CONTENTS

Chapter 8

HEALTH CARE FACILITY HYGIENE

8.1. MAIN OBJECTIVES OF HOSPITAL HYGIENE. HYGIENIC REQUIREMENTS FOR ACCOMMODATION, PLANNING AND SANITARY-TECHNICAL IMPROVEMENT OF HOSPITALS

Hospital hygiene develops standards and requirements for the placement, planning and sanitary-technical support of medical facilities with the aim of creating optimal conditions for patients' staying, effective treatment process and favorable working conditions for medical personnel.

A modern hospital is a complex set of buildings providing a wide variety of functions. In recent years, there has been a clear trend towards a complication of the structure and function of hospitals.

The hospital not only provides inpatient medical care to the population, but also carries out specialized advisory activities, as well as carries out preventive measures. Large hospitals (regional, provincial, republican) also carry out organizational and methodological work.

Hence, along with highly qualified and specialized medical activities, the hospital carries out measures to prevent relapse of diseases, organizes preventive monitoring of patients taking into account long-term results of treatment, carries out great work on the examination of disability, rehabilitation treatment, and the return of patients to socially useful work.

There are various health care facilities (HCFs) that solve certain tasks and perform strictly defined functions. These include:

- hospitals of various capacities;
- dispensaries (anti-tuberculosis, dermatovenerological, oncological, neuropsychiatric, etc.);
- outpatient organizations (for example, city, district, dental clinics, medical units, medical health centers at enterprises);

- organizations for the protection of motherhood and childhood (maternity hospitals, childcare facilities, nurseries, orphanages);
- sanatorium and resort organizations;
- ambulance stations;
- sanitary and anti-epidemic organizations (hygiene and epidemiology centers, anti-malarial stations, disinfection stations, etc.).

The functional division of health care facilities in different countries can vary widely.

When developing hygienic requirements for the placement, planning, and sanitary-technical improvement of hospitals, two main points should be taken into account:

- favorable conditions of hospital stay should be created for the patient, a medical and protective regime should be provided, conditions for the prevention of health care-associated infections (HAIs), and the possibility of adverse environmental factors (city noise, toxic atmospheric air substances, etc.) should be excluded;
- hospital organizations — the working environment for medical personnel. The work of medical personnel is specific — a large neuro-emotional stress, night shifts, extreme situations, the use of radioactive substances, X-ray, laser and microwave radiation, ultrasound, various medicines, anesthetics, etc. These features determine the requirements for creating favorable working conditions, eliminating the occurrence of occupational pathology.

Requirements for the Placement of a Hospital in the City

When constructing a hospital, they first of all consider a situational plan, i.e. placement of a hospital in the city, and choose a site for it.

Hospitals can be located on the outskirts of the city and on sites surrounded by urban areas. Somatic hospitals are usually located within settlements, specialized hospitals (psychiatric, tuberculosis, etc.) with long-term treatment of patients should be located in the natural area, among green massifs.

Outpatient organizations should be within walking distance to the public. When placing a hospital within a city building, it is necessary to reduce the building density of the site, freeing up territory for the hospital park. This, in turn, dictates the development of the site by hospital buildings of predominantly high-rise composition.

Hospitals located on the outskirts of the city have a more fragmented composition and a relatively small number of stores, which allows for maximum use of natural factors.

The site for the hospital land plot should be selected taking into account the lines of public passenger transport and city-wide engineering structures

(water supply, sewage) and located in an elevated, dry and well-ventilated area, near green areas.

Medical buildings should be built away from sources of noise and air pollution, industrial enterprises, railways, city highways with heavy traffic, airfields, large sports facilities, municipal facilities for the treatment and disposal of wastewater and solid waste, industrial areas, etc. Between the hospital section and industrial enterprises sanitary protection zones should be located. Hospital buildings should be upwind relative to air polluting facilities.

Hospitals are recommended to be built on well-insulated, dry, elevated areas with a calm relief. The most favorable are gentle slopes facing the south, which provides a natural runoff of atmospheric water and the best conditions for insolation. Lines of communication with the hospital should be convenient, the carriageway should be asphalted in order to reduce noise and vibration from vehicles.

Requirements for the Hospital Land Plot

The most rational is rectangular configuration of the hospital land plot with the aspect ratio 1:2 or 2:3, which allows conveniently placing the hospital building with access roads to them. Medical buildings should be located no closer than 50 m from the red line[1] of the street to reduce city noise. The size of the hospital land plot is determined by the number of beds (table 8.1).

Table 8.1. Land area per 1 hospital bed*

Hospital bed capacity	50	150	300–400	500–600	800	1000
Land area per 1 bed, m^2	300	200	150	100	80	60

* SanPiN 2.1.3.2630-10.

From a hygienic point of view, the most acceptable building area is not more than 15% of the total area which makes it possible, if necessary, to expand the construction of the hospital. At least 60% of the land area should be allocated for green spaces, access roads and footpaths occupy the remaining 40%. In order to create the optimal sanitary, anti-epidemic, medical and protective regime and psychological comfort, several functional zones are distinguished on the hospital territory: medical, non-infectious, pathological anatomical buildings, clinics, outbuildings (utility buildings).

Several access roads are provided in the hospital territory: to the zones of medical buildings, as well as to the pathoanatomical building and to the household zone.

[1] The term «red line» or frontage line refers to the border, which separates the piece of land allotted for house buildings construction, from public areas. On project maps, this line is indicated in red, hence the name comes from.

The distance between infectious, household and somatic buildings should be at least 50 m. The placement of medical buildings is very important from the point of view of aeration and insolation, therefore, the wards' windows of the medical buildings in the middle climatic zone should be oriented to the southeast, in the south climatic zone — to the south or north to protect the wards from overheating. The most unfavorable windows' orientation in these latitudes is the western.

The landscaping zone allows patients to relax in the fresh air and helps create a therapeutic and protective regime. The value of green spaces is great and is determined by their influence on microclimatic environmental conditions. In green areas, a favorable microclimate is preserved both in summer and in winter. In the summer, air temperature, radiation temperatures of the soil, fences, buildings and sidewalks are reduced which is especially important for southern cities. In the landscaping zone, the noise intensity decreases by 30–40% of the original value. The windproof effect of trees extends to a distance equal to their tenfold height.

Vegetation also has an anti-dust effect, both in summer and in winter. Particularly great is the dustproof value of shrubby fences and lawns which clean the air by filtering it. Many species of plants and trees produce phytoncides which have a detrimental effect not only on saprophytic but also on pathogenic microorganisms.

Maximum landscaping of the hospital area with the installation of sites for climatotherapy and physiotherapy exercises is recommended.

In the general plan of hospitals, it is necessary to provide installation of separate sites with green spaces for non-infectious, infectious and children's wards. The layout of the territory of children's hospitals should include walking areas for children in compliance with the principle of group isolation, namely: several sections isolated from each other are specially allocated for walking and recreation for children of different ages from different departments.

Certain sanitary and hygienic requirements are also imposed on the internal layout of hospitals.

Hospital Building Systems

In the hygienic assessment of hospital construction, the rational placement of hospital buildings on the site, which is commonly called the master plan, is of great importance. To a large extent, such plan is determined by the development system.

Currently, there are 3 building systems for hospital complexes: centralized, decentralized (pavilion) and mixed. These terms should be understood conditionally, since there are a number of transitional forms.

At the beginning of the 19th century, hospital organizations built according to the so-called **pavilion system** were developed. Hospitals were built in the form of a complex of small buildings (pavilions) consisting of large halls with two-way lighting, plenty of sun and air. In these hospitals, in addition to the wards, there were also some sanitary and household utility rooms. This type of hospital had enormous advantages over barrack hospitals and has long established itself in the practice of hospital construction. Subsequently, the pavilion system was transformed, it was a separate building, inside which there was a series of wards with a corridor.

The pavilion building system provided prevention of HAIs, low-rise buildings made it possible to actively use the hospital garden for patient walks, and it became easier to create a favorable medical and protective regimen.

Further development of medical science, use of X-ray diagnostics, functional diagnostics, physiotherapy, water and mud therapy and other methods led to the fact that the pavilion development began to slow down the medical diagnostic process. The provision of specialized medical care to patients with territorial separation of departments has become difficult. It was found that it is economically unprofitable to have expensive medical diagnostic equipment in each hospital building whose utilization rate is small.

The next stage of hospital construction was the **centralized development system**. With this development, all the functional units of the hospital — medical departments, a clinic, administrative premises were located in one multi-storey building. It became possible to make more rational use of all treatment and diagnostic rooms, the operating conditions of sanitary-technical devices and equipment were facilitated, the paths of movement of patients and staff were shortened, food was delivered faster from the catering unit to the wards, and construction and maintenance costs were reduced. A significant advantage compared to the pavilion system was also the reduction in the area of the hospital site. The compact layout of the hospital allowed increasing the ratio of green spaces by 1 bed by 20–30%.

However, many departments (polyclinic, administrative premises) in one building created certain difficulties in organizing a medical and protective regimen and prevention of HAIs, and made it difficult to use the hospital garden for patients to walk. The shortcomings of the centralized development system led to the search for new compositional solutions for hospital complexes.

So, a **mixed building system** emerged, in which the reception department and all the main somatic and clinical diagnostic departments (X-ray,

physiotherapy, clinical diagnostic laboratory), the pharmacy are located in the main building, and the polyclinic, maternity, children's, and infectious diseases departments are located in separate buildings which have administrative services and a pathoanatomical department. The mixed building system combines many of the advantages of a decentralized (pavilion) and centralized system and until the1960s; such hospitals with 120–400 beds were in full compliance with the development of medical science and technology and, from a hygienic point of view, created favorable conditions for patients. The main architectural and planning decisions of the hospital made it possible to prevent HAIs and create a medical and protective regimen.

Subsequently, it became possible to build large multidisciplinary hospitals. Mixed development was modernized and became known as the **block system**. In the block system, all departments occupying independent buildings are combined into one common block and are connected by passages. Infectious and radiological departments, as well as support services, were taken to separate buildings. Experience shows that the structure and functions of a hospital should be in unity and close interconnection. A fundamental change in the functions of a hospital inevitably leads to a change in its structure.

The Main Structural Units of the Hospital

Currently, the structure of a modern hospital has ten main departments:

- admission and discharge department;
- ward department;
- diagnostic and treatment departments;
- laboratories;
- central sterilization department;
- pharmacy;
- food service;
- pathoanatomical department;
- administrative service;
- laundry room.

Admission department

One of the most important units of the hospital is the admission department. In the admission department, newly admitted patients are seen and examined, they are distributed according to the nature and severity of the disease, they are sanitized and primary medical documentation is filled in. If necessary, first aid is provided at the admission department, and patients are monitored until the diagnosis is clarified (sedimentary wards). In large hospitals, the admission department includes a resuscitation section

for admission medical care in case of violation of vital functions. In hospitals with 500 beds or more, a diagnostic department is organized as calculated 2–3 beds per 100 hospital beds.

