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# ZOONOTIC THREATS IN UZBEKISTAN: A COMPREHENSIVE REVIEW OF TEN YEARS' SURVEILLANCE AND FUTURE PROSPECTS

**Bozoraliev Shokhuh**
Tashkent State Medical University
showy.angren@mail.ru

## Introduction

Zoonotic diseases—those transmitted between animals and humans—constitute a persistent and complex threat to global health, agriculture, and socioeconomic stability. The World Health Organization estimates that more than 60 % of all known infectious diseases and approximately 75 % of emerging human pathogens originate from animals. In recent decades, globalization, urbanization, and environmental change have further intensified human–animal contact, increasing the risk of spillover events and re-emergence of endemic infections. The Republic of Uzbekistan, situated at the heart of Central Asia, is no exception. Its continental climate, varied geography ranging from desert to mountain ecosystems, and large livestock population provide a natural setting for the maintenance and transmission of numerous zoonotic agents.

Uzbekistan's economy relies heavily on agriculture and animal husbandry, with millions of cattle, sheep, goats, and camels raised across rural areas. The close and often traditional relationships between humans and livestock, coupled with uneven access to veterinary and medical services, create favorable conditions for zoonotic infections. Several diseases of veterinary and public-health significance—such as brucellosis, anthrax, rabies, echinococcosis, and Crimean–Congo haemorrhagic fever (CCHF)—are recognized by the Ministry of Health and the State Veterinary Committee as priority threats. The presence of natural foci of plague in desert and steppe regions, sporadic outbreaks of zoonotic tuberculosis, and ongoing surveillance for avian and swine influenza viruses further emphasize the importance of the "One Health" approach, which integrates human, animal, and environmental health perspectives.

Brucellosis remains one of the most widespread zoonoses in Uzbekistan, particularly in rural regions where livestock vaccination coverage and diagnostic capacity are limited. Human brucellosis cases are primarily linked to occupational exposure among farmers, veterinarians, and meat-processing workers. Anthrax, caused by Bacillus anthracis, persists in endemic foci associated with contaminated soil and animal products, periodically resulting in localized outbreaks. Rabies continues to be a major concern, especially due to infections transmitted by stray dogs, although ongoing vaccination campaigns have contributed to gradual reductions in incidence. Echinococcosis, caused by Echinococcus granulosus and E. multilocularis, represents a silent but significant burden, with high infection rates reported among livestock and domestic dogs, leading to human cystic echinococcosis that often requires surgical treatment. Meanwhile, sporadic human cases of CCHF have been documented, reflecting the circulation of Hyalomma ticks and endemic viral activity in several regions.

The epidemiological situation of these diseases is influenced by multiple factors, including environmental conditions, livestock management practices, and the mobility of human and animal populations. Surveillance data in Uzbekistan remain fragmented across sectors, and true disease burdens are likely underestimated due to limited diagnostic testing and under-reporting, particularly in remote areas. Nonetheless, recent national and international initiatives—such as the Joint External Evaluation (JEE, 2022) and the One Health Zoonotic Disease Prioritization Workshop—have improved coordination between public-health and veterinary institutions, leading to the identification of eight priority zoonotic diseases for targeted action.

This article aims to present an updated overview of the prevalence, trends, and control measures of the major zoonotic diseases in the Republic of Uzbekistan from 2010 to 2024. By analyzing available epidemiological and surveillance data, it seeks to highlight regional patterns, identify

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gaps in reporting systems, and discuss the implications for public health and biosafety. Strengthening integrated surveillance, enhancing laboratory capacity, and promoting community education will be essential for mitigating zoonotic risks and ensuring sustainable disease control within the framework of the national One Health strategy

## Materials and Methods

### Study Design

This study employed a retrospective, descriptive epidemiological design to assess the prevalence and distribution of major zoonotic diseases in the Republic of Uzbekistan from 2015 to 2024. The investigation focused on seven key zoonoses prioritized in the national "One Health" framework: Crimean–Congo haemorrhagic fever (CCHF), anthrax, rabies, brucellosis, zoonotic tuberculosis, plague, zoonotic influenza (avian and swine), and echinococcosis.

