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ANALYSIS OF THE EPIZOOTIC DYNAMICS OF REGISTERED INFECTIOUS DISEASES IN THE WEST KAZAKHSTAN REGION

ANNOTATION

An analysis of the epizootic dynamics of registered infectious diseases in the West Kazakhstan region was conducted based on statistical data by district for 2009-2025.

The study examined the prevalence and frequency of outbreaks of diseases such as rabies, carnivore plague, pasteurellosis, brucellosis, listeriosis, swine influenza, anthrax, and other infectious diseases in various districts of the region. A comparative analysis of the data revealed seasonal and annual fluctuations in epizootic trends.

The characteristics of the spread of diseases by district were studied, and a trend towards an increase in the incidence of certain infections was identified. For example, stable registration of rabies and carnivore plague was noted in the Akzhaik and Bokeiordinsky districts, and a sharp increase in the incidence of pasteurellosis was recorded in the Shyngyrlau district. These data indicate the need to strengthen measures to control and prevent the epizootic situation.

In addition, regional differences in incidence rates have been identified, confirming the dependence of the epizootic situation on regional characteristics. The spread of particularly dangerous infections, such as carnivore plague and rabies, causes significant damage to livestock farming, highlighting the importance of effective work by the region's veterinary services.

The results of the study indicate the need to develop comprehensive strategies for the prevention and control of infectious diseases through continuous epizootic monitoring and systematic data collection. Such an approach will improve the effectiveness of planning and management in the veterinary service and ensure stability in the livestock sector.

In this regard, improving veterinary and preventive measures aimed at stabilizing the epizootic situation in the West Kazakhstan region appears to be a pressing task. The recommendations formulated on the basis of the analysis can be used as a scientifically sound basis for decision-making in the field of livestock development and the control of infectious diseases.

Key words: *Farm animals, infectious diseases, epizootic dynamics, epizootic situation.*

Introduction. Infectious diseases among farm animals pose a significant threat to regional epizootic stability and veterinary safety. The West Kazakhstan Region is one of the country's key areas for livestock development, making the study of the structure and dynamics of registered zoonotic and infectious diseases in this region highly relevant [1].

An assessment of the epizootic situation reveals that the most frequently reported diseases in the region include rabies, blackleg, pasteurellosis, braxy, listeriosis, anthrax, sheep pox, leptospirosis, and brucellosis. Many of these diseases pose a threat not only to animals but also to humans, thus making their control one of the main priorities of veterinary and sanitary services [2, 3].

Rabies remains one of the most dangerous zoonoses and has been reported almost every year in the West Kazakhstan Region. This situation can be attributed to various biogeographical factors, the growth of wild carnivore populations, and insufficient vaccination coverage [4].

Blackleg and pasteurellosis are consistent components of the regional epizootic landscape. These diseases are most actively recorded during the summer grazing season, which is associated with the long-term persistence of pathogens in the soil and their resistance to extreme environmental conditions [5, 6]. For instance, in his 2018 study, Zhumabekov K.S. thoroughly described the seasonal activity and soil transmission risks of blackleg [7].

In recent years, cases of listeriosis, leptospirosis, infectious bovine rhinotracheitis, malignant edema, and anthrax have also been reported, indicating the need to strengthen epidemiological surveillance in the region [8, 9].

According to international studies (FAO, WOA), the main factors contributing to the spread of diseases include animal migration, insufficient veterinary measures, breaches of biosecurity protocols, persistence of natural foci, and climate change [10, 11]. These findings are also relevant in the context of Kazakhstan. For example, Sihvonen and Tuovinen (2020) emphasized the importance of border control in preventing rabies and brucellosis in Finland, while Subramaniam (2019) discussed the persistence of pasteurellosis and anthrax in endemic areas in Asian countries [12, 13].

Domestic researchers such as Saparbekova D. (2020), Nurtaev A. (2019), and Shyngyssova A. (2022) have conducted in-depth analyses of the geographical distribution and prevention of animal diseases. Based on the results of epizootic monitoring, they highlight the need to eliminate disease foci and increase vaccination coverage for pasteurellosis, braxy, rabies, and blackleg [14-16].