The layout of the admission department should exclude the possibility of cross-infection of patients. Usually, there is a waiting room, an examination room and a room for the sanitary treatment of patients (in large hospitals as a lock). In addition, the admission department includes the lobby-waiting room, reception desk with information desk, doctor's office, toilets for staff and patients, storage rooms for clothes of newly arrived patients, gurneys and cleaning items. Discharge rooms are usually adjacent to the lobby. It is important that the person discharged from the hospital leaves through a separate door, disconnected from the entrance for incoming patients.

In order to prevent HAIs, the emergency wards for children's, obstetric, tuberculosis, infectious, skin and venereal departments should be separated and located in each of these departments. Premises for the reception and discharge of the mentally ill should be independent and located in the department itself.

In a centralized and mixed hospital development system, the emergency room is located in the main building, and in a decentralized system, in the building with the largest number of beds. In all cases, the admission department should be located near the entrance to the hospital. The path of the ambulance from the street to the admission department should be short, not intersect with the internal roads of the hospital land plot. Today, new hospitals provide a ramp for an ambulance with a special vestibule at the entrance to the reception.

Ward Department

The main structural and functional unit of the hospital building is the **ward section** which is an isolated complex of wards, medical and auxiliary and utility rooms, a corridor, and a sanitary unit. The hospital section is provided for patients with homogeneous diseases. The treatment section for 25–30 beds is considered appropriate to ensure favorable staying conditions, successful organization of the treatment process and patient care, maintaining cleanliness and order in the premises. Two treatment sections make up a department with the general staff of medical personnel. In the hospital building, treatment sections occupy about 60% of the area.

The **ward department** is the main functional element of the hospital. The capacity of the department is usually 60 beds, in some cases their number can be increased or slightly reduced. In each ward for adults, 60% of the rooms for 4 beds and 20% of single and double beds are designed.

The sections should be grouped compactly, the service rooms (treatment room, enema room, sanitary facilities, etc.) are separated. The nurse posts should be located so that from the workplace it would be possible to view the corridor and the entrances to all the sections and auxiliary rooms. Food is delivered to the department with a special elevator located in the pantry.

Important elements of the treatment section are corridors and stairs.

Corridors not only connect the rooms, but they represent a convenient auxiliary area. Rather wide (at least 2.4–2.5 m) corridors can be used as canteens, posts for nurses, premise for daytime staying of patients, moreover, their width allows free movement and rotation of the stretcher and gurneys. In addition, the corridors (especially the side ones) serve as additional reservoirs of clean air which is necessary for through ventilation of the wards.

Stairs should also provide free movement of orderlies with a stretcher, convenient turns of the stretcher on the inter-flight platforms. The width of the marches should be at least 1.6–1.8 m.

Single and double corridor wards are distinguished.

Single corridor departments can be with unilateral and bilateral corridor development.

Unilateral corridor system is the earliest system; it was used in pavilion type hospitals with a small number of beds. In such system, the treatment side is oriented to the southern rumbas, the side corridor to the north, it also serves as a reservoir of clean air and is used for daytime staying of patients. The wards have good insolation and active natural ventilation. However, such layout is economically disadvantageous, so a different type of internal layout has emerged — single-corridor with *bilateral location of rooms*. This layout is typical for hospitals in a centralized system, where the department has a central corridor, on both sides of which there are sections and utility rooms. However, through natural ventilation of the sections over here proved to be impossible; artificial ventilation was required. In addition, not all sections have a favorable orientation over the cardinal directions: in sections facing the northern rumbas, conditions are formed that do not meet the hygienic requirements for microclimate and insolation (table 8.2).

Subsequently, as a transitional variant of single-corridor system, a dashed corridor system emerged, i.e. free areas of the corridor were provided which created light breaks (halls), which were used for the daytime staying of patients.

Due to the development of the construction of multi-unit hospitals with the block system and an increase in the number of stores, the need arose for the maximum compactness of the hospital complex in the city. **Two-corridor department** emerged which were located in a high-rise monoblock around the

Table 8.2. Orientation requirements for hospital premises

Premises	To the north of 45° n.l.	45–55° n.l.	To the north of 55° n.l.
Wards	S, SE, E, N*, NE*, NW*	S, SE, E, NE*, NW*	S, SE, SW, NW*, NE*
Operating, resuscitation, sectional rooms	N, NE, NW	N, NE, NW	N, NE, NW E

* It is allowed to orient the windows of wards, if the total number of beds in them does not exceed 10% of the total number of beds in the department.

entire perimeter of the building. The department has two parallel corridors, on the outer sides of which and at the end of the building there are sections. The territory between the two corridors is occupied by auxiliary rooms, doctors' offices, mines for sanitary equipment and transport hubs. The treatment rooms are oriented on three sides of the horizon, but the premises of the central part of the department are poorly ventilated, there is no natural lighting. To create a favorable microclimate and air regime in the premises of such departments, air conditioning, effective artificial lighting with fluorescent lamps is necessary. The expansion of the monoblock buildings made it possible to create a compact two-corridor development of the department, when the sections are oriented towards all directions. A variety of options for such corridor system appeared — T-shaped, angular, polygonal, square, curved, and round. Such departments are compact, have good visibility, are economically viable, but from a hygienic point of view, they are all not without some or other disadvantages. That is unsatisfactory insolation in a number of sections, lack of natural light in rooms located in the center of the department, difficulty of creating a favorable air regime. The elevators in the center of the compartment create additional noise.

To create the most favorable therapeutic and protective regimen, sections with 1–2 beds are most appropriate. Sections for 4 people are convenient for patient care and economically viable. Sanitary design standards divide the treatment sections into 4 groups:

- non-infectious departments for adults including psychiatric;
- children's non-infectious departments;
- infectious departments;
- radiological departments.

Such division was carried out taking into account the specifics of the treatment process (use of radioactive substances), the characteristics of diseases (danger of nosocomial infection) and the age of patients.

The sections are a place for patients for 24-hour stay, so they should have sufficient area and cubic capacity per patient with favorable thermal, air and light conditions. In this regard, the following optimal sizes of the area and cubic capacity of a section are provided for in non-infectious departments: a single-bed section without a gateway — 9 m^2; a single-bed section with a gateway — 12 m^2; in sections with 2 or more beds — 7 m^2 per 1 bed; the height of the sections is not less than 3 m; cubic capacity per 1 bed — at least 20 m^3.

Diagnostic and Treatment Department

The third structural unit of the modern hospital is the diagnostic and treatment department. As mentioned above, this hospital unit is the most mobile and extensive, more often undergoing modernization. The increase in the area of the hospital complex is mainly due to the expansion of this unit, the emergence of new structural units in its composition.

The operating unit is the main structural unit of the diagnostic and treatment department. The layout and operation schedule of the operating unit should provide for maximum aseptics. The surgical suite is a group of rooms designed to provide all surgical services to patients. It includes operating room, rooms for patient's preparation and anesthesia, room for sterile preparation of the surgeon, room for instrument and materials sterilization and storage, room for instrument cleaning. The main condition for placing the operating unit is its reliable isolation from other departments and services of the hospital while maintaining convenient connections with the anesthesiology department, treatment sections of the surgical profile, and the central sterilization department. From this point of view, it is better to select a separate extension or wing of the hospital building for the operating unit. You can also place the operating unit on the top floor of the hospital and necessarily in the dead-end zone (horizontal, vertical). To comply with aseptics in the operating unit, clean and purulent zones are distinguished. The set and layout of rooms for clean and purulent operations are identical. In the layout respect, the premises of the operating unit are conditionally divided into 4 groups depending on the degree of aseptic compliance and protection against HAIs. The most stringent requirements for aseptic treatment are presented to operating rooms followed by preoperative and anesthetic rooms, then rooms for storing blood, equipment and, finally, rooms for staff (protocol, nursing, urgent analysis laboratory) and a «clean area» of sanitary inspection room for staff.

It is advisable to design operating rooms for one operating table with an area of 36–48 m^2 with a room height of at least 3.5 m. Operating rooms intended for demonstration should have viewing galleries, domes, and

television installations. In recent years, in the practice of overseas hospital construction, a tendency has appeared to design windowless operating rooms to protect against noise and dust. However, staff working in such rooms with artificial lighting complain of fatigue and poor health.

The anesthesiology and resuscitation department is provided in multidisciplinary hospitals with a capacity of 500 beds or more. As a rule, in large hospitals, two units are created — for new patients and for patients from theoperating unit and other departments of the hospital. One unit of anesthesiology-resuscitation is located on the first floor at the hospital admission department, the second one is in the unit of diagnostic and treatment departments, closer to the operation unit.

The main structural units of the department are resuscitation room, pre-resuscitation (18 m^2), intensive care units, urgent analysis laboratory (36–48 m^2), rooms for diagnostic and medical equipment and other auxiliary rooms.

When planning the department, everything should be provided for the medical and diagnostic process: supply of oxygen and other therapeutic gases, vacuum, electric current, water to each bed, and the opportunity created to place any equipment near the bed, and a connection with the patient observation center.

The capacity of **the functional diagnostic departments** depends on the total number of beds in a medical institution. In hospitals with 400 beds or more, two departments are arranged: one for the care of patients in the hospital, the other for the outpatient department. The department of functional diagnostics also includes various rooms for conducting special investigation methods, namely: ECG, vector cardiography, xihemotherapy and capillaroscopy, electrokymography, tachoscillography, heart rate monitoring, oscillography and plethysmography, ballistocardiography, rheovasography, myoencephalography, EEG, endoscopic examinations of the stomach, intestines, bronchi, bladder, studies of the main metabolism, examination of the respiratory system, and endocrine system. The diagnostic and treatment process in modern hospitals also provides a variety of X-ray studies.

The **X-ray diagnostic service** of the hospital is organized on the basis of the central X-ray diagnostic department with independent X-ray rooms in some wards (infectious, tuberculosis, emergency rooms, etc.). It is advisable to place the central X-ray department at the border of the hospital and the clinic, on one of the floors of the hospital's diagnostic and treatment building.

In the **rehabilitation treatment department**, all types of therapy are used (electro-, light-, water-, mud-therapy), as well as physical therapy, massage,

mechanical and occupational therapy. In modern hospitals, these departments often occupy a separate building with large premises. The building has a *physiotherapy department* with an office for electric and phototherapy, microwave and ultra high frequency therapy, as well as inhalation; heat treatment room with rooms for thermal procedures, applications of paraffin and ozokerite. In the *hydrotherapy department*, there is a shower room, bathrooms (general, local, subaquatic), underwater massage shower. A mandatory element of such department is a 180 m^2 swimming pool.

Mud therapy is also part of the arsenal of medical and rehabilitation treatment. For mud-therapy procedures, cabins for undressing are arranged, mud-treatment rooms at the rate of 8–12 m^2 per 1 couch in the shower. For physical therapy classes, there are separate rooms, as well as group rooms with a total area of at least 100 m^2. There are also separate rooms for massage and mechanotherapy. In addition to special rooms, this department provides lounges for patients after treatment procedures. Lounge areas should be equipped with couches and armchairs. The service rooms except for the doctor's office, include pantries for linen, oxygen and carbon dioxide cylinders, rooms for repair and storage of equipment, and shower rooms for staff.

