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# THE IMPORTANCE OF MODERN DIAGNOSTICS FOR INFECTIOUS DISEASES

Abdullaev Ulugbek Meylik ogli
Assistant at the Department of Microbiology,
Virology and Immunology, Tashkent State Medical University

Kholikov Khujakhror,
Rahmatillayev Boburjon
Students at the Tashkent State Medical University

**Abstract**
This article highlights the role and importance of modern diagnostic methods in identifying infectious diseases. In today's globalization, the rapid spread of infectious diseases, the emergence of their new forms, and mutations are further intensifying the need for an effective diagnostic system. Modern laboratory tests, molecular-genetic examinations, express tests, and digital medicine technologies play a crucial role in the early detection of diseases, assessment of risk levels, and prevention of epidemics.
The article analyzes the advantages of these technologies, their application in practice, and their impact on the healthcare system. Furthermore, proposals and recommendations are provided for improving the diagnostic process, controlling infections, and enhancing medical safety. The research results indicate that modern diagnostic methods are a decisive factor not only in saving patients' lives but also in protecting public health in general.

**Keywords**: Infectious diseases, modern diagnostics, molecular diagnostics, express tests, serological examinations, early detection, epidemic control, laboratory analyses, digital medicine, spread of infections, healthcare system, biological safety, genetic examinations, accuracy of diagnosis.

## Introduction

Infectious diseases have always posed a threat to public health, and their global spread and danger require strict control on a global scale. Epidemics and pandemics pose a great risk to human health and necessitate the introduction of new technologies in modern approaches, vaccination, diagnostics, prophylaxis, and treatment. The healthcare system of the Republic of Uzbekistan is implementing effective reforms in this regard and introducing innovative methods for the prevention, early detection, and treatment of infectious diseases. The article shows the importance of modern approaches in providing medical care and monitoring the spread of diseases. Furthermore, the spread indicators of major infectious diseases and the achievements made in this area are analyzed through an epidemiological table. The article highlights important measures aimed at preventing infectious diseases through reforms implemented in recent years, diagnostic methods, vaccination campaigns, and sanitary-hygienic measures. The main parts of this are the following:



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**1. Vaccination strategy and immunization.** The role of vaccination in combating infectious diseases is very large. Vaccination, being the most effective method of prophylaxis, significantly reduces the spread of diseases. Programs have been implemented in the healthcare system of the Republic of Uzbekistan to expand the scope of vaccination and protect the population from diseases through prophylactic immunization. Large-scale vaccination campaigns against measles, viral hepatitis, ARVI, and influenza were conducted in 2023–2024. Vaccination is considered the cheapest yet most effective measure in healthcare. Vaccination efforts against hepatitis A, B, C, measles, diphtheria, and influenza continue in the country. In the first half of 2024, 7,126 children were vaccinated against viral hepatitis A. Vaccination efforts not only improve health but also help prevent economic losses. For example, as a result of vaccination against measles, while 5,036 cases were recorded in 2023, this figure dropped to 112 by 2024. This shows the effectiveness of vaccination in preventing the disease. A decrease in cases of viral hepatitis A, B, and C was also observed. Highly effective vaccination and sanitary-hygiene standards have been established as prophylactic measures.

**2. Diagnostics and laboratory control.** Diagnostics plays a large role in the early detection of infectious diseases. New methods, particularly Real-Time PCR technology, have created the possibility for quick and accurate detection of diseases. This, in turn, creates the possibility for controlling the spread of diseases and early treatment. Laboratories integrated into the e-Health system facilitate the monitoring and tracking of diseases. Furthermore, the signs of infectious diseases are detected using serological and immunological tests.

**3. Epidemic monitoring and analysis.** Modern epidemiological monitoring systems, including the Electronic Monitoring System (EMS), help monitor the epidemiological situation in real-time mode. This system provides the possibility for quick detection of disease spread and problems. Specific data are collected by regions, and forecasts regarding the spread of diseases are developed through statistical analyses. Special warnings, advice, and instructions are sent through electronic systems and mobile applications to prevent the spread of diseases among the population.

**4. Quality of medical care and clinical protocols.** Great attention is paid to increasing the qualifications of specialists, infectologists, and epidemiologists who work based on international clinical protocols in the treatment of infectious diseases. Furthermore, the most modern and effective treatment methods are applied to patients. International experiences and modern medical research are taken into account in the development of clinical protocols. Continuing education courses and seminars on the treatment of infectious diseases are regularly held in Uzbekistan. Local preparations such as "Rutan" are being tested in the treatment of COVID-19 and ARVI in children. Treatment practice based on individual clinical protocols for patients has been established.