Analyses conducted in the West Kazakhstan Region indicate significant differences in disease incidence across districts. For example, the Karatobe, Syrym, Boralday (Börli), and Akzhaik districts demonstrated higher registration rates. This is directly linked to livestock density, pastureland distribution, and sanitary conditions [17, 18].

Overall, the dynamics of infectious disease spread in the West Kazakhstan Region between 2009 and 2025 were inconsistent. Sharp annual fluctuations in certain diseases indicate the need to improve forecasting systems for epizootic risks. In this context, it is essential to develop specific preventive strategies by integrating international experience with national scientific research [19, 20].

Materials and Methods. The research was based on epizootic data collected between 2009 and 2025 from 13 districts of the West Kazakhstan Region. The data were obtained from the district branches of the Committee for Veterinary Control and Supervision under the Ministry of Agriculture of the Republic of Kazakhstan, as well as from the regional veterinary departments. The dataset included the annual incidence and spread of infectious diseases registered in each district, such as rabies, blackleg, pasteurellosis, braxy, listeriosis, anthrax, swine erysipelas, sheep pox, brucellosis, leptospirosis, malignant edema, and others.

Quantitative statistical methods were applied to assess the frequency and structure of infectious disease outbreaks. For each disease, the number of cases recorded annually and at the district level was calculated, and their relative proportions were determined.

A comparative epizootiological analysis was conducted to identify differences in the prevalence of infectious diseases across various years and districts.

Trend analysis methods were used to assess the increase or decrease in the number of reported infectious disease cases over the 2009-2025 period.

To visualize the geographic distribution of diseases, cartographic mapping techniques were employed.

In evaluating the seasonal, regional, and multi-year patterns of disease spread, factors such as the veterinary and sanitary situation, livestock density, climatic conditions, and the extent of vaccination coverage were taken into account.

The results of the study serve as a foundation for assessing the spatial and temporal structure of infectious diseases and for improving disease prevention and control strategies in the region.

Results and Analysis. During the study, a comprehensive approach was applied using quantitative-statistical, comparative, dynamic, cartographic, and graphical analysis methods to evaluate the epizootic situation of infectious diseases registered in the West Kazakhstan Region from 2009 to 2025.

Quantitative-statistical analysis enabled the calculation of the annual and district-level incidence rates and the structural proportions of each disease (as shown in Table 1). This method allowed for the identification of the most prevalent and recurrent forms of infectious diseases.

Table 1 – Incidence and structural proportion of infectious diseases in 2009–2025

№	Disease name	Incidence (number of cases)	Structural proportion (%)
1	Blackleg	257	51.4%
2	Pasteurellosis	44	8.8%
3	Rabies	163	32.6%
4	Listeriosis	3	0.6%
5	Braxy	6	1.2%
6	Anthrax	3	0.6%
7	Sheep pox	4	0.8%
8	Infectious rhinotracheitis	8	1.6%
9	Swine erysipelas	2	0.4%
10	Brucellosis	5	1.0%
11	Foot-and-mouth disease	2	0.4%
12	Malignant edema	1	0.2%
13	Salmonellosis	1	0.2%
14	Leptospirosis	1	0.2%
	Total	500	100%

Analysis of Table 1 shows that a total of 500 cases of infectious diseases in farm animals were registered in the West Kazakhstan Region during the period from 2009 to 2025.

Blackleg was identified as the most common infectious disease, accounting for 51.4% of all cases (257 cases). This finding demonstrates the widespread presence, high risk, and persistent epizootic threat posed by blackleg in the region.

Rabies ranks second, with 163 recorded cases (32.6%). This confirms its ongoing circulation among animals and underscores its significance as a major zoonotic disease that poses a direct threat to human health.

Pasteurellosis was recorded 44 times, representing 8.8% of the total, and is considered an important factor contributing to epizootic instability.

