



„ONE HEALTH“ PERSPECTIVE ON LEPTOSPIROSIS IN HUMANS AND ANIMALS

Galya Gancheva

Department of Infectious Diseases, Epidemiology, Parasitology and Tropical Medicine, Faculty of Public Health, Medical University – Pleven, Bulgaria.

ABSTRACT:

Introduction: Leptospirosis is a globally important zoonosis caused by *Leptospira* spp. that incorporates all facets of a “One Health” problem. Effective prevention requires a trans-disciplinary approach in order to understand the way pathogenic spirochetes interact with the environment and vertebrate reservoir hosts.

Purpose: to study the incidence of leptospirosis in Europe, Bulgaria and the Pleven region with the context of the “One Health” perspective.

Material and methods: A retrospective study of the incidence of leptospirosis in Europe, Bulgaria and the Pleven region was conducted for a 17-year period (2007–2023). We used official statistics from the ECDC, NCIPD, and annual reports of the Regional Health Inspectorate – Pleven.

Results: Significant and divergent changes in the incidence of leptospirosis were observed, associated with transformations in the socio-economic profiles of European countries, including Bulgaria. An increased incidence of leptospirosis has been registered in France and Germany, whereas a decrease was noted in Eastern European nations such as Romania and Bulgaria. The factors determining these divergent changes vary by region.

Conclusions: Leptospirosis represents a classic “One Health” issue requiring thorough knowledge of transmission mechanisms, involved animal reservoir hosts, environmental reservoirs of the pathogen, climatic drivers, and the impact of human occupational and recreational behavior patterns. These elements vary regionally and temporally, necessitating ongoing global surveillance. Improvements in treatment and prevention rely on advancements in diagnostic tests, the application of novel genomic approaches to better understand epidemiology, continuous education of at-risk populations and animal owners, and the development of broad-spectrum protective vaccines with minimal adverse effects.

Keywords: leptospirosis, One Health, Europe, Bulgaria, Pleven region,

INTRODUCTION

The recent global challenges highlighted by the SARS-CoV-2 pandemic have underscored the critical, codependent relationship among human, animal, and environmental health. Recognizing this paradigm, the World Health Organization (WHO) initiated an expert “One Health” panel in May 2021. This group provides cross-cutting consultation to four key international entities: the WHO, the Food and Agriculture Organization of the United Nations (FAO), the World Organisation for Animal Health (WOAH), and the United Nations Environment Programme (UNEP).

The One Health approach serves as an integrated, unifying framework designed to sustainably balance and optimize the shared health of people, animals, plants, and ecosystems. By mobilizing diverse sectors, disciplines, and grassroots communities, this collaborative methodology addresses multi-level threats to ecosystems while simultaneously responding to core collective requirements—such as clean water, reliable energy, secure food systems, climate change adaptation, and long-term sustainable development [1, 2].

Leptospirosis stands out as a quintessential One Health disease affecting both humans and animals. The condition is driven by pathogenic spirochetes belonging to the genus *Leptospira* [3]. Transmission within and between species depends on a complex interplay involving: (1) animal reservoir hosts that shed the replication-competent bacteria via urine over extended periods, (2) the capacity of these spirochetes to persist in environmental reservoirs like soil and water, and (3) regular human-animal-environmental contact [3, 4]. Climate change has driven an increase in extreme flooding events, which, combined with shifts in human-animal interfaces post-pandemic, have created an environment highly conducive to the resurgence of leptospirosis [3, 5, 6]. Furthermore, the non-specific early presentation of the disease frequently leads to clinical under-recognition, as severe cases can mimic symptoms of respiratory and systemic viral infections like COVID-19.

While traditionally categorized as an affliction exclusive to warm, humid tropical climates with high annual rainfall, pathogenic *Leptospira* species have increasingly been documented in semi-arid environments, such as the southwestern United States [3, 7]. This expanding

geographical footprint impacts communities across a wide spectrum of socio-economic backgrounds. Consequently, clinicians, veterinarians, and public health officials must maintain a high index of clinical suspicion globally, irrespective of immediate geography [3, 5]. Cross-disciplinary collaboration is essential to trace outbreaks and implement localized mitigation. Over the past decade, substantial progress has been achieved due to diagnostic enhancements, molecular epidemiological tools, targeted educational outreach, and updated vaccine compositions [3, 5].