In recent years, a new form of health care has emerged — **day hospitals**; for them, as a rule, the premises of ordinary hospitals are used. In some cases, day hospitals may be located in residential and public buildings. However, in these cases, such hospitals should be isolated from the main building with a wall and equipped with independent ventilation and sewage systems, as well as a separate entrance for patients be arranged. In residential and public buildings, it is not allowed to place day hospitals of dermatovenereological, psychiatric, infectious, and tuberculosis profiles.

The architectural and planning decisions of the day hospital, its rooms and premises should provide for optimal sanitary-hygienic and anti-epidemic regimes and conditions of stay of patients and staff.

The structure of the day hospital and the layout of its premises should exclude the possibility of crossing «clean» and «dirty» patient flows. The capacity of the day hospital sections should be no more than 4 beds, and the specialization of its premises is determined taking into account the «profile» of the beds, its «capacity» and local conditions.

An important element of the treatment and diagnostic department are **clinical diagnostic laboratories**. Modern physico-chemical research methods, use of electronics and automation make clinical diagnostic laboratories independent specialized departments that are able conducting the most complex and delicate studies.

The multi-unit hospital has a powerful clinical diagnostic unit which includes specialized departments: clinical (for the study of urine, feces, sputum, gastric juice), histological, biochemical, microbiological, serological, and cytological. Clinical diagnostic laboratories should have separate rooms for reception and registration of analyzes of patients in the hospital and clinic, as well as for photometry, centrifugation, staining of samples and preparations. In microbiological laboratories, compartments for bacteriological research, a medium preparation room, washing, service rooms, pantries for tools and linen, and showers for staff are mandatory. The premises of the microbiological department should be isolated from the rest of the laboratory premises, and a separate entrance should be provided for visitors.

Pathoanatomical Department

In multi-bed hospitals, an independent department of morbid anatomy is provided which is usually located in a separate building, has its own access roads and is located in a separate section of the hospital park. Sectional area of at least 20 m^2 is designed for one table. In hospitals with 600 beds or more, sectional rooms with two tables are allowed with a larger area, respectively. The set of premises of this department, except for sectional ones, includes a pre-section, a histological research laboratory, a photolaboratory, a laboratory, rooms for storing corpses, a mourning hall, as well as office and other premises for staff, an office, and a lobby-waiting room.

Autopsy rooms for infectious patients should be isolated and have a separate entrance from outside.

Features of Planning Decisions of Specialized Departments of Hospitals

Children department

The layout of children's departments is designed primarily to exclude HAIs. Children's departments are isolated from adult departments and have independent admitting office, diagnostic and treatment departments. A children's department for 60 beds or more is housed in a separate building with independent access roads and a landscaped area. The set of premises in each section of the department should provide the possibility of its independent functioning if quarantine is established in one of them. All sections in departments for children under 3 years old must be boxed, at least 40–50% of boxed sections are allocated for children under 7 years old and at least 10–20% — in departments for children over 7 years old. In children's departments open verandas with removable windows at the rate of 2.5 m per child are arranged. The total area of the veranda should ensure simultaneous placement of 50% of the number of patients in the department.

To receive children into non-infectious wards, boxes should be provided in the amount of 5% of the beds in the ward and admission and examination boxes — 3% of the beds. For children older than 1 year, the capacity of the rooms is not more than 4 beds, for children under 1 year — not more than 2 beds. The rooms (bedroom, restroom, dining room, bathroom) for mothers should be outside the department, the number of places in these rooms should be taken equal to 50% of the number of beds for children under 3 years of age (table 8.3).

Table 8.3. Area of the wards of the children's hospital*

Premises	Area per one bed, m^2
Reception box	15
For newborns (isolation ward)	6
For children under 1 year old with 24-hour stay of mothers	10
For children under 7 years old, with 24-hour stay of mothers	12
Children over 7 years old, with a caregiver	14
Dining room (for children over 3 years old)	1.2 per one seat
Children's play room, day stay	0.8 per bed, not less than 12

* SanPiN 2.1.3.2630-10.

Obsetric Department

Planning decisions of the obstetric department are designed to ensure strict isolation of healthy women in childbirth from patients, to ensure their admission flow, to contribute to the exclusion of HAIs (table 8.4). In the obstetric department, there are physiological and observational units (the so-called 2nd or suspicious department) for women in labor with fever, pustular and other diseases.

Table 8.4. Permissible levels of microbial contamination of air in maternity hospitals*

Premises	Air sampling	Total number of colonies per 1 m^3 of air
Operating delivery rooms	Before work	Not higher than 250
	During work	Not higher than 500
Rooms for premature and debilitated children	Before work	Not higher than 500
	During work	Not higher than 750

* SanPiN 2.1.3.2630-10.

For the admission parturient women the obstetric department, a filter is arranged through which the woman in labor passes from the waiting area. Two examination rooms are provided — one for entering the obstetric physiological department and the department of pregnancy pathology, and the second one for entering the observational department. After examination in the filter room where thermometry is carried out, an anamnesis is collected, and epidemiological data is clarified, pustular skin diseases, flu, tonsillitis, etc. are detected, the woman in labor is first sent to the examination room, and then to the sanitary treatment room and, finally, to the department.

Both physiological and observational departments have a common planning scheme — prenatal wards, the delivery room, intensive care wards, postpartum wards, and wards for newborns. Each department provides an independent set of medical diagnostic and support facilities. Medical staff is strictly assigned to each department. The placement of 1–2 parturient women together with their newborns favorable in the ward provides favorable hygienic conditions.

The rooms for discharge of puerperas from the postpartum physiological and observational departments should be separate. A dressing room for mothers and newborns should be located next to the premises for visitors.

Infectious Department

Until the 18th century, specialized infectious disease hospitals did not exist, only plague patients were isolated in special houses belonging to the monastic order of St. Lazarus, later they were called infirmaries. At the time of Peter I, construction of hospitals for the treatment of «sick people» began. In 1752, a Senate decree was issued in Russia on the construction of special infectious hospitals for patients with «sticky diseases». Those were pavilion-type buildings, where the separation of patients by the nature of infections was not provided. An effective system for isolating infectious patients in special rooms did not exist until the middle of the 19th century.

In 1880, the Society for the Preservation of Public Health decided to build in St. Petersburg «special hospitals for the infectious people». After consultation with Professor S.P. Botkin, an infectious diseases hospital was built in which patients were placed according to the principle of group isolation, i.e. infected with various infections were placed in various buildings. A department for patients with an unclear diagnosis and a special department for especially dangerous infections were created at the hospital. Later, disinfection chambers were built in such hospitals for the disinfection of hospital linen and things of patients.

The planning decisions of the infectious departments are based on the system of isolation of patients, conditionally divided into «dirty» and «clean»

flows, sanitary treatment and disinfection of rooms, discharge of patients, linen, equipment.

To prevent HAIs, box is most reliable (fig. 8.1). The box is a complex of premises with a separate street-side entrance to admit patients. The box includes entrance vestibule, sanitary unit with bathtub, ward, and gateway (the small premise between double doors). The patient enters the box through the entrance vestibule directly from the street. The gateway connects the box with the central corridor, through it the staff passes to the patient. In the gateway, there is a washbasin, a hanger for bathrobes and a cabinet for transferring food to the box.

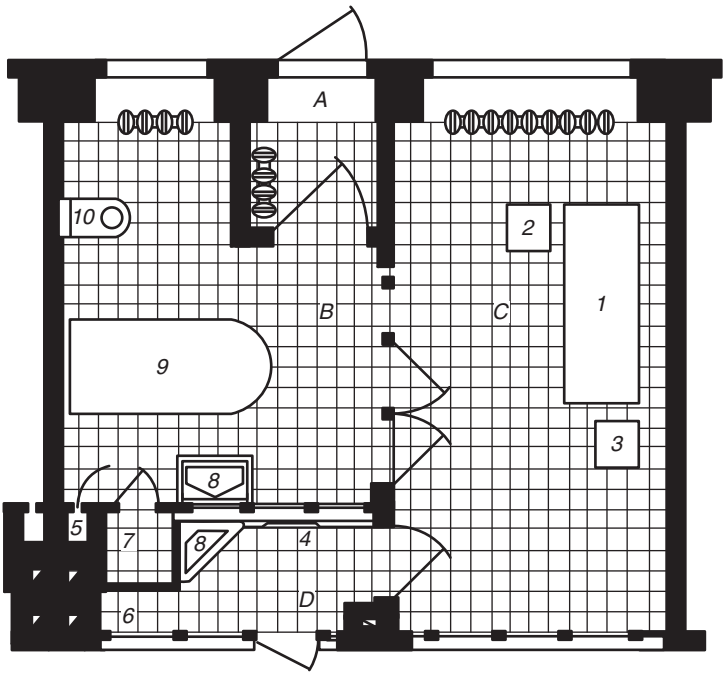


Fig. 8.1. Boxing for one bed: A — vestibule with exit to the street; B — bathroom; C — ward; D — gateway at the exit to the corridor; 1 — bed; 2 — table; 3 — stool; 4 — hanger for a doctor's gown; 5 — exhaust ventilation duct; 6 — cabinet for transferring food to the box; 7 — cabinet for cleaning items; 8 — wash basin; 9 — bath; 10 — lavatory pan

The boxed ward (semi-box) consists of the same premises as the box, but has no entrance from the street. Patients enter the semi-boxes from the corridor of the department. In the section consisting of semi-boxes, where only patients with the same diseases can stay.

The infectious diseases hospital should have a admission department, a hospital, medical and diagnostic rooms (X-ray, operating room, intensive care unit, functional diagnostics room, physiotherapy, sigmoidoscopy room, delivery room), laboratories, a sterilization room, a pharmacy, a food department, pathology and disinfection department, and an administrative office, transport sanitation service, treatment facilities for wastewater disinfection. The composition of units is determined by the number of beds (bed capacity) and the purpose of the hospital.

Each department may consist of one or two sections, completely isolated from each other.

The infectious disease department should consist of boxes, semi-boxes, and wards. In each infectious department, a neutral zone should be allocated, where the offices of doctors and hostesses are located.

The best layout option is a fully boxed department. Patients with acute intestinal infections and infectious hepatitis can be placed in wards without special insulation measures, i.e. no gateways are required for each section. For patients with airborne infections, it is necessary to have single and double rooms with locks and separate bathrooms.

Boxes can also serve for individual hospitalization of infectious patients. After discharge, the patient leaves the box through the outer door, and in the box they undergo the final disinfection.

The boxed ward eliminates the admission department as a functional unit of the hospital. The most rational pavilion system for building an infectious diseases hospital is when each infectious department is located in an independent building and serves patients with the same diseases. In multi-storey buildings, departments for homogeneous infections are recommended to be placed on a floor-by-floor basis. Each floor is designed for only one infection, it has a separate elevator, a stairwell, an urgent analysis laboratory, a pre-preparation, sterilization, operating room, pantries, and locks for staff.

Patients with airborne infection should be placed in the upper floors in order to avoid the spread of infectious aerosol from the sections to the rooms located above this department.

One of the important conditions for preventing the introduction of infection into the hospital is strictly individual patient transportation. After the patient is delivered, the ambulance car undergoes disinfection at the infectious hospital territoria, where a special service is provided.

