

TEXTBOOK

# MEDICAL REHABILITATION

Edited by

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# Chapter 1

## BASICS OF MEDICAL REHABILITATION

### 1.1. HEALTH AND DISEASE

#### 1.1.1. Basic concepts

Disease and health are two main forms of the vital process. States of health and diseases can pass many times into one another throughout an individual human life. Aristotle regarded health and disease as two qualitatively different categories.

WHO defines **health** not only as the absence of diseases and physical defects, but also as a state of physical, spiritual and social wellbeing. Besides, health should be considered as a multicomponent dynamic process. The following health components can be distinguished.

- **Somatic health** — the current state of organs and systems of the body stemming from the biological program of development, acting through universal basic needs.
- **Physical health** (physical wellbeing) — the optimum level of development of the morpho-functional capabilities of organs and systems, which ensures the following adaptive reactions: — lack of any disturbances in the body build and functioning of the body systems:
  - parameters reflecting the physical efficiency and tolerability to physical loads;
  - active attitude to physical exercises and sports, attentive attitude towards the health, advertency to own well-being.
- **Mental health** — an optimum state of the psychic sphere related to the healthy development of ultimate psychic functions of human. Such a state is driven by the healthy development at all its stages and is determined by both biological and social needs, as well as by the potentials for the personal enhancement.
- **Psychological health** — a whole of human interests, which concerns the potentials for self-fulfillment, display of initiative, and assertiveness.

- **Moral health** — a complex of characteristics of activities of the human being, which are related to the motivational and demand-informative spheres, and which determine its behavior and the statement of values.
- **Reproductive health** — a state of wellbeing in all aspects concerning the functions and processes of the reproductive system.

From the medico-social point of view, health is regarded as:

- individual;
- group-wide;
- regional;
- public (population health, demographic health).

Individual health is assessed by the well-being of a particular person, presence or absence of diseases in the person, by the physical condition and the level of development, which are revealed after respective investigations, by the working ability, individual perception of living, etc. For example, depending on the intensity, the same markers of physical development may be positive, favorable in the general assessment of health, or may be factors of risk in its decay, in the propensity for the progression of a specific disease. Human physical development is closely connected to the **functional state of the body** — another component of health, which is determined by the reserves of its main systems. According to academician N.M. Amosov, the sum of **spare capacities** of the main functional systems determines the amount of health; “total spare capacities” not only characterize the health status, but also determine human attitude to a disease. Spare capacities of the body, being one of the main health indicators, determine the human viability. Their role especially rises in case of change to the external environment, in sub-extreme and extreme situations, upon progression of a specific disease. A comprehensive way to improve the functionality of the body is the **physical load**, which is used to attain the most economical proportions of the body functions, and there arises a possibility to measure the human adaptation material — the total reserve of adaptation and reserve of adaptation to a load.

Currently, health status is taking on new significance; it is regarded as an expression of the human culture and status. It should be noted that the concept of health includes not only lack of physical defects or diseases, but also high physical and mental potentials.

To attain a health status or to maintain it, it is vital that every human develops a **culture of health** which implies theoretical knowledge of the factors favoring to health as well as competent use of the health promotion principles in everyday life.

The following **factors** having the maximum impact on the formation of health culture among people of different age groups are distinguished.

- **Social and cultural.** Among the people of intellectual occupations, there are twice as many of those who go in for health-improvement gymnastics or other physical loads at leisure rather than among unskilled workers or economically inert people (aged over 40–45 years old).
- **Pedagogical** — impact is superimposed upon the image of the “health culture” formed by the cultural and social environment. It is known that effective education in the field of health culture may lead to a change in the mind set, to the adequate assessment and revaluation of negative life values, emergence of the required skills and in the end may form or change not only the behavior but the lifestyle in general.
- **Medico-physiological** — already existing factors, in particular, in aged people, a regimen of motion activity, a daily regimen, sanitary measures, organization of movement education, i.e. human experience in the field of health culture and habits.

Many factors influence the level and health status of human:

- biological, psychological properties of the human (inheritance, body build features, etc.);
- natural environmental conditions (climate, flora, fauna, etc.);
- environmental condition;
- social and economic, political conditions active in a given country;
- level of healthcare development, degree of readiness and qualifications of the medical staff.

**Risk factors** can be **primary**, acting initially and promoting health disturbances; **secondary**, which provoke progression of diseases; **tertiary** etc. Distinguished are also **primary grand** risk factors, which include smoking, alcohol abuse, improper feeding, and psycho-emotional stress. **Secondary grand** risk factors include diabetes, arterial hypertension (AH), rheumatism, allergy, immunodeficiency, etc.