### Data Sources

Official national surveillance data were collected from multiple governmental and international sources, including:

- The **Ministry of Health of the Republic of Uzbekistan**, particularly annual epidemiological bulletins and disease notification reports.
- The **State Committee for Veterinary and Livestock Development**, which maintains animal health surveillance statistics.
- International health agencies such as the **World Health Organization (WHO)**, the **World Organisation for Animal Health (WOAH)**, and the **Food and Agriculture Organization (FAO)**, whose databases (e.g., WAHIS, FAOSTAT) include zoonotic disease records submitted by Uzbekistan.
- Peer-reviewed literature and official reports from **CDC** and national research centers involved in zoonosis control.

All retrieved data were verified for consistency by cross-referencing reported case numbers across at least two independent sources when possible.

### Data Extraction and Processing

Data were extracted for each disease by year, region, and host type (human or animal) where available. Records containing incomplete or contradictory entries were re-examined using secondary references or excluded from the quantitative analysis. For years with missing values, trend interpolation was avoided to prevent artificial bias in disease trend estimation.

### Variables and Indicators

The primary variables included annual case counts, incidence rates per 100,000 population, and, when available, animal infection rates or outbreak frequencies. Supplementary indicators—such as vaccination coverage, mortality rate, and outbreak location—were also included where data existed (notably for rabies and anthrax).

### Data Analysis

Descriptive statistical analysis was performed using Microsoft Excel 2021 and SPSS 26.0. Temporal trends were visualized using line and bar charts, while spatial distribution across regions of Uzbekistan was mapped using ArcGIS 10.8. The analysis aimed to identify changes in disease patterns over the decade and to evaluate the impact of national One Health initiatives on zoonosis control.

### Ethical Considerations

All data used in this study were obtained from publicly accessible governmental and institutional reports; hence, no individual patient identifiers were included. Ethical approval was not required, as the study relied solely on aggregated secondary data.

## RESULTS

Zoonotic diseases, which are transmitted from animals to humans, remain an enduring public health concern in Uzbekistan. The period between 2015 and 2024 demonstrates diverse patterns of persistence, resurgence, and control across major zoonoses. The table provides a decade-long

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overview of eight significant zoonotic diseases: Crimean–Congo hemorrhagic fever (CCHF), anthrax, rabies, brucellosis, zoonotic tuberculosis, plague, zoonotic influenza, and echinococcosis. Together, these data highlight the evolving epidemiological landscape of zoonoses in Uzbekistan, influenced by factors such as animal husbandry practices, environmental changes, socioeconomic transitions, and improvements in public health surveillance.

**1. Crimean–Congo Hemorrhagic Fever (CCHF)**

CCHF is a tick-borne viral hemorrhagic disease endemic to Central Asia. In Uzbekistan, the annual number of confirmed CCHF cases fluctuated from **7 in 2020** to **21 in 2024**, showing a **gradual resurgence** after the COVID-19 pandemic period. The initial rise between 2015 (14 cases) and 2017 (19 cases) reflects both improved diagnostic capacity and heightened tick activity due to warm climatic trends.

The decline to single-digit cases in 2019–2020 corresponds to intensive vector control efforts and the restriction of livestock movement during the pandemic. However, post-pandemic years (2022–2024) show a renewed increase, possibly linked to resumed agricultural mobility, expanded grazing areas, and the reestablishment of livestock markets.

These findings align with WHO and FAO reports indicating that the **Ferghana Valley, Samarkand, and Surkhandarya regions** remain high-risk zones. The upward trend emphasizes the need for integrated tick control, community education among shepherds, and improved biosafety for healthcare workers handling suspected cases.

**2. Anthrax**

Anthrax, caused by Bacillus anthracis, is a long-standing zoonotic disease in Uzbekistan, primarily affecting livestock herders and those handling animal products. The data show **relative stability with a mild upward trend**, from **18–28 cases in 2015–2019** to **31 cases in 2024**.

The persistence of anthrax reflects continued spore contamination in endemic soils, insufficient vaccination coverage among livestock, and the exposure of agricultural workers. While Uzbekistan's Ministry of Agriculture has maintained annual livestock vaccination programs, compliance and coverage remain inconsistent, especially in remote areas.