To prevent the spread of HAIs, transport nodes are allocated for «dirty» and «clean» flows. For patients of each building (boxed, semi-boxed and treatment-section), special elevators with a blown elevator shaft and flight of

stairs are provided which divide the building into two parts with an open balcony, creating air gaps that prevent the spread of airborne infections. The staff enter each section through their transport hub located at the ends of the building. Discharged patients use the same elevators. This structure of the infectious diseases hospital provides isolation of infectious patients and minimizes the possibility of the spread of HAIs.

When planning the departments of an infectious disease hospital, the shortest and most direct routes for the movement of patients, things and vehicles should be provided. Entrances, stairwells, elevators should be separate for newly admitted and discharged patients. The most favorable single-corridor unilateral development of the department. Two-sided building, even in boxed buildings, contributes to overheating of boxes in the summer. In addition, such building presents a known danger of nosocomial transmission of «volatile» infections. For example, cases of HAIs with measles and chicken pox are described in those parts of the hospital building where the boxes were located on both sides of the corridor.

Buildings and wards, entrances and exits of individual buildings, and groups of rooms (treatment rooms, sanitary inspection rooms, chamber disinfection wards, etc.) should be located taking into account the strict separation of «clean» processes and processes associated with the reception and maintenance of infectious patients, with infected things and materials.

The site of the infectious diseases hospital should be isolated from other buildings, people should have limited access to the territory. Entrance checkpoint and inquiry office for visitors are should mandatory. On the site, there are zones of therapeutic infectious buildings, pathoanatomical building, landscape gardening and household zones. Zones should be separated by strips of green space with a width of at least 15 m. Separate garden and park areas are provided for various infectious diseases departments, the area for each of them should be determined based on at least 25 m^2 per bed.

Common for all infectious disease departments of hospitals, there are the central sterilization and disinfection departments, a food department, laboratory, pharmacy, an X-ray room, and the functional diagnostics department.

The arrangement of wards with more than 3 beds is considered inappropriate. Quarantine wards should be single-rooms. An infection department with more than 10 beds has an operating room, which is used not only for operations but also for other procedures (endoscopy, blood transfusion, etc.).

In the infectious disease department, a ward for 1 bed is provided for adults — 7.5 m^2, for children — 6.5 m^2 (in the wards there is a toilet and a gateway).

In children's infectious diseases departments, the number of places for mothers is 20% of the beds in the children's department.

The recommended areas of wards and premises are perresented in the table 8.5.

Table 8.5. The area of the wards and premises of the infectious diseases department*

Premises	Area, m2
Ward for adults	7.5 per 1 bed
Wars for chidren	6.5 per 1 bed
Box and semi-box for 1 bed	22
Box and semi-box for 2 beds	27
Sanitary inspection room for patients	25
Dressing room	6
Bathroom	10
Toilet	3

* SanPiN 2.1.3.2630-10.

Outpatient Department

The outpatient department as an independent part of the hospital is an independent building adjacent to the diagnostic and treatment department. The entrance to the polyclinic is isolated from the entrance to the hospital and is located close to the street. The main premises of the polyclinic for adults are treatment and diagnostic rooms, waiting rooms for patients, reception, lobby with wardrobe. Medical and auxiliary rooms are located in departments — therapeutic, surgical, gynecological, etc.

The layout of the polyclinic should provide direct and short routes for the movement of patients, the convenience of communication with medical offices. During the period of mass epidemics of influenza, it is advisable to provide separation of patient flows into and out of the clinic, for which emergency exits should be provided. The area of general practice rooms (therapist, neurologist, psychiatrist) should be at least 12 m^2, and the area of specialized rooms requiring equipment (urological, surgical, gynecological, ocular) should be at least 15–18 m^2. The emergency room should be located on the ground floor. It should have a separate entrance through which stretchers should pass freely.

In children's polyclinic, it is necessary to maximize the separation of incoming patients. For this purpose, two entrances are provided: for healthy and sick children. At the entrance, children enter the filter box, where they undergo an external examination of the pharynx, skin and measurement of the body temperature. In case of suspicion for an infectious disease, the child is sent to a separate box, where he is examined by a doctor. Boxing has an independent exit

to the street. For mothers with babies a separate room is provided for their feeding and swaddling.

The area of medical offices is 12–15 m^2, their number, placement and composition of auxiliary rooms are set depending on the category of the polyclinic and design assignment.

Hospital water supply

The organization of optimal drinking water supply for hospitals requires:

- connecting the hospital to the centralized drinking water supply system of a settlement;
- use of underground water as a source of water supply which, as a rule, meets the requirements of the standard for the choice of a water source and in some cases for the quality of drinking water;
- use of surface water sources only with the correct organization of the sanitary protection zone and with the creation of sewage treatment plants.

Uninterrupted supply of sufficient water of good quality to the hospital prevents infectious gastrointestinal diseases. It is better to connect the hospital to the city water supply line, where the water quality in all respects meets the hygienic requirements for potable water. In this case, the water flow per 1 bed can be brought up to 400 l/day. In such circumstances, it is not difficult to organize the supply of hot water to the hospital which is especially important for operating rooms and washing.

The issue of water supply in rural conditions or in small towns where there is no centralized water supply is completely differently solved. In these cases, the hospital should have a local water supply. When choosing such water source, you should focus on underground water as the most reliable source from a sanitary point of view. First of all, it is recommended to use artesian wells with water of a relatively consistent composition; deep bedding protects water from bacterial and chemical pollution. Water that meets the requirements of sanitary standards can go to the hospital without additional treatment. Water consumption per bed can be about 100 l/day. If it is impossible to organize artesian water supply, then other water sources should be chosen (springs of sufficient power, open reservoirs, wells).

Wells can be used to supply the hospital with water if there are no other options. The flow rate of the well, as a rule, is insignificant and does not allow water supply of more than 50 l/day for 1 bed. This, of course, creates inconvenience in the care of patients. When constructing mine (dug) wells, all relevant sanitary requirements must be followed.

The placement of wells in the hospital land plot should be correct from a sanitary point of view. It is necessary to take into account the possibility of

groundwater pollution from facilities located in the household zone and the infectious diseases department zone. It is highly desirable to create a well with a radius of sanitary protection zone 20 m near the well.

Waste collection, disposal and disinfection system

The hospital spending a lot of water becomes a source of a considerable amount of wastewater which should be considered as infected even in general hospitals. The disposal and disinfection of this wastewater is of particular concern. It is better to connect the hospital to a citywide sewage system with the neutralization and disinfection of wastewater at a city sewage treatment plant.

In the absence of a citywide sewage system, the hospital is forced to resolve the issues of sewage disinfection on its own. For these purposes, the so-called small sewage system is used, where soil methods for disinfecting wastewater are used, since the soil has the ability to self-clean.

In trauma hospitals, a large amount of gypsum is used, so installation of gypsum sumps should be provided in the premises for its preparation.

Wastewater from the mud therapy facilities must be diverted to the prefabricated sump through special drains.

For the treatment of wastewater from the catering unit in hospitals with 1000 beds or more, installation of grease traps (outside the building) should be provided.

In addition to liquid wastewater, the hospital serves as a source of a large amount of medical waste representing epidemiological, chemical, radiation and environmental hazards.

Thus, a therapeutic-profile hospital with 400 beds discharges class B waste from 0.5 to 1 kg per day, in the surgical departments it increases to 2 kg per day, and in the operating unit up to 15 kg per day per bed. The structure of class B wastes in surgical hospitals is as follows: syringes — 30%, vascular catheters — 7%, injection needles — 6%, catheters for various purposes (urethral, endotracheal, probes, etc.) — up to 4%, dressings — up to 50% and more.

The morphological composition of HCF waste is significantly different from the structure of municipal solid waste. In hospital waste, the first place is taken by uninfected waste (paper, swab — about 50%), then food waste (30%), infected waste makes up 10–15% (dressings, operational waste), glass — 5%.

The maximum accumulation rate for uninfected waste is 10 kg per 1 bed per day, for food waste 6 kg per 1 bed per day.

The problem of medical waste disposal is of particular importance. As early as in 1973, WHO classified this category of waste as hazardous and pointed out the need to create a special service for its destruction and recycling.

Today, the thermal method for the destruction of medical waste, of course, cannot be recognized as optimal, since the combustion produces dioxins and harmful gases. The ash formed after burning is toxic in its chemical composition, therefore, its disposal in landfills of household waste is unsafe. Such medical waste treatment methods as microwave, thermochemical, steam, etc. have not found wide practical application. At present, chemical disinfection methods using disinfectants are used for these purposes.

Of particular danger are injection needles and disposable syringes, since uncontrolled accumulation can lead to their reuse. Today, this waste is centrally transferred for further processing.

Biological waste from hospitals,pathoanatomical departments and veterinary hospitals are buried in special designated areas.

Of particular importance is the burning of waste from surgical departments which (for aesthetic and epidemiological reasons) should in no case be taken to a landfill.

In medical organizations, reusable products and devices are used that are subject to disinfection, pre-sterilization cleaning and sterilization. For this purpose, central sterilization departments are intended. The accumulation of dirty linen and multiple circulation of bedding is a characteristic feature of hospitals. To collect and store clean and dirty laundry, the hospital must be provided with the necessary amount of process equipment (rack-carts, transport inside carts, sealants, etc.), disposable packaging and transport containers.

In operating rooms, obstetric hospitals (delivery units and other facilities with aseptic regimen, as well as in wards for newborns), only sterile linen should be used.

Clean and dirty laundry from and to the laundry room must be delivered in packaged form (in containers) by dedicated vehicles.

After discharge (death) of the patient, as well as contamination of mattresses, pillows, blankets should undergo disinfection chamber processing. To do this, the hospital must keep an exchange pool of bedding.

The collection, temporary storage and disposal of waste of various hazard classes occur in accordance with the rules for the collection, storage and disposal of wastes of HCF.

8.2. INFECTIONS ASSOCIATED WITH THE PROVISION OF MEDICAL CARE

The epidemiological safety of medical technology and the hospital environment is one of the most important components of ensuring the quality of medical care.

Term Healthcare Associated Infections refers to infections that develop in patients who receive medical care at any medical facility that were not present or were not in the incubation period in patients at the time of their hospitalization.

HAIs first appear 48 hours or more after hospital admission, or within 30 days after having received health care.

HAIs include:

- associating the underlying disease in hospitalized patients, as well as appearing after discharge of patients;
- associated with the provision of any type of medical care (in outpatient, educational, sanatorium and health-improving institutions, social welfare institutions, emergency medical care, home care, etc.);
- cases of infection of medical workers as a result of their professional activities.

The following **mechanisms of transmission** of HAIs pathogens are distinguished: contact, artifical, airborne (aspiration), and fecal-oral.

HAIs are the most common adverse event during the provision of health care, and to date, no institution or country can claim to have resolved this problem. Based on data from a number of countries, it can be assumed that HAIs affect hundreds of millions of patients every year worldwide. The burden of HAIs in low- and middle-income countries is several times higher than in high-income countries.

