result of the implementation of public policies. They relate to the coverage of interventions, the prevalence of behaviours and the prevalence of health risk factors.

Examples: the rate of exclusive breastfeeding up to 6 months of age, the rate of immunisation coverage, the prevalence of tobacco use, the rate of contraceptive use, the proportion of hypertensive patients who have their blood pressure under control.

d) **Impact indicators** measure the ultimate goals/objectives of the health system: the health of the population, financial protection, responsiveness to non-medical expectations of patients and the

efficiency of the health system or the long-term effects of public health policies.

Examples: life expectancy at birth, maternal mortality (SDG 3.1.1), premature mortality from noncommunicable diseases (SDG 3.4.1), cardiovascular disease mortality, diabetes prevalence, out-of-pocket payments (65).

6.3.3.B. Data Collection

Data sources may include:

- Administrative sources: national health accounts; databases and records on infrastructure, medicines, medical records, etc.; health policy data;
- Data resulting from the evaluation of health facilities: availability and quality of health services, coverage of health services, population health status;
- Studies carried out at population level on the service coverage, population health status, equity, protection against social and financial risks, responsiveness of the health system to the non-medical expectations of the population;
- The reporting/notification systems of health-care facilities;
- The civil registration system.

Data collection tools are essential tools for effectively collecting, managing and analyzing data. Tools may include: questionnaires, interviews, focus group discussions, observations, case studies, mobile data collection applications, routine data from medical and health facilities, other documents and records. Tools will be selected according to the specific objectives and requirements of the public policy document and the scope of the monitoring and evaluation activities.

6.3.3.C. Data Analysis and Synthesis

Data analysis and synthesis includes data quality assessment, estimates and projections, in-depth studies, use of research data, and evaluation of health system progress, performance and efficiency.

The quality of data collected for monitoring and evaluation is crucial. Data are reported according to generally accepted quality procedures. The quality of the data and the indicators derived from them should meet certain general criteria, such as relevance, scientific soundness and applicability of the indicators to users (*Table 26*).

Identifying and accounting for errors due to incomplete reporting, inaccuracies or lack of representativeness is essential and greatly enhances the credibility of the results. This involves the following steps:

- Assessment of the completeness of reporting by healthcare facilities and other institutions;
- Assessing the accuracy of the sub-national denominators of the population (estimated annually by the National Bureau of Statistics based on the census data);
- The accuracy of coverage estimates based on reported data;
- The systematic analysis of the values of the indicators coming from facilities and household surveys;
- Adjustments to the values of the indicators, using transparent and well-documented methods.

Data quality assessment and adjustment should be carried out regularly and the results of these assessments should be made public. The monitoring and evaluation component of the public policy or health system should address this issue and identify the institutions responsible for the data quality assessment and adjustment process.

Table 26. **General Criteria for Indicators**

General criteria	Characteristics
Relevance:	- Indicator is related to a specific issue of concern; - Indicator is health-related and linked to factors that have an influence to health; - Indicator is sensitive to changes in the situation in question; - Indicator give an early warning of pending changes.
Scientific soundness:	- Indicator is free of or minimises biases and confounding factors and is representative of the conditions in question; - Indicator is scientifically credible, reliable and valid. It is generated based on standardised protocols and procedures; - Indicator is based on the best available data of acceptable quality; - Indicator is robust and unaffected by minor changes in the method or scale used in its construction; - Indicator is consistent and comparable over time and space.
Applicability to users:	- Indicator is relevant to policy and management needs; - Indicator is based on data that are available or can be collected or monitored with a reasonable financial/time input; - Indicator is easily understood and applied by potential users; - Indicator is acceptable to stakeholders; - Indicator is available when needed.

6.3.3.D. Data Communication

Data should be transformed into relevant information to facilitate evidence-based decision making. This involves communicating and disseminating statistics in a format and language accessible to key decision-makers. Information is used at different levels of the health system for health service delivery, health system management, resource allocation, planning, advocacy and policy development. Information is

used by a wide range of users, each with different technical perspectives, vocabularies and communication methods. Dissemination needs to take into account the needs of different users and identify the most effective ways and channels of communication.

The timing of information dissemination must be planned to match planning cycles and user needs. The dynamic links between demand, supply and quality of information must encourage a culture of information seeking and the promotion of information use. Some of the most effective mechanisms involve linking data and information to the actual allocation of resources (budgeting) and the development of indicator-based planning.