Notably, anthrax outbreaks are typically localized, occurring in the **Kashkadarya, Bukhara, and Karakalpakstan** regions where traditional animal slaughtering practices are common. Public health education campaigns, coupled with stricter veterinary oversight, are essential to further reduce human cases. The modest increase in recent years underscores the necessity for sustained investment in rural veterinary infrastructure.

**3. Rabies**

Rabies remains one of the most preventable yet persistent zoonoses in Uzbekistan. The table indicates a **slight decrease** from **11 cases in 2015** to **8–10 cases annually** in recent years. Although this appears stable, each case represents a fatal outcome and a preventable tragedy.

The consistent presence of rabies highlights challenges in controlling stray dog populations, limited vaccination among domestic animals, and delayed post-exposure prophylaxis (PEP) in rural communities. The **Tashkent, Namangan, and Andijan** regions report most cases, often associated with dog bites.

Over the past decade, the Ministry of Health has improved the availability of rabies immunoglobulin and vaccines. However, surveillance gaps and the absence of comprehensive animal control programs hinder complete eradication. Continued intersectoral collaboration between veterinary and human health services under the "One Health" framework is crucial to achieving zero human rabies deaths by 2030.

**4. Brucellosis**

Brucellosis remains the **most prevalent zoonotic disease in Uzbekistan**, with annual case numbers ranging from **588 (2020)** to **742 (2015)**. Despite a gradual decline in the mid-2010s, the disease persists as a major occupational hazard among farmers, veterinarians, and dairy workers.

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The **Brucella melitensis** species, transmitted through unpasteurized milk or contact with infected animals, is the dominant cause. The observed decrease from 2015 to 2020 corresponds with improved livestock vaccination and public awareness campaigns. However, the **resurgence from 2021 onward** (up to 701 cases in 2024) suggests gaps in continuous control, likely due to incomplete herd immunization and informal livestock trade.

FAO's regional zoonoses program identifies Uzbekistan as a key area for brucellosis surveillance, recommending targeted interventions in **Fergana, Samarkand, and Jizzakh** regions. Continued monitoring and farmer training are needed to sustain reductions.

**5. Zoonotic Tuberculosis**

Zoonotic tuberculosis (TB), primarily caused by Mycobacterium bovis, accounts for a small but persistent share of TB cases in Uzbekistan. Over the decade, reported zoonotic TB cases hovered between **164 and 189 annually**, showing **stable endemicity without significant growth**.

These figures suggest controlled transmission due to improved milk pasteurization and veterinary inspections. However, the continued presence of zoonotic TB indicates undetected reservoirs within livestock and limited diagnostic differentiation between M. tuberculosis and M. bovis in rural laboratories.

WHO's 2023 TB report highlights Uzbekistan's advances in TB surveillance but calls for improved cross-sectoral diagnostic integration. Future strategies must strengthen the "One Health" laboratory network to accurately trace and manage zoonotic TB cases.

**6. Plague**

Plague, historically endemic in Central Asia, shows **no reported human cases** from 2015–2024 in Uzbekistan. The country's **Karakalpakstan and Navoi desert regions**, known as natural plague foci, are continuously monitored through rodent and flea surveillance.

The absence of cases suggests effective vector control and environmental monitoring. However, ecological changes due to climate variation or rodent migration may reactivate dormant foci. Sustained funding for field monitoring and rapid response systems is therefore vital to maintain this zero-case status.

**7. Zoonotic Influenza (Avian and Swine)**

Zoonotic influenza cases remain rare, with occasional isolated detections (1–3 per year). Between 2015 and 2024, the data show sporadic cases of **avian influenza (H5N1/H9N2)** and occasional **swine-origin influenza (H1N1)**.

The complete absence of reported cases in 2020 reflects the dominance of the SARS-CoV-2 pandemic, during which testing priorities shifted. Renewed detections in 2021–2024 align with increased international monitoring of avian influenza strains.

Uzbekistan participates in FAO's Central Asian Influenza Network, which conducts avian surveillance at poultry farms and migratory bird sites. Continued investment in veterinary laboratory diagnostics is critical to detect potential mutations and prevent cross-species transmission.

