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Emergent and re-emergent zoonotic infectious diseases in Uruguay (2004-2024) and socio-environmental changes. a one health perspective

Abstract

The One Health approach aims to operate at the intersection of human, animal, and environmental influence to prevent and control the scale of these shifts. In recent decades, Uruguay has experienced various productive and socio-environmental alterations. This communication presents some relationships between emerging and increasing zoonotic diseases and some socio-environmental-climatic determinant factors under the One Health framework. We identify emerging and re-emerging zoonotic diseases (e.g. rabies, Leishmaniasis, avian influenza, western equine encephalitis) based on Uruguayan WOAH and the zoonotic reports from the Ministry of Agriculture and Livestock and the Ministry of Public Health. We analyse the outbreaks, cases, deaths, distribution, and time progression. Finally, we compare the monitoring sources and reports and show their differences. There are some differences among them that need to be verified.

Keywords: zoonoses, determinant factors, environment, climate, public health, policies

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Introduction

The One Health approach,[1] operating at the urgent intersection of human, animal, and environmental influence, is crucial to prevent and control the scale of these shifts. One Health (OH) optimises interdependent human, animal, and ecosystem health,[1] although its application is complex.[2] Emerging zoonotic infections are linked to socio-environmental changes, antimicrobial resistance, and climate change.[3,4] Latin America is particularly vulnerable to disease spread due to its dynamic economies and porous borders.[5]

Uruguay in southeast South America has a temperate-humid climate with no dry season. It is part of the Pampas region, with grasslands as the predominant landscape,[6] subject to droughts, floods, and extreme temperatures. Uruguay boasts high per capita income, low inequality, and a large middle class. Yet, it faces socio-economic challenges.[7] Uruguay maintains a good regional health status due to effective border health and preventive actions. However, the emergence of pathogens across the country indicates diverse potential zoonosis sources with uncertain health repercussions.[8]

In recent decades, Uruguay has experienced various productive and socio-environmental-climatic alterations. We identify emerging and re-emerging zoonotic diseases (e.g., rabies, Leishmaniasis, avian influenza, western equine encephalitis) based on the Uruguayan World Organisation of Animal Health, WOAH and the zoonotic reports from the Ministry of Agriculture and Livestock and the Ministry of Public Health.

We analyse the outbreaks, cases, deaths, distribution, time progression, and some socio-environmental-climatic determinant factors of emerging, re-emerging and increasing zoonotic diseases under the One Health framework based on two Research Questions (RQs): RQ 1: What are the emerging zoonoses in Uruguay, and what are their main contributing factors? RQ 2: How is the situation monitored?

Finally, we compare the monitoring sources and reports and show their differences. Understanding and action on these issues are crucial in addressing this global health concern.

Material and methods

We conducted descriptive statistical analyses of the Uruguayan reports of infectious diseases: WOAH, World Organisation of Animal Health (2016-2023), MGAP, Ministry of Agriculture, Livestock and Fisheries zoonosis reports (2016-2021), MSP, Ministry of Public Health notifications on zoonoses, and other relevant reports (e.g., Zoonosis Commission). Then, we analysed the most prominent emerging and re-emerging diseases and some of their socio-environmental-climatic determinant factors, conducted a contextual and historical review of them, compared their differences, and presented the current situation, presenting the data for the country's political-administrative divisions (19 Departments) (Figure 1).

Figure 1 Uruguay map showing the political-administrative division (19 departments)

Source: Maps land (published under the Creative Commons Attribution-Share Alike 3.0 Licence).

We also identified significant climatic and environmental disturbances during 2004-2024. Finally, in Table 1, we investigated their relationship to disease emergence by contrasting the WOAH, MGAP, and other reports, highlighting differences in records (2016-2023).

Emerging and re-emerging infectious diseases in Uruguay

Throughout 2004-2024, Uruguay has witnessed the emergence or re-emergence of six diseases, each with unique challenges. These diseases, including Bat rabies (since 2007), Visceral Leishmaniasis (2015), Dengue (2016), Highly Pathogenic Avian Influenza (2023), Chikungunya (2023), and Western Equine Encephalitis (2023), demand our immediate attention and action. We delve into Rabies, Visceral Leishmaniasis, Avian Influenza, and Western Equine Encephalitis, each presenting its complexities.