Less frequent diseases included: listeriosis (0.6%), braxy (1.2%), anthrax (0.6%), sheep pox (0.8%), infectious rhinotracheitis (1.6%), brucellosis (1.0%), swine erysipelas and foot-and-mouth disease (0.4% each), as well as malignant edema, salmonellosis, and leptospirosis, each recorded only once with a structural proportion of 0.2%.

These rare diseases occurred sporadically and have lower epidemiological risk, but still require timely monitoring and control.

The comparative epizootiological analysis formed the basis for identifying variations in disease occurrence across years and districts.

As a result of the comparative analysis of infectious disease incidence in farm animals across the 13 districts of the West Kazakhstan Region from 2009 to 2025, significant differences in the intensity and structure of disease spread between the regions were identified (as described in Table 2).

Table 2 – Total number of reported infectious disease cases by district (2009-2025)

№	District Name	Number of Cases	Structural Proportion (%)
1	Baiterek	38	7.6%
2	Borli	62	12.4%
3	Syrym	60	12.0%
4	Shyngyrlau	43	8.6%
5	Karatobe	45	9.0%
6	Bokeyorda	56	11.2%
7	Terekti	34	6.8%
8	Akzhaik	47	9.4%
9	Kaztalov	26	5.2%

10	Oral (Uralsk)	21	4.2%
11	Zhanakala	22	4.4%
12	Zhanibek	12	2.4%
13	Taskala	34	6.8%

Comparative analysis of the structural proportions of epizootic cases based on the data in Table 2 shows that the districts of Borli (12.4%), Syrym (12.0%), Bokeyorda (11.2%), Akzhaik (9.4%), Karatobe (9.0%), and Shyngyrlau (8.6%) were the regions with the highest number of infectious disease reports. The high percentage of cases registered in these districts highlights the complexity of the epizootic situation and the significant level of veterinary risk. Such patterns are frequently observed in areas with intensive livestock farming, proximity to border zones, and frequent contact with wild fauna.

Following these are Baiterek (7.6%), Terekti (6.8%), Taskala (6.8%), and Kaztalov (5.2%). Although these districts also recorded a notable number of cases, their structural share is somewhat lower compared to the top six. This may indicate more effective epizootic control or consistent implementation of preventive veterinary measures.

The Oral (4.2%), Zhanakala (4.4%), and Zhanibek (2.4%) districts had the lowest percentage of reported cases. This may reflect relatively stable epizootic conditions or the localized nature of disease outbreaks. However, lower rates do not imply the absence of risk, and regular veterinary surveillance should be maintained in these areas as well.

In general, the data indicate an uneven distribution of infectious diseases across the districts of the West Kazakhstan Region. Given the variability in the structural share of diseases at the district level, a differentiated approach to epizootic monitoring is essential for effective disease outbreak prevention and control.

Dynamic trend analysis of annual infectious disease incidence further shows that the epizootic situation has fluctuated over time, as illustrated in Figure 1.

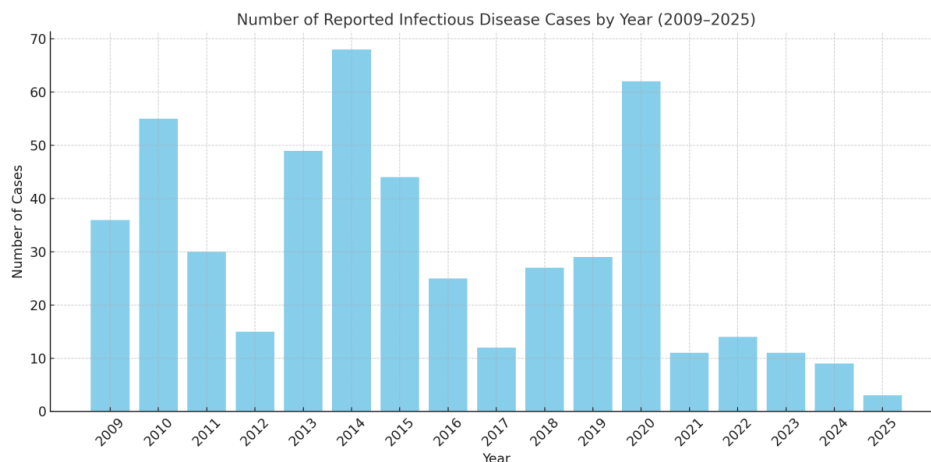


Figure 1 – Dynamics of infectious disease cases by year

According to Figure 1, the year 2014 had the highest number of recorded infectious disease cases, accounting for 13.6% of all reported cases during the study period. This peak indicates a sharp deterioration in the epizootic situation at that time. Elevated activity was also noted in 2010 (11.0%), 2020 (12.4%), and 2013 (9.8%), reflecting other periods of heightened epizootic pressure (Figure 1).