**8. Echinococcosis**

Echinococcosis, caused by Echinococcus granulosus (cystic form), remains a **major parasitic zoonosis** in Uzbekistan. The decade-long data demonstrate a slow decline from **438 cases in 2015** to **341 in 2020**, followed by a gradual increase to **402 in 2024**.

The disease burden is concentrated in **rural and pastoral communities**, particularly in **Karakalpakstan, Surkhandarya, and Kashkadarya**, where home slaughtering and contact with stray dogs are common. The mid-decade decline likely resulted from improved meat inspection and public health campaigns. The post-pandemic resurgence could reflect reduced veterinary surveillance and increased stray dog populations.

Cystic echinococcosis imposes a considerable socioeconomic burden due to surgical costs and disability-adjusted life years (DALYs). Preventive strategies should emphasize deworming of dogs, livestock vaccination trials, and mass education on safe meat-handling practices.

**9. General Trends and Public Health Implications**

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Across the studied decade, Uzbekistan's zoonotic disease profile reveals a **dual pattern** of progress and persistence. Diseases with strong veterinary vaccine components, such as anthrax and brucellosis, show moderate control but remain endemic due to uneven immunization. Vector-borne infections like CCHF demonstrate climatic sensitivity, while parasitic and viral diseases like echinococcosis and rabies remain tied to socioeconomic and behavioral factors.

The **COVID-19 pandemic period (2020–2021)** represents a critical inflection point: while some diseases declined due to restricted movement, others resurged post-pandemic due to surveillance gaps and delayed vaccination programs.

The absence of plague and low influenza incidence reflect effective early warning systems. However, the overall stability of zoonotic disease burden underscores that Uzbekistan, like many agrarian economies, remains vulnerable to animal–human interface diseases.

Government initiatives — such as the "One Health Strategy 2022–2030," modernization of the Sanitary-Epidemiological Service, and cooperation with WHO, FAO, and OIE — have enhanced detection and response capacity. Yet, persistent challenges include limited laboratory integration, uneven rural healthcare access, and insufficient public awareness of zoonotic risks.

## CONCLUSION AND FUTURE PROGNOSIS

The decade-long overview of zoonotic diseases in Uzbekistan (2015–2024) reveals a complex but steadily improving landscape in the management of zoonotic threats. Despite significant progress in public health infrastructure and One Health collaboration, zoonoses remain a persistent concern due to the country's agricultural dependence, environmental diversity, and cross-border animal movement.

Overall, the trends demonstrate **relative stability** with **localized fluctuations** driven by climatic variation, vector behavior, and socio-economic conditions. Major endemic diseases such as **brucellosis**, **echinococcosis**, and **anthrax** continue to contribute most to the national zoonotic burden, while high-risk vector-borne infections such as **Crimean–Congo hemorrhagic fever (CCHF)** show sporadic outbreaks but no nationwide spread.

### Key Achievements

Uzbekistan's consistent coordination with WHO, FAO, and OIE frameworks has strengthened its surveillance and early response systems. The implementation of the Joint External Evaluation (JEE) recommendations and integration of the One Health approach have notably improved risk assessment capacities, intersectoral coordination, and laboratory diagnostics.

The country successfully maintained a **zero-case status for plague** during the entire decade, and zoonotic tuberculosis remained under epidemiological control. The **steady decline of rabies and anthrax** in humans underscores the effectiveness of mass vaccination campaigns and veterinary outreach programs. Additionally, improved laboratory networks and pathogen-specific training have enhanced diagnostic accuracy for brucellosis and CCHF.

### Persistent Challenges

However, some challenges remain evident. Data from multiple sources indicate that **a unified national zoonotic surveillance database** is still lacking — most figures are scattered among ministerial bulletins, WHO assessments, and regional studies. This data fragmentation limits comprehensive year-by-year epidemiological comparisons and hinders real-time risk analysis.

Moreover, rural areas face persistent gaps in veterinary coverage, biosecurity measures, and community education. **Brucellosis and echinococcosis** remain widespread due to informal livestock markets, limited herd vaccination, and traditional slaughtering practices. Similarly, sporadic **CCHF outbreaks** suggest that tick control measures and personal protective behavior among agricultural workers require reinforcement.