Rabies is a viral disease that is almost always fatal, causing thousands of deaths. Dogs are the primary source of infection in 99% of human cases, but in the Americas, vampire bats are also significant vectors. About 95% of deaths occur in Africa and Asia.[9]

Uruguay was declared rabies-free in 1960. However, an outbreak occurred between 1964 and 1968; the last human case was in 1966.[10] In the 1980s, two canine rabies cases were reported. The introduction of infected vampire bats (*Desmodus rotundus*) from Brazil and changes in land use, particularly the habitat provided by the intensive cultivation of trees for cellulose production near the border, led to the first documented outbreak of paralytic rabies in livestock in the country. By 2014, there had been over 300 reported cases.[11]

Uruguay has 22 bat species, with only one being hematophagous (*Desmodus rotundus*), which colonies and rabies-infected insectivorous bats have increased recently, threatening urban rabies reintroduction because Uruguay has had no rabies vaccination campaigns since 2001.[11] The National Academy of Veterinary Medicine expressed concern about the stray dog population and the lack of knowledge about the health status of stray animals and reservoirs, making it impossible to regain rabies-free status.[12]

At the end of 2022 and the beginning of 2023, three cases of rabies were reported in bats, confirming the ongoing risk to people and pets and the virus's continued aerial cycle in bats,[13] which were not included in WOAH reports. In June 2024, an animal rabies case involving a domestic cat was reported. Since the country has been free from urban rabies since 1983, this is the first suspected species to jump from a bat rabies variant to a companion animal, underscoring the need for constant vigilance and monitoring.[14]

Leishmaniasis, caused by over 20 species of *Leishmania protozoa*, is primarily transmitted by sandfly bites. It presents in three primary forms: visceral (fatal if untreated, common in Brazil, East Africa, and India), cutaneous, and mucocutaneous (mainly in Latin America and Africa). Cutaneous Leishmaniasis is most common in the Americas, involving various animal reservoirs and sandfly species. Environmental factors like climate change, urbanisation, and deforestation influence disease incidence. Control measures include early diagnosis, treatment, vector control, surveillance, and managing animal reservoirs. The importance of early diagnosis cannot be overstated, as it is a critical responsibility in the fight against this disease.[15] Only visceral Leishmaniasis is recognized in dogs, manifesting as a chronic multisystemic disease with symptoms ranging from skin lesions to more severe systemic effects.[16]

In Uruguay, two sandfly species were first reported in the early 20th century. Still, no further specimens were found until 2010, when two male *Lutzomyia longipalpis* were discovered in Artigas and Salto.[16] In 2015, a study in Salto found that 11 out of 49 dogs tested positive for the parasite.[16] The first human case of visceral Leishmaniasis was confirmed in 2018 in a child from Salto.[16] Subsequent studies showed that the disease mainly affected male dogs aged 2 to 4 years, with 86% exhibiting various clinical signs.[17]

The disease has been reported in 9 of Uruguay's 19 departments, with 99% of cases in Artigas and Salto. The endemic transmission, with the presence of the vector and autochthonous cases, was only confirmed in 3 departments: Salto, Artigas, and Rivera. Cases in the remaining departments are imported from endemic areas. Figure 2 shows the yearly evolution, cumulative cases per year and monthly. The maximum (2019) and minimum (2023) occurred during severe El Niño (high rainfall) and La Niña (low rainfall) climatic conditions; the latter was an extreme drought from 2021 to 2023, highlighting the potential role of climatic factors in the spread of Leishmaniasis.

Like other influenza viruses, Avian Influenza has a natural reservoir in aquatic birds, making eradication impossible.[18] It primarily affects birds, poultry, over 100 wild species, mammals, and humans. The virus spreads through aerosols, secretions, faeces, and contaminated surfaces. The symptoms can range from mild flu-like illness to severe respiratory disease, neurological symptoms, and death in humans.[19]

The first avian influenza cases were reported in Uruguay in February 2023, with dead black-necked swans (*Cygnus melancoryphus*) found on a coastal lagoon (Laguna Garzón) in Maldonado (likely induced by extreme La Niña-induced drought conditions), affecting both wild and domestic animals, including species such as swans (*Cygnus sp.*), turkeys (*Pavo sp.*), geese (*Anser sp.*), herons (*Ardea sp.*), and sea lions (*Otaria sp.*), leading to restrictions on the movement and trade of wild

birds and their products, the declaration of a sanitary emergency, and the detection of the virus in marine mammals.[19]