6.3.3.E. Data Use

Adopting a health policy document means making evidence-based decisions to provide effective health services to all citizens with the limited resources available. **Evidence-informed decision making** means a systematic and transparent approach that applies structured and replicable methods to identify, appraise and make use of evidence across decision-making processes, including for implementation. This requires a coordinated effort by data producers and users at all levels of the health system.

The availability of good quality data or statistical indicators enables health planners, managers and providers at all levels of the health system to make evidence-based decisions. At higher levels, aggregated data are needed for the development of strategic policy documents and resource allocation. Improving the relationship between data quality and, implicitly, statistics, data demand and data use creates a cycle that can contribute to improving health policy documents.

The use of health data to inform decisions and actions to improve the quality of health services and to meet performance targets is also a key element of health system accountability.

Review Exercises

1. Determine the type of planning.

Policy document	Strategic planning	Operational planning	Ad-hoc planning
1. National programme on prevention and control of priority noncommuni-cable diseases 2023-2017			
2. Preparedness and response plan for COVID-19 infection			
3. National health strategy "Health – 2030"			
4. The action plan of the National Programme on Cancer Control 2016-2025 for 2024.			

2. Select the specific components for the two types of planning.

Characteristics	Strategic planning	Operational planning
1. Vision		
2. Strategic direction		
3. Specific objective		
4. Deadline		
5. Direction of action		
6. Financing sources		
7. Measures of impact		
8. Indicators of monitoring		
9. Indicators of evaluation		
10. Cost		

3. Which of the following are defined as health policy?

a) Laws adopted by the Parliament

b) A set of pathways for moving patients through the health system

c) Actions formulated to address challenges related to health issues

d) The process of decentralisation of health care
e) Job description of a health professional

4. What are the most common health policy development activities, in the order in which they are carried out?
a) analysis, planning, implementation and evaluation
b) development, evaluation, assessment, commitment and appraisal
c) analysis, interpretation, integration and classification
d) evaluation, grading, delivery and inspection
e) monitoring, classification, standardization and evaluation

5. Find at the following email address:
https://iris.who.int/bitstream/handle/10665/94384/9789241506236_eng.pdf?sequence=1
WHO Global Action Plan for the Prevention and Control of Noncommunicable diseases 2013-2020. Familiarise yourself with this Plan and answer the following questions.
a) What health problems have been identified?
b) What is the vision of this Plan?
c) What are the objectives of the Plan?
d) What policy options are recommended to Member States for each objective?

Review Questions

1. Give the definition of health policy.
2. What types of health planning do you know?
3. What is strategic planning?
4. How is strategic planning different from operational planning?
5. Who are the actors in the health policy process?
6. What are the stages of planning?
7. Describe each stage of the planning process.
8. What is SWOT analysis in the health policy process?
9. What are the criteria for prioritizing health problems?
10. What are the criteria for prioritizing problem-solving interventions?
11. What is a SMART objective?
12. What analytical techniques are used to evaluate intervention options?
13. What is monitoring?
14. What is evaluation?
15. What is the difference between monitoring and evaluation?
16. What is the importance of monitoring and evaluation?
17. Give examples of monitoring indicators.
18. Give examples of evaluation indicators.
19. What is data quality in the context of monitoring and evaluation?
20. What are the purposes of using monitoring and evaluation data?