On a global scale, Sri Lanka experiences a particularly heavy burden of leptospirosis, recording more than 700 deaths annually—a figure exceeding twice the local mortality rate for dengue fever. The estimated annual hospital admission rate there reaches 52.1 patients per 100,000 individuals, though these surveillance figures require careful interpretation due to their reliance on broad clinical definitions rather than comprehensive laboratory confirmation [3]. Agricultural work, particularly in rice paddies, represents a major risk factor across Sri Lanka, Thailand, India, Indonesia, Iran, the Philippines, Tanzania, and Korea, giving rise to its historical designation as “rice field fever” [3].

Conversely, in developed nations, cases are predominantly tied to specific occupational tasks or recreational water exposures [3]. High-risk professions include wildlife research, trapping, livestock handling (such as dairy farming, veterinary work, and abattoir operations), water-intensive crop cultivation (including bananas, pineapples, taro, and berries), military deployments, aquaculture, and sewage system maintenance [3]. Parallel to occupational risks, recreational pursuits like adventure racing, canoeing, kayaking, spelunking, open-water swimming, triathlons, and white-water rafting have accounted for multiple well-documented outbreak events

over the last two decades [3]. In resource-poor urban settings, suboptimal housing infrastructure and compromised sanitation increase exposure risks via infected rodent vectors and free-roaming dog populations [3, 6]. Notably, recent documentations of urban leptospirosis in southern Europe, the United States, and the United Kingdom suggest that growing housing insecurity, homelessness, and structural damage following natural disasters or major financial crises can trigger the re-emergence of the disease even in highly developed metropolitan areas [3].

The primary **objective** of this paper is to analyze and evaluate the historical incidence of leptospirosis across Europe, Bulgaria, and specifically the Pleven region through a unified One Health analytical lens.

MATERIALS AND METHODS:

A retrospective epidemiological study was executed to evaluate leptospirosis trends over a 17-year observation period spanning from 2007 to 2023. Data collection focused on three geographical tiers: continental Europe, national data from Bulgaria, and regional statistics from the Pleven district. The primary source material comprised verified official statistics obtained from the European Centre for Disease Prevention and Control (ECDC), the National Centre of Infectious and Parasitic Diseases (NCIPD) in Bulgaria, and the comprehensive annual health registries compiled by the Regional Health Inspectorate – Pleven.

RESULTS AND DISCUSSION:

An examination of data regarding human leptospirosis cases extracted from consecutive ECDC annual surveillance reports (2007–2023) indicates that the absolute peak of laboratory-confirmed infections within the EU/EEA occurred in 2019, totaling 1,049 cases (Table 1).

Table 1. Distribution of confirmed leptospirosis cases by country and year, EU/EEA, 2007–2023

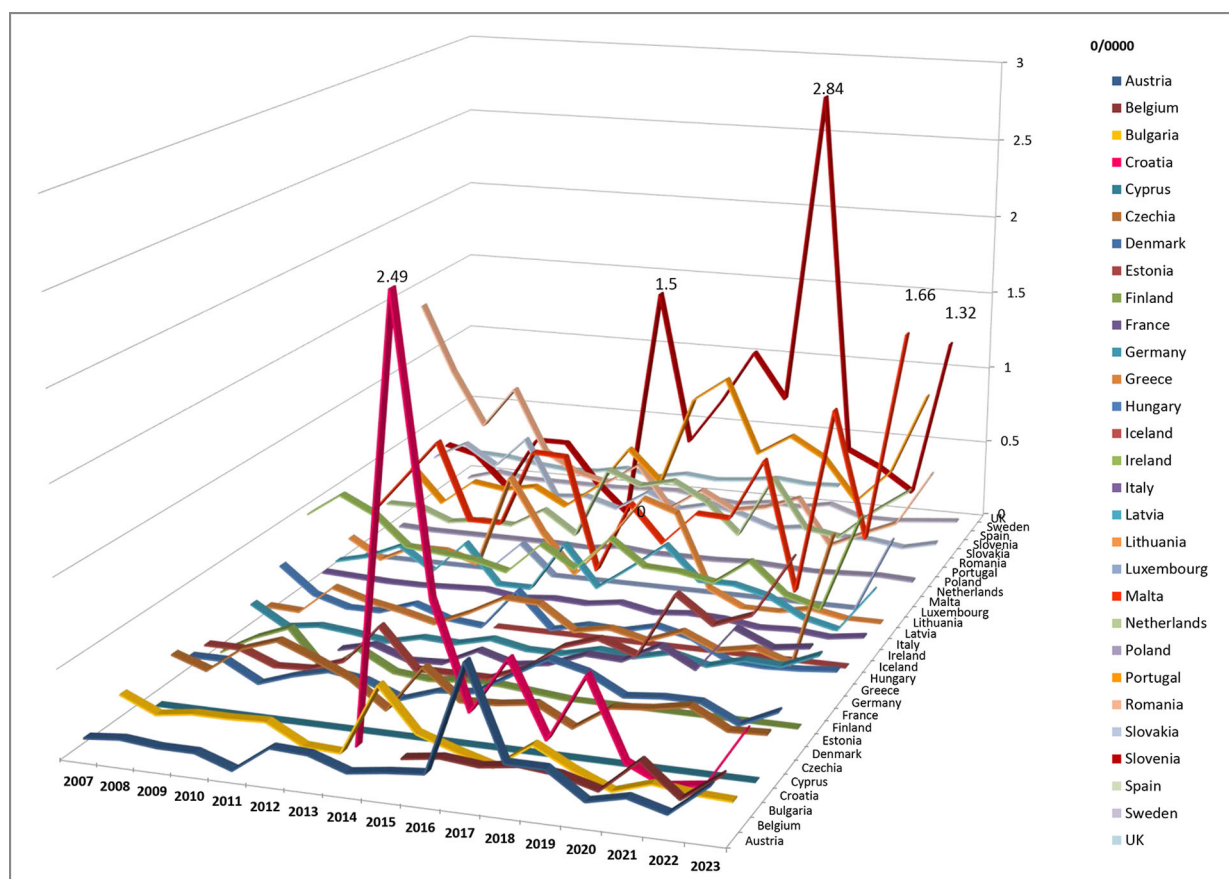
Region/Country	Reported Cases																
Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Austria	9	11	9	9	3	16	15	9	12	14	68	24	24	11	15	10	26
Belgium	8	5	9	5	9	14	14	21	16	19	17	20	18	11	33	13	32
Bulgaria	16	9	11	11	12	4	3	31	14	9	5	15	7	1	6	4	3
Croatia	-	-	-	-	-	-	0	105	36	11	24	7	22	4	0	1	14
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czechia	24	17	32	40	31	22	6	35	17	18	21	10	24	27	30	19	21
Denmark	8	8	2	6	9	7	3	7	8	15	22	19	13	14	14	8	14
Estonia	2	2	1	1	2	5	2	2	2	3	5	6	5	10	8	9	14
Finland	2	8	12	0	8	2	1	2	2	1	0	0	0	0	0	0	0
France	.	.	.	39	71	25	36	96	58	79	134	129	201	129	308	245	269
Germany	165	66	92	70	50	85	80	123	87	91	129	117	160	120	166	154	234
Greece	13	12	31	24	20	14	24	36	35	19	24	18	27	17	21	14	94
Hungary	31	15	9	9	16	9	7	31	10	15	14	19	14	3	2	3	5
Iceland	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0
Ireland	22	29	25	17	16	15	13	22	16	26	19	19	17	25	16	13	43
Italy	45	40	38	33	43	46	33	42	38	54	32	41	34	18	26	13	29
Latvia	2	3	5	2	6	1	1	7	2	5	8	4	4	3	1	0	5
Liechtenstein	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Lithuania	6	2	5	5	3	20	10	3	10	18	16	3	0	0	1	0	0
Luxembourg	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3
Malta	1	2	3	1	1	3	3	0	2	1	2	2	4	0	6	2	9
Netherlands	37	37	25	30	29	48	26	100	86	95	77	45	111	60	54	87	114
Norve	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poland	7	2	4	4	3	2	0	10	4	4	2	7	4	1	2	6	5
Portugal	38	15	32	29	33	21	37	65	44	101	117	69	82	70	43	65	119
Romania	296	200	128	181	98	74	65	92	37	65	44	51	66	10	29	45	110
Slovakia	17	23	16	27	7	8	5	12	7	10	7	3	5	3	3	1	4
Slovenia	7	6	2	9	9	4	0	31	11	17	24	18	59	12	10	7	28
Spain	3	5	0	0	4	0	0	0	3	16	19	65	49	20	45	50	62
Sweden	1	6	4	4	4	4	5	6	3	1	4	3	7	0	0	2	4
UK	81	76	53	42	52	78	50	78	67	76	98	88	92	-	-	-	-
EU/EEA (with UK until 2019)	841	599	548	598	539	528	439	966	627	783	932	802	1049	569	839	771	1261
EU/EEA (without UK)	760	523	495	556	487	450	389	888	560	707	834	714	957	569	839	771	1261

The incidence rates across the European continent demonstrated profound variability throughout the tracking cycle. Markedly elevated yet fluctuating rates were clustered in nations like Croatia, Malta, and Slovenia (Fig. 1) [4, 8, 9, 10, 11, 12, 13]. Aggregated descriptive data covering all laboratory-confirmed European cases (n = 12,180) reveal that the 40–49 age cohort was most

frequently affected (18.7%), followed directly by the 50–59 age bracket. Biological males comprised 76.5% of the total case cohort. Autochthonous (locally acquired) cases made up the vast majority at 82.5%. Clinical severity was high, requiring hospitalization in 90.1% of reported cases, though the survival rate remained robust at 97.4%.

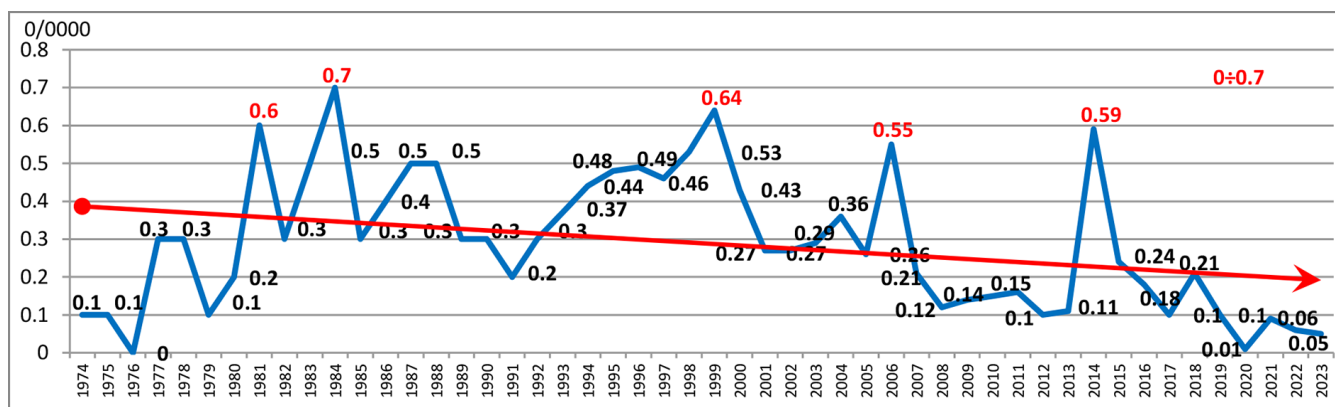
Fig. 1. Incidence of leptospirosis in the European Union/European Economic Area (2007 – 2023).



A historical analysis over a 50-year horizon positions leptospirosis as the second most prevalent zoonotic disease within Bulgaria, surpassed only by Q fever. The highest historical incidence rates nationally were logged in 1981 (0.6 per 100,000), 1984 (0.7 per 100,000), 1999

(0.64 per 100,000), 2006 (0.55 per 100,000), and 2014 (0.59 per 100,000) [14]. Despite these periodic spikes, the macro-epidemiological trend is steadily declining. By the final year of this study (2023), the national incidence dropped to 0.05 per 100,000 (Fig. 2).

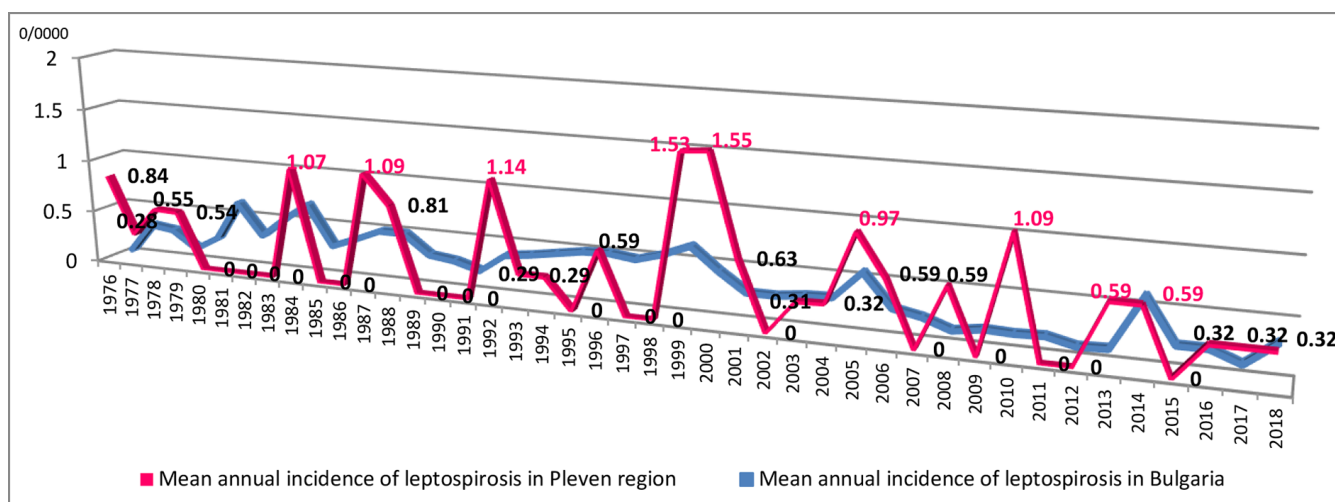
Fig. 2. Incidence of leptospirosis in Bulgaria (1974 – 2023).



Over the same timeline, regional data for the Pleven administrative district revealed uneven transmission dynamics. In specific peak years, local infection rates signifi-

cantly outpaced the national baseline. However, no new cases of human leptospirosis have been registered in the Pleven region since 2018 (Fig. 3).

Fig. 3. Incidence of leptospirosis in the Pleven region (1976 – 2018).



Leptospirosis in Veterinary Populations

Animal reservoirs demand rigorous public health scrutiny, though fragmented European veterinary data restricts comprehensive continental modeling. Inside Bulgaria, the primary pathogenic driver in domestic livestock is identified as serovar *Pomona*, followed by serovar *Tarassovi mitis*. Swine serve as the main biological reservoir for both serovars. Clinically affected and subclinically recovered animals function as chronic excretors, contaminating soil and aquatic environments via shedding in urine. Livestock infections typically manifest atypically or subclinically; signature syndromic indicators are restricted to livestock abortions (frequently involving marked fetal jaundice), localized hematuria in adult cows, and sudden mortality in vulnerable calves. High-grade pyrexia and hematuria represent primary clinical presentations in calves, though these episodes frequently go unnoticed under standard field management conditions [10].

Bulgaria maintains a structured administrative and legal architecture governing the National Program for the

Surveillance and Eradication of Leptospirosis in Animals. The competent supervisory authority is the Bulgarian Food Safety Agency (BFSA), operating under the Ministry of Agriculture and Food. Implementation is decentralized across 28 Regional Food Safety Directorates (RFSD). Laboratory confirmation is centered at the National Reference Laboratory for Leptospirosis in Animals, nested within the National Diagnostic Research Veterinary Institute (NDNIVMI) in Sofia, supported by two regional testing hubs in Veliko Tarnovo and Stara Zagora. This program runs uniformly across all 28 administrative districts.

Livestock facilities face mandatory registration requirements under Article 51, Paragraph 1 of the Veterinary Activities Act (VMA). The BFSA coordinates all animal identification protocols, managing an integrated information system containing real-time data on animal movements, owner profiles, farm locations, health statuses, and prophylactic veterinary interventions. Statutes dictating ruminant and swine identification are reinforced via Ordinance No. 61 (2006) and Ordinance No. 6 (2013), re-

quiring ruminant tagging by the fifth day post-birth. Nationally, leptospirosis is categorized under Annex 3 of Article 6, Paragraph 1 of Regulation No. 23 (2005), mandating immediate inclusion in monthly and annual reports via the Directorate of Animal Health and Welfare and Food Control (DAHWF), effectively transposing Council Directive 82/894/EEC.

Active surveillance operates in alignment with Chapter VI, Section I, Article 117 (1) of the Animal Health Act alongside the active 2022–2024 national surveillance framework. Proactive blood sampling is mandated annually for 10% of adult cows, 100% of active breeding boars, and 5% of sows. Paired acute and convalescent serological screenings are strictly required for all aborted livestock immediately post-event and again 10–15 days later. Breeding bulls stationed at selection and reproduction hubs under the Executive Agency for Selection and Reproduction in Livestock Breeding (EASRZH) undergo systematic double serological evaluation alongside post-mortem inspection lines at commercial slaughterhouses. Confirmatory diagnosis requires direct pathogen identification via blood, urine, or parenchymal organ tissue sections from aborted fetuses or carcasses. In parallel, serological screening via the Microscopic Agglutination Test (MAT) is logged as positive when an antibody titer $\geq 1:200$ is verified with a subsequent rise across a 7–10 day interval, or when a standalone single screening yields a high-reactive titer exceeding 1:3,200.

Prophylactic and Preventive Strategies

Multimodal prevention strategies are deployed internationally. In veterinary medicine, inactivated whole-cell bacterin vaccines are widely distributed for canines, cattle, and swine (and for equine populations inside the United States) [3]. Regular annual cattle vaccination programs achieve an estimated 90% reduction in herd clinical signs. In New Zealand, a dramatic drop in human leptospirosis incidence from 15.7 per 100,000 (1970–1979) down to 4.4 per 100,000 (1990–1998) directly correlated with the universal rollout of dairy cattle immunization protocols in the late 1970s [3]. Classic canine prevention centers on bivalent vaccines covering *L. interrogans* serovars *Icterohaemorrhagiae* and *Canicola* [3]. Persistent breakthrough infections across Europe and the US prompted the addition of two regional serovars: *Pomona*

and *Grippotyphosa* in the US (since 2001), and *Grippotyphosa* and *Australis* or *Bratislava* in European regions. Human vaccination models are targeted exclusively to high-risk occupational cohorts in nations such as China, Japan, South Korea, and France [3, 7]. Optimizing these immunizations requires precise local mapping of circulating leptospiral species and serovars to match regional exposure risks.

Beyond immunization, targeted public health education for at-risk groups is vital. Prophylactic advice stresses the consistent use of personal protective equipment (PPE), strict separation of production animals from living quarters, prompt clearing of fecal waste, hygienic hand-washing protocols, boiling drinking water in high-risk zones, avoiding swimming in stagnant open water bodies, and avoiding walking barefoot through mud or rice paddies. Rigorous pest and rodent control programs combined with early clinical evaluation for febrile illnesses significantly lower human morbidity [3, 7, 11, 15].

Chemical prophylaxis represents another preventive arm. Routine weekly administration of doxycycline (200 mg orally) is utilized as a standard preventive protocol for rice paddy workers in endemic zones of Sri Lanka. To date, international surveillance has not detected any acquired antimicrobial resistance phenotypes within pathogenic *Leptospira* spp. [3, 7, 11].

CONCLUSIONS:

Leptospirosis serves as a classic, complex One Health problem. Managing its transmission requires a cross-cutting understanding of complex wildlife and domestic animal reservoirs, environmental persistence pathways, regional weather shifts, and evolving human occupational and leisure behaviors. Because these parameters fluctuate dynamically across space and time, integrated global surveillance frameworks are essential.

Advancements in controlling and mitigating leptospirosis require: (1) high-sensitivity diagnostic assays, (2) advanced genomic tools to track micro-epidemiological strains, (3) continuous educational campaigns targeting livestock producers and high-exposure occupations, and (4) the engineering of broad-spectrum, multi-serovar vaccines designed to minimize adverse localized reactions.

REFERENCES:

1. Epps J, Massey PD, Ranmuthugala G, Colvin A, Usher K, Heal C, et al. A One Health approach to leptospirosis: Current serosurveillance practices and climate change leave Australia at increasing risk. *Aust N Z J Public Health*. 2026 Feb;50(1):100297. [PubMed]
2. Sykes JE, Haake DA, Gamage CD, Mills WZ, Nally JE. A global one health perspective on leptospirosis in humans and animals. *J Am Vet Med Assoc*. 2022 Jul 25;260(13):1589–1596. [PubMed]
3. Antonioli A, Guis H, Picardeau M, Goarant C, Flamand C. One Health Field Approach Applied to Leptospirosis: A Systematic Review and Meta-Analysis Across Humans, Animals and the Environment. *Open Forum Infect Dis*. 2024 Dec 30;12(1):ofae757. [PubMed]
4. Pham HT, Tran MH. One Health: An Effective and Ethical Approach to Leptospirosis Control in Australia. *Trop Med Infect Dis*. 2022 Nov 21;7(11):389. [PubMed]
5. Esteves SB, Grolla ACMM, Cortez A, de Paula Nhanharelli J, de Lima EM, Fornazari F, et al. A systematic review and meta-analysis of *Leptospira* spp. infection in wildlife: Contributions to

a One Health perspective. *One Health*. 2026 May 4;22:101433. [PubMed]

6. Azócar-Aedo L, Meniconi G, Pino-Olguín C, Gallardo M. Seropositivity for Pathogenic *Leptospira* in Dogs, Cats, and Horses at a Teaching Veterinary Hospital in Southern Chile. *Trop Med and Infect Dis*. 2025 Sep 3;10(9):253. [PubMed]

7. Lopez-Robles G, Cordova-Robles FN, Sandoval-Petris E, Montalvo-Corral M. Leptospirosis at human-animal-environment interfaces in Latin America: drivers, prevention, and control measures. *Biotechnia*. 2021; 23(3):89-100. [Crossref]

8. European Centre for Disease Prevention and Control. Leptospirosis factsheet for health professionals. Stockholm, ECDC. Aug 22 2026. [Internet]

9. Habus J, Persic Z, Spicic S, Vince

S, Stritof Z, Milas Z, et al. New Trends in Human and Animal Leptospirosis in Croatia, 2009–2014. *Acta Trop*. 2017 Apr;168:1-8. [PubMed]

10. Korniienko LY, Ukhovskiy VV, Moroz OA, Chechet OM, Romanko MY, Aliekseieva GB, et al. Epizootological and Epidemiological Aspects of Leptospirosis in Ukraine for the Period 2003–2022. *Regul Mech Biosyst*. 2023;14(3):497-505. [Internet]

11. Ukhovskiy VV, Vydayko NB, Aliekseieva GB, Bezymennyi MV, Polupan IM, Kolesnikova IP. Comparative Analysis of Incidence of Leptospirosis among Farm Animals and Humans in Ukraine. *Regul Mech Biosyst*. 2018;9(3):409-416. [Internet]

12. Bertelloni F, Cilia G, Turchi B, Pinzauti P, Cerri D, Fratini F. Epidemiology of leptospirosis in North-Central Italy: Fifteen years of serological

data (2002–2016). *Comp Immunol Microbiol Infect Dis*. 2019 Aug;65:14-22. [PubMed]

13. Angelova S, Mitova Y, Doycheva V. Epidemiological Analysis of Leptospirosis in Bulgaria, 1999–2018. *Acta Medica Bulgarica*. 2021 Apr;48(1):53-58. [Crossref]

14. de Oliveira D, Airam Querino V, Sara Lee Y, Cunha M, Nery Jr N, Wessels Perelo L, et al. Relationship between Physicochemical Characteristics and Pathogenic *Leptospira* in Urban Slum Waters. *Trop Med Infect Dis*. 2020 Sep 16;5(3):146. [Crossref]

15. Krairojananan P, Thaipadungpanit J, Leepitakrat S, Monkanna T, Wanja EW, Schuster AL, et al. Low Prevalence of *Leptospira* Carriage in Rodents in Leptospirosis-Endemic Northeastern Thailand. *Trop Med Infect Dis*. 2020 Sep 30;5(4):154. [Crossref]

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Address for correspondence:

Galya Gancheva

Department of Infectious Diseases, Epidemiology, Parasitology and Tropical Medicine, Faculty of Public Health, Medical University-Pleven;

1, St. Kliment Ohridski Str., 5800, Pleven, Bulgaria.

E-mail: galya_gancheva@abv.bg,