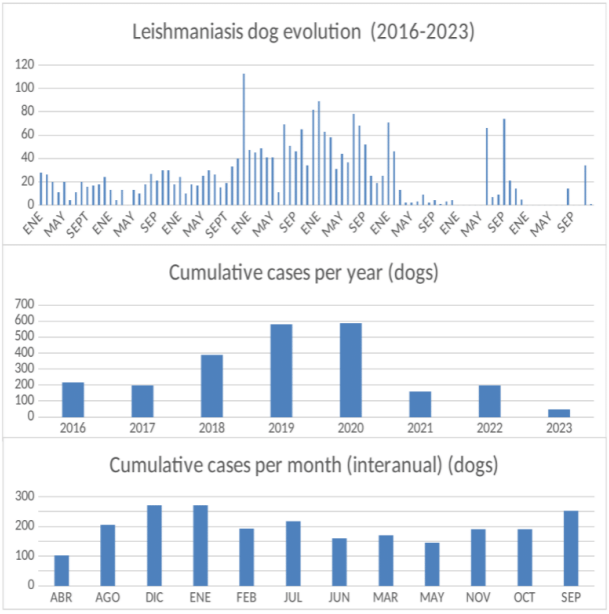

Figure 2 Canine leishmaniasis evolution (2016-2023), cumulative cases per year and monthly (interannual).

The disease primarily affected the southern coastal region, except in Tacuarembó, with only one reported outbreak in March. Yet, it had the highest number of cases and deaths (N= 94). Peaks in disease spread were observed in March and September, and some outbreaks involved multiple species, as seen in March in Flores and September in Canelones, where sea lions were also affected.

Western Equine Encephalomyelitis (WEE) is a viral disease primarily affecting horses and, occasionally, humans. It is transmitted by infected mosquitoes, which acquire the virus from birds, with horses as incidental hosts. The disease typically occurs during warm and humid seasons but can persist year-round. The Western variant is prevalent in the Americas, being present in Uruguay. Passerine birds serve as the primary reservoirs.[20] Infected horses pose little risk of direct transmission to other organisms, making mosquito control essential for disease prevention. With veterinary care, a high recovery rate is generally observed.[21]

On December 2, 2023, the first WEE-reported case marked the onset of a significant sanitary event contained by May 2024, exposing 16,863 horses.[22] Of these, (64%) showed neurological symptoms and recovered, 25% died with neurological symptoms, and 7% died with a confirmed positive diagnosis. The national equine population's morbidity rate was 0.26%, and the mortality rate was 0.09%. The disease spread rapidly and intensely between December 2023 and January 2024, moving from the northwest to the southeast of the country. The most affected areas were low-lying, humid terrains with dense vegetation, bird presence, and abundant mosquito populations.[23] By January 30, Uruguay reported its first human virus case in a decade in San José,[20] a department with many cases in horses.

The disease was detected in twelve of nineteen departments, with disease-free zones in the southwest and the southeast. The number of cases and deaths are similar, which does not align with the previously mentioned survival rate. The range of susceptible animals varied significantly, from 12 to 151, indicating high risk in certain areas. Río Negro recorded the most outbreaks, cases, and deaths, although Artigas surpassed it in the number of susceptible animals (123 and 151, respectively; Tacuarembó ranked third with 33). The incidence was notably concentrated in Río Negro, San José, Paysandú, and Artigas, bordering Argentina.

Monitoring and reporting of infectious diseases

Table 1 compares the monitoring sources of infectious diseases and shows their differences.

Table 1 Monitoring sources differences (2016-2023). OB: outbreak/ B.Ab.: Brucella abortus/ B. An: Bacillus Anthracis/ Rab: Rabies/ Tub: Tuberculosis/

Selected examples of differences between WOAH – MGAP and other reports				
Year	**MGAP**	**WOAH**	**Others**	**Notes**
2016	N/R	1 OB - B.ab. - Rivera. January.	-	Possible occurrence (1-3 January). Public information is not available.
	1 OB – B.an. – Flores, March	N/R	-	-
	1 OB – B.ab. – Treinta y tres, April	N/R	-	-
	N/R	1 OB – B.ab. – Salto, April	-	-
	N/R	1 OB – B.an. – Paysandú, July	-	-
	N/R	1 OB – B.ab. – Canelones, November	-	-
	1 OB – B.ab. – Paysandú, December	N/R	-	-
2017	1 OB – Tub. – Canelones, April	N/R	-	-
	+10 OBs. B.ab. – (1 Artigas, 1 Cerro Largo, 3 Florida, 3 Paysandú, 1 San José, 2 Tacuarembó), June	N/R	-	-
	1 OB – B.ab. – Rocha, December	N/R	-	

Table 1 Continued...