HAIs represent the most frequent adverse event during care delivery and no institution or country can claim to have solved the problem yet. Based on data from a number of countries, it can be estimated that each year, hundreds of millions of patients around the world are affected by HAIs. The burden of HAIs is several folds higher in low- and middle-income countries than in high-income ones. There is also now a worldwide consensus that urgent action is needed to prevent and control the spread of antibiotic resistant organisms and in health care effective infection prevention and control (IPC) is one solution.

Every day, HAIs results in prolonged hospital stays, long-term disability, increased resistance of microorganisms to antimicrobials, massive additional costs for health systems, high costs for patients and their family, and unnecessary deaths.

Although HAIs are the most frequent adverse event in health care, its true global burden remains unknown because of the difficulty in gathering reliable data: most countries lack surveillance systems for HAIs, and those that do have them struggle with the complexity and the lack of uniformity of criteria for diagnosing it (WHO, 2019).

According to WHO, defective IPC practices during everyday healthcare delivery also cause harm to hundreds of millions of patients worldwide every year. The European Centre for Disease Prevention and Control estimated that more than 2.6 million new cases of healthcare associated infections occur every year in Europe, with a cumulative burden estimated in disability-adjustedlife-years that is higher than all other reported 32 communicable diseases. The burden of health-careassociated infections was also recently highlighted in southeast Asian countries[1]. The US Center for Disease Control and Prevention identifies that nearly 1.7 million hospitalized patients annually acquire HCAIs while being treated for other health issues and that more than 98,000 patients die due to these[2]. According to official statistics, in the Russian Federation an average of 0.7–0.8 cases of HAIs per 1000 hospitalized are registered annually. In 2018, 27.071 cases of HAIs were registered[3].

The incidence rate of HAIs is significantly higher in premature infants and newborns, the elderly, patients with a severe course of the main pathology, having oncological, autoimmune, allergic diseases, and persons undergoing invasive medical procedures during organ transplantation.

Patients with HAIs stay in the hospital 2–3 times longer than patients without signs of infection. On average, their discharge is delayed by 10 days, the cost of treatment increases by 3–4 times and the risk of death by 5–7 times. HAIs significantly reduce the quality of life of the patient, leading to a loss of reputation of healthcare facilities.

Among HAIs, the most common are infections of surgical wounds, blood flow, genitourinary tract, lower respiratory tract, gastrointestinal tract, postpartum infections and endometritis also occur.

The most important risk factor for the contact transmission of HAIs pathogens are the hands of medical personnel. This factor is associated with up to 50–70% of the occurrence of all HAIs.

Factors Contributing to the Growth of HAIs in Modern Conditions

1. Creation of large hospital complexes with a peculiar ecology: high density of patients (mostly weakened), their constant and close communication with each other in a confined space; the large number of medical personnel who constantly and closely communicate with patients

[1] B. Allegranzi, C. Kilpatrick et al., 2017. DOI: https://doi.org/10.1016/S2214-109X(17)30427-8.
[2] Haque M., Sartelli M., McKimm J., Abu Bakar M. Health care-associated infections — an overview // Infect. Drug Resist. 2018. Vol. 11. P. 2321–2333.
[3] State report on the state of the sanitary-epidemiological well-being of the population in the Russian Federation in 2018.

(admission, transfer, discharge); circulation of a number of strains of opportunistic microorganisms.

2. The formation of a powerful artificial mechanism for the transmission of pathogens during invasive medical and diagnostic procedures, and use of medical equipment.
3. Activation of the natural mechanisms of transmission of pathogens due to close communication of patients and medical personnel in HCF.
4. The presence of a constant significant array of sources of infection in:
   - patients admitted to a hospital with unrecognized infectious diseases;
   - medical personnel (carriers with erased infections);
   - persons in whom HAI is superimposed on the underlying disease in the hospital.
5. Widespread, uncontrolled use of antibiotics contributes to the emergence of drug resistance of microorganisms.
6. The formation of hospital strains of a large number of microorganisms.
7. An increase in the number of patients being cared for and cured by the achievements of modern medicine.
8. The increase in the proportion of patients with reduced body defenses (elderly patients, young children).
9. The use of sophisticated equipment for diagnosis and treatment, which requires special methods of disinfection and sterilization.
10. The increase in the volume and types of medical services provided to the population by outpatient clinics, private clinics.
11. The growth of infectious diseases among the population as a whole including socially caused infections (hepatitis, HIV infection, tuberculosis, etc.), increases the risk of their introduction and nosocomial spread in hospitals.

It has been noted that the largest number of HAIs carriers is accounted for by HCF staff, especially paramedical personnel. which is associated with the performance of professional duties in cleaning, washing the premises, and contacts with contaminated material.

It is known that the hands of medical personnel are repeatedly in contact with microorganisms, the frequency of detection of conditionally pathogenic and pathogenic microorganisms on the skin of the hands of medical personnel may be high. In a hospital, representatives of conditionally pathogenic microflora have the ability to saprophytic way of feeding, live and accumulate on environmental objects, where they multiply, and virulence increases. The results of bacteriological analyses of swabs from environmental objects showed the significance of pathogenic infections, such as sepsis and purulent complications of surgical wounds in pathogens.

Infection occurs in the wards, dressing rooms, intensive care units, through the hands of medical personnel, surgical instruments, dressings, and care items. Staphylococci form resistance to antibiotics and disinfectants. Patients are often the source of numerous species of gram-negative opportunistic bacteria of *E. coli* and *Enterobacter* genera. These microbes are stored on the skin of the hands of medical personnel while providing additional transmission of the pathogen. That is why thorough washing of the hands of medical personnel is an important factor in the prevention of HAIs.

Classifications of HAIs

Classifications of infections associated with the provision of medical care are shown in Scheme 8.1.

HAIs according to affected contingents may occur in patients (and in persons caring for patients); among medical personnel (related to the performance of professional duties in different conditions of medical care), as well as among students and employees of secondary and higher medical educational institutions if they are related to professional activities.

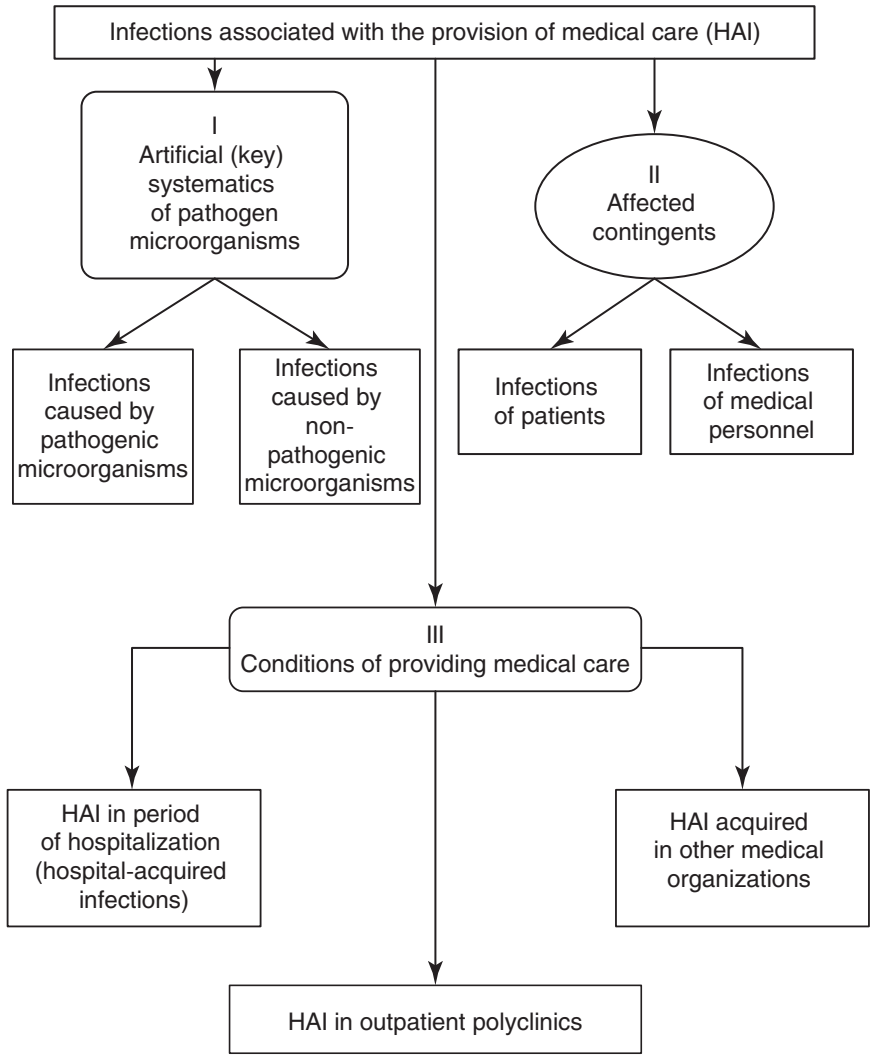
Classification of HAIs **based on the artificial systematics of pathogen microorganisms** includes groups of infections caused by pathogenic, opportunistic, and non-pathogenic microorganisms.

Classification of HAIs caused by pathogenic microorganisms:

- based on the pathogen reservoir: anthroponoses, zoonoses, saprozoonoses;
- according to the phylogenetic systematics of microorganisms: prion, viral, bacterial, mycoses, mixed infections, parasitic;
- according to the transmission mechanism: intestinal, airborne, external integuments.

Classification of HAIs caused by opportunistic microorganisms:

- by etiology — staphylococcal; streptococcal; Pseudomonas aeruginosa; Klebsiella biofilm infections; infections caused by E. coli and other microbial associations; candidiasis; aspergillosis;
- by localization of the pathological process — urinary tract infection; respiratory tract; in the field of surgical intervention; musculoskeletal system; skin and subcutaneous tissue; reproductive tract; central nervous system; gastrointestinal tract; ENT organs; eye; of cardio-vascular system; blood flow;
- according to the conditions of infection invasion — endogenous; exogenous infections; infections caused by the formation of a hospital strain;



Scheme 8.1. Classification of HAIs

- by the type of medical technology — infections associated with devices: with mechanical ventilation, catheterization of the bladder, catheterization of blood vessels, etc.; infections associated with medical procedures: blood transfusion, injection, etc.

Prevention of HAIs

The main **goal of the prevention of HAIs** is to defining the strategy of:

- reducing the incidence rate and related disability, mortality of patients;
- social and economic damage reducing based on the development of the theoretical foundations of the management of HAIs;
- introduction of a scientifically based system of epidemiological surveillance and a set of effective organizational, preventive, anti-epidemic and therapeutic diagnostic measures into healthcare practice.

The main **objectives of the prevention of HAIs** are the following.

1. Improving the regulatory, legal and methodological support of the system for the prevention of HAIs, harmonization with international requirements.
2. Improving state supervision and control over the implementation of measures to prevent HAIs.
3. Improvement of the epidemiological surveillance of the HAIs and its software support.
4. Improvement of laboratory diagnostics and monitoring of causative agents of HAIs.
5. Creation of targeted comprehensive programs for the prevention of HAIs.
6. Improving the staffing structure and staff of epidemiological activities in healthcare organizations.
7. The introduction of modern approaches and the optimization of sanitary and hygienic measures for the prevention of HAIs in healthcare organizations.
8. Improving the training system for medical personnel in the prevention of HAIs.
9. Optimization of the principles of prevention of HAIs among medical personnel.
10. Improving the effectiveness of preventive and anti-epidemic measures.
11. Improving the effectiveness of disinfection and sterilization measures. Evaluation of the effectiveness of a set of measures for the prevention of HAIs.
12. Development of scientific research in the field of epidemiology and prevention of HAIs.