REFERENCES

1. Dahlgren G, Whitehead M. The Dahlgren-Whitehead model of health determinants: 30 years on and still chasing rainbows. Public Health 2021; 199: 20–24.
2. Detels R et al. Oxford textbook of Global Public Health. Oxford textbook, 2015.
3. Donabedian A. Twenty years of research on the quality of medical care: 1964-1984. Eval. Health Prof. 1985;8(3):243-265.
4. Eisenberg L. Does social medicine still matter in an era of molecular medicine? Journal of Urban Health, 1999, 2, vol. 76, pg. 164-175.
5. European Core Health Indicators. Available at: https://health.ec.europa.eu/indicators-and-data/european-core-health-indicators-echi_en.
6. Eurostat. Preventable and treatable mortality statistics. Statistics Explained. Eurostat, 2020.
7. Hobson, William. What is Social Medicine? Br Med J,1994, vol. 2, pg. 125-30.
8. Hotărârea Guvernului nr. 1291 din 2 decembrie 2016 cu privire la aprobarea Programului național de control al cancerului pentru anii 2016-2025. Available at: https://www.legis.md/cautare/getResults?doc_id=96628&lang=ro
9. Hotărârea Guvernului nr. 386 din 17 iunie 2020 Cu privire la planificarea strategică. Available at: https://www.legis.md/cautare/getResults?doc_id=145294&lang=ro.
10. Hotărârea Guvernului nr. 129 din 15 martie 2023 cu privire la aprobarea Programului național de prevenire și control al bolilor netransmisibile prioritare în Republica Moldova pentru anii 2023-2027. Available at: https://www.legis.md/cautare/getResults?doc_id=136642&lang=ro.
11. Hotărârea Guvernului nr. 387 din 14 iunie 2023 cu privire la aprobarea Strategiei naționale de sănătate „Sănătatea 2030”. Available at: https://www.legis.md/cautare/getResults?doc_id=138493&lang=ro.
12. Hotărârea Guvernului nr. 874 din 23.12.2024 cu privire la Programul unic al asigurării obligatorii de asistență medicală. Available at: https://www.legis.md/cautare/getResults?doc_id=146494&lang=ro.
13. Indicator 3.b.3: Proportion of health facilities that have a core set of relevant essential medicines available and affordable on a

sustainable basis. Available at: https://unstats.un.org/sdgs/metadata/files/Metadata-03-0B-03.pdf.
14. Lange, KW. Rudolf Virchow, poverty and global health: from “politics as medicine on a grand scale” to “health in all policies”. Global Health Journal, 2021, vol. 5, pg. 149-154. ISSN: 2414-6447.
15. Last MJ. A Dictionary of Epidemiology. Oxford University Press, USA, 220 p.
16. Legea ocrotirii sănătății nr. 411 din 28.03.1995. Available at: https://www.legis.md/cautare/getResults?doc_id=142787&lang=ro#.
17. Lohr KN (ed). Medicare: a strategy for quality assurance. Washington DC: Institute of Medicine/National Academy Press, 1990.
18. Longest BB. Health Policymaking in the United States. 4th ed. Chicago, IL: Health Administration Press; 2006.
19. Lopez AD, Mathers CD, Ezzati M, et al. Measuring the Global Burden of Disease and Risk Factors, 1990–2001. In: Lopez AD, Mathers CD, Ezzati M, et al., editors. Global Burden of Disease and Risk Factors. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2006. Chapter 1. Available at: https://www.ncbi.nlm.nih.gov/books/NBK11817/ Co-published by Oxford University Press, New York.
20. Maximova K, Loyola EE, Rippin H et al. Exploring educational inequalities in hypertention control, salt knowledge and awareness, and patient advice: insights from the WHO STEPS survey of adults from nine Eastern European and Central Asian countries. In: Public Health Nutrition. 2023;26(S1):s20-s31. doi:10.1017/S1368980023000356.
21. Mosialos E., Dixon A., Figueras J., Kutzin J. Funding health care: options for Europe. European Observatory on Health Systems and Policies. World Health Organization. 2002, 327 p. ISBN 0 335 20924 6. Available at: https://eurohealthobservatory.who.int/docs/librariesprovider3/studies---external/funding-health-care.pdf?sfvrsn=ec926603_3&download=true.
22. Murray CJL, Frenk J. A framework for assessing the performance of health systems. In: Bulletin of the World Health Organization, 2000, 78 (6). Available at: https://iris.who.int/bitstream/handle/10665/268164/PMC2560787.pdf?sequence=1&isAllowed=y.