**Literature review on the topic:**

Currently, there are a number of infectious diseases that are very necessary for us to study and know. Any outbreak of an infectious disease causes an epidemic. **Epidemic** is the widespread spread of infectious diseases in a certain region, province, or country. In this case, the number of patients is



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5–10 times more than usual. All infectious diseases of animals are divided into 5 groups: **Group 1 - Alimentary infections.** Transmitted through soil, feed, and water. The digestive system is damaged. These infections include anthrax, foot-and-mouth disease, glanders, and brucellosis. **Group 2 - Respiratory infections.** Damage to the mucous membranes of the respiratory tract and the lungs. The infection is mainly transmitted through the airborne droplet route. These diseases include parainfluenza, exotic pneumonia, sheep and goat pox, and carnivorous animal plague. **Group 3 - Transmissible infections.** Transmitted through blood-sucking arthropods. The causative agents are always or during specific periods in the blood. Encephalomyelitis, tularemia, and infectious anemia of horses belong to these diseases. **Group 4 - Infections whose causative agents pass through the skin without the participation of intermediaries.** Whooping cough, rabies, and cowpox are among these diseases. **Group 5 - Infections that cause damage through an unidentified route.** Sources for the formation of epizootics of highly dangerous diseases can be mudflows, floods, conducting earthworks without coordination with the state veterinary service, animals, food products, feed, and other means imported from abroad, places where wild birds flying from abroad gather, increase in the number of rodents and insects in places where foci of highly dangerous diseases exist, and bioterrorism.

Most diseases that occur in humans are infectious. Their origin is associated with the entry of living causative agents into the human body and their multiplication under certain conditions, as well as their return to the external environment. Consequently, the sick person becomes a source of the disease, spreading the disease microbe (causative agent) to others. Infectious diseases are caused by extremely small living creatures invisible to the eye, namely viruses. Despite their very simple structure, they breathe, feed, and multiply like other living organisms. One of the specific characteristics of infectious disease causative agents is that they release **toxins** (poison) when they enter the body and multiply, disrupting the function of tissue cells. Each causative agent has a specific appearance and causes "its own" disease. Different causative agents release different toxins that affect the body differently and have their own "place of residence" in the human body, meaning the causative agent selects the most favorable tissue for multiplication. These characteristics belonging to a certain type of microbe are called **specific characteristics**. These specific characteristics of the causative agents determine the presence of a certain infectious disease. For example, the typhoid microbe only causes typhoid fever.

Thus, any infectious disease arises as a result of the entry of a living specific causative agent into the body and its multiplication. If there were no barriers to the multiplication of viruses, people would have perished under the effect of the poisons they released. However, the human body has the ability to fight microbes, that is, to kill them and neutralize the poisons they release. This ability is called **resistance to infectious diseases** or **immunity**. Innate and acquired types of immunity are distinguished. **Innate immunity** refers to the resistance to disease passed down from generation to generation, which is characteristic only of a certain species, that is, animal or human, and which determines resistance to certain diseases. For example, only pigs get swine fever.

## Research Methodology

Other species of humans and animals do not contract this disease. **Acquired immunity** is formed after contracting a certain infectious disease or after specific vaccination. **Vaccination** is the



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artificial introduction of killed or weakened infectious disease causative agents or their neutralized toxins (poisons) into the human body. After vaccination, the causative agent is neutralized in the body with the help of **antibodies** developed against that causative agent.

Viruses can be transmitted from a sick person or animal to a healthy person through the following routes:

**1. Contact route** - infection resulting from contact with a sick person or using the sick person's items (items contaminated with urine, feces, and sputum), whereby the microbe enters through some part of the body.

**2. Alimentary route** - infection through the consumption of food contaminated with feces, urine, sputum, and others through the mouth.

**3. Airborne droplet route** - infection resulting from microbes in the droplets released when a sick person sneezes, coughs, or speaks entering the body through the respiratory organs.

**4. Transmissive** - infection resulting from microbes entering the body due to a tick or some other insect bite.

There can also be virus carriers called **virus carriers**. These are people who were previously sick but have not fully recovered because the symptoms and signs indicating the disease are not detected in them. Live disease viruses are present in the bodies of such people; the person does not feel this, but they become a factor for transmitting the infection to others. Below we will examine several infectious diseases.