Prevention of HAIs is a system of organizational, general sanitary and special preventive measures aimed at reducing the risk of infection and disease among patients and staff in healthcare facilities.

In the system of measures for the prevention of HAIs, there are three areas of work: reducing the risk of infection, reducing the risk of disease and the creating specific immunity (fig. 8.2).

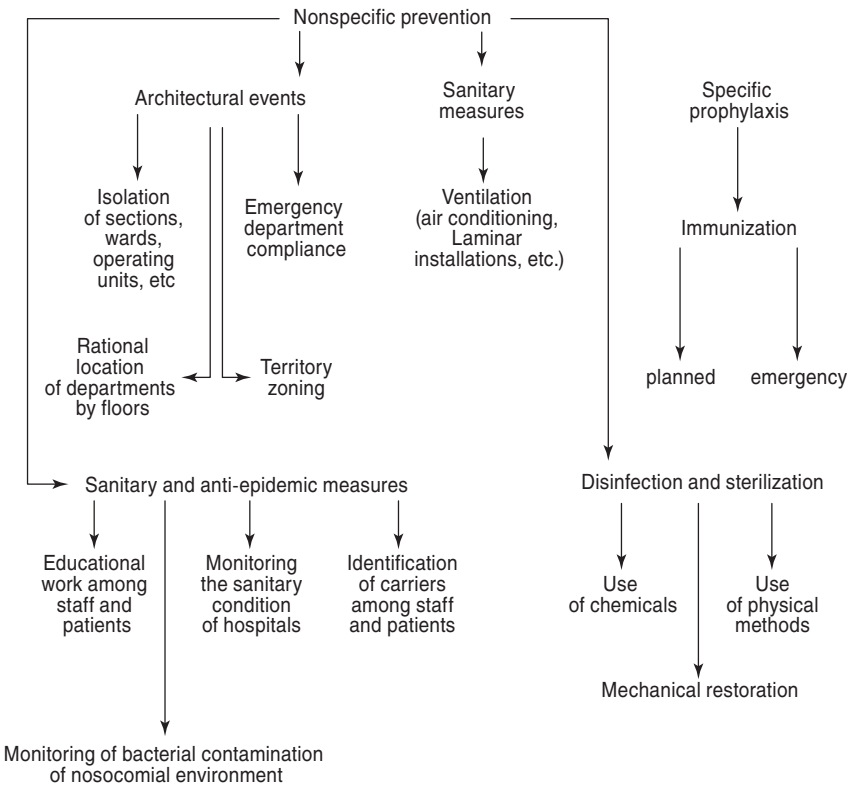


Fig. 8.2. Prevention of nosocomial infection (by E.G. Borovik). Isolation of pathogenic and opportunistic microorganisms is especially significant for Health care-associated infections (HAIs)

Nonspecific Methods of Prevention

Non-specific methods of prevention include architectural and planning, sanitary-technical, sanitary-anti-epidemic, disinfection and sterilization measures.

Architectural and planning measures are aimed at preventing the spread of pathogens and include the zonig of territory of hospital land plot, the rational placement of departments by floors and the isolation of ward sections from operating units.

It is known that the main pathway for the spread of nosocomial pathogens is the air environment. The construction of hospitals in the form of high-rise monoblocks promotes the concentration of patients, staff and visitors around vertical communication centers, an increase in the number of elevator shafts,

various channels for laying cables and pipes. The approach of wards to each other both vertically and horizontally often leads to the placement of two wards with walk-through sections on the same floor. All this can ultimately lead to the rapid spread of HAIs.

Sanitary measures include, first of all, properly organized ventilation of the premises. When *organizing the ventilation* of buildings of medical facilities, it is necessary to ensure rational air exchange and exclude the possibility of overflow of air flows from dirty rooms to clean ones.

Buildings of medical organizations should be equipped with systems of supply and exhaust ventilation with mechanical induction and natural exhaust without mechanical induction. The amount of air supply to the ward should be 80 m^3/h per 1 patient.

The air supplied to the operating rooms, anesthesia, labor, resuscitation, postoperative rooms, intensive care units, as well as rooms for patients with skin burns, HAIs patients and other similar treatment rooms, must be treated with air disinfection devices that ensure the inactivation of microorganisms and viruses in the processed air not less than 95%.

In infectious including tuberculosis departments, exhaust ventilation with mechanical induction is arranged through individual channels in each box and semi-box which must be equipped with air disinfection devices.

The air exchange rate of the wards of the infectious departments is calculated by the multiplicity and should be at least 2.5 ward volumes per hour; for postoperative wards, resuscitation rooms, operating rooms and delivery rooms — at least 10-fold air exchange.

It is especially important that the air flow from the operating rooms to the adjacent premises, and from these rooms to the corridor, be ensured in the operating units. In the delivery suite, it should be from the birth halls to the corridor.

In aseptic operating rooms, in which operations are particularly complex and time-consuming (cranial, organ and tissue transplantation, etc.), air conditioning systems are designed with the supply of up to 500–700 volumes of air purified from microorganisms into the operating rooms.

The organization of ventilation in the corridors, gateways, staircase and elevator halls plays a significant role in optimizing air exchange in the wards. It has been established that with an increase in the number of stores of the ward buildings up to 12 floors and higher, the bacterial pollution of the air of the staircase and elevator halls increases by 3–5 times or more, the corridors of the ward departments by 2.5–3 times.

In the corridors of the ward sections, a ventilation device with an air exchange rate of 0.5 volume of the room is recommended, and in the corridors of the operating and delivery units, an exhaust ventilation device.

To exclude the possibility of contaminated air coming from the stairwell and elevator halls to the wards, it is advisable to arrange a transition zone between them with air in it.

To rule out the possibility of air masses coming from the wards, staircase elevators and other rooms to the operating unit, an airlock with air pressure must be installed between the rooms and the operating unit.

Optimization of planning decisions and air exchange in hospitals reduces the incidence of HAIs and increases the efficiency of bed pool.

Full-scale experimental studies have established a direct relationship between the incidence of HAIs and the rational use of hospital beds in hospitals on the architectural and planning decisions of medical complexes, their sanitary condition and the level of microbial pollution of the air.

In infectious hospitals consisting of Meltzer boxes and semi-boxes with individual ventilation, with proper operation and compliance with the relevant sanitary-hygienic and anti-epidemic norms and rules, there is practically no possibility of nosocomial infection of patients. However, a significant part of the outbreaks of HAIs in children's, surgical and obstetric hospitals is associated with the planning and organization of air exchange.

Thus, 42% of large outbreaks of mumps, measles, and chicken pox investigated were related to the absence of boxes, semi-boxes, wards with a gateway in the children's wards and poor operation of the supply and exhaust ventilation systems. All this contributed to the spread of infection in departments that are not functionally interconnected. A similar picture was noted in the analysis of outbreaks of HAIs of purulent-inflammatory and viral etiology in maternity hospitals.

A high correlative relationship was found between the air exchange rate of the operating units and the frequency of purulent-inflammatory complications.

With an increase in the rate of air exchange from 5 to 30 in 1 h our, the total bacterial contamination of the air decreased by more than 13 times, while the number of purulent-inflammatory complications decreased from 12.6 to 3.2%.

With an increase in air exchange in operating rooms to 500–700 volumes per hour, the number of postoperative purulent-septic complications decreases during clean operations to 0.3–0.5%, and in the absence of ventilation it increases to 23–25% or more.

The **effectiveness of sanitary and anti-epidemic measures** is ensured by the fulfillment of all requirements, sanitary culture of patients and staff, correct setting of bacteriological control, identification of pathogenic bacteria among staff and patients, and rehabilitation of these persons.

Disinfection and sterilization measures are aimed at the destruction of pathogens on objects, materials, and tools.

Advances in the methods of disinfection and sterilization of medical instruments are noted. In particular, a new technology for disinfection of endoscopes has been introduced, new detergents and disinfectants have been developed, and portable sterilizers using pulsed infrared radiation are used.

Specific Prevention

The second necessary link in the prevention of HAIs is specific measures aimed at increasing the patient's resistance to these infections. Effective specific prevention includes measures aimed at preventing the development of the disease in people in case of infection. Its purpose is to create immunity within the incubation period. For example, in order to specifically prevent purulent-inflammatory diseases in puerperas and newborns, pregnant women are actively immunized with purified staphylococcal toxoid. Specific prevention includes *routine and emergency immunization*. Depending on the infectious disease, *active* (vaccines, toxoids) or *passive* (human immunoglobulins, heterologous sera) immunizations or a combination of them are used for emergency prophylaxis.

8.3. FEATURES OF PROFESSIONAL ACTIVITIES OF DOCTORS OF DIFFERENT SPECIALTIES

Medical institutions are the place of professional activity of doctors. Medical activity is highly diverse and often varies significantly in professional actions, work schedule, work density, degree of contact with patients. Even the work of one and the same specialist to a large extent depends on the narrow specialization and the type of medical institution in which he works. For example, a therapist in a clinic, hospital, and sanatorium performs different professional actions, carries a different neuro-emotional and physical load. The work of doctors of the surgical profile also varies significantly in terms of conditions, volume and nature of the operations performed, etc.

Thus, depending on the specialization and specific job responsibilities, the following **professional factors** affect the health worker: physical, chemical, biological, and physiological.

Physical factors that have a significant impact on the health of medical staff are ionizing and laser radiation, ultrasound and microwave fields, altered atmospheric pressure (working in pressure chambers) noise, vibration.

Adverse *factors of a chemical nature are* highly active drug chemotherapeutic agents, antiseptics, medical gases, drug aerosols, disinfectants and narcotic drugs, the concentrations of which can significantly exceed acceptable levels. It is known that drugs such as iodine, bromine, arsenic, camphor, nitroglycerin, under certain conditions, can cause chronic poisoning of medical personnel.

Biological factors are microorganisms, viruses, protein-vitamin preparations, immunological preparations, allergens.

Adverse *psychophysiological factors* are: increased psychoemotional and muscle tension; tension of visual and auditory analyzers. The work of medical staff is among the complex and responsible types of human activity. It is characterized by significant intellectual stress, high level of attention, in some cases physical effort, high ability to work in extreme conditions with a shortage of time for performing medical manipulations. An adverse factor is the overstrain of individual organs and systems. For example, work with a microscope, optical instruments, the use of small parts in bacteriology are among the categories of visual work of the highest accuracy. The working regime of doctors involves night and daily shifts, the absence of a fixed lunch break, excessive workload, is associated with high neuro-emotional stress, responsibility for the patient's life. All this required a study of the professional activities of doctors in order to hygienically regulate their working conditions.

It has been established that in each group of specialists the leading role belongs to a certain factor or their group: for dentists, anesthetists, surgeons, this role belongs to chemical, physical, physiological factors. A high degree of contact with pathogenic microflora is noted among tuberculosis doctors, and otorhinolaryngologists. Over 60% of doctors believe that their professional activity is accompanied by constant psycho-emotional stress. This is noted primarily by psychiatrists, surgeons and obstetrician-gynecologists at hospitals, emergency doctors.