Conversely, the lowest number of reported cases occurred in 2025 (0.6%), 2024 (1.8%), and 2017 (2.4%). The low incidence rates during these years may be attributed to the effectiveness of preventive measures and consistent implementation of veterinary surveillance and control efforts.

Notably, some years demonstrated sudden surges in disease cases. For instance, in 2020, 62 cases were recorded, accounting for 12.4% of the total. This increase may be related to natural and ecological factors, seasonal transmission patterns, or worsening epidemiological conditions in specific districts.

In contrast, only 3 cases were reported in 2025, representing just 0.6% of the overall structure. This low figure suggests that disease outbreaks were well controlled, prophylactic measures were effectively implemented, and veterinary services operated efficiently during that period.

In summary, the frequency of infectious disease reports over the years has shown an unstable pattern, with noticeable peaks and declines. These fluctuations are influenced by multiple factors and

emphasize the importance of systematic monitoring and consistent implementation of preventive measures in managing the epizootic situation.

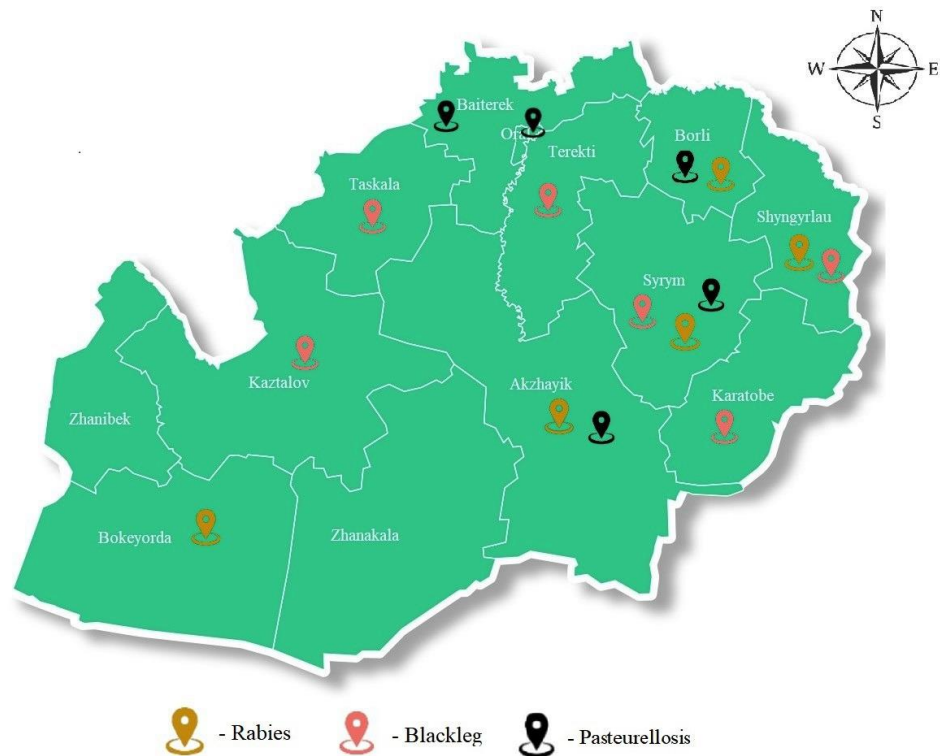


Figure 2 – The epizootic situation across districts of the West Kazakhstan Region

The cartographic visualization method allowed for the spatial assessment of the epizootic situation across districts of the West Kazakhstan Region, facilitating the geographical analysis of disease distribution patterns (Figure 2).