The effects of **climate change** — including warmer winters and longer tick activity seasons — may further elevate CCHF and other vector-borne risks in the coming decade. Urbanization and agricultural intensification could also expand human–animal interfaces, increasing the risk of novel zoonotic spillovers.

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**Future Prognosis (2025–2035)**

Looking ahead, Uzbekistan's zoonotic disease landscape is expected to experience **gradual but measurable improvement**, provided that current initiatives continue to mature under the One Health framework. The national capacity for disease prevention, detection, and response will likely expand through digital surveillance, genomic diagnostics, and increased collaboration with regional networks.

**1. Brucellosis and Anthrax**

Brucellosis will likely remain a **priority zoonosis** through 2030, with moderate declines expected due to expanded livestock vaccination and improved milk pasteurization practices. However, achieving full elimination will depend on controlling informal livestock trade and strengthening veterinary field services. Anthrax, already relatively stable, is projected to decline further as vaccination coverage and soil decontamination efforts improve.

**2. CCHF and Other Vector-Borne Diseases**

CCHF is projected to show **periodic re-emergence** in endemic zones, particularly in southern and western provinces. With climate warming and increased mobility of livestock, isolated clusters may occur every 2–3 years. Uzbekistan's future preparedness will rely on strengthening vector surveillance, developing local diagnostic kits, and maintaining continuous health worker training. Regional coordination with Kazakhstan, Turkmenistan, and Tajikistan will be crucial for managing cross-border tick-borne threats.

**3. Rabies**

If current mass vaccination of dogs continues and post-exposure prophylaxis becomes universally accessible, **human rabies cases could approach zero by 2030**, aligning with WHO's "Zero by 30" global target. However, maintaining this achievement will require sustainable municipal funding for dog population control and public awareness.

**4. Zoonotic Tuberculosis**

Zoonotic TB incidence is expected to **remain low**, though better differentiation between M. bovis and M. tuberculosis through molecular diagnostics may reveal slightly higher true incidence. Integration of veterinary and human TB databases will help clarify the burden and prevent underreporting.

**5. Echinococcosis**

Echinococcosis may persist as a **public health challenge**, particularly in pastoral communities. Without nationwide dog deworming programs, human cases will likely remain at current levels (350–450 annually). Nevertheless, implementation of community-based pilot control programs could lead to regional declines within 5–7 years.

**6. Plague and Zoonotic Influenza**

These diseases are expected to remain **sporadic and low-risk**. Active environmental monitoring and regional alert systems will continue to prevent reemergence. However, ongoing mutation in avian influenza strains (H5N1, H9N2) requires vigilance, especially along migratory bird routes crossing Central Asia.

**Strategic Outlook**

To achieve substantial reductions in zoonotic disease incidence by 2035, Uzbekistan should focus on **three strategic priorities**:

1. **Integrated National Database:**

Developing a single digital platform consolidating data from human, veterinary, and environmental health sectors would dramatically improve early detection and evidence-based policy decisions.

2. **Rural Health Strengthening:**

Expanding mobile veterinary clinics, community health education, and livestock vaccination campaigns will be essential for reducing disease reservoirs in high-risk zones.

pISSN:2349-5707 Volume:12,Issue 11,November-2025 eISSN:2349-5715

3. **Research and Innovation:**
Investment in genomic surveillance, climate–health modeling, and predictive analytics will help anticipate zoonotic emergence under changing environmental and socio-economic conditions.

**Final Perspective**

Uzbekistan's achievements over the past decade demonstrate strong political commitment to zoonotic disease control and alignment with global health security standards. While endemic diseases such as brucellosis and echinococcosis persist, their long-term reduction is achievable through coordinated, science-based interventions.

By 2035, with sustained One Health integration, Uzbekistan has the potential to become a **regional leader in zoonotic disease management**, demonstrating how middle-income countries can balance agricultural growth with health security and biosafety.

In summary, the prognosis for zoonotic disease control in Uzbekistan is **cautiously optimistic**: sustained progress is expected, but long-term success depends on continuous investment, data integration, and community-level engagement — ensuring that both humans and animals share a healthier, safer environment in the decade ahead.

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