RITA

2025

Rabia en las Américas

PERÚ

XXXVI CONFERENCIA ANUAL **RITA**

RABIA EN LAS AMÉRICAS



LIMA, PERÚ **2025**

19 AL 24 OCTUBRE

LIBRO DE RESÚMENES - BOOK OF ABSTRACT - LIVRO DO RESUMOS

Organizado por:

RABIES IN THE AMERICAS

CITBM

Centro de Investigaciones Tecnológicas, Biomédicas y Medioambientales

XXXVI CONFERENCIA ANUAL **RITA**

RABIA EN LAS AMÉRICAS



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Edición 2025
Lima, Perú

Editor
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XXXVI Conferencia Anual de Rabia en las Américas, Perú 2025

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Centro de Investigaciones Tecnológicas, Biomédicas y Medioambientales



XXXVI Conferencia Anual de Rabia en las Américas 2025

XXXVI Conference on Rabies in the Americas 2025

XXXVI Conferência Internacional sobre Raiva nas Américas 2025

Acerca de la RITA / About RITA / Sobre RITA

RABIES IN THE AMERICAS

RITA 2025 Rabia en las Américas PERÚ

Acerca de la RITA

RITA Inc. es una organización internacional no gubernamental y sin fines de lucro dedicada profesionalmente al estudio y control de la rabia. Desde 1990, organiza anualmente la Conferencia Rabia en las Américas (RITA), un encuentro científico internacional enfocado en la presentación y discusión de los avances más recientes en investigación, vigilancia, control y prevención de esta enfermedad.

Entre los asistentes se encuentran investigadores, académicos, autoridades sanitarias, estudiantes y profesionales de la medicina, salud pública y veterinaria, entre otros. La conferencia ofrece una oportunidad única para actualizar conocimientos sobre los progresos en el campo de la rabia, establecer redes de colaboración con expertos de todo el mundo y dar visibilidad a las instituciones patrocinadoras en un escenario internacional.
Dado que la rabia es una enfermedad zoonótica, RITA constituye un foro ideal para fomentar el intercambio entre científicos, médicos, veterinarios, funcionarios de salud pública, biólogos de fauna silvestre y otros profesionales biomédicos, bajo el principio de “Una Sola Salud”.

Desde su primera edición en Atlanta, Georgia (EE. UU.), RITA ha evolucionado de un pequeño encuentro entre colegas con intereses comunes a un evento internacional ampliamente reconocido y de gran relevancia en el ámbito de la rabia. Actualmente, es la conferencia anual más grande, abierta e independiente dedicada exclusivamente a esta enfermedad en el mundo.
Aunque su enfoque principal está en la región de las Américas, RITA convoca cada año entre 250 y 400 participantes de diversas partes del mundo. Además, suele celebrarse en paralelo con otros encuentros importantes, como el Plan de Control de la Rabia de América del Norte (NARMP) y la REDIPRA (Reunión de Directores de los Programas Nacionales de Control de Rabia en América Latina).

A lo largo de sus más de 30 años de historia, la organización de la RITA ha sido compartida entre diversos países, como Estados Unidos, Canadá y México. Perú la acogió por primera vez en 2000, en Lima. Y esta vez, continuará consolidando la sólida tradición de cooperación internacional.

About RITA

RITA Inc. is an international, non-governmental, non-profit organization professionally dedicated to the study and control of rabies. Since 1990, it has organized the Rabies in the Americas (RITA) Conference, an international scientific meeting focused on presenting and discussing the latest advances in rabies research, surveillance, control, and prevention.

Participants include researchers, academics, health authorities, students, and professionals from the fields of medicine, public health, and veterinary science, among others. The conference offers a unique opportunity to stay up to date on recent developments in rabies, establish collaborative networks with experts worldwide, and raise the visibility of sponsoring institutions on an international stage.

As rabies is a zoonotic disease, RITA provides an ideal forum for fostering exchange among scientists, physicians, veterinarians, public health officials, wildlife biologists, and other biomedical professionals, under the “One Health” concept.

Since its first edition in Atlanta, Georgia (USA), RITA has evolved from a small gathering of like-minded colleagues into a widely recognized international event of great relevance in the field of rabies. Today, it stands as the world’s largest, most open, and independent annual conference dedicated exclusively to this disease.

Although its main focus remains on the Americas, RITA attracts between 250 and 400 participants each year from all around the world. It is often held in conjunction with other important meetings, such as the North American Rabies Management Plan (NARMP) and REDIPRA (Meetings of Directors of the National Rabies Control Programs in Latin America).

Throughout its more than 30-year history, the organization of RITA has been shared among several countries, including the United States, Canada, and Mexico. Peru first hosted the conference in 2000, in Lima, and this year continues to strengthen RITA’s long-standing tradition of international collaboration.

Sobre RITA

A RITA Inc. é uma organização internacional, não governamental e sem fins lucrativos, dedicada profissionalmente ao estudo e controle da raiva. Desde 1990, organiza anualmente a Conferência Raiva nas Américas (RITA), um encontro científico internacional voltado para a apresentação e discussão dos avanços mais recentes na pesquisa, vigilância, controle e prevenção dessa doença.

Entre os participantes estão pesquisadores, acadêmicos, autoridades de saúde, estudantes e profissionais das áreas de medicina, saúde pública e veterinária, entre outros. A conferência oferece uma oportunidade única para atualizar conhecimentos sobre os progressos no campo da raiva, estabelecer redes de colaboração com especialistas de todo o mundo e dar visibilidade às instituições patrocinadoras em um cenário internacional.

Por se tratar de uma doença zoonótica, a RITA constitui um fórum ideal para promover o intercâmbio entre cientistas, médicos, veterinários, autoridades de saúde pública, biólogos de fauna silvestre e outros profissionais biomédicos, sob o princípio de “Uma Só Saúde”.

Desde sua primeira edição em Atlanta, Geórgia (EUA), a RITA evoluiu de um pequeno encontro entre colegas com interesses comuns para um evento internacional amplamente reconhecido e de grande relevância na área da raiva. Atualmente, é a conferência anual mais ampla, aberta e independente dedicada exclusivamente a essa doença no mundo.

Embora o foco principal esteja na região das Américas, a RITA reúne anualmente entre 250 e 400 participantes de diversas partes do mundo. O evento costuma ocorrer em paralelo com outros encontros importantes, como o Plano de Controle da Raiva da América do Norte (NARMP) e a REDIPRA (Reunião de Diretores dos Programas Nacionais de Controle da Raiva na América Latina).

Ao longo de mais de 30 anos de história, a organização da RITA tem sido compartilhada entre diversos países, como Estados Unidos, Canadá e México. O Peru sediou a conferência pela primeira vez em 2000, em Lima, e nesta edição continua a fortalecer a sólida tradição de cooperação internacional que caracteriza a RITA.

Bienvenida / Welcome / Bem-vindo

RABIES IN THE AMERICAS

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Bienvenida

En nombre del Centro de Investigaciones Tecnológicas, Biomédicas y Medioambientales (CITBM) y de la Universidad Nacional Mayor de San Marcos (UNMSM), expresamos nuestra más cordial bienvenida a todos los participantes de la XXXVI Conferencia Anual de Rabia en las Américas (RITA) 2025, celebrada por segunda vez en Lima, Perú.

Es un honor para nuestra universidad, la Decana de América, recibir a investigadores, profesionales de la salud pública y veterinaria, académicos, autoridades sanitarias y estudiantes de distintos países que comparten un mismo compromiso: avanzar hacia la eliminación de la rabia bajo el enfoque de Una Sola Salud.

El CITBM, como centro de investigación de excelencia de la Universidad Nacional Mayor de San Marcos, se ha consolidado como un espacio de convergencia para la ciencia interdisciplinaria, la innovación tecnológica y el fortalecimiento de capacidades en salud pública y medio ambiente. Ser anfitriones de esta edición de RITA reafirma nuestro compromiso con la generación y aplicación del conocimiento científico al servicio del bienestar humano y animal.

Esta reunión constituye una oportunidad excepcional para compartir avances, experiencias y estrategias de control y prevención de la rabia, así como para fortalecer redes de colaboración entre investigadores y profesionales de todo el continente americano y otras regiones del mundo.

Confiamos en que las mesas redondas, ponencias y posters de esta edición contribuirán significativamente a alcanzar el objetivo global de eliminar las muertes humanas por rabia transmitida por perros para el año 2030, y a enfrentar los nuevos desafíos que plantea su persistencia en la fauna silvestre.

Deseamos que su estadía en Lima sea una experiencia enriquecedora, en la que la ciencia, la cooperación y la amistad se unan para fortalecer el espíritu de trabajo conjunto que caracteriza a la comunidad RITA.

Sean todos bienvenidos a Lima, Perú, y a la Universidad Nacional Mayor de San Marcos, cuna del conocimiento y promotora del progreso científico en nuestra región.

¡Bienvenidos a la XXXVI RITA 2025 – Lima, Perú!

Saludos cordiales:

Dr. Sergio Recuenco
CITBM - UNMSM
Presidente del Comité Local Organizador de la XXXVI RITA 2025 Perú

Welcome

On behalf of the Center for Technological, Biomedical and Environmental Research (CITBM) and the Universidad Nacional Mayor de San Marcos (UNMSM), we extend our warmest welcome to all participants of the 36th Annual Rabies in the Americas (RITA) Conference 2025, held for the second time in Lima, Peru.

It is an honor for our university—the Dean of the Americas—to host researchers, public health and veterinary professionals, academics, health authorities, and students from various countries who share a common commitment: advancing toward the elimination of rabies under the One Health approach.

The CITBM, as a center of research excellence at the Universidad Nacional Mayor de San Marcos, has become a hub for interdisciplinary science, technological innovation, and capacity strengthening in public health and environmental research. Hosting this edition of RITA reaffirms our commitment to the generation and application of scientific knowledge in service of both human and animal well-being.

This conference represents an exceptional opportunity to share progress, experiences, and strategies for rabies control and prevention, as well as to strengthen collaborative networks among researchers and professionals across the Americas and other regions of the world.

We trust that the round tables, presentations, and posters of this year's meeting will make a significant contribution toward achieving the global goal of eliminating human deaths from dog-mediated rabies by 2030, and toward addressing the new challenges posed by its persistence in wildlife.

We hope your stay in Lima will be an enriching experience where science, collaboration, and friendship come together to strengthen the spirit of teamwork that defines the RITA community.

Welcome to Lima, Peru, and to the Universidad Nacional Mayor de San Marcos—cradle of knowledge and a proud promoter of scientific progress in our region.

Welcome to the 36th RITA 2025–Lima, Peru!

Warm regards,

Dr. Sergio Recuenco
CITBM – UNMSM
President of the Local Organizing Committee of the XXXVI RITA 2025 Peru

Bem-vindo

Em nome do Centro de Pesquisas Tecnológicas, Biomédicas e Ambientais (CITBM) e da Universidad Nacional Mayor de San Marcos (UNMSM), damos as boas-vindas a todos os participantes da XXXVI Conferência Anual Raiva nas Américas (RITA) 2025, realizada pela segunda vez em Lima, Peru.

É uma honra para nossa universidade, a Decana das Américas, receber pesquisadores, profissionais de saúde pública e veterinária, acadêmicos, autoridades sanitárias e estudantes de diversos países que compartilham um mesmo compromisso: avançar rumo à eliminação da raiva sob o enfoque de Uma Só Saúde.

O CITBM, como centro de excelência em pesquisa da Universidad Nacional Mayor de San Marcos, consolidou-se como um espaço de convergência para a ciência interdisciplinar, a inovação tecnológica e o fortalecimento de capacidades em saúde pública e meio ambiente. Ser anfitriões desta edição da RITA reafirma nosso compromisso com a geração e aplicação do conhecimento científico a serviço do bem-estar humano e animal.