23. Murray CJL, Salomon JA, Mathers C, Lopez AD. Summary Measures of Population Health: Concepts, Ethics; Measurements and Application. World Health Organization, Geneva, 2002. ISBN 92 4 154551 8. 799 p. Available at: https://iris.who.int/bitstream/handle/10665/42439/9241545518.pdf.
24. National Bureau of Statistics of the Republic of Moldova. Available at: https://statistica.gov.md/ro.
25. Omran AR. The epidemiologic transition: a theory of epidemiology of population change. Milbank Meml Fund Q, 1971, vol. 49, pg. 509-538.
26. Ordinul Ministerului Sănătății nr. 1033 din 11.11.2021 Cu privire la aprobarea Listei Naționale a Medicamentelor Esențiale. Available at: https://www.legis.md/cautare/getResults?doc_id=128625&lang=ro.
27. Ordinul comun al Ministerului Sănătății și Companiei Naționale de Asigurări în Medicină nr. 1070/283-A din 23 decembrie 2024 privind aprobarea criteriilor de contractare a prestatorilor de servicii medicale în sistemul asigurării obligatorii de asistență medicală pentru anul 2025 și modalității de facturare și achitare a serviciilor medicale acordate. Available at: http://cnam.md/wp-content/uploads/2025/01/283-A-1070-23.12.2024_.pdf?x35461.
28. Ordinul comun al Ministerului Sănătății și Companiei Naționale de Asigurări în Medicină nr. 1089/288 din 23 decembrie 2024 privind aprobarea Normelor metodologice de aplicare a Programului unic al asigurării obligatorii de asistență medicală. Available at: https://www.legis.md/cautare/getResults?doc_id=146939&lang=ro.
29. Pan American Health Organization Health Indicators. Conceptual and operational considerations. Washington, D.C.: PAHO; 2018.
30. Penina O, Mesle F, Vallin J. Mortality trends by causes of deat in the Republic of Moldova. Chisinau, 2022. CEP Medicina, 277 p. ISBN 978-9975-82-233-6.
31. Penina O. Regional mortality disparities in the Republic of Moldova. Chișinău, 2022. CEP Medicina, 116 p. ISBN 978-9975-82-234-3.
32. Raevschi E. Mortalitatea cardiovasculară prematură în Republica Moldova. Chișinău, 2017. Tipogr. „Elan Poligraf", 162 p. ISBN 978-9975-66-571-1.
33. Rogado J, Pangua C, Serrano-Montero G et al. Covid-19 and lung cancer: A greater fatality rate? Lung Cancer. 2020 Aug;146:19-22. doi: 10.1016/j.lungcan.2020.05.034.

34. Rose G. Strategy of Preventive Medicine. Oxford, UK: Oxford University Press; 1992.
35. Rosen G. What Is Social Medicine? A Genetic Analysis of Concept. 1947, vol. 21.
36. Rosen G. Poverty and Health. American Journal of Public Health, 1969.
37. Schneider, Jane-Mary. Introduction to Public Health, 3rd edition. 2011.
38. Standardul de calificare: Medicină. Ordinul Ministerul Educației, Culturii și Cercetării nr. 516/2020. Available at: https://mecc.gov.md/sites/default/files/sc_7_cncrm_medicina.pdf
39. Standardul de calificare: Asistență medicală generală. Ordinul Ministerul Educației, Culturii și Cercetării nr. 516/2020. Available at: https://mecc.gov.md/sites/default/files/sc_6_cncrm_asistenta_medicala_generala.pdf.
40. STEPS: prevalence of noncommunicable disease risk factors in the Republic of Moldova, 2021. Copenhagen: WHO Regional Bureau for Europe; 2022. Available at: https://iris.who.int/bitstream/handle/10665/365274/WHO-EURO-2022-6785-46551-67555-eng.pdf?sequence=1.
41. Thacker SB, Birkhead GS. Surveillance. In: Gregg, MB, ed. Field epidemiology. Oxford, England: Oxford University Press; 2008.
42. Țurcanu Gh, Obreja G, Șalaru I. Costs, effects and cost-effectiveness of tobacco control strategies in the Republic of Moldova. World Health Organization, 2011.
43. Universal Declaration of Human Rights. 1948. Available at: https://www.un.org/en/about-us/universal-declaration-of-human-rights.
44. United Nations. Principles and recommendations for population and housing censuses. 2008. ISBN 978211561593. DOI: https://doi.org/10.18356/be1ae14b-en.
45. United Nations Development Programme. The SDGs in Action. Goal 3. Good Health and well-being. Available at: https://www.undp.org/sustainable-development-goals/good-health.
46. UNFPA. The demographic transition. In: PAPP101-S01: Demography on the world stage. Available at: http://papp.iussp.org/sessions/papp101_s01/PAPP101_s01_090_010.html.
47. Vieira da Silva, LM. Jules Guerin and social Medicine in 1848. Journal of Medical Biography, 2024, no.1, vol. 32, pg. 96-102.