Among the numerous medical specialties, **the work of anesthesiologists** occupies a special place. An anesthesiologist often finds himself in diverse, sometimes unpredictable, work situations related to managing the vital processes of the patient's body. An anesthesiologist works with precision equipment that requires not only practical skills but also technical knowledge. Professional actions of doctors in this specialty require determination, long-term effort, attention, quick assessment of a variety of information.

The duties of the anesthesiologist include preparing the patient for surgery, anesthesia, maintaining and normalizing the functions of the body of the patient during surgery and in the postoperative period. An anesthesiologist receives information about the patient's condition according to the readings of devices, verbal contact with surgeons, and the patient's reaction. Most signals arrive simultaneously or at short time intervals which requires constant attention and starting readiness. Having received this or that signal, the anesthesiologist must carry out appropriate manipulations according to the situation, the patient's condition, and the stage of the operation. In this case, the doctor requires special composure, speed of reaction. These moments of work place high demands on the intellect and neuro-emotional sphere.

Most hospitals do not have special anesthesia rooms, rooms for setting up cardiopulmonary bypasses, separate resident rooms for anesthetists, showers for staff.

The content of anesthetics (ether, fluoroethane) in the operating room air can be increased, especially with an open or half-closed anesthetic circuit.

Complaints of doctors about headaches, increased fatigue, sleep disturbance increase with an increase in the length of service. Anesthesiologists are characterized by an increased incidence of conjunctivitis, tonsillitis, acute respiratory infections, which is largely associated with professional activity. Ether and other anesthetics are especially unfavorable for pregnant women. This is manifested in a greater frequency of late and early toxicosis, premature birth and miscarriage. The relationship between the nature of the course of pregnancy and the duration of work with anesthetics during the working week is noted. More cases of pregnancy pathology were noted by anesthesiologists who work in the operating room 25 hours/week or more, and smaller ones — by doctors in contact with anesthetics no more than 15 hours/week.

Hence, there is a need to regulate the working conditions of anesthesiologists and reduce the concentration of anesthetics in the air.

The work of surgeons makes high demands on the professional qualities and neuro-emotional sphere of the doctor, involves great physical and mental endurance. Surgeons operate in a wide range: from the finest manipulations under a microscope to operations requiring significant physical effort (traumatological operations). The surgeon must be able to make decisions quickly, be consistent in his actions, feel personal responsibility for the life and health of the patient. Often the work requires the surgeon's ability to fit in a tight time frame, then his work becomes highly intensive.

Fatigue after the operation day is noted by almost all surgeons, regardless of the length of service and the type of medical institution. The exception is young doctors with less than 3 years of experience working at research institutes and clinical hospitals.

The greatest fatigue is noted after 24-hour shifts. Among the diseases of surgeons acquired during their professional activities, hypertension, hypotension, varicose veins of the lower extremities, flat feet should be noted. So, hypertension is registered after the first 5 years of work, and by 10–12 years its ratio is growing and makes up 24% of cases of other diseases. Hypotension becomes more frequent at the beginning of work, and by 10–12 years it decreases to 2.7–6% as a result of its transition to hypertension.

Varicose veins of the lower extremities reach a maximum by 4–6 years of work. In the incidence of surgeons of the older (50 years and older) age group, chronic ischemic heart disease and atherosclerotic lesion of cerebral vessels

come first which indicates the dominant role of the surgeon's professional activity as the cause of their occurrence.

High neuro-emotional and physical stress, concomitant X-rays, and elevated concentrations of anesthetics in the operating room air adversely affect ovarian-menstrual function in women. In 21% of female surgeons, there is a violation of the menstrual cycle, and in 37% — violations of the course of pregnancy (early and late toxicosis, spontaneous miscarriages, premature birth, etc.). During the holidays, all women returned to normal periods.

Among the doctors of the surgical profile, **obstetricians and gynecologists** should be distinguished. Their professional activities are associated with both planned and emergency operations, management of childbirth, often complicated, implementation of diagnostic and therapeutic procedures. The obstetrician-gynecologist is in constant readiness for difficult situations with high neuro-emotional stress due to responsibility for the life of the mother and child. The work of an obstetrician-gynecologist requires attention, accurate and fine coordination of sensory and motor functions. Ninety three percent of obstetrician-gynecologists are women, of which up to 80% are of a wide profile and no more than 20% are of a narrow profile.

Strong emotional stress, prolonged static load, presence of narcotic fumes and gases in the breathing zone are noted by 93.8% of the surveyed obstetrician-gynecologists. Most often, these doctors note increased fatigue, pain in the heart, irritability, headache. With age, with an increase in the length of service in the operating room and the number of births received, the frequency of complaints increases.

The work of an obstetrician-gynecologist causes a subjective feeling of fatigue, which doctors note both at the end of the working day, and after a daily watch. With an increase in length of service, fatigue resistance also increases, which is associated with a weekly operational load, a large number of daily and night shifts, and also with the nature of professional activity (for example, abdominal surgery, abortion, childbirth, complex diagnostic procedures, etc.). Fatigue leads to a change in some functional indicators, namely:

- the latent period of a simple sensorimotor reaction is lengthened;
- the processing speed of information decreases;
- memorization and deferred memory deteriorate.

Night sleep did not relieve fatigue after a working day in 20% of doctors, and in 67% after 24-hour shifts. The leading place in the general structure of the incidence of obstetrician-gynecologists is occupied by diseases of the heart and blood vessels, especially hypertension, hypotension, angina pectoris. This data is consistent with the results of an analysis of the overall incidence among surgeons and anesthesiologists.

Features of the professional activities of doctors conducting ultrasound examinations. Advances in science and technology made it possible to introduce a new highly effective diagnostic and therapeutic equipment into practical medicine based on the use of ultrasonic vibrations. For example, use of ultrasound scanning systems in the diagnosis is very promising. Ultrasound refers to mechanical vibrations of an elastic medium with a frequency exceeding the upper limit of audibility — 20 kHz. The unit of measurement for ultrasound intensity is Watt per square centimeter (W/cm^2). Ultrasound diagnostics is carried out using an ultrasonic installation, consisting of a sensor and a transducer — a piezoceramic plate located in a sound probe (antenna). In the sensor, ultrasonic vibrations are converted into electrical signals which after appropriate processing are issued in the form of a one- and two-dimensional image on the display screen.

Currently, hospitals use a variety of ultrasound medical devices. For example, waves with a frequency of 2.25–5 MHz are used to study the heart, in gynecology — 3.5 MHz, and for eye echography — 10–15 MHz.

The most common research method is contact, when the transducer is applied directly to the skin using contact substances (mineral or paraffin oil). US specialists complain about headaches, dizziness, general weakness, fatigue, sleep disturbance, drowsiness during the day, irritability, weakened memory, increased sensitivity to sounds, fear of bright light, cold extremities, bouts of paleness or redness of the face, and dyspeptic disorders. At the initial stages of the damage, vegeto-vascular dystonia and asthenic syndrome develop. Cerebral disorders are often combined with the phenomena of autonomic polyneuritis of the hands.

Ultrasound can be spread by contact. Therefore, while observing changes in the contact zone, most often the hands, an increase in their sensitivity, an increasing feeling of weakness in the hands, sweating of the palms, and a decrease in tactile sensitivity are noted.

On radiographs of the hands of doctors of ultrasound diagnostic rooms, foci of enostosis in the phalanges and metapiphysis of the radius and small bones of the wrist were detected 2 times more often. Thermography showed focal reductions in temperature sensitivity, more pronounced in the area of the wrist formations and forearms.

In addition to the specific professional effects of high-frequency ultrasound, the formation of other unfavorable factors associated with the peculiarities of the labor process in US-doctors is noted. Thus, visual stress caused by the need for constant monitoring of the image of the scanned organ on the screen, and overstrain of the musculoskeletal system due to the forced posture of the doctor and stereotypic movements with the right hand holding the emitter are noted. Of great importance is the neuro-emotional stress of the doctor associated

with decoding the image of the scanned organ, identifying the pathological process and determining indications for surgical treatment.

Clinical and hygienic studies have shown that it is possible for doctors of ultrasound diagnostic cabinets to develop the same type of peripheral disorders as autonomic polyneuritis of the hands in combination with angioedema syndrome, which suggests an etiological relationship between these disorders and working conditions, primarily with exposure to high-frequency ultrasound.

Preventive measures when working with ultrasonic devices should be aimed at preventing contact sound through solid and liquid media, to combat the spread of ultrasound in the air of the working area and to comply with hygienic standards.

Hygienic recommendations have been developed to optimize and improve the working conditions of health workers involved in ultrasound diagnostics. So, the area of the diagnostic room should be at least 20 m^2, sanitary improvement includes the supply of hot and cold water, supply and exhaust ventilation, and certain microclimate parameters.

The estimated norm of the doctor's load with 6.5 hours of work is 33 conventional units. The physician needs to use personal protective equipment, and to take a 15-minute break after every 1.5–2 hours of work.

Of great importance in the system of medical and preventive measures for working with ultrasound are physical and preventive procedures: massage, therapeutic exercises, water procedures, UV irradiation of the erythema-tan spectrum, vitamin prophylaxis (especially vitamins C and B group). A systematic monitoring of the health status of workers through periodic medical examinations is also necessary. When hiring, a preliminary medical examination of the candidate is performed.

Features of the professional activities of doctors in conditions of high barometric pressure. A special place in the hygienic assessment of the working conditions of medical workers is taken by a relatively new branch of medicine — hyperbaric oxygenation (HBO). The number of diseases successfully treated with this method is increasing, which means that the number of specialists using this method is expanding.

Working conditions in the pressure chambers are specific: confined space, high atmospheric pressure, a relatively long stay (2 hours or more) together with the patient, monotony and hypokinesia during the «expulsion» from the pressure chamber.

Work under conditions of increased barometric pressure refers to the field of professional activity, in which due to the unusual nature of the conditions and potential health risks, increased demands are placed not only on the level of professional training and health of medical personnel, but also on the psychophysiological characteristics of the body of specialists.

Work in pressure chambers is absolutely contraindicated for people with diseases, in which there is a potential risk of decompression disorders (emphysema, obstruction of the bronchial tree, previous pulmonary tuberculosis, chronic bronchopulmonary diseases, pathological conditions of the nasal cavity, and middle ear).

Increased attention when admitted to work in the pressure chamber should be given to the state of the cardiovascular system, where the formation and transport of gas bubbles occur and the processes of saturation and desaturation of the body are observed. Persons with severe vegetative dystonia, with hypertension and hypotension with a tendency to vascular spasms cannot be allowed to such work.

Restrictions on admission to work should be imposed for people with reduced visual acuity, since there is an opinion that increased barometric pressure can cause retinal detachment. For women, a pronounced violation of the ovarian-menstrual cycle and the presence of chronic gynecological diseases with the risk of uterine bleeding are contraindications.

Work in conditions of high atmospheric pressure in the pressure chambers involves high personal responsibility and discipline, strict adherence to safety regulations.