Selected examples of differences between WOAH – MGAP and other reports				
Year	**MGAP**	**WOAH**	**Others**	**Notes**
2018	N/R	2 OBs. – B ab. – (1 Durazno, 1 Paysandú), January	-	-
	N/R	1 OB – Tub. – Maldonado, February		
	1 OB – Tub. – Durazno, February	N/R		
	N/R	1 OB – B ab. – Artigas, February		
	2 OBs. – Tub. – (1 Maldonado, 1 Paysandú),	N/R		
	8 OBs. – B. ab. – (1 Maldonado, 2 Cerro Largo, 3 Artigas, 1 Paysandú, 1 San José), March	N/R		
	1 OB – Tub. – Durazno, April	N/R		
	N/R	1 OB – Tub. – Durazno, May		
	8 OBs. – B. ab. – (6 Tacuarembó, 1 Cerro Largo, 1 Artigas), May	N/R		
	1 OB – Tub. – Paysandú, May	N/R		
	N/R	1 OB – B. ab. Paysandú, June		
	1 OB – Tub. – Flores, November	N/R		
	1 OB – B. ab. – Rio Negro, December	N/R		
	N/R	1 OB – B. ab. – Rocha, December		
2019	-	-	-	MGAP long period without reporting events (January 13 – February 9, 4 reports, 27 days)
	N/R	1 OB – B. ab. – San José, March		
	1 OB – Tub. – Paysandú, June	N/R		
				MGAP period with intermittent event reports (weeks 22, 25, 27; 18 of 41 days free of zoonoses between Late May and early July 2019)
	6 OBs. – Tub. – (1 Durazno, 2 Flores, 3 Río Negro), July	N/R		
				MGAP period with intermittent event reports (weeks 36, 37, 40, 41 and 43; 30 of 55 days free of zoonoses between early September to late October)
	2 OBs. – B.ab. – (2 Río Negro), December	N/R		
2020	1 OB – B. an. – Río Negro, January	N/R	-	-
	N/R	1 OB – B. ab. – Cerro Largo, February		
	N/R	1 OB – B. ab. – Rocha, March		
	N/R	1 OB – B. ab. – Treinta y Tres, April		
	1 OB – B. ab. – Rio Negro, June			
	1 OB – B. ab. – Rocha, June	N/R		
	N/R	1 OB – B.ab. – Paysandú, June		
	1 OB – Tub. - Río Negro, June	N/R		
	1 OB – B. ab. – Cerro Largo, August	N/R		
	N/R	1 OB – B. ab. – Salto, August		
	1 OB – B. ab. – Paysandú, October	N/R		
	2 OBs – B. ab. – (1 Tacuarembó, 1 Paysandú), November	N/R		
	4 OBS – B. ab. – (3 Canelones), December	N/R		
	N/R	1 OB – B. ab. – Paysandú, December		

Table 1 Continued...

Selected examples of differences between WOAH – MGAP and other reports				
Year	**MGAP**	**WOAH**	**Others**	**Notes**
2021	N/R	1 OB – B. ab. – Canelones, January	-	-
	1 OB – B.ab. – Maldonado, January	N/R		
	1 OB – B- ab. – Paysandú, January	N/R		
	N/R	1 OB – B. ab. – Canelones, January		
	2 OBs – Tub. – (1 Treinta y Tres, 1 Colonia), February	N/R		
	N/R	1 OB – B. ab. – Treinta y Tres, February		
2022	-	N/R	1 OB – Rab. – 2 cases found in bats- Paysandú (since November)[12]	-
2023	-	N/R	1 OB – Rab. - found in bat, Montevideo March [13]	-

There are semi-annual reports that expose monthly data. The errors, though seemingly small, significantly impact the accuracy of the reports and suggest a need for more control despite the little data and records to review. For example. In 2021, the MGAP report for week nine showed one outbreak of Tuberculosis for Treinta y Tres and 1 of Brucella abortus. Two outbreaks of B. abortus in the WOAH, but no Tuberculosis was reported. The same outbreak is missing on one side and left on the other. These errors are easily corrected if reviewed: there are generally few values to review in addition to being monthly.

There needs to be clarity between consecutive WOAH reports, which partly use MGAP data to generate them. The fact that MGAP reports are carried out weekly and WOAH reports on a semi-annual basis (with monthly values) leads to clarity and understanding regarding the dates. The WOAH should verify the submitted reports. In addition, the MGAP records range from January 2016 to March 2021. Why has it yet to be updated for three years?

Conclusion

Zoonotic infectious diseases have emerged, re-emerged, and increased in Uruguay over the last few years. Several socio-environmental-climatic determinant factors could cause or trigger their occurrence.

If left unchecked, climate warming conditions could lead to a significant increase in disease events. The potential severity of these consequences should be considered, and urgent steps must be taken to prevent such a scenario.

Climatic factors, such as El Niño and La Niña events, the variations in rainfall, and warming could have influenced the occurrence of Leishmaniasis and Avian Influenza.

Although the monitoring works well, some discrepancies in their reporting show the need for consistent information from different sources, underscoring the importance of collaboration and a unified approach to dealing with these diseases.

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Conflicts of interest

The authors declare there is no conflict of interest.

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