In particular, spatial clustering of frequently registered infectious diseases such as pasteurellosis, blackleg, and rabies was identified in several districts:

Rabies has been reported annually in the districts of Borli, Bokeyorda, Akzhaik, Syrym, and Shyngyrlau. The natural landscape of these areas (e.g., forest zones, border proximity) likely increases the risk of contact with wild animals, contributing to the widespread distribution of the disease. These findings suggest a direct link between ecological factors and rabies prevalence.

Blackleg was systematically registered in Taskala, Karatobe, Kaztalov, Syrym, Shyngyrlau, and Terekti districts. The relatively even spread of the disease across these areas indicates its endemic nature and underscores the necessity of consistent epizootic monitoring.

Pasteurellosis was more frequently observed in the Borli, Syrym, Baiterek, Akzhaik, and Oral districts. This pattern may be associated with areas of high livestock density or weakened veterinary control systems.

Overall, the results of the study indicate that some infectious diseases (particularly blackleg, rabies, and pasteurellosis) are persistently registered across the region. This necessitates enhanced preventive efforts by veterinary services and the systematic implementation of epizootic monitoring.

Furthermore, considering both spatial and temporal variations, it is recommended to implement district-level, differentiated veterinary-sanitary measures in a timely and targeted manner.

Conclusion. The results of this study demonstrate that the epizootic situation of infectious diseases among farm animals in the West Kazakhstan Region from 2009 to 2025 was complex and characterized by significant spatial and temporal variation.

Through the integrated use of quantitative-statistical, comparative, dynamic, and cartographic analysis methods, the following key findings were established:

- A total of 500 cases of infectious diseases were registered during the study period;
- Blackleg (51.4%), rabies (32.6%), and pasteurellosis (8.8%) were identified as the most frequently reported and structurally significant infectious diseases, posing the highest epizootic threat in the region;

▪ Rare zoonotic diseases such as listeriosis, braxy, anthrax, brucellosis, and infectious rhinotracheitis had low structural proportions but still pose potential biological safety risks.

At the district level, the epizootic situation was uneven. The highest number of disease cases was recorded in Borli, Syrym, Bokeyorda, Akzhaik, Karatobe, and Shyngyrlau districts. Elevated incidence in these areas is likely related to natural-geographical factors, the intensity of livestock farming, and increased interaction with wild fauna.

Significant variation was also observed across different years. The peak levels of disease registration occurred in 2014 (13.6%), 2020 (12.4%), and 2010 (11%), while the lowest levels were recorded in 2025 (0.6%), 2024 (1.8%), and 2021 (2.2%). These fluctuations clearly reflect the influence of ecological, seasonal, social, and management factors on the course of epizootic processes.

The use of cartographic visualization enabled precise spatial assessment of disease distribution and identification of epizootic hotspots. This method was particularly effective in mapping the geographic clustering of pasteurellosis, blackleg, and rabies.

Overall, the results confirm that epizootic risk remains in the West Kazakhstan Region. However, a noticeable decline in disease incidence in recent years indicates the effectiveness of implemented preventive measures. Based on these findings, the following actions are recommended:

- Strengthening veterinary and sanitary measures in high-risk districts;
- Conducting annual epizootic monitoring;
- Implementing differentiated epizootic control approaches;
- Systematizing vaccination programs as a key condition for ensuring regional biological safety.

The outcomes of this study provide a methodologically sound foundation for making evidence-based decisions in epizootic risk management and for improving veterinary policy at the regional level.

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ТҮЙІН

Батыс Қазақстан облысы жағдайында тіркелген жұқпалы аурулардың эпизоотиялық динамикасын талдау 2009-2025 жылдар аралығындағы аудандық деңгейдегі статистикалық мәліметтер негізінде жүргізілді. Зерттеу барысында облыстың әртүрлі аудандарында құтыру, қарасан, пастереллез, браздот, листериоз, шошқа тілмесі, сібір жарасы және басқа да жұқпалы аурулардың таралуы мен өршу қарқыны зерделенді. Мәліметтерді салыстырмалы талдау эпизоотологиялық үрдістердің маусымдық және жылдық ауытқуларын анықтауға мүмкіндік берді.