**Epidemiology of the disease.** The source of **anthrax** disease is domestic animals, mainly small and large livestock, as well as horses. Sick animals excrete the microbes through their urine and feces. After the animal dies, its skin, wool, internal organs, and blood remain infectious for a long time. The disease is transmitted to humans through close contact and care of living and dead animals. Anthrax can mainly occur in shepherds, veterinarians, slaughterhouse workers, leather factory workers, furriers, and those who collect scrap.

**Development of the disease.** Anthrax is transmitted through contact, alimentary, and airborne droplet routes. A portion of the anthrax bacillus that enters the human body is drawn in by special cells in the blood—**phagocytes**—and the rest spread through the lymph and blood throughout the body. Anthrax microbes reach the liver, spleen, lungs, intestinal wall, and subcutaneous connective tissue. Later, the microbe perishes in these organs under the influence of the body's defense forces or forms foci of infection. When the body of a patient who died from anthrax is dissected, the blood is observed to be thick and darkened. The liver and spleen enlarge and turn dark red. Bleeding occurs in other internal organs (including the brain). Similar **hemorrhagic changes** are observed in all other organs and tissues. Numerous anthrax bacilli are found in the areas where hemorrhage occurred.

**Course of the disease.** The incubation period (the period from the microbe entering the body until the first signs of the disease appear) lasts from a few hours to 6-8 days, averaging 2-3 days. The skin form (cutaneous form) and the septic form of anthrax are known clinical varieties. The skin form of anthrax is also called **anthrax carbuncle**.



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The anthrax carbuncle is often located on exposed parts of the body (face, neck, arms). Where the anthrax bacillus entered, a red nodule first appears. This nodule quickly turns into a vesicle. Serous fluid mixed with blood appears inside the vesicle. After the vesicle ruptures, an ulcer appears in its place; this ulcer quickly hardens, dries, and is covered with a dark brown scab. The scab (carbuncle) is painless, but it gradually enlarges. Small vesicles appear around the scab, which is very characteristic of anthrax. A considerable area around the anthrax carbuncle swells up.

**Course of the disease (Rabies).** The incubation, or latent, period lasts 1-2 months, sometimes shortening to 2 weeks or lengthening to 1 year. The length of the latent period depends on the location, size, and depth of the wound caused by the bite of a rabid animal. If the wound is on the head or face, the latent period shortens. In children, this period generally lasts shorter than in adults. Three periods are distinguished in the clinical presentation of rabies: 1) Initial period; 2) Excitation period; 3) Paralysis period. The initial period lasts 2-3 days. The patient's sleep is disturbed, their appetite is suppressed, a feeling of fear appears, and their mood fluctuates.

Later, they lie down indifferent to their surroundings. Their temperature slightly rises. The wound where the animal bit hurts with spasms. Signs of fear of water (hydrophobia) and air (aerophobia) appear. If the patients attempt to drink liquid when thirsty, the swallowing and respiratory muscles immediately cramp up, contract, and hurt severely. At this time, the patient suffers greatly and is in agony, which is why they fear water, let alone drink it. Sometimes, not only seeing liquid but even hearing its name causes panic. This condition is very characteristic of the rabies disease. Spasms of the respiratory and swallowing muscles can also be caused by air movement. The patient's temperature rises up to 38 degrees, their voice is hoarse, their body sweats, they drool, they get hiccups, their pupils dilate, their limbs hurt, and their eyes look scared of something. Their pulse beats fast, and the heart starts beating irregularly. Breathing is irregular and shallow, with occasional deep breaths. Muscle spasms begin with the respiratory and swallowing muscles and then spread to all muscles. Convulsions begin. In this state, a slight sound, sunlight, lamplight, or a slight touch of something to the patient's body causes muscle spasms.

## Conclusion and Suggestions

At a time when infectious diseases remain the most pressing threat to human health, the importance of modern diagnostic methods is increasing further. Rapid, accurate, and reliable diagnosis not only saves the patient's life but also serves to break the chain of disease transmission throughout society. The diagnostics currently applied, such as PCR, express tests, genetic analyses, serological methods, and diagnosis aided by artificial intelligence, are bringing a new approach to medical practice. The main advantage of modern diagnostics is the possibility of early detection of the disease, prevention of complications, and selection of the correct treatment strategy. Every accurate diagnosis is not only the recovery of one patient but also the safety of the entire society. Therefore, introducing innovative technologies in medicine, modernizing laboratories, and equipping specialists with modern knowledge is the most important step towards a healthy future.

Modern diagnostics is not a simple process, but the strongest weapon in preserving human health. The rational use of its capabilities is the duty of every society and a responsibility to future generations.



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