Risk factors create an adverse background and thus promote emergence and progression of diseases (Table 1.1).

**Table 1.1.** Grouping of factors, which govern health and risks

| Factor, which determines health<br>(specific weight, %) | Group of risk factors                                                                                                                                                                                            |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lifestyle (49–53)                                       | Smoking, intake of alcohol, drugs, imbalanced nutrition, stress, hypodynamia, poor living conditions, abuse of medications, loneliness, low cultural level, low education level, high level of urbanization, etc |
| Genetics, human biology (18–22)                         | Predisposition to hereditary, degenerative diseases                                                                                                                                                              |

End of table 1.1

| Factor, which determines health<br>(specific weight, %) | Group of risk factors                                                                                                                                                                                          |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ambient environment (17–20)                             | Pollution of air and water with carcinogens and other hazardous substances, pollution of soil; sharp changes to atmospheric phenomena; enhanced helio-space, radiation-induced, magnetic, and other radiations |
| Public health service (8–10)                            | Inefficiency of preventive arrangements, poor quality, restricted availability, and untimeliness in rendering medical aid                                                                                      |

The theory of risk factors in conditionality of deviations from health made it possible to put forward the concept of *health promotion* consisting of the two phases:

- phases of clearing, reduction in the action of risk factors;
- phases of health promotion, health generation (in fact, *promotion*).

The second phase is much more difficult to implement because it is truly **preventive**, it is based on prevention of risk factors and direct causes of diseases, and moreover, it is a phase of development, strengthening of health in healthy people, referred to as **sanogenesis** (Table 1.2)

**Table 1.2.** Health formation stages (Yu.P. Lisitsyn, 1988)

| Phase I<br>(clearing risk factors)                                                                                                    | Phase II<br>(formation of health factors)                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Low social and medical activity.<br>Low general and hygienic culture                                                                  | High social and medical activity.<br>High level of general and hygienic culture, social optimism                                                             |
| Low labor activity.<br>Dissatisfaction with work.<br>Psychoemotional stress.<br>Inaction, apathy, mental discomfort, depression, etc. | High labor activity.<br>Satisfaction with work.<br>Physical and mental comfort. Harmonious development of physical, mental, and intellectual abilities, etc. |
| Environmental pollution.<br>Low environmental activity                                                                                | Environment enhancement. High environmental activity, environmental competent behavior                                                                       |
| Low physical activity, hypodynamia                                                                                                    | High physical activity                                                                                                                                       |
| Irrational, imbalanced nutrition                                                                                                      | Rational, balanced nutrition                                                                                                                                 |

*End of table 1.2*

| Phase I<br>(clearing risk factors)                     | Phase II<br>(formation of health factors)            |
|--------------------------------------------------------|------------------------------------------------------|
| Alcohol abuse, smoking, use of drugs, toxic substances | Lack of bad habits                                   |
| Tension of family relations, daily life dependency     | Amicable family relations, well-developed daily life |

Health and disease, being a process of adaptation, are essentially different in that in the former case adaptation is implemented within the reaction norm, and in the latter case — with the reaction norm narrowed. Differences are more related to the numerical criterion. For example, presence of good health does not exclude any defect in the body, and vice versa.

**Pre-existing disease** — a latent (hidden) period of a disease, or a stage of functional readiness of the body for progression of a certain disease. The onset of a disease expresses the process of primary impact by pathogenic causes upon the body and its protective reactions. Protective reactions in many cases may bring an end to the emergence of disturbances and not allow progression of clinical signs of a disease. The initial period on different types of a disease may be very short (for example, a mechanical injury, acute poisoning) or very long (metabolic diseases, tumors). However, for most of the currently known diseases the time of onset and duration of a pre-existing disease is difficult to determine. It may change individually within the same disease (for example, hypertension disease, myocardial infarction — MI), in case of some viral diseases, varying within a wide range.

The word “disease” originally implied “pain” or “sickness”. R. Virchow (1821–1902) is the author of the most concise of the known definitions of a disease, which is “life under abnormal conditions”. The primary and main process in the progression of each disease is damage, disorganization of body structures and functions; all the reactive, protective, and adaptive processes are secondary and develop following the damage as a result of any specific pathogenic impact upon the body.

Distinguished are external and internal causes of diseases:

- **external causes** — mechanical, physical, chemical, biological and social factors;
- **internal causes** — heredity, build, age, and gender.