Аудандар бойынша аурулардың таралу ерекшеліктері зерттеліп, кейбір инфекциялар бойынша ауру көрсеткіштерінің ұлғаюы байқалды. Мысалы, Ақжайық және Бөкейорда аудандарында құтыру және қарасан ауруларының тұрақты тіркелуі, сондай-ақ Шыңғырлау ауданында пастереллез ауруының кенеттен өршуі көрініс тапқан. Бұл эпизоотиялық жағдайды бақылау мен алдын алу шараларын күшейту қажеттігін көрсетеді.

Сонымен қатар, талдау барысында аурулардың тіркелу деңгейі бойынша географиялық ауытқулар байқалады, бұл эпизоотиялық жағдайдың аудандық ерекшеліктерге тәуелділігін дәлелдейді. Қарасан және құтыру сияқты аса қауіпті инфекциялардың таралуы мал шаруашылығына елеулі зиян келтіріп, облыс аумағындағы ветеринариялық қызметтің маңыздылығын арттырады.

Зерттеудің нәтижелері эпизоотиялық процестерді кешенді мониторингтеу және деректерді жүйелі жинақтау арқылы жұқпалы аурулардың таралуын болдырмау және тиімді алдын алу стратегияларын әзірлеу қажеттігін көрсетеді. Мұндай талдаулар ветеринариялық қызметтің жоспарлау және басқару жүйесін жетілдіруге, мал шаруашылығының тұрақтылығын қамтамасыз етуге мүмкіндік береді.

Осы тұрғыда, Батыс Қазақстан облысында эпизоотиялық жағдайды тұрақтандыруға бағытталған ветеринариялық алдын алу шараларын жетілдіру маңызды міндет болып табылады. Зерттеу ұсыныстары мал шаруашылығын дамыту және жұқпалы аурулармен күрес саласында ғылыми негізделген шешімдер қабылдауға негіз болады.

РЕЗЮМЕ

Анализ эпизоотической динамики зарегистрированных инфекционных заболеваний в Западно-Казахстанской области проведён на основе статистических данных по районам за 2009–2025 годы. В ходе исследования были изучены распространённость и частота вспышек таких заболеваний, как бешенство, чума плотоядных, пастереллёз, браздот, листериоз, грипп свиней, сибирская язва и другие инфекционные болезни в различных районах области. Сравнительный анализ данных позволил выявить сезонные и годовые колебания эпизоотических тенденций.

Изучены особенности распространения заболеваний по районам, выявлена тенденция к росту заболеваемости некоторыми инфекциями. Так, стабильная регистрация бешенства и чумы плотоядных отмечена в Акжайыкском и Бөкейординском районах, а также зафиксирован резкий подъём заболеваемости пастереллёзом в Шыңғырлауском районе. Эти данные свидетельствуют о необходимости усиления мер по контролю и профилактике эпизоотической ситуации.

Кроме того, выявлены территориальные различия в уровне заболеваемости, что подтверждает зависимость эпизоотической обстановки от региональных особенностей. Распространение особо опасных инфекций, таких как чума плотоядных и бешенство, наносит существенный ущерб животноводству, подчёркивая важность эффективной работы ветеринарной службы региона.

Результаты исследования указывают на необходимость разработки комплексных стратегий профилактики и сдерживания инфекционных заболеваний посредством постоянного эпизоотического мониторинга и систематического сбора данных. Такой подход позволит повысить эффективность планирования и управления в ветеринарной службе, а также обеспечит стабильность в сфере животноводства.

В связи с этим совершенствование ветеринарно-профилактических мероприятий, направленных на стабилизацию эпизоотической обстановки в Западно-Казахстанской области, представляется актуальной задачей. Рекомендации, сформулированные на основе анализа, могут быть использованы в качестве научно обоснованной базы для принятия решений в области развития животноводства и борьбы с инфекционными болезнями.