48. Washington Group on Disability Statistics. Available at: https://www.washingtongroup-disability.com/.
49. Wilson IB, Clearly PD. Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. JAMA. 1995;273(1):59-65. doi:10.1001/jama.1995.03520250075037.
50. Winkelmann J, Panteli D, Blümel M, and Busse R. Universal health coverage and the role of evidence-based approaches in benefit basket decisions. In: Eurohealth, 2018, Vol. 24, No. 2.
51. Winslow, CEA. The united field of public health. Mod Med 1920;2:183-91.
52. WHOQOL group. Development of the WHOQOL: rationale and current status. The International Journal of Mental Health, 1994, vol. 23. 0020-7411.
53. WHOQOL-100, Field Trial. The 100 questions with response scales. Geneva: World Health Organization. Division of Mental Health, 1995.
54. World Health Organization. Regional Office for Europe. Declaration of Alma Ata. 1978. WHO/EURO:1978-3938-43697-61471.
55. World Health Organization. Ottawa Charter for Health Promotion. Geneva, 1986.
56. World Health Organization. Health21. The health for all policy framework for the WHO European Region. Copenhagen, 1999. ISBN 92 890 13494. Available at: https://iris.who.int/handle/10665/272657.
57. World Health Organization. The World Health Report 2000. Health Systems: Improving Performance. Geneva, 2000. ISBN 924156198x. Available at: https://www.who.int/publications/i/item/924156198X.
58. World Health Organization. International classification of functioning, disability and health, WHA-21. 2001. Available at: https://www.who.int/standards/classifications/international-classification-of-functioning-disability-and-health.
59. World Health Organization. The World Health Report 2003: Shaping the Future. ISBN 92 4 156243 9. Available at: https://iris.who.int/bitstream/handle/10665/42789/9241562439.pdf;jse.
60. World Health Organization. International Health Regulation (2005). Available at: https://www.who.int/health-topics/international-health-regulations#tab=tab_1.

61. World Health Organization. Everybody's business: strengthening health systems to improve health outcomes: WHO's framework for action. 2007.
62. World Health Organization. Monitoring, evaluation and review of national health strategies: a country-led platform for information and accountability. World Health Organization, Geneva, 2011.
63. World Health Organization. Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2030. Available at: https://www.who.int/teams/noncommunicable-diseases/governance/roadmap.
64. 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. Available at: https://www.who.int/publications/m/item/how-to-use-the-icf---a-practical-manual-for-using-the-international-classification-of-functioning-disability-and-health.
65. World Health Organization. Regional Office for Europe. Self-assessment tool for evaluation of essential public health operations in the WHO European Region. Copenhagen, 2015. ISBN 978 92 890 50999.
66. World Health Organization. Global Reference List of 100 Core Health Indicators (plus health-related SDG). Geneva, 2018. Available at: https://www.who.int/publications/i/item/2018-global-reference-list-of-100-core-health-indicators-(-plus-health-related-sdgs).
67. World Health Organization. International Statistical Classification of Diseases and Related Health Problems, ICD-10, version: 2019. Available at: https://www.who.int/standards/classifications/classification-of-diseases.
68. World Health Organization. International Statistical Classification of Diseases and Related Health Problems, ICD-11. 2019. Available at: https://www.who.int/standards/classifications/classification-of-diseases.
69. World Health Organization. Basic documents: forty-ninth edition (including amendments adopted up to 31 May 2019). Geneva; 2020. Available at: https://apps.who.int/gb/bd/pdf_files/BD_49th-en.pdf.
70. World Health Organization. WHO Global Health Expenditure Database. [Interactiv] 2022. Available at:

https://apps.who.int/nha/database/country_profile/Index/en.
71. World Health Organization. Application of the essential public health functions: an integrated and comprehensive approach to public health. Geneva. World Health Organization, 2024.
72. World Health Organization. WHO Quality of Life-BREF (WHOQOL-BREF). Available at: https://www.who.int/tools/whoqol/whoqol-bref/docs/default-source/publishing-policies/whoqol-bref/english_whoqol_bref.
73. World Health Organization. NCD Global Monitoring Framework. Available at: https://www.who.int/publications/i/item/ncd-surveillance-global-monitoring-framework.
74. World Health Organization. Quality of care. Available at: https://www.who.int/health-topics/quality-of-care#tab=tab_1.
75. World Health Organization. Health Systems Strengthening Glossary. Available at: https://cdn.who.int/media/docs/default-source/documents/health-systems-strengthening-glossary.pdf.