It should be noted that formation of internal causes in the evolution process during develops also in close interaction with the ambient environment.

Each disease progresses during some time (greater or smaller). Some diseases proceed quite rapidly, other diseases progress slowly. The following three stages in the progression of a disease are distinguished.

- **Onset of a disease** — latent period in the progression of a disease (pre-existing disease).
- **Stage of disease itself.**
- **Outcome of disease** — recuperation (complete and incomplete); disease protraction or transition to a chronic form; lethal outcome.

**Recuperation** — a process of restoration of the broken functions of a sick body and its adaptation to existence in the ambient environment. The main criterion of recuperation for a human as a social being is return to work activities. Recuperation in this meaning is referred to as **rehabilitation** (from Latin *re* — again, *abilitas* — suitability). At the same time, it means both return of a comeback to the former work activity and professional conversion of the person in view of the change in health status.

Recuperation is distinguished as follows:

- **complete** — no traces of those disturbances present during a disease are left;
- **incomplete** — there are traces of a disease in the form of varying degree of disordered functions in certain organs and their regulation.

One of the manifestations of incomplete recuperation is **recurrence** (return) of a disease.

**Mechanisms of recuperation** can be represented as follows:

- urgent, unsteady, “emergency” protective and compensatory processes or reactions (seconds, minutes);
- relatively steady protective and compensatory mechanisms of moderate duration (the adaptation phase as per Selye, “a fixation phase” according to A.I. Strukov);
- prolong and steady protective and compensatory processes (months, years).

**Improvement of organism** in the evidence-based medicine assumes a complex of measures aimed at the increase in the level of human physical fitness using exercises, motion activity, tempering procedures, alternation of active and passive rest, and rational nutrition.

**Adaptation** — means habituation of organism to the continuously changing conditions of existence in an external environment elaborated in the process of evolutionary development. Without adaptation, it would be impossible to maintain normal human life and habituation to various factors of the external environmental — climatic and temperature-related, to hypoxia, impact of infectious agents upon the body, etc.

**Disadaptation** — some disturbance of adaptation, habituation of the body to continuously changing conditions of external and internal environment, i.e., the condition of a dynamic discrepancy between a living organism and external environment, leading to the disturbance of physiological functioning, changes in the forms of behavior, and progression of pathological processes.

For example, breach of the principles of sports training resulting in the inadequacy of physical loads to the functional state of the body is fraught with the same consequences, which are regarded as adaptation through a disease. In view of this, one can assume that the disease as a result of adaptation progresses in those cases when separate elements of the health structure turn out to be invalid, biologically unreliable against the irritant force (be it an external or internal irritant — a virus, a microbe, intoxication, etc.). In particular, this refers to the **reserves of the body**, a level of nonspecific resistance, and immune defense. Most remarkably, that is manifested in the progression of the so-called **diseases of civilization**, which arise owing to the breach of the principles of a healthful lifestyle. So, chronic imbalanced motion and nutrition (overeating in the setting of hypokinesia), decrease in muscular efforts (hypodynamia) will sooner or later result in the disturbance of physical development, detraining of the cardiovascular system, decrease in the working capacity, the rise of the symptoms of circulatory inefficiency while performing physical, and then any professional burdens. It becomes evident that the health promotion of persons of various ages is possible only owing to the change of life habits.

The human life habit and behavior aimed at health maintenance and favorably affecting health can be called a **healthy life habit**. This concept includes all elements of the activity aimed at protection, improvement and strengthening of health. The purpose of a healthy life habit, according to the definition given by WHO is the reduction of risk of progression of serious diseases or premature death.

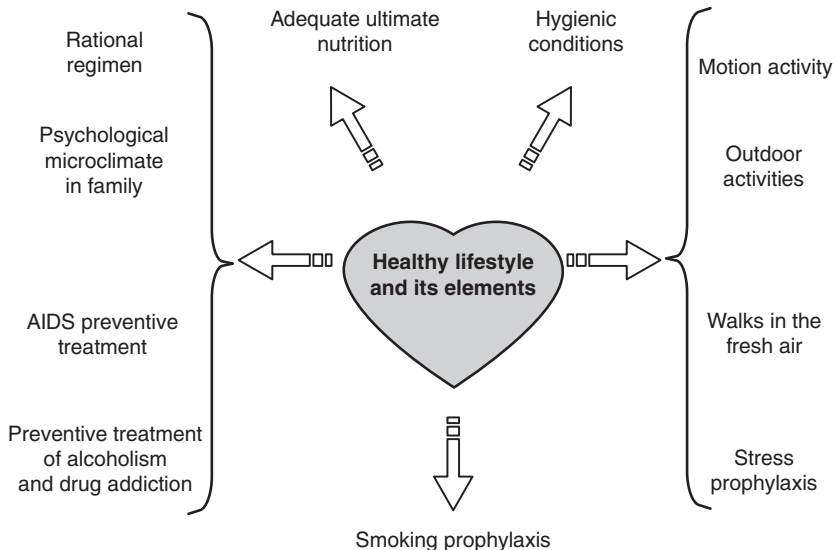
The major factors of a life habit affecting human health are presented in Fig. 1.1.

Among the life habit factors, the following are referred to as the main ones.

- **Physical activity**, according to WHO data, promotes physical, psychic, and social health, as well as improves the quality of life of elderly people. Physical activity should be regarded as an indispensable element in the prevention of chronic diseases, as well as a basis of a healthy life habit.
- **Nutrition**. Presently, the connection between nutritional factors (especially low consumption of fruit and vegetables) with the progression of cardiovascular and oncological diseases has been proved.

- **Bad habits.** Owing to smoking cessation, revision of nutrition regimen, and increase in the level of physical activity, it is possible to prevent, for example, at least 75% of cases of coronary heart disease (CHD).

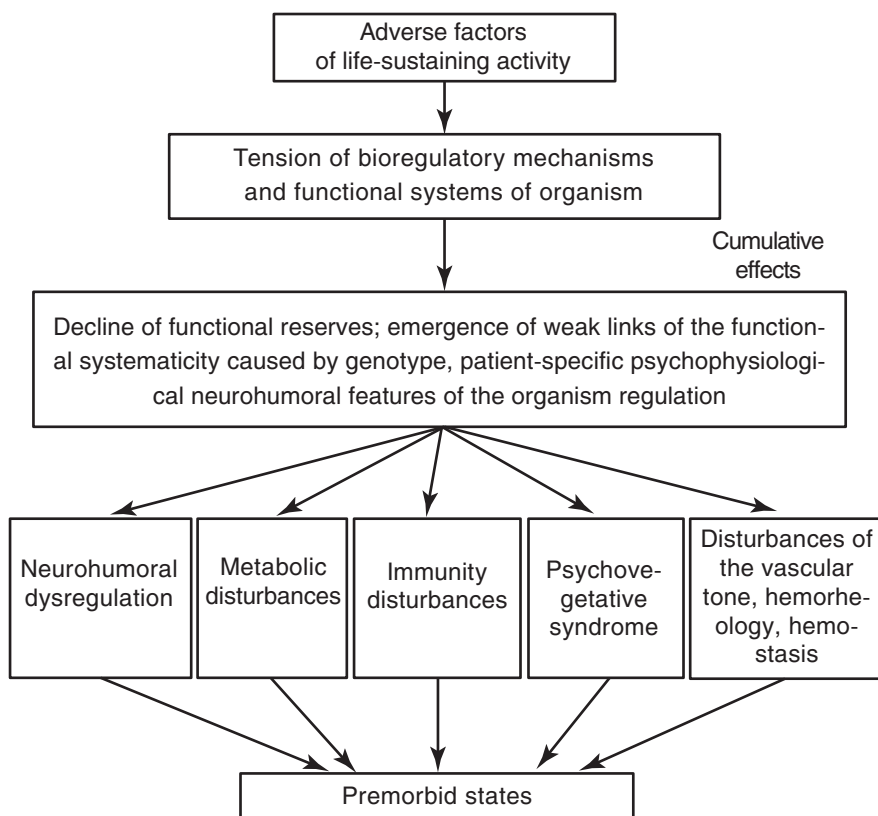
**Stress.** It is known that stress is related to a high predisposition to CHD, a hypertensive state, etc. (Fig. 1.2).



**Fig. 1.1.** Basic lifestyle factors influencing person's health (according to A.N. Razumov)

The following life habit factors for the adult population are referred to as the main ones:

- education level;
- life stance;
- conformity of a work position and place to the education level;
- occupational activity;
- staff morale at the workplace;
- physical and psychological state;
- physical activity;
- the moral and psychological situation in the family.



**Fig. 1.2.** Emergence of health disturbances in case of stress stimulations (according to A.N. Razumov, V.I. Pokrovsky)

By the health level, all the population can be distributed into the following main groups.