Este encontro constitui uma oportunidade excepcional para compartilhar avanços, experiências e estratégias de controle e prevenção da raiva, bem como para fortalecer as redes de colaboração entre pesquisadores e profissionais de todo o continente americano e de outras regiões do mundo.

Confiamos que as mesas-redondas, apresentações e pôsteres desta edição contribuirão significativamente para alcançar o objetivo global de eliminar as mortes humanas por raiva transmitida por cães até o ano de 2030, além de enfrentar os novos desafios impostos por sua persistência na fauna silvestre.

Desejamos que sua estadia em Lima seja uma experiência enriquecedora, na qual a ciência, a cooperação e a amizade se unam para fortalecer o espírito de trabalho conjunto que caracteriza a comunidade RITA.

Sejam todos bem-vindos a Lima, Peru, e à Universidad Nacional Mayor de San Marcos, berço do conhecimento e promotora do progresso científico em nossa região.

Bem-vindos à XXXVI RITA 2025 – Lima, Peru!

Atenciosamente,

Dr. Sergio Recuenco
CITBM – UNMSM
Presidente do Comitê Organizador Local da XXXVI RITA 2025, Peru

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1. Programa

Los códigos O# corresponden a presentaciones orales, P# a pósters y W# a webinars / O# correspond to oral presentations, P# to posters, and W# to webinars / O# correspondem a apresentações orais, P# a pôsteres e W# a webinars.

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22. O1.2 Ring vaccination radii for canine rabies control: variability in guidelines and practices in the Americas.
23. O1.3 Understanding canine rabies virus transmission using genomics in a decade-long epidemic in Arequipa, Peru.
24. O1.4 Cobertura de vacunación antirrábica canina: comparación entre reportes oficiales y encuestas de hogares en Ayacucho (2021–2024).
26. O1.5. Canine Rabies in Vaccinated Dogs: An Additional Challenge for Control in Arequipa, Peru.
27. O1.6. Socioeconomic Disparities in Canine Rabies Surveillance: High-Resolution Evidence from Peru.

28. Sesión Oral 2: Rabia canina & Vigilancia II / Canine Rabies Control & Surveillance II / Controle e Vigilância da Raiva Canina II
29. O2.1. Rabies In Borneo: An Asia-Pacific platform to operationalize One Health practices to eliminate dog-mediated rabies.

30. O2.2. Implementation of a mobile phone–supported microplanning approach in Arequipa's dog mass vaccination campaign: acceptance and performance.
31. O2.3. Trends and statistical analysis of animal aggressions suspected of rabies in Haiti, 2017–2024.

32. Conferencia especial 1/ Special conference/ Conferência especial 1. Optimizing Mass Vaccination Campaigns for Rabies (and Epidemic) Prevention: A Cluster Randomized Trial

34. Mesa Redonda 1: Hacia unos Andes libres de rabia: Integrando el control y la eliminación de la rabia canina / Round Table 1: Toward a Rabies-Free Andes: Integrating Canine Rabies Control & Elimination / Mesa Redonda 1: Rumo a uma região Andina livre da raiva: integrando o controle e a eliminação da raiva canina

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39. O3.1. Perceptions and Barriers Regarding Feline Rabies Americas: An Approach from the One Health Perspective.
40. O3.2. Epidemiological dynamics of rabies in domestic animals in andahuaylas, Peru: trend analysis, vaccination coverage, and transmission determinants (2021–2025).
41. O3.3. Asociación entre altitud geográfica e incidencia de rabia silvestre en ganado bovino en la región de Apurímac (2004-2015).

43. Sesión de Pósters 1 /Posters session 1 /Pósteres 1
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45. P1.2. Targeted rabies surveillance in feral dogs in a canine rabies endemic area of Peru.
46. P1.3. Spatiotemporal Modeling of Rabies Using Graph Neural Networks: A Proposal in Low- Supervision Contexts.
48. P1.4. Epidemiology of rabies in Peru, 1984-2018.

49. P1.5. Strengthening Rabies Prevention Through Education and Community-Based Vaccination: Insights from Amici Cannis' Efforts in Ecuador.
50. P1.6. Geocodificação e Geoespacialização dos dados da Raiva no Estado do Acre entre 2020 e 2025.
51. P1.7. Caracterización epidemiológica de la rabia en bolivia (2020- 2025).
53. P1.8. Evaluación de la tolerancia y respuesta inmune a la vacunación antirrábica en caninos y felinos menores de tres meses de edad.
54. P1.9. Rabia canina en arequipa peru, una mirada gráfica a diez años de trabajo.
55. P1.10. Modelamiento de la vacunación de cachorros menores de 3 meses y su impacto en la cobertura antirrábica canina en Arequipa, Perú.
56. P1.11. El Perú en camino a ser un país libre de rabia canina. Situación de la rabia canina en el perú, 2015-2025.
57. P1.12. Animal welfare considerations in the release of sterilized street dogs.
59. P1.13. Comparative diagnosis of rabies using fluorescence antibody test (fat) and rt-q-pcr at the maranhão central public health laboratory (lacen-ma/brazil) during 2023 and 2024.
60. P1.14. Análise espacial da ocorrência de raiva bovina no município de Paracambi, Rio de Janeiro, Brasil.
61. P1.15. The Overlooked role of feline rabies in socially unequal contexts: implications for zoonotic disease control.
62. P1.16. Tendiendo puentes entre la academia y los productores: método para promover la prevención de la Rabia Paralítica Bovina.

64. Sesión Oral 4: Rabia en murciélagos no hematófagos/ Non-hematophagus Bat Rabies/ Raiva de morcego não hematófago

65 Conferencia especial 2/ Special conference 2/ Conferência especial 2. Reflections from 19 years of vampire bat rabies research in Peru.

66 O2.1. Is the Nucleoprotein Gene Sufficient for Phylogenetic Inference in Bat-Borne Rabies?
67. O2.2. The Cousin Across the Pacific: The Bizarre Biogeography of Bat-Borne Rabies.
68. O2.3. Drivers of sporadic European bat lyssavirus 2 infections in *Myotis myotis.*

70. O2.4. Raiva em morcegos: vigilância laboratorial sob o olhar da saúde única na Amazônia Brasileira.

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73. O2.6. A Bayesian framework for optimising vampire bat roost discovery and quantifying livestock bite risk.
74. O2.7. Expert elicitation on vampire bats and rabies: implications for United States surveillance, management, and research.
75. O2.8. Whole-genome phylogeography of rabies virus circulating in *Desmodus rotundus* in Mexico.
77. O2.9. Raiva secundária: cão como vetor de variante silvestre em caso humano no Brasil.
78. O2.10. Impact of the Implementation of Pre-Exposure Rabies Prophylaxis (PrEP) on the Reduction of Wild-Type Rabies Incidence in Prioritized Regions of Peru, 2011–2024.

79. Mesa Redonda 2: Uniendo fuerzas contra la rabia salvaje en la Amazonía/ Round Table 2: Joining Forces Against Wild Rabies in the Amazon/ Mesa Redonda 2: Unindo forças contra a raiva selvagem na Amazônia

80. Declaraciones de panelistas/ Declarações dos painelistas/Statements by panelists

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85. P2.2. Espoliações Causadas por Morcegos Hematófagos em Comunidade do Alto Rio Negro, Amazônia Brasileira.
86. P2.3. Vampire Bats and Maize: Exploring Traditional Agricultural Practices with Implications for Rabies Management.
87. P2.4. Notification of *Desmodus rotundus* attacks in an urban area in the capital of Maranhão, São Luís (Brazil).
89. P2.5. La variante antigénica V3 asociada a *Desmodus rotundus* en el noroeste de México.

90. P2.6. Advancing Rabies Molecular Diagnostics: Evaluation of a compact automated extraction platform for use inside the Wadsworth Center rabies suite.
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91. P2.8. Technical evaluation of rapid kits for rabies diagnosis.
92. P2.9. Establecimiento de la técnica de rt-PCR en tiempo real en diferentes estructuras de cerebros de *Desmodus rotundus*, inoculados en cautiverio.
94. P2.10. Structural Equation Modeling of Human Rabies Prophylaxis in São Paulo: A Latent Variable Approach.
95. P2.11. Pseudotyped Baculoviruses with Chimeric Rabies Glycoprotein G: An Innovative Platform to Activate Innate and Cellular Immunity.
96. P2.12. Optimization of the production of a pseudotyped baculovirus with the rabies virus glycoprotein G.
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102. O3.2. The westernmost detection of Lyssavirus rabies raccoon variant in the United States: Genomics as a tool for rabid pet source tracking.
103. O3.3. Ecology and Epidemiology of Vampire Bat-borne Rabies.
104. O3.4. Comparative rabies diagnostic findings in gestating mongooses and a bat.
105. O3.5. Evidencia de transmisión sostenida sugiere a *Potos flavus* como reservorio de un antiguo linaje de rabia, relacionado con el clado de murciélagos.
107. O3.6. Rabies in Canada, 2013 - 2022: A decade in review.
108. O3.7. Recent developments in rabies epidemiology in Canada.
109. O3.8. Saguis: risco crescente de transmissão da raiva na cidade de São Paulo.

110. Sesión Oral 7: Intervenciones con vacunas orales/ Oral Vaccine Interventions/ Intervenções de Vacinação Oral

111. O3.9. Progress in elimination of fox-mediated rabies in Türkiye.
112. O3.10. Large-Scale Oral Rabies Vaccination (ORV) Campaigns in Namibia: A Scalable Tool for Dog-Mediated Rabies Control.
113. O3.11. Collaborative study on the rabies antibody detection in wildlife samples in Europe.
114. O3.12. Evaluation of oral rabies vaccination using a higher titer vaccinia virus rabies recombinant product in North Carolina and Maine, USA

116. Premio Ivanete Kotait a estudiantes/jóvenes investigadores latinoamericanos/ Ivanete Kotait Award Latin American student/young researcher / Prêmio Ivanete Kotait de Estudante/Jovem Pesquisadora Latino Americana
117. O3.13. Susceptibility and antiviral gene expression of immortalized *Desmodus rotundus* Kidney Cells (FKDR) upon Lyssavirus rabies infection.

119. Sesión Oral 8: Diagnóstico y herramientas moleculares/ Diagnostics and Molecular Tools/ Diagnóstico e Ferramentas Moleculares
119. O3.14. Análise filogenética do gene N do vírus da raiva no Brasil: Diversidade molecular e distribuição geográfica.
120. O3.15. In silico prediction of rabies virus-specific B-cell epitopes for the development of immune-based diagnostic assays.
121. O3.16. Comparative diagnosis of rabies using fluorescence antibody test (FAT) and RT-q-PCR at the Maranhao Central public health laboratory (LACEN-MA/BRAZIL) during 2023 and 2024.
122. O3.17. Deep Learning Models for Rabies Virus Detection in Cell Cultures
124. O3.18. Identification of single nucleotide polymorphisms (SNP´s) in whole genomes of rabies virus and vaccine strains in Mexico.

125. Sesión Oral 9: Desarrollo de vacunas/ Vaccine development/ Desenvolvimento de vacinas
125. O3.19. Long-term persistence and boostability of immune responses following different rabies pre-exposure prophylaxis priming schedules of a PCEC rabies vaccine.
126. O3.20. Immunogenicity of an adjuvanted, combination inactivated rabies-vectored, Lassa fever vaccine in healthy adults: interim results of a first-in-human Phase 1 trial.