Persons with such functional disorders of the nervous system as psychoemotional irritability, neurasthenia, epilepsy, and also persons prone to explicit or latent form of claustrophobia are not allowed to work. Of great importance is the age qualification of medical personnel. According to the current rules in our country, men aged between 18 to 50 years old are allowed to work under compressed air pressure of not more than 1.9 atm, and from 18 to 45 years old at a pressure of more than 1.9 atm. However, given the need for a high level of professionalism when performing medical actions in practice, the age of staff, especially operating surgeons, can be increased to 55 years.

Health Status of Medical Staff

In recent years, there has been a deterioration in the health status of medical personnel, as evidenced by an increase in recorded cases of general and occupational morbidity.

The proportion of medical workers with chronic pathology according to medical records is about 15–20% lower than according to the results of the survey which indicates a significant lack of structures designed to monitor their health status. More than 60% of registered cases of occupational diseases are detected when patients seek medical help, and not during periodic medical examinations. This indicates to the need for continuous medical monitoring of the health of personnel in the health care system.

In HCF, the structure of the **general incidence** of medical personnel by 46% is determined by respiratory diseases, by 14% by cardiovascular diseases, followed by diseases of the digestive system, nervous, musculoskeletal and genitourinary systems — only 5–6% of the total number of diseases.

The structure of **occupational diseases** of medical workers was dominated by: respiratory tuberculosis, serum and infectious hepatitis, bronchial asthma, medication-drug allergies, dermatites. These diagnoses make up 80–93% of all registered cases of occupational diseases in the health care system, including chronic forms of all occupational diseases.

Occupational diseases were registered in groups of medical workers — nurses (43%), laboratory assistants and paramedics (23%), orderlies (9%), doctors (25%), obstetricians and forensic workers (2% each).

The main causes of occupational diseases are violation of safety rules, lack or non-use of personal protective equipment, professional contact with an infectious factor (up to 50%). Occupational morbidity was detected, as a rule, in insufficiently trained groups of workers.

A system for registering **infectious industrial injuries** in the appropriate form such as injections, cuts, punctures, and mucous membrane contamination has been introduced in HCF. Injuries when working with needles among nurses occur in 63%, paramedics — 28%, doctors — 16%, and laboratory assistants — 3%.

Diseases of medical personnel due to blood contact infection. On average, the risk of HIV infection with percutaneous blood entry from an HIV patient is 0.3%. The highest risk of infection is observed with deep lesions of the skin exposed to visible blood on medical instruments which were located in the patient's vein or artery (for example, with a needle during phlebotomy) or in the patient's body in contact with it. The larger the volume of blood involved, the higher the risk. With superficial skin lesions, the risk of infection is 0.1% or less depending on the blood volume and HIV titer. This is consistent with the fundamental international guidelines «Fundamentals of Infection Control» (1997) according to which the risk of HIV infection of staff is low (with respect to viral hepatitis B — 0.3%), however, taking into account the extreme severity of the infection and its consequences, professional HIV infection is recognized as a very serious problem.

Workers of the blood service, clinical laboratories, surgical units, intensive care units, dentistry, and emergency medical care are at most risk of parenteral HIV infection.

The risk of hepatitis B virus infection after an injection with a contaminated needle is 7–30%. Given the severity of the infection, this is a serious problem, since viral hepatitis B is the most common occupational disease of medical personnel. Serological evidence of hepatitis B virus infection is found in 38%

of surgeons and 50% of hemodialysis doctors. Hundreds of healthcare providers die every day from viral hepatitis B.

Prevention of diseases of medical staff due to bloodborne contamination. Taking into account of human blood and biomaterials contamination with HIV and hepatitis B, C viruses, cytomegaviruses, oncogenic viruses, the rules for occupational contamination prevention apply to all medical and preventive treatment facilities independently of their profile.

These rules are reduced to **the maximum skin and mucous membranes protection** of medical staff from infection. To prevent occupational contamination, the following conditions must be met:

- all manipulations associated with possibility of hands contamination with blood, serum and other biological fluid should be carried out with gloves;
- once removed rubber gloves are not reused. Gloves are processed with 70% alcohol, 3% chloramine, an alcohol solution of chlorhexidine, etc.;
- observe measures when performing manipulations with cutting and pricking tools (needles, scalpels, scissors); opening bottles, vials, test tubes with blood or serum; needling and cuts of gloves and hands should be avoided;
- if the skin is damaged, immediately treat it with 70% alcohol or lubricate the wound with 5% iodine solution;
- manipulations with medical instruments, pipettes, laboratory glassware, devices that come in contact with blood or serum should be performed only after their preliminary disinfection;
- medical staff who have wounds on their hands, exudative skin lesions or weeping dermatitis, are suspended from caring for patients and contact with care items during illness;
- the surface of the working tables at the end of the working day (in case of blood contamination — immediately) is processed with 3% chloramine or 6% hydrogen peroxide with 0.5% detergent. Moreover, if the surface is contaminated with blood or serum, the procedures are performed twice: immediately and with an interval of 15 minutes;
- paperwork should be done on a clean table;
- it is forbidden to eat, smoke and use cosmetics while sitting at the working table;
- it is impossible to carry out parenteral and treatment and diagnostic procedures in rooms intended for patient care.

3-fold **immunization** from hepatitis B for reliable protection of medical staff is carried out, i.e. in 1 and 6 months after the initial vaccination.

In case of injured hands or other parts of the body with contamination of skin and mucous membranes with biological fluids, a healthy worker who has not

previously been vaccinated against hepatitis B is immunized according to epidemic indications also 3 times within shorter timelines. Vaccination in these cases should be done as soon as possible: not later than 1–2 days after the injury. Injured person should be observed at the infectious disease specialist for at least 6–12 months.

Medical observation is carried out with a mandatory examination for markers of viral hepatitis B, C and HIV infection.

Periodic screening is a part of the medical and preventive support for employees, including medical staff. Preliminary periodic screening is carried out in order to identify medical contraindications to a particular type of work and to prevent the spread of infectious and parasitic diseases which is especially important in in-patient clinic.

Periodic screening, in addition, is aimed at identifying the fact and degree of exposure to harmful occupational factors to determine the necessary rehabilitation measures.

Preliminary, upon admission to work, and periodic screenings are carried out by local medical facilities. The centers of Russian Federation Oversight Committee for Sanitation and Epidemiology monitor the completeness of the contingents determined by the administration of medical facilities for examination and the timeliness of periodic screening.

8.4. HYGIENIC REQUIREMENTS FOR NUTRITIONAL DEPARTMENTS OF MEDICAL ORGANIZATIONS

Efficient and balanced diet is an important factor in immunity improvement and health resumption.

The hospital is an independently functioning organization, where special attention is paid to the patients' nutrition.

Good hospital nutrition is becoming a positive emotional factor for patients. Nutrition is built on the numeric system of diets; it covers almost all diseases and can serve as one of the therapeutic methods. The diet takes into account the characteristics of the disease, types of drug therapy including aggressive treatment methods (radiotherapy, barotherapy, chemotherapy, the use of antibiotics, hormones) in conditions of limited patient mobility. Diets consist of certain products taking into account their diversity during a week and the cooking peculiarities. In therapeutic diets, crushed and mashed foods, steamed and baked dishes, which serve as a favorable nutrient medium for foodborne pathogens, are used. In some cases, food products can serve as channels for the entry into the body of toxicants, helminth eggs, heavy metals, radioactive substances, genetically modified food, and nutritional supplements. Therefore, hygienism over patients' nutrition has a great importance.

Food department

Placement of food department in the hospital depends on the building system and the number of stories. The food department occupies a separate wing, an annex or an independent building in big hospitals. In the hospital, the food department is located on the top floor with a predominance of outlet ventilation. Products are stored in separate rooms with the division into categories: dry (cereals, pasta, flour, salt, sugar, bread, etc.) — on shelves with curtains, vegetables and potatoes — in a dry closed room in bins (chests), greenery — in refrigerated chambers on racks.

Perishable products are stored in refrigerated chambers at a temperature within 0–2 °C (meat, fish). There are separate chambers for dairy products, fruits, and ready-cooked foods.

The term of storage of oil and poultry in chambers is up to 5 days, sausages and milk — 72 hours. In small nutrition units, it is allowed to store various perishable products in one refrigerated chamber but on separate shelves for meat, fish, dairy products.

The plan of food department provides a set of rooms that ensure **the accuracy of the technological process of cooking**.

The first stage is the preparatory room where primary sanitation is carried out. This is a vegetable preparation room, a room for meat and fish processing, semi-finished products on separate tables for each type of product.

The second stage is the cooking room where boilers, stoves, kitchen appliances (meat grinders, mixers, grinders, etc.) are located. There are special outlet devices above gas or electric cookers. There are chefs in large nutrition units specializing in the preparation of first and second courses, cold dishes. The pastry chef has a separate room with equipment for preparing dough and fillers. A separate cooker is used only for baking.

The third stage is washing the dishes. There are sinks for washing kitchen utensils (boilers, pans, trays, knives, kettles, etc.). A separate sink is used to wash tableware (plates, cups, cutlery). Washing is carried out according to the rules approved by sanitary inspection. Nowadays, washing the dishes is carried out in automatic dishwashers.

An important detail is the marking of cutting boards (for example, for bread, cooked meat, raw meat, appetizers, dough) and the allocation of separate tables for processing raw and finished products. It is forbidden to mix food from the previous cooking with freshly cooked food. Boiled milk is stored chilled in a separate bowl.

The last stage is the distribution or transportation of ready meals to the department. With a centralized food department, the transportation of ready-to-eat food is carried out by the time of delivery of food to patients. In a separate

room — secondary food processing room, there is a stove for heating food, making tea, coffee, drinks.

In the ward, dishes for walking patients are laid out on tables. For bed patients, dishes on special carts are delivered to the ward by employees of food department. They collect dishes from wards and wash them in secondary food processing room.

In the servery compartments, food is stored for no more than 2 hours, less the time spent on transportation.

Food is given out after sampling carried out by the duty doctor and the respective entry in the quality control log of the finished food, which is stored in food department.

In order to prevent food poisoning in patients, special attention is paid to the health and personal hygiene of food department staff. Upon admission to work, each candidate undergoes a preliminary checkup and tests for the carriage of acute intestinal infections and tuberculosis. A quarterly physical examination of food department staff is carried out with the results noted in the employee's medical book. The staff must observe the rules of personal hygiene, work in special regularly changing clothes.

Self-check and Tasks

1. List the basic hygiene requirements for hospital placement in the city.
2. List the basic hygiene requirements for the hospital land plot.
3. List the main hospital building ststems. Decribe their advantages and disadvantages.
4. List the basic hygiene requirements for the layout of the main structural units of the hospital.
5. Indicate the design features of specialized hospitals.
6. List the basic hygiene requirements for water supply, sanitation, and medical waste disposal.
7. What are the healthcare associated infections? What factors contribute?
8. What causes of nosocomial infections do you know?
9. Describe the system of measures for HAIs prevention.
10. What are professional factors influencing the health of medical staff of various specialties?
11. Describe the risk factors for food poisonings and intestinal infections in the food department and measures to prevent them.