- First group — healthy people.
- Second group — almost healthy people having risk factors.
- Third group — patients at the compensation stage.
- Fourth group — patients at the decompensation stage.

Among the **factors of healthy life habits**, it is quite difficult to distinguish the main and minor ones as they can produce the desired health-improving effect, form and develop human health only in the complex. Nevertheless, one cannot help distinguishing such a factor of life habit as human **physical activity**, the customary motion regimen, whose specific features substantially influence

health (namely, the level and harmony of physical development, the functional state of the body), and whose specificities allow judging about the moral, willed and value-based/motivational mindsets.

### 1.1.2. Health promotion aids

#### Active motion regimen

People who do not have chronic diseases are advised to practice aerobic activity (walking, jogging, swimming, physical exercises in the daily regimen). At the same time, it is important to watch the **heart rate (HR)** prior to the start (at rest) and during the performance of exercises. An admissible increase in HR is no more than 70% (for example, if at rest the HR was 70 beats per minute, while during the exercises, it should not exceed 120 per minute).

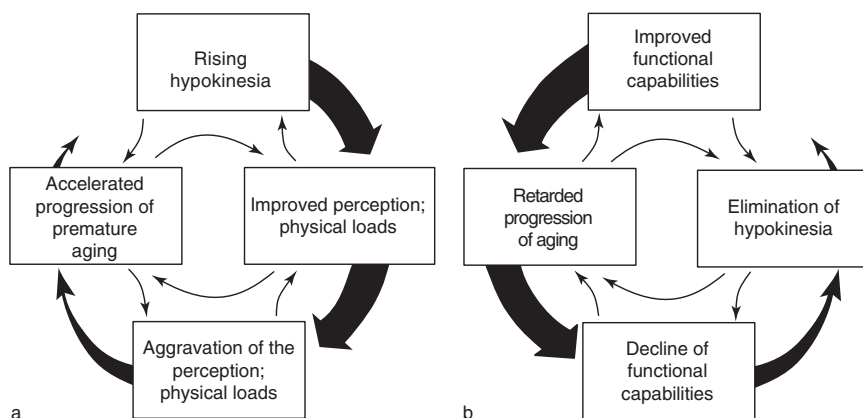
#### Physical exercises

Physical exercises are necessary for the development and normal functioning of the body throughout the lifetime. There are three main types of regular exercises done in the motion activity regimen, which help maintain a high physical fitness:

- **aerobic** — for the development of endurance, improvement of the functioning of the cardiovascular system and respiratory organs;
- **back limber exercises** — are done to preserve and maintain the correct posture and mobility in the spine and joints of limbs;
- **power exercises** — are done to train specific muscle groups; they help perform daily work, avoid traumatism and overfatigue.

The “protective” influence of physical exercises in conformity to modern outlooks should be regarded as a manifestation of the important health-improving effect — recovery of deficit of the vital influences of motion activity. In the conditions of hypodynamia (decrease in the motion activity, for example, as a result of a disease, life habit, etc.), a one-of-a-kind vicious circle is formed: motor impairment results in the decay of metabolism processes and energy, which, in turn, becomes a prerequisite of decrease in the functional abilities of the body and accelerated aging.

The next link of progressing changes becomes the deterioration in the ability to perceive physical loads and bear their impact. This, in extent, reduces the feasibility of performing physical loads and naturally results in motor impairment (Fig. 1.3).



**Fig. 1.3.** Vicious circle of motor impairment (a) and positive changes in the body occurring upon exclusion of hypokinesia (b) of the body and, above all, the most vital ones — cardiovascular and respiratory.

## Jogging

Jogging is referred to natural motions of a cyclic pattern (i.e., when actions identical in structure repeat stereotypically). Such motions are most useful to the body; they occur in conditions favorable for respiration and blood circulation. Owing to that, the human is able to perform quite a prolonged work that perfectly trains and develops the functional systems.

## Walking and jogging

Walking and jogging are classic examples of cyclical muscular activity, which has some special features from the physiological viewpoint. By the mechanism of chain reflexes, each elementary motion being part of the cycle is dependent on the previous motion and determines the subsequent motions. Successive cycles are interlinked in the same way — the end of one cycle prepares and launches the beginning of another one, which ensures that one cycle comes after another. The following **types of walking** are distinguished.

- **Regular walking** — improves metabolism, normalizes cardiac function, enhances blood circulation, lung ventilation, and is still one of the most affordable means of health promotion.
- **Accelerated walking** — improves muscles, develops stamina, persistence, and other volitional powers.