127. O3.21. Antibody response to a Baculovirus-Based Rabies Vaccine Candidate in Cattle.
128. O3.22. Industrial development of human Rabies Vaccine - Scale up and improvements of virus production in cell-based platform.
129. O3.23. From days to hours: flow cytometry as a rapid tool for titrating pseudotyped baculoviruses as a vaccine platform against rabies.
131. O3.24. SYN023 mAb Cocktail for Rabies Prophylaxis

132. Sesión de Pósters 3/ Posters session 3/ Pósteres
133. P3.1. A review of pediatric rabies cases reveals a unique clinical presentation associated with bat-borne infections.
134. P3.2. No evidence of vertical transmission of rabies vírus in bats.
135. P3.3. Animal aggressions on humans in the municipality of Pedreiras, Maranhão (Brazil), from January 2021 to May 2025.
136. P3.4. Analysis of the inmune response profile in the central nervous system of a patient who died due to rabies transmitted by *Callithrix jacchus* - Case Report.
137. P3.5. Genetic Clustering of Rabies Virus Variants: Proximity among Samples from Brazilian Reservoirs.
138. P3.6. Particularidades do atendimento para profilaxia da raiva humana a profissões de risco.
139. P3.7. Perfil Epidemiólogico dos Atendimentos Antirrábicos Causados por Primatas-Não-Humanos no Brasil.
140. P3.8. Situación de la vacunación antirrábica humana esquema pre exposición en la selva central 2023. Región Junín.
142. P3.9. Profile of Human Rabies Prophylaxis International Border Zone, 2007–2020.
143. P3.10. An OutRAGEous proposal: Could Rabies Virus suppress the fever response? Implications for disease pathogenesis and possible rabies treatment using fever therapy.

145. Sesión Oral 10: Rabia Humana/ Human Rabies/ Raiva Humana
146. O4.1. Epidemiological panorama of human rabies in the Americas: analysis of regional averages from 1970 to 2025.
147. O4.2. Human Rabies Care in Attacks/Accidents Caused by Bats in Brazilian Municipalities Along the Brazil-Peru Border, 2007-2020.
148. O4.3. Autopsy findings of patients with Rabies Encephalitis--- A study from a Tertiary Care Hospital in North India.

149. O4.4. Retraction of a Journal Article Reporting the Successful Treatment of a Rabies Patient.
150. O4.5. Rabia zoonótica en Loreto, Perú: evidencia de transmisión persistente por murciélagos.
152. O4.6. Milwaukee Protocol, versions (v.) 7A-7K.

153. Sesión Oral 11: PEP & PrEP
153. O4.7. Profilaxis antirrábica preexposición en comunidades nativas amazónicas del Perú (2017–2024): implementación y resultados en la prevención de la rabia silvestre.
154. O4.8. Infiltração lesional de imunobiológicos para a profilaxia da raiva humana: opção segura e econômica.
155. O4.9. Profilaxia da raiva humana: quatro condutas distintas para um mesmo acidente envolvendo 22 pessoas – Relato de Caso.
156. O4.10. Barriers to Accessing Rabies Post-Exposure Prophylaxis in Nepal.

158. Premio George M. Baer para la Investigación Latinoamericana / George M. Baer Prize for Latin American Research / Prêmio George M. Baer de Pesquisa Latino-Americana
159. O4.11. Technical academic training for health personnel and training of rabies trainers in Lázaro Cárdenas, Michoacán, in response to a case of human rabies.

160. Sesión Oral 12: Antivirales/ Antivirals/Antivirais
161. O4.12. Identification of rabies virus polymerase inhibitors that block viral replication in human brain organoids.
162. O4.13. Antibody Gene Therapy for Rabies.
163. O4.14. Diseño y caracterización de candidatos a proteínas señuelo contra la rabia: un estudio in silico bioinformático.
165. O4.15. From Bioinformatics to bench: repurposing approved drugs for anti-rabies activity in Latin America.
166. O4.16. Specific glycan residues modulate the neutralizing function of anti-rabies antibodies.
167. O4.17 Lovastatin Decreases the Size of Negri Bodies: A Potential Regulator in Rabies Infection?
169. Sesión Oral 13: Patogenia de la rabia/ Rabies Pathogenesis/ Patogênese da Raiva

169. O4.18. Differences in transmission rates leading to endemicity and host adaptation are correlated with neurophysiological activity of different rabies virus variants.
170. O4.19. Neuroimaging/MRI findings of patients with Rabies Encephalitis. A study from a Tertiary Care Hospital in North India.
171. O4.20. G and L genes of rabies virus regulate viral myotropism and neuroinvasiveness.

173. Ganadores de presentación de poster/ Poster presentation Winners/ Vencedores da aprensentação de posters.

174. Ganadores de presentación oral/ Oral presentation Winners/ Vencedores da aprensentação oral.

175. Sesion de clausura/closing session/Sessão de encerramento. Research Directions in Rabies Prevention & Control - 'Days of Future Past'…?

178. Seminario Web: Consideraciones para la profilaxis humana preexposición a la rabia en comunidades desatendidas de Sudamérica/ Considerations for Pre-exposure Human Prophylaxis Against Rabies in Neglected Communities in South America/ Considerações sobre a profilaxia humana pré-exposição contra a raiva em comunidades negligenciadas na América do Sul

179. The historical precept & modern concept of pre-exposure prophylaxis against rabies.
180. Development of an ideal preventative rabies vaccine.
180. Don't let the perfect be the enemy of the good: how PrEP could save lives
181. Affordable, accessible, effective? The dilemma of rabies serological testing in under-resourced high risk areas
182. Massive rabies PrEP program in the peruvian amazon basin: advances, challenges & lessons learned after 14 years
183. Rabies control in remote regions of the Brazilian amazon: strategies for riverine communities
184. The health economics of human rabies pre-exposure rabies vaccination

185. Patrocinadores/ Sponsors/ Patrocinadores

Programa / Program / Programa

RABIES IN THE AMERICAS

RITA 2025 Rabia en las Américas PERÚ

XXXVI Rabia en las Américas
Conferencia - RITA 2025
Lima, Peru
Octubre 19 - 24, 2025

Domingo, 19 de octubre	
13:00 - 15:30	Entrega de pósteres en el módulo de registro
13:00 - 17:15	Registro
17:30 - 18:30	Ceremonia de apertura
18:30 - 20:00	Recepción y Cóctel de bienvenida
Lunes, 20 de octubre	
07:30 - 08:30	Registro
08:30 - 08:45	Charla inaugural: “Why RITA in Peru? The Challenge of Rabies Control” Dr. Sergio Recuenco, CITBM, UNMSM, Peru.
08:45 - 10:15	**Sesión oral 1: Control y vigilancia de la rabia canina**

Moderadores:
Dres. Ad Vos &
Ricardo Castillo

"Global Progress Towards 'Zero by 30': Updates from the United Against Rabies Forum"
Dr. Rachel Tidman, World Organization of Animal Health.

"Ring Vaccination Radii for Canine Rabies Control: Variability in Guidelines and Practices in the Americas"
MVZ. Alejandra Dávila-Barclay, One Health Unit, School of Public Health and Administration, Universidad Peruana Cayetano Heredia, Lima, Peru.

"Understanding canine rabies virus transmission using genomics in a decade-long epidemic in Arequipa, Peru"
MVZ. Alejandra Dávila-Barclay, One Health Unit, School of Public Health and Administration, Universidad Peruana Cayetano Heredia, Lima, Peru.

"Cobertura de vacunación antirrábica canina: comparación entre reportes oficiales y encuestas de hogares en Ayacucho (2021–2024)"
Dra. Nelly Huamani Basilio, Dirección Regional de Salud Ayacucho, MINSA, Perú.

"Canine Rabies in Vaccinated Dogs: An Additional Challenge for Control in Arequipa, Peru"
Antuannete Irene Vela Oyola, One Health Unit, School of Public Health and Administration, Universidad Peruana Cayetano Heredia, Lima, Peru.

"Socioeconomic Disparities in Canine Rabies Surveillance: High-Resolution Evidence from Peru"
Dr. Ricardo Castillo-Neyra, Department of Biostatistics, Epidemiology, and Informatics, School of Medicine, University of Pennsylvania, PA, USA.

10:15 - 11:00	**SESIÓN DE POSTERS SOBRE RABIA EN PERROS Y OTROS ANIMALES DOMÉSTICOS & COFFEE BREAK**
11:00 - 11:45	**Sesion oral 2: Control y vigiancia de la rabia canina II**
Moderadores: Dres. Charles Rupprecht & Nathalia Correa	"Rabies In Borneo: An Asia-Pacific platform to operationalize One Health practices to eliminate dog-mediated rabies" Dra. Andrea Britton, Ultimate Efficacy Consulting and Public Health Association of Australia, Australia. "Implementation of a mobile phone–supported microplanning approach in Arequipa's dog mass vaccination campaign: acceptance and performance" Dr. Sergio Guerrero, Pan Animalia Galápagos (Worldwide Veterinary Service South America), Quito, Ecuador. Mission Rabies, Cranborne, United Kingdom. "Trends and statistical analysis of animal aggressions suspected of rabies in Haiti, 2017–2024" Dr. Parlo Cesar St Vil, Directorate of Epidemiology, Laboratories and Research (DELR), Ministry of Public Health and Population (MSPP), Port-au-Prince, Haiti.
11:45 - 12:30	**Conferencia especial 1**: "Optimizing Mass Vaccination Campaigns for Rabies (and Epidemic) Prevention: A Cluster Randomized Trial" Dr. Ricardo Castillo-Neyra, Department of Biostatistics, Epidemiology, and Informatics, School of Medicine, University of Pennsylvania, PA, USA.
12:30 - 13:20	**ALMUERZO**

13:30 - 15:00	**Mesa redonda 1: Hacia unos Andes libres de rabia: integracion del control y eliminación de la rabia canina**
Moderadores: Dres. Marco Vigilato & Ana Navarro	Dr. Grover Paredes (Virtual), Disease Prevention and Control Unit, Ministry of Health and Sports, Bolivia. Dra. Silene Manrique Rocha, Secretariat of Health and Environmental Surveillance, Ministry of Health, Brazil. Dr. Alberto Aspilcueta, Department of Public Health and Sanitary Planning, Ministry of Health, Chile. Dr. Román Bances, National Coordination of Zoonosis, Ministry of Health, Peru. Dr. Parlo Cesar St Vil, Directorate of Epidemiology, Laboratories and Research, Ministry of Public Health and Population, Port-au-Prince, Haiti.
15:00 - 15:45	**SESIÓN DE POSTERS SOBRE LA RABIA EN PERROS DOMÉSTICOS Y OTROS ANIMALES & COFFEE BREAK**
15:45 - 16:30	**Sesión oral 3: Otros animales domésticos**
Moderadores: Dres. Mirtha Colman & Ana Navarro	"Perceptions and barriers regarding feline rabies in the Americas: an approach from the One Health perspective" Dra. Nathalia María del Pilar Correa Valencia, Universidad de Antioquia, Medellín, Colombia. "Epidemiological Dynamics of Rabies in Domestic Animals in Andahuaylas, Peru: Trend Analysis, Vaccination Coverage, and Transmission Determinants (2021–2025)" Dra. Ornela Chavez Inagaki, Facultad de Ciencias de la Salud, Universidad Peruana de Ciencias Aplicadas, Lima, Peru.

	"Asociación entre altitud geográfica e incidencia de rabia silvestre en ganado bovino en la región de Apurímac (2004-2015)" Dr. Martín E. Pineda-Serruto, Laboratorio de Parasitología y Salud Pública, Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Micaela Bastidas de Apurímac, Apurímac, Perú.
16:30 - 17:30	**Sesión especial**: Conservación de Murciélagos Proyección de película seguida de un panel de discusión con expertos en ecología de murciélagos.
19:30 - 22:00	**Reunión del comité directivo internacional + Cena (Solo con invitación)**

Martes, 21 de octubre	
07:30 - 08:30	Registro
08:30 - 09:15	**Conferencia especial 2**: "Reflections from 19 years of vampire bat rabies research in Peru" Dr. Daniel Streicker, School of Biodiversity, One Health & Veterinary Medicine, University of Glasgow, United Kingdom.
09:15 - 10:15	**Sesión oral 4: Rabia en Murciélagos No Hematófagos**
Moderadores: Dres. April Davis & Sergio Recuenco	"Is the Nucleoprotein Gene Sufficient for Phylogenetic Inference in Bat-Borne Rabies?" Dra. Analorena Cifuentes-Rincón, Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA, USA. "The Cousin Across the Pacific: The Bizarre Biogeography of Bat-Borne Rabies" Dra. Alison Hoeger, University of Queensland, Australia

	“Drivers of sporadic European bat lyssavirus 2 infections in Myotis myotis” Dr. Fred Touzalin, University College Dublin, Ireland. University of Glasgow, United Kingdom. “Raiva em morcegos: vigilância laboratorial sob o olhar da saúde única na Amazônia Brasileira” Dra. Taciana Fernandes Souza Barbosa Coelho (Virtual), Laboratório de Raiva do Instituto Evandro Chagas (IEC), Brazil.
10:15 - 11:00	**SESIÓN DE POSTERS SOBRE RABIA EN MURCIÉLAGOS, HERRAMIENTAS MOLECULARES Y DIAGNÓSTICAS Y DESARROLLO DE VACUNAS & COFFEE BREAK**
11:00 - 12:30	**Sesión oral 5: Rabia en murciélagos hematófagos**
Moderadores: Dres. David Moran & Ivan Vargas	“Avaliação in vitro de diferentes linhagens genéticas de vírus da raiva características de morcegos” Dra. Helena Beatriz de Carvalho Ruthner Batista, Instituto Pasteur de São Paulo, Brazil. “A Bayesian framework for optimising vampire bat roost discovery and quantifying livestock bite risk” Dra. Rita Ribeiro, School of Biodiversity, One Health & Veterinary Medicine, University of Glasgow, United Kingdom. “Expert elicitation on vampire bats and rabies: implications for United States surveillance, management, and research” Dra. Amy J. Davis (Virtual), USDA APHIS WS National Wildlife Research Center, USA. “Whole-genome phylogeography of rabies virus circulating in Desmodus rotundus in Mexico” Dra. Paulina Fragoso Zamora, Facultad de Ciencias Naturales, Universidad Autónoma de Querétaro, Mexico.

	“Raiva secundária: cão como vetor de variante silvestre em caso humano no Brasil” Dra. Silene Manrique Rocha, Secretariat of Health and Environment Surveillance, Ministry of Health, Brazil. “Impact of the implementation of pre-exposure rabies prophylaxis (PrEP) on the reduction of wild rabies incidence in prioritized regions of Peru, 2011–2024” Dr. Moisés Apolaya Segura, Dirección Prevención y Control de Enfermedades Metaxénicas y Zoonosis, Ministerio de Salud, Peru.
12:30 - 13:20	**Almuerzo**
13:30 - 15:00	**Mesa redonda 2: Uniendo fuerzas contra la rabia silvestre en la Amazonía**
Moderadores: Dres. Felipe Rocha & Marco Vigilato	Dr. Grover Paredes (Virtual), Disease Prevention and Control Unit, Ministry of Health and Sports, Bolivia. Dra. Fernanda Voietta Pina, Secretariat of Health and Environmental Surveillance, Ministry of Health, Brazil. Dra. Stephany Yepes (Virtual), National Zoonosis Program, Ministry of Health and Social Protection, Colombia. Dr. Alberto Aspilcueta, Department of Public Health and Sanitary Planning, Ministry of Health, Chile. Dr. Charles Rupprecht, Lyssa LLC, Georgia, USA Dr. Moises Apolaya, Directorate of Prevention and Control of Metaxenic Diseases and Zoonoses, Ministry of Health, Peru.

15:00 - 15:45	**SESIÓN DE POSTERS SOBRE RABIA EN MURCIÉLAGOS, HERRAMIENTAS MOLECULARES Y DIAGNÓSTICAS Y DESARROLLO DE VACUNAS & COFFEE BREAK**
15:45 - 17:15	**Mesa redonda 3: Barreras éticas y culturales para el control de la rabia en poblaciones indígenas amazónicas**
Moderadores: Dres. Sergio Recuenco & Silene Manrique Rocha	Dr. Martín Casapía, Universidad de la Amazonía Peruana, Peru. Dra. Magaly Blas, Director of the Mamás de Río Program, Professor at Universidad Peruana Cayetano Heredia, Peru. Dr. Felipe Rocha, PANAFTOSA/SPV-OPS/OMS.
17:15 - 17:30	**Cierre del día y anuncios logísticos**
19:30 - 22:15	**Cena de patrocinadores RITA 2025 (solo con invitación)**

Miércoles, 22 de octubre	
07:30 - 08:30	Registro
08:30 - 10:15	**Sesión oral 6: Vectores de rabia en fauna silvestre terrestre**

Moderadores:
Dres. David Moran &
Thomas Müller

"Proposing a system for rabies detection in terrestrial wild mammals in Guatemala"
Dr. David Moran, Center for Health Studies, Universidad del Valle de Guatemala, Guatemala.

"The westernmost detection of Lyssavirus rabies raccoon variant in the United States: Genomics as a tool for rabid pet source tracking"
Dr. Matthew W. Hopken (Virtual), United States Department of Agriculture, USA.

"Ecology and Epidemiology of Vampire Bat-borne Rabies"
Dr. Diego Soler-Tovar, Faculty of Agricultural Sciences, Universidad de La Salle, Bogota, Colombia.

"Comparative rabies diagnostic findings in gestating mongooses and a bat"
Dr. Miguel A. Maldonado-Cedeño, Puerto Rico Department of Health, Centers for Disease Control and Prevention (CDC), University of Puerto Rico, Cayey Campus, Puerto Rico.

"Evidencia de transmisión sostenida sugiere a Potos flavus como reservorio de un antiguo linaje de rabia, relacionado con el clado de murciélagos"
Dra. Carina Rosario Mantari Torpoco, Instituto Nacional de Salud, Peru.

"Rabies in Canada, 2013 – 2022: A decade in review"
Dr. Danielle Julien, Public Health Agency of Canada, Canada.

"Recent developments in rabies epidemiology in Canada"
Dr. Cin Lam Thang, Canadian Food Inspection Agency, Canada.

"Saguis: risco crescente de transmissão da raiva na cidade de São Paulo"
Dra. Carla M. P. Vázquez, Espaço Pasteur, Instituto de Infectologia Emílio Ribas, São Paulo, Brazil.

10:15 - 11:00	**SESIÓN DE POSTERS SOBRE RABIA HUMANA, PATOGÉNESIS Y PEP/PrEP & COFFEE BREAK**
11:00 - 12:00	**Sesión oral 7: Intervenciones de vacunación oral**

Moderadores: Dres. Sergio Recuenco & Ricardo Castillo

"Progress in elimination of fox-mediated rabies in Türkiye"
Dr. Ad Vos, Ceva Santé Animale, France.

"Large-Scale Oral Rabies Vaccination (ORV) Campaigns in Namibia: A Scalable Tool for Dog-Mediated Rabies Control"
Dr. Thomas Müller, Institute for Molecular Virology and Cell Biology, Friedrich-Loeffler-Institut, Federal Research Institute for Animal Health, WHO/WOAH/FAO Reference Centre for Rabies, Germany.

"Collaborative study on the rabies antibody detection in wildlife samples in Europe"
Dra. Marine Wasniewski, ANSES-NANCY Laboratory for Rabies and Wildlife, European Union Reference Laboratory for Rabies, France.

"Evaluation of oral rabies vaccination using a higher titer vaccinia virus rabies recombinant product in North Carolina and Maine, USA"
Dra. Amy T. Gilbert, United States Department of Agriculture, USA.

12:00 - 12:30	**PREMIO IVANETE KOTAIT**

"Susceptibility and antiviral gene expression of immortalized Desmodus rotundus Kidney Cells (FKDR) upon Lyssavirus rabies Infection"
Dra. Lina M. Violet-Lozano, Universidade Federal do Rio Grande do Sul (UFRGS), Brazil.

12:30 - 13:20	**ALMUERZO**
13:30 - 15:00	**Sesión oral 8: Herramientas diagnósticas y moleculares**

Moderadores: Dres. Susan Moore & Ricardo Lopez

"Análise filogenética do gene N do vírus da raiva no Brasil: Diversidade molecular e distribuição geográfica"
Dra. Helena Beatriz de Carvalho Ruthner Batista, Instituto Pasteur de São Paulo, Brazil.

"In silico prediction of rabies virus-specific B-cell epitopes for the development of immune-based diagnostic assays"
Dr. Miguel Angel Chávez Fumagalli, Computational Biology and Chemistry Research Group, Vicerrectorado de Investigación, Universidad Católica de Santa María, Arequipa, Peru.

"Comparative diagnosis of rabies using fluorescence antibody test (FAT) and RT-q-PCR at the Maranhão Central Public Health Laboratory (LACEN-MA/Brazil) during 2023 and 2024"
Dr. Eric Takashi Kamakura de Carvalho Mesquita, Agência Estadual de Defesa Agropecuária do Maranhão, Laboratório Central de Saúde Pública do Maranhão, Conselho Regional de Medicina Veterinária do Maranhão, Brazil.

"Deep Learning Models for Rabies Virus Detection in Cell Cultures"
Dr. Joan Manuel Amaya Cuesta, Animal; Plant Health Agency (APHA), United Kingdom.

"Identification of single nucleotide polymorphisms (SNPs) in whole genomes of rabies virus and vaccine strains in Mexico"
Dra. Jacqueline García Cano, Universidad Autónoma de Querétaro, Mexico.

15:00 - 15:45	**SESIÓN DE POSTERS SOBRE RABIA HUMANA, PATOGÉNESIS Y PEP/PrEP & COFFEE BREAK**
15:45 - 17:00	**Sesión oral 9: Desarrollo de vacunas**

Moderadores:
Dres. Ad Vos &
Carlos Palacios

"Long-term persistence and boostability of immune responses following different rabies pre-exposure prophylaxis priming schedules of a PCEC rabies vaccine"
Dra. Fernanda Salgado (Virtual), Bavarian Nordic Belgium, Brussels, Belgium.

"Safety and Immunogenicity of an Inactivated Attenuated Rabies Virus Vaccine Expressing Lassa Fever Virus Glycoprotein Complex Antigen: Interim Results of a Randomized Placebo-Controlled, Phase I Trial"
Dr. Matthias J. Schnell, Thomas Jefferson University, Sidney Kimmel Medical College, USA.

"Antibody responses to a baculovirus-based rabies vaccine candidate in cattle"
Dr. Ricardo Choque Guevara, Farmacológicos Veterinarios S.A.C., Peru.

"Industrial development of human Rabies Vaccine - Scale up and improvements of virus production in cell-based platform"
Dra. Milena Apetito Akamatsu, Centro BioIndustrial, Instituto Butantan/Fundação Butantan, São Paulo, Brazil.

"From days to hours: flow cytometry as a rapid tool for titrating pseudotyped baculoviruses as a vaccine platform against rabies"
Dr. Freddy Ricardo Ygnacio Aguirre, Farmacológicos Veterinarios S.A.C., Peru.

"SYN023 mAb Cocktail for Rabies Prophylaxis"
Dr. Eric Tsao, Synermore Biologics.

17:00 - 17:15	**Anuncio de ganadores categoría posters**
20:00 - 22:00	**Cena de gala**

Jueves, 23 de octubre	
07:30 - 08:45	Registro
08:45 - 10:15	**Sesión oral 10: Rabia humana**

Moderadores: Dres. Sergio Recuenco & Stephen Scholand

"Epidemiological panorama of human rabies in the Americas: analysis of regional averages from 1970 to 2025"
Dr. Clayton Bernardinelli Gitti, Universidade Federal Rural do Rio de Janeiro, Brazil.

"Human Rabies Care in Attacks/Accidents Caused by Bats in Brazilian Municipalities Along the Brazil-Peru Border, 2007-2020"
Dra. Silene Manrique Rocha, Secretariat of Health and Environment Surveillance, Ministry of Health,

"Autopsy findings of patients with Rabies Encephalitis--A study from a Tertiary Care Hospital in North India"
Dr. Vikas Suri, Department of Internal Medicine PGIMER, Chandigarh, India.

"Retraction of a journal article reporting the successful treatment of a rabies patient"
Dr. Alan C. Jackson, Department of Clinical Neurosciences (Neurology), Cumming School of Medicine, University of Calgary, Canada.

“Rabia zoonótica en Loreto, Perú: evidencia de transmisión persistente por murciélagos”
Dr. Cesar Ramal Asayag, Universidad Nacional de la Amazonía Peruana. Hospital Regional de Loreto, Iquitos, Peru.

“Milwaukee Protocol, versions (v.) 7A-7M”
Dr. Rodney E. Willoughby, Medical College of Wisconsin, Milwaukee, Wisconsin, USA.

10:15 - 11:00	**COFFEE BREAK**
11:00 - 12:00	**Sesión oral 11: PEP & PrEP**

Moderadores: Dres. Felipe Rocha & Sergio Recuenco

“Profilaxis antirrábica preexposición en comunidades nativas amazónicas del Perú (2017–2024): implementación y resultados en la prevención de la rabia silvestre”
Dr. Angela Talia Cristina Laos Bejarano, Dirección de Prevención y Control de Enfermedades Metaxénicas y Zoonosis, MINSA, Peru.

“Infiltração lesional de imunobiológicos para a profilaxia da raiva humana: opção segura e econômica”
Dr. Carla M. P. Vázquez, Espaço Pasteur, Instituto de Infectologia Emílio Ribas, São Paulo, Brazil.

“Profilaxia da raiva humana: quatro condutas distintas para um mesmo acidente envolvendo 22 pessoas – Relato de Caso”
Dr. Carla M. P. Vázquez, Espaço Pasteur, Instituto de Infectologia Emílio Ribas, São Paulo, Brazil.

“Barriers to Accessing Rabies Post-Exposure Prophylaxis in Nepal”
Dr. Rakesh Chand, Department of Veterinary Medicine, University of Cambridge, United Kingdom.

12:00 - 12:30	**PREMIO GEORGE BAER**

“Technical academic training for health personnel and training of rabies trainers in Lázaro Cárdenas, Michoacán, in response to a case of human rabies”
Dra. Alma Deyanira Aguilera Acosta, Servicios de Salud Pública de la Ciudad de México, Michoacán, Mexico.

12:30 - 13:20	**ALMUERZO**
13:30 - 15:00	**Sesión oral 12: Antivirales**

“Identification of Rabies Virus Polymerase Inhibitors that Block Viral Replication in Human Brain Organoids”
Dra. Belén Lizcano Perret, Laboratory of Virology and Antiviral Research, Department of Microbiology, Immunology and Transplantation, Rega Institute Herestraat, Belgium.

“Antibody Gene Therapy for Rabies”
Dra. Jyoti Yadav (Virtual), Scott-Ritchey Research Center, College of Veterinary Medicine, Auburn University, USA.

Moderadores:
Dres. Ad Vos &
Carlos Palacios

“Diseño y caracterización de candidatos a proteínas señuelo contra la rabia: un estudio in silico bioinformático”
Paul Galvez Murillo, Laboratorio de Química de Proteinas y Centro de Investigación y Estudios Médicos, Facultad de Medicina Humana, Universidad Católica de Santa María, Arequipa, Peru.

“From Bioinformatics to Bench: Repurposing Approved Drugs for Anti-Rabies Activity in Latin America”
Dra. Joana Aguiar (Virtual), Universidade de São Paulo, Brazil.

"Specific Glycan Residues Modulate the Neutralizing Function of Anti-Rabies Antibodies"
Dr. Sandriana dos Ramos Silva, Instituto Pasteur, Brazil.

"Lovastatin Decreases the Size of Negri Bodies: A Potential Regulator in Rabies Infection?"
Dr. Cesar Martin Leyva Molina, Universidad Privada San Juan Bautista, Peru.

15:00 - 15:45	**COFFEE BREAK**
15:45 - 16:30	**Sesión oral 13: Patogénesis de la rabia**

"Differences in transmission rates leading to endemicity and host adaptation are correlated with neurophysiological activity of different rabies virus variants"
Dr. Karsten Hueffer, University of Alaska Fairbanks, USA.

Moderadores: Dres. Alan Jackson & Jane Megid

"Neuroimaging/MRI findings of patients with Rabies Encephalitis--- A study from a Tertiary Care Hospital in North India"
Dr. Vikas Suri, Department of Internal Medicine PGIMER, Chandigarh, India.

"G and L genes of rabies virus regulate viral myotropism and neuroinvasiveness"
Dr. Nijiho Kawaguchi, International Institute for Zoonosis Control, Hokkaido University, Japan.

16:30 - 17:30	**Sesión de clausura**

Plabras del presidente de la RITA INC.
Dr. Carlos Palacios, Fundación Pablo Cassará, Instituto de Ciencia y Tecnología Dr. César Milstein. Ciudad Autónoma de Buenos Aires, Argentina.

Palabras de cierre
Dr. Charles Rupprecht, Lyssa LLC, Georgia, USA.

Reconocimiento a las mejores presentaciones orales.

Anuncio de RITA 2026
Presentación del país y la institución anfitriona y detalles preliminares de la conferencia del próximo año.

Palabras de cierre y clausura
Dr. Sergio Recuenco, CITBM, UNMSM, Peru.

18:00 - 20:30	**Cóctel de clausura**

Viernes, 24 de octubre	
08:30 - 09:00	**Café**
09:00 - 12:00	**Webinar "Consideraciones sobre la profilaxis pre-exposición humana contra la rabia en comunidades desatendidas de Sudamérica"**

“Welcome: the historical precept and modern concept of PrEP against rabies”
Dr. Charles Rupprecht, Lyssa LLC, Georgia, USA.

“The burden of rabies in Amazonia: progress and challenges to surveillance, prevention and control”
Dr. Felipe Rocha, PANAFTOSA/SPV-OPS/OMS.

“Development of an ideal preventative rabies vaccine”
Dr. Hildegund Ertl, The Wistar Institute, Philadelphia, USA.

“Don’t let the perfect be the enemy of the good: how PrEP could save lives”
Dr. Alexander (Sandy) Douglas, Jenner Institute, Nuffield Department of Medicine, University of Oxford, United Kingdom.

“Affordable, accessible, effective? The dilemma of rabies serological testing in under-resourced high-risk areas”
Dra. Susan Moore, University of Missouri, USA.

“Massive rabies PrEP program in the Peruvian Amazon Basin: advances, challenges and lessons learned after 14 years”
Dr. Sergio Recuenco, CITBM, UNMSM, Peru.

“Rabies control in remote regions of the Brazilian Amazon: strategies for riverine communities”
Dra. Silene Manrique Rocha, Secretariat of Health and Environmental Surveillance, Ministry of Health, Brazil.

“The health economics of human rabies pre-exposure rabies vaccination”
Dra. Stephanie A. Shwiff, United States Department of Agriculture, USA.

Audience Q&A/discussion

20 de octubre / October / Octobre

Sesión Oral/ Oral Session / Sessão Oral





O1.1. Global progress towards 'Zero by 30': Updates from the united against rabies forum

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Keywords. Dog-mediated rabies, Zero by 30, United Against Rabies

Introduction. The United Against Rabies (UAR) Forum was launched by the Tripartite organisations in 2020 to implement the objectives set out in Zero by 30: the Global Strategic Plan to end human deaths from dog-mediated rabies by 2030. The United Against Rabies Forum now encompasses more than 90 organisations from a diverse range of sectors, with representation from 38 countries.

Objective. This work aims to update on the activities and outputs of the UAR Forum in 2024 and 2025, highlighting progress in development of tools and resources, stakeholder engagement, and Monitoring and Evaluation (M&E) of the Zero by 30 goal.

Methods. The Forum aims to facilitate connections between stakeholders to reduce duplication and fragmentation of efforts, support countries in the development and implementation of national strategies and improve access to existing tools and resources. This is achieved through coordination of stakeholders, and dissemination of scientific research, events and technical outputs.

Results. Key achievements include the launch of the global M&E framework for rabies, providing indicators to track progress toward Zero by 30; expansion of the Forum's Partnership Map to visualise collaboration; and the publication of new resources, including a Scientific Watch Bulletin, a repository of dog population estimation approaches, and updated training materials. Enhanced communication through newsletters, podcasts, and webinars increased engagement and knowledge sharing, while cross-sector collaboration continued to strengthen links between rabies-endemic countries and technical partners.

Conclusions. After five years, the UAR Forum continues to evolve to meet the needs of rabies-endemic countries. By linking partners, providing tools and

resources, and enabling monitoring of progress, the Forum plays a pivotal role in sustaining global momentum and accelerating action towards the elimination of dog-mediated human rabies deaths.

O1.2. Ring vaccination radii for canine rabies control: variability in guidelines and practices in the Americas

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Keywords. Focal areas, Health policies, Legislation, Outbreak control strategies, Ring vaccination.

Introduction. Ring vaccination has been used as an effective control strategy for multiple infectious diseases to reduce their spread by setting an intervention area inthe outbreak zone. Rabies control programs in the Americas use control areas, defined by a radius from the index case, for emergency vaccination, epidemiological investigation, and risk communication. However, these radii may be insufficient or not supported by evidence, and may hinder control programs.

Objective. To compare action radii specifications in official rabies control policies and evaluate practical control area coverage in a rabies-endemic region of Peru.

Methods. We conducted a search and document analysis of national legislation and guidelines of 27countries in the Americas. We extracted specified radii values for urban scenarios and their references. To assess the variability in practices, we estimated the area covered by outbreak control activities in Arequipa, Peru, using data extracted from outbreak investigation reports.

Results. We reviewed documents from eleven South American countries, three Central American,one North American and one from the Caribbean.

Only nine specified a radii value. The most common indicated radii were 500 meters (n=3) and 1000 meters (n=3), used by neighboring countries like Peru and Bolivia, respectively. Two Central American countries indicate a 5-kilometer radius. Colombia was the only country to cite some evidence of dog home ranges. We found high variability in the area covered during outbreak control activities in Peru, almost always smaller than the official 500-meter radius.

Conclusions. Countries in the Americas observe variable urban rabies outbreak control radii. There is a gap between guidelines and real-world practices, at least in one urban rabies endemic city. Understanding dogs' ecology in urban environments and the spatial epidemiology of dog rabies, could help develop evidence-based guidelines or reframe regional control strategies and policies.

O1.3. Understanding canine rabies virus transmission using genomics in a decade-long epidemic in Arequipa, Peru

Alejandra Dávila-Barclay[1], Sandeep Kasaragod[2,3], Edith Zegarra[4], Ynés Monroy[4], Elvis W. Díaz[1], Kirstyn Brunker[2,3], Ricardo Castillo-Neyra[1,5,6]

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Keywords. Whole-genome sequencing, Nanopore, Rabies virus, Canine rabies, Arequipa

Introduction. Since 2015, Arequipa city, Peru, has faced a 10-year epidemic of dog rabies with 398 cases. In 2019, we used next-generation sequencing to analyze the distribution of rabies virus (RABV) in collaboration with local health authorities. Using phylogeographic analyses we made inferences on the origins of the epidemic and attributed it to a single introduction from Puno, a region neighboring Arequipa and Bolivia, almost 2 years before it was first detected. In 2022, targeted sequencing of an outbreak outside Arequipa city, allowed us to link the cases to two different introductions from Puno and Arequipa city. Several questions regarding the transmission dynamics and evolution of the circulating RABV in the city still remain.
Objective. To characterize the transmission dynamics of RABV in Arequipa city, Peru, using genomic epidemiology, and inform outbreak control strategies. Methods. Rabies-positive brain tissue samples (n=163), from Arequipa (2015-2025), were sequenced using a sample-to-sequence workflow on Nanopore's MinION, producing whole-genome sequences (WGS). WGS from archival livestock canine RABV samples (n=4) from Puno (2010-2012) were utilized for the phylogenetic analysis.
Results. Phylogenetic reconstruction (n=167) showed a definite signature of evolution and multiple co circulating lineages. There is evidence of lineage extinction and lineage persistence over the years, and multiple clusters of temporally proximate cases with minimal genetic divergence. Two distinct lineages evidenced a divergence between the Arequipa outbreak and the previously characterized outside Arequipa. A single 2021 sample from Cerro Colorado district clustered with two historical sequences from Puno.
Conclusions. In contrast to the 2019 analysis, new data suggest that Puno is the source of multiple introductions to Arequipa. Further analyses of local transmission chains may inform control strategies, such as identifying source populations that sustain transmission within a source-sink system. Our work highlights the potential for genomics-informed surveillance to monitor epidemics in Peru and Latin America.

O1.4. Cobertura de vacunación antirrábica canina: comparación entre reportes oficiales y encuestas de hogares en Ayacucho (2021–2024)

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Palabras Clave. Vacunación antirrábica canina, Encuestas de hogares, vigilancia, Ayacucho

Introducción. La vacunación antirrábica canina constituye una intervención prioritaria de salud pública para prevenir la transmisión del virus rábico y alcanzar la meta nacional de eliminación de la rabia. En el Perú, la Dirección Regional de Salud (DIRESA) Ayacucho reporta anualmente las coberturas de vacunación obtenidas en las campañas oficiales; paralelamente, la Encuesta Nacional de Programas Presupuestales (ENAPRES) recopila, mediante encuestas de hogares, información sobre tenencia y vacunación de perros. Dado que ambas fuentes son independientes y muestran resultados que a menudo difieren, es relevante evaluar su comparación y valor para la vigilancia epidemiológica.

Objetivos. Comparar la cobertura de vacunación antirrábica canina reportada por la DIRESA Ayacucho con la estimada por ENAPRES durante el periodo 2021 al 2024

Métodos. Se realizó un análisis comparativo y de concordancia entre ambas fuentes. Se calcularon las correlaciones de Pearson y Spearman para evaluar la relación lineal y monotónica respectivamente. Adicionalmente, se aplicó el método de Bland-Altman para identificar el sesgo y los límites de concordancia entre las coberturas reportadas y las estimadas.

Resultados. Las coberturas de vacunación estimadas por ENAPRES fueron entre 23% y 29% menores que las reportadas por la DIRESA Ayacucho. Las correlaciones observadas entre ambas fuentes fueron bajas a moderadas (coeficientes entre -0.26 y 0.36), indicando una correspondencia parcial. El análisis de Bland Altman evidenció un sesgo sistemático, con tendencia de ENAPRES a subestimar las coberturas en todos los años evaluados.

Conclusiones. Aunque tanto los registros administrativos como las encuestas aportan información valiosa, los resultados muestran que ENAPRES no refleja en igual magnitud las coberturas reportadas oficialmente por la DIRESA Ayacucho. Se recomienda fortalecer los sistemas de información y promover el uso complementario de ambas fuentes para mejorar la planificación, monitoreo y evaluación de las campañas de vacunación antirrábica canina.

O1.5. Canine Rabies in Vaccinated Dogs: An Additional Challenge for Control in Arequipa, Peru

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Keywords. Breakthrough infection, Canine rabies, Vaccine failure, Vaccine surveillance.

Introduction. In 2015, the reintroduction of the canine rabies virus was detected in the city of Arequipa, and its transmission continues despite control efforts. During the last years we have seen the rabies cases in dogs with a history of vaccination. These “breakthrough infections” raise concerns and could cause new challenges for the elimination program.
Objective. To characterize “breakthrough infections” in recently vaccinated dogs in Arequipa and explore possible correlates of these cases.
Methods. An observational retrospective study analyzed 210 confirmed canine rabies cases reported between 2019 and 2023. Cases in dogs

vaccinated within the previous 12 months were classified as breakthrough infections. Data collected included sex, age, district incidence, and vaccine brand (Rabivac or Nobivac). We compared the probability of breakthroughs by vaccine brand and other variables.

Results. Seventeen cases met the inclusion criteria. Among these, 10 (58.8%) had received Rabivac, 6 (35.3%) Nobivac, and in one case we could not determine the brand 1 (5.9%). In dogs vaccinated with Rabivac, there were 6.4 breakthrough infections per 100,000 vaccinated dogs, compared with 1.4 for Nobivac. Most breakthroughs (76%) occurred in males, with a median age of 18 months (IQR: 11–24). Cases were mainly reported in Cerro Colorado (29%), Pedregal (24%), and Ciudad de Dios (18%), with a higher occurrence between 2021 and 2022. These distributions in age, sex, and location reflect the distribution of dog rabies cases in the city.

Conclusions. We found indications of post-vaccination rabies infections in Arequipa that appear to be associated with vaccine brand. No relationship was observed with local epidemiological conditions or other variables. However, the lack of vaccine traceability prevents definitive conclusions and limits the identification of potential failures and timely responses. Strengthening vaccine traceability and post-vaccination surveillance is important to improve rabies control.

O1.6. Socioeconomic disparities in canine rabies surveillance: High-Resolution Evidence from Peru

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Keywords. Canine rabies, Social Inequalities, Spatial analysis, Surveillance.

Introduction. Dog-mediated rabies disproportionately affects low- and middle-income countries, but few studies have investigated within-city disparities in risk and surveillance. Understanding how neighborhood socioeconomic status (SES) shapes canine rabies burden is critical for designing equitable control strategies.

Objective. To quantify the relationship between neighborhood SES, canine rabies incidence, and surveillance effort in the dog rabies-endemic city of Arequipa, Peru, and to evaluate whether active surveillance reduces inequities in case detection.

Methods. We analyzed an eight-year (2015–2022) high-resolution surveillance dataset containing 347 confirmed rabies cases and 2,119 samples submitted for testing. Rabies cases and samples were georeferenced and linked to SES. Our primary metric for assessing rabies disparities was sample positivity, defined as the proportion of submitted samples that tested positive, as it captures both disease burden and surveillance effort. We assessed trends in case counts and sample positivity by SES, and applied generalized additive models to identify spatial heterogeneity and positivity hotspots. We compared passive vs. active surveillance data to evaluate their impact on disparities.

Results. Rabies cases were disproportionately concentrated in socioeconomically disadvantaged neighborhoods ($p<0.0001$). Sample positivity increased with neighborhood disadvantage across all time periods ($p<0.05$), indicating insufficient surveillance relative to disease burden in low-SES areas. Spatial analysis revealed a significant hotspot of high sample positivity—indicating unequal surveillance—even after adjusting for access to health facilities. Active surveillance—targeting dry water channels—yielded a greater proportion of samples from disadvantaged areas ($p<0.05$) and reduced disparities in sample positivity.

Conclusions. Socioeconomic disadvantage is strongly associated with elevated rabies risk and insufficient surveillance within a single city. Combining passive and spatially targeted active surveillance can mitigate inequities and improve case detection. Targeted mass dog vaccination and surveillance in disadvantaged areas are essential to advance equity and accelerate progress toward dog- mediated rabies elimination.

O2.1. Rabies In Borneo: An Asia-Pacific platform to operationalize One Health practices to eliminate dog-mediated rabies

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Keywords. Rabies In Borneo, One Health, vaccination, rabies elimination.

Introduction. The rabies incursion in Sarawak, Malaysia was first diagnosed in June 2017 with the death of two young children. The COVID-19 pandemic redirected resources, delaying control measures and complacency of animal owners resulted in an increased rabies prevalence and human deaths. Innovative action was needed using One Health approaches for rabies control and prevention of virus spillover to cats and wildlife.

Objective. Share the establishment and success of the Rabies In Borneo (RIB) platform to operationalize One Health approaches to rabies control and elimination in Southeast Asia.

Methods. The RIB platform was formed by the Department of Veterinary Services, Place Borneo and Sarawak SPCA in 2022 mirrored on the Rabies In The Americas conference to unite global, regional and local rabies stakeholders to operationalize One Health approaches to eliminate dog-mediated rabies.

Results. The annual RIB conference enables Asia-Pacific regional networking, sharing of rabies control-elimination knowledge and implementation information. Given the diverse socio-cultural, ethnic, religious and linguistic communities in Borneo, community engagement is critical. The ASEAN Rabies Elimination Strategy (ARES) updates, success stories and

new innovations are shared. Key learnings have included the importance of reviewing current One Health rabies control strategies, promoting international collaboration, fostering research and innovation, implementing evidence-based policies and advocacy campaigns, and actively involving communities and NGOs. The emphasis on culturally appropriate communication and rabies awareness, along with the promotion of responsible dog ownership and dog/cat population management, have highlighted the multifaceted nature of strategies needed for sustainable rabies control.

Conclusion. The RIB conference has laid the foundation for a comprehensive and sustainable approach to dog-mediated rabies elimination in the region to support meeting the zero by 30 global mission. The commitment of all stakeholders will be instrumental in actioning the knowledge shared. Recommendations from RIB serve as a roadmap for One Health action plans, making a significant step towards a rabies-free Borneo.

O2.2. Implementation of a mobile phone–supported microplanning approach in Arequipa's dog mass vaccination campaign: acceptance and performance

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Keywords. Canine rabies control, Rabies mass vaccination, Mobile technology, Technology adoption.

Introduction. Canine rabies remains a major public health concern in Southern Peru, where large-scale dog vaccination campaigns are essential to

prevention. To address operational challenges, Mission Rabies with local partners introduced a mobile phone-supported microplanning approach in Arequipa in 2025, implemented through the WVS App. The tool was designed to strengthen coordination, monitoring, data management and spatial planning through polygon-based strategies.

Objective. Assess the acceptance and operational benefits of implementing a microplanning approach through the WVS App in a large-scale canine rabies vaccination program.

Methods. A mixed-methods design combined quantitative analysis of 546 vaccination sessions with qualitative interviews. Following training, the WVS App was used in both fixed-point and mobile sessions. Quantitative data included start/end times, GPS vaccination points, path tracking, and adherence to polygon boundaries. Vaccination rates per vaccinator/hour were compared between strategies using a two-sample t-test. Qualitative interviews with coordinators and vaccinators were analyzed using Rogers' Technology Adoption Model to identify adoption profiles, facilitators, and barriers.

Results. By July 2025, over 46,000 vaccinations were recorded, with 80+ staff trained. Mobile sessions achieved higher mean vaccination rates than fixed-point (15.46 vs. 12.93 dogs/hour, $p < 0.001$). App data showed effective vaccination times averaged under 4.5 hours/day, indicating untapped capacity. Polygon- based planning improved adherence to designated zones, reducing overlaps and supporting more consistent coverage. Qualitative findings indicated 84% acceptance, with early adopters (typically younger staff) embracing the tool quickly, while late adopters adapted gradually through sensitization and peer support. Facilitators included clearer work organization and instant access to data, while barriers reflected technology anxiety, highlighting the need for targeted guidance.

Conclusions. High acceptance and operational gains suggest digital tools can support more coordinated, data-driven campaigns. Evidence indicates polygon-based strategies may enhance vaccinators' performance, while adoption profiles provide insights for tailoring training and integration to maximize long-term benefits.

O2.3. Trends and statistical analysis of animal aggressions suspected of rabies in Haiti, 2017–2024

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Keywords. Animal aggressions, Rabies, surveillance, Post-Exposure prophylaxis (PEP); Haiti

Introduction. Rabies remains endemic in Haiti. Reported aggressions by suspected rabid animals—mainly dogs—serve as an indirect indicator of human exposure and demand for Post-Exposure Prophylaxis.
Objective. To describe 2017–2024 trends, demographic and geographic profiles, and statistically significant changes.
Methods. Weekly national surveillance data on aggressions (2017–2024). Annual trends modeled with segmented Poisson regression (joinpoint). Inter-annual comparisons by age and sex used a global chi-square test; a targeted 2023→2024 two-proportion test was performed. Geographic concentration was summarized by the Gini index; seasonality assessed with Kruskal–Wallis.
Results. 33,355 aggressions were reported (2017–2024). A 2018–2019 peak (>5,500/year) was followed by a significant decline after 2019 (RR/year = 0.92; 95%CI 0.92–0.93; p<0.001). Before 2018, the trend increased (RR/year = 1.45; 95%CI 1.39–1.50). Age distribution varied across years (χ^2 = 91.8; df = 21; p = 8.1×10^{-11}); from 2023 to 2024, the share of <15 years decreased 34.5%→32.3% (p = 0.049). Sex distribution was broadly stable (χ^2 = 13.9; df = 7; p = 0.052). In 2024, Centre (23%), Nord (10%), and Artibonite (9%) accounted for most cases; Gini = 0.32. No consistent seasonal pattern (Kruskal–Wallis p = 0.33).
Conclusions. Aggressions by suspected rabid animals have declined steadily since 2019. Children remain proportionally highly exposed despite a recent decrease. Priorities include ensuring Post-Exposure Prophylaxis availability, strengthening mass dog vaccination, and targeting high-burden departments to advance toward elimination of dog- mediated human rabies deaths.

Optimizing Mass Vaccination Campaigns for Rabies (and Epidemic) Prevention: A Cluster Randomized Trial

Speaker:
Ricardo Castillo-Neyra

Ricardo Castillo-Neyra[1,2,3], Sherrie Xie[1], Elvis W. Diaz[3], Jorge Cañari[3], Gian Franco Condori[3], Brinkley Raynor Bellotti[4], Valerie Paz-Soldan[3,5], Maria Rieders[6], Bhaswar B. Bhattacharya[6], Michael Z. Levy[1,3]

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Introduction. Mass vaccination campaigns are critical for controlling infectious diseases, but in practice, they often leave under-vaccinated pockets where pathogens can persist, evolve, and re-emerge. Mass dog vaccination campaigns in Peru exemplify these challenges. We hypothesized that spatially optimized vaccination placement and data-driven door-to-door vaccination can significantly increase participation in mass vaccination campaigns.
Objective. To evaluate dog rabies vaccination uptake across three arms: (1) mathematically optimized vaccination site placement; (2) adaptive, data-driven door-to-door vaccination; and (3) current practice (control).
Methods. We have conducted a stepped-wedge cluster randomized trial across 36 clusters over three years. The trial began with the optimized vaccination placement arm, which was later enhanced with a door-to-door "precision vaccination" arm delivered through a mobile app integrating spatial

and historical participation data. Intervention effects were evaluated using a logistic regression model that included indicators for each intervention, a fixed categorical effect for secular trends, and a cluster-level random effect.

Results. Compared to current practice, the combination of mathematically optimized site placement and precision vaccination increased the odds of participation in the mass dog vaccination campaign by 27%, after adjusting for covariates and study design (OR = 1.27; 95% CI: 1.08–1.59; $p < 0.01$). In contrast, mathematically optimized site placement alone did not significantly affect participation after adjusting for covariates and study design (OR = 1.05; 95% CI: 0.94–1.16; $p = 0.39$).

Conclusions. Integrating spatial optimization with adaptive, data-driven strategies can make mass vaccination campaigns more effective and equitable. Combining mathematically optimized site placement with real-time, door-to-door “precision vaccination” significantly increased coverage. These findings show that technology and data-driven approaches can help close equity gaps by reaching underserved populations that traditional campaigns often miss. Beyond rabies, this approach offers a scalable model for improving vaccination uptake against other infectious diseases, bridging the gap between mathematical theory and on-the-ground implementation.

Mesa Redonda 1: Hacia unos Andes libres de rabia: Integrando el control y la eliminación de la rabia canina / Round Table 1: Toward a Rabies-Free Andes: Integrating Canine Rabies Control & Elimination / Mesa Redonda 1: Rumo a uma região Andina livre da raiva: integrando o controle e a eliminação da raiva canina

Moderadores /Moderators/ Moderadores:
Drs. Marco Vigilato & Ana Navarro

DECLARACIONES DE PANELISTAS/ DECLARAÇÕES DOS PAINELISTAS/STATEMENTS BY PANELISTS

BOLIVIA
Dr. Grover A. Paredes Martínez
Unidad de Prevención y Control de Enfermedades, Ministerio de Salud y Deportes, Bolivia.

El Programa Nacional de Enfermedades Zoonóticas, dependiente de la Dirección de Epidemiología, ha implementado cinco lineamientos clave en coordinación com los SEDES y CEMZOOS. Estos incluyen la microplanificación de campañas masivas, vigilancia epidemiológica activa y pasiva, toma de muestras (invasivas y no invasivas), estimación de población canina, y el estudio y control epidemiológico de brotes. Gracias a estas acciones, se han observado resultados positivos en áreas históricamente afectadas por la rabia. Sin embargo, persisten debilidades importantes. Entre ellas destacan la crianza excesiva de perros en zonas periurbanas, influida por factores como la pobreza, y la presencia de perros callejeros sin vacunación desde edades tempranas. Um porcentaje significativo de dueños no participa en las campañas de vacunación, ni en sus fases posteriores, lo que mantiene la circulación del virus rábico en algunos departamentos del país. También se identifican deficiencias en la estabilidad y capacitación del personal técnico a nivel municipal, así como una débil promoción de la tenencia responsable. A pesar de ello, existen oportunidades como el uso de vacunas de cultivo celular bajo estándares OPS/OMS y el compromiso de instituciones públicas y privadas en campañas masivas. Además, el Ministerio de Salud cuenta con una estrutura funcional para aplicar protocolos de vigilancia, control y prevención

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BRASIL
Dra. Silene Manrique Rocha
Secretaría de Vigilancia en Salud y Ambiente, Ministerio de Salud, Brasil

O Brasil consolidou um programa eficaz de controle da raiva canina, combinando vacinação massiva, bloqueio de focos e integração entre vigilâncias para eliminar a raiva autóctone e interromper a transmissão humana por cães. O PNCR mantém coberturas vacinais caninas satisfatórias em áreas de risco, com ausência de circulação da variante canina nos últimos 5 anos. Desafios: As fronteiras com países endêmicos seguem vulneráveis à reintrodução viral, demonstrado pela epizootia de 2015. O Acordo Brasil–Bolívia (2015/2017) fortaleceu a cooperação, resultando na eliminação dos casos caninos. A transição epidemiológica evidencia o declínio total das variantes caninas e predominância das silvestres associadas a Cerdocyon thous e Morcegos, com 172 casos esporádicos em cães entre 2016 e 2025, sem registro de epizootias urbanas. Esse cenário reforça a importância da vigilância ativa, da integração intersetorial e da abordagem “Uma Só Saúde” para prevenir reemergências da doença. Para alcançar e manter a certificação do Brasil como país livre da raiva humana transmitida por cães, é fundamental manter a cobertura vacinal, fortalecer a vigilância epidemiológica/laboratorial e ampliar a cooperação transfronteiriça. O plano pós-validação, baseado na integração entre ciência, gestão e cooperação internacional, garantirá a sustentabilidade dos avanços e consolidará o Brasil na eliminação da raiva canina.

PERÚ
Dr. Román Bances Santamaria
Coordinación Nacional de Zoonosis, Ministerio de Salud, Perú

La rabia canina es una prioridad de salud pública en el Perú debido a su potencial riesgo de transmisión al ser humano. En las últimas décadas se han logrado importantes avances gracias a las campañas de vacunación masiva del Ministerio de Salud (MINSA), alcanzando coberturas superiores al 80% en varias regiones, reduciendo drásticamente los casos en humanos y animales. El fortalecimiento de la vigilancia epidemiológica, capacitación del personal y la implementación de laboratorios regionales han permitido una detección y respuesta más rápidas ante brotes. La educación comunitaria, la cooperación interinstitucional con SENASA, gobiernos locales y organismos internacionales han reforzado la prevención. Aún persisten retos como la existencia de focos endémicos en Puno y Arequipa, limitaciones logísticas y recursos, subregistro de mordeduras y riesgo de reintroducción del virus entre regiones y fronteras. Los principales desafíos hacia la eliminación incluyen

mantener coberturas de vacunación sostenidas, fortalecer la vigilancia activa, integrar el enfoque “Una Salud”, incorporar herramientas digitales y fomentar la participación comunitaria. El éxito dependerá del compromiso de autoridades, profesionales y comunidades para garantizar la sostenibilidad de los logros alcanzados.

CHILE

Dr. Alberto Aspilcueta
Departamento de Salud Pública y Planificación Sanitaria, Ministerio de Salud, Chile

En el marco del Programa Nacional de Prevención y Control de la Rabia, Chile ha avanzado significativamente en el abordaje de la variante canina del virus rábico, manteniéndose libre de casos humanos de rabia variante canina desde el año 1972. En consecuencia, Chile se encuentra en proceso de validación ante OPS como libre de rabia canina, meta que representa un hito en la salud pública y que está alineada con el enfoque de "Una Salud". Para alcanzar esta certificación, se han intensificado las acciones de vigilancia, incluyendo la notificación desde centros veterinarios bajo la estrategia de “Centros centinelas”, para el fortalecimiento del análisis de muestras sospechosas en mascotas, por nuestro laboratorio de diagnóstico de referencia en Chile (ISP). También se han mantenido anualmente las campañas de vacunación antirrábica en animales de compañía, en especial en zonas fronterizas del norte del país, dada la situación de rabia canina en los países colindantes, con el objetivo de contar con un cordón inmunitario en animales en estas zonas de mayor riesgo de ingreso. Las metas son poder mantener en cero los casos de rabia variante canina en Chile y frente al ingreso de un animal positivo, hacer la detección oportuna para interrumpir la transmisión a otras personas.

HAITÍ

Dr. Parlo St Vil
Dirección de Epidemiología, Laboratorios e Investigación, Ministerio de Salud Pública y Población, Puerto Príncipe, Haití

Durante los últimos años, Haití ha logrado avances en el control de la rabia canina mediante la consolidación de un sistema de vigilancia más integrado y la formación de más de 300 personales de salud en ocho departamentos, con el apoyo técnico y financiero de la OPS, los CDC y el Banco Mundial. En algunos lugares se ha logrado campañas de vacunación antirrábica canina, ampliando progresivamente la cobertura. Asimismo, se ha fortalecido la coordinación intersectorial entre el Ministerio de Salud Pública y de la Población (MSPP) y el Ministerio de Agricultura (MARNDR), mejorando la detección, la notificación y la respuesta ante los casos sospechosos en humanos y animales. No obstante, persisten desafíos importantes, como la disponibilidad limitada de vacunas humanas y caninas, las dificultades logísticas para acceder a las zonas rurales y la necesidad de mejorar la notificación y la confirmación de casos en laboratorio. La visión nacional se alinea con el objetivo global de “Cero muertes humanas por rabia transmitida por perros para 2030”, priorizando la expansión de la vacunación canina, el fortalecimiento de la vigilancia bajo el enfoque One Health y la sostenibilidad de los recursos técnicos y financieros para lograr la eliminación de la rabia en Haití.

O3.1. Perceptions and Barriers Regarding Feline Rabies in the Americas: An Approach from the One Health Perspective

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Keywords. Feline rabies, One Health, Risk perception, Surveillance, Zoonosis

Introduction. Feline rabies represents an underestimated emerging risk within zoonotic control strategies. Addressing this issue requires an understanding of public perceptions, knowledge gaps, and operational limitations, within the framework of a One Health perspective.
Objective. To explore country and regional level perceptions and intervention priorities regarding feline rabies across the Americas, identifying key barriers and knowledge gaps for effective control.
Methods. A structured online survey was designed and distributed via digital platforms between June 2-27, 2025. A total of 121 individuals from 17 countries participated. Data analysis was conducted using Sphinx software, incorporating descriptive statistics and simple variable cross-tabulations.
Results. A total of 81% of respondents considered feline rabies to be an emerging issue requiring greater attention across the Americas. The most frequently identified knowledge gaps included vaccination coverage and effectiveness (62%), epidemiological surveillance (54%), and transmission dynamics (52%). The top intervention priorities were public awareness and education campaigns (71%), increased feline vaccination coverage (57%), and enhanced collaboration between public health and veterinary sectors (53%). The main barriers to control were lack of public awareness (66%), inconsistent surveillance and reporting (40%), and the absence of feline rabies-specific policies (39%). While country-level comparisons were explored, most cross-tabulated associations were not statistically significant, except for a weak association with perceived barriers. Qualitative responses emphasized the need to improve feline-specific rabies surveillance, standardize diagnostic protocols, and strengthen vaccination programs, particularly for stray animals. Community education and the integration of a One Health approach were also

highlighted as essential to address ecological, social, and health factors perpetuating feline rabies transmission.
Conclusions. Findings highlight the need for integrated policies and public education campaigns to raise awareness of feline rabies as a zoonotic threat. Strengthening surveillance systems and enhancing multisectoral collaboration are critical components for effective control within the One Health framework.

O3.2. Epidemiological dynamics of rabies in domestic animals in andahuaylas, Peru: trend analysis, vaccination coverage, and transmission determinants (2021–2025)

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Keywords. Bovine rabies; poverty; epidemiological surveillance; bats; vaccination.

Introduction. Rabies is a reemerging zoonosis that disproportionately affects rural communities in Latin America, causing public health and livestock losses. In Apurímac-Peru, around 640 cases were reported in the last decade, over 90% in cattle. Andahuaylas, one of its most vulnerable provinces of Apurimac, continues to report rabies in domestic and wild species. Positive cases were confirmed by the National Agrarian Health Service – Apurímac.
Objective. To analyze the epidemiology of animal rabies in Andahuaylas (2021–2025), describing its spatial-temporal distribution, affected species, vaccination coverage, associated factors, and the health response implemented.

Materials and Methods. A retrospective ecological study was conducted using data on confirmed cases, diagnostic tests, vaccination campaigns, livestock population, and bat cave locations from animal health and agricultural sources. Monthly time series, distribution maps, and correlations between cases and variables such as livestock density, cave presence, vaccination coverage, and access to veterinary services were analyzed.
Results. Between 2021 and 2025, 70 bovine rabies cases were reported in Andahuaylas. Fifty bat caves were identified across 10 of 20 districts, confirming active wild reservoirs. Vaccination coverage in cattle remained below 30%, despite increased outbreaks. Persistent hotspots were linked to low vaccination, limited veterinary access, and cave proximity. Districts with reduced connectivity showed higher case occurrence. Time series analysis revealed seasonal reemergence patterns associated with bat activity and insufficient herd immunity.
Conclusions. Bovine rabies reemerges in hotspots associated with low vaccination, wild reservoir ecology, and socioeconomic vulnerability. Non-stratified interventions are less effective in dispersed and poor settings. The detection of 50 caves highlights the need for strengthened bat surveillance, intersectoral coordination, animal movement control, and improved vaccination logistics to achieve protective coverage and prevent economic losses in small-scale producers.

O3.3. Asociación entre altitud geográfica e incidencia de rabia silvestre en ganado bovino en la región de Apurímac (2004-2015)

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Palabras clave: Andes; Quirópteros; Rabia bovina; Vigilancia.

Introducción. Los bovinos son susceptibles al virus de rabia silvestre transmitida por Desmodus rotundus. En 2014, Apurímac, Perú, registró el mayor número de casos (n=75) respecto a otras regiones (33%). El calentamiento global favorecería nuevos nichos ecológicos para Desmodus.
Objetivo. Determinar la asociación entre brotes de rabia silvestre a distintas altitudes del valle de Apurímac y tiempo calendario entre 2004 y 2015.
Métodos. Se hizo un estudio ecológico con datos secundarios del Sistema Integrado de Gestión en Salud Animal del Servicio Nacional de Sanidad Agraria, sobre altitud (m) determinada mediante GPS Geo Explorer 3 y Google Earth Pro © 2013 considerando las regiones Yunga=500-2300, Quechua=2301-3500, Suni=3501-4000 y Puna=4001-4800 y fecha de brotes sospechosos por vigilancia pasiva de rabia confirmada por inmunofluorescencia directa, para estimar frecuencias de brotes por sexo y edad y por altitud, se consideró la población del IV Censo Nacional Agropecuario, de 298 214 bovinos. Los datos fueron analizados por chi-cuadrado, t-Student, correlación rho de Spearman y modelos lineales generalizados de Poisson, enlace log utilizando Stata v14.0 (StataCorp LP).
Resultados. Se analizaron 525 brotes sospechosos de rabia silvestre (altitudes: 999 – 4586 m); la mayoría de casos se notificaron entre 2013-2015 (31.1%), seguido por 2010-2012 (29.5%), 2007-2009 (25.9%) y 2004-2006 (13.5%); el 54.7% de casos ocurrieron en lluvia, 56.7% en hembras y 59.6% en adultos > 20 meses; se halló diferencias en brotes según altitudes, años y estacionalidad (p=0.001), siendo mayor en la región Quechua. No hubo correlación entre altitud de brote y tiempo calendario, ni asociación entre altitud del brote con tiempo calendario controlado por estacionalidad y tipo de crianza.
Conclusiones. Se asoció número de casos de rabia silvestre con altitud (p<0.05), sin asociación al tiempo calendario ni estacionalidad; se observó asociación negativa con la temperatura mínima promedio (p<0.01). El SENASA y MINSA deberían establecer una vigilancia activa.

Sesión Pósters/ Posters / Pósteres

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Rabia en perros y otros animales domésticos/ Rabies in dogs and other domestic animals/ Raiva em cães e outros animais domésticos

RABIES IN THE AMERICAS

RITA 2025 Rabia en las Américas PERÚ

P1.1. Notifiable but Neglected? Examining the Practical Impact of Rabies Notification in Nepal

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Keywords. Rabies, Notifiable disease, One Health, Policy implementation, Nepal

Introduction. In August 2019, Nepal designated animal rabies as a notifiable disease under the Animal Health and Livestock Services Act, 2055 (1999) and Regulation, 2056 (2000). This decision followed a regional call for rabies notification during the "Zero by 30" SAARC workshop held in Kathmandu. While the policy was presented as a major step in rabies control, its real-world implementation remains uncertain.

Objective. To examine whether the notifiable status of animal rabies has led to improved reporting and operational responses in Nepal.

Methods. A desk review of policy documents and communications was conducted, alongside preliminary interviews with veterinary practitioners, animal welfare organisations, and government officials. The focus was on awareness of rabies notification status, clarity of reporting procedures, and stakeholder roles.

Results. Although rabies is legally notifiable, its impact on reporting practices has been minimal. Many frontline actors were unaware of the disease's notifiable status. Confusion persists regarding who is responsible for reporting, how to report, and what actions follow notification. No formal operational guidelines were found. Government authorities offered inconsistent views on reporting duties, channels, and expected outcomes. The purpose of notification itself remains unclear, with little understanding of whether it should trigger surveillance, vaccination, or exposure response.

Conclusions. The decision to make rabies notifiable in Nepal has had limited operational value. Rather than representing a genuine commitment to control and stemming from strong national preparedness, it appears to have been a response to international influence. Without clear procedures, assigned responsibilities, and institutional support, the notification policy remains largely symbolic.

P1.2. Targeted rabies surveillance in feral dogs in a canine rabies endemic area of Peru

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Keywords. Active surveillance, Arequipa city, Direct immunofluorescence, Feral dogs

Introduction. In the city of Arequipa, where canine rabies is endemic, dog vaccination and surveillance have focused solely on inner-city dogs. However, feral dogs have established themselves in the outskirts and other regions. Little is known about the role of these dogs in the transmission of the rabies virus in Arequipa. Feral dogs pose a public health and economic problem, having been linked to livestock and human attacks, as well as a human rabies case. In the rural district of Yarabamba, Arequipa, a controlled culling intervention was implemented to curb the rising rate of attacks, which has declined since the intervention.

Objective. We conducted targeted surveillance to detect rabies virus in the feral dog population of Yarabamba through the systematic sampling of brain samples and testing. Methods. Packs of feral dogs were identified and followed in Yarambamba. Mapping of commonly used dog paths supported the strategic placement of traps. Ethological assessment and verification of physical traits were conducted to verify feral status. Brains were collected and submitted for testing in the Regional Reference Laboratory.

Results. Between May and June 2025, a total of 19 feral dogs were captured or darted and euthanized in Yarabamba. None showed neurological signs

compatible with rabies. All 19 samples tested negative for rabies virus. Follow-up on the population dynamics of the remaining pack members was limited.
Conclusions. Feral dogs and their possible role in rabies virus transmission remain poorly understood in Peru. This is the first report of rabies surveillance in these animals. Next steps should include integrating surveillance with population control activities already being conducted, and expanding surveillance to other districts. If rabies virus circulates among these dogs, they could delay rabies elimination efforts since they are not included in vaccination campaigns and are located outside of surveillance areas.

P1.3. Spatiotemporal Modeling of Rabies Using Graph Neural Networks: A Proposal to Enhance Epidemiological Surveillance in Low-Supervision Contexts

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Keywords. Knowledge graph, Graph Neural Networks, Machine learning, Canine rabies, Epidemiology.

Introduction. Dog rabies remains a significant public health threat in low- and middle-income countries, particularly in urban areas where unreported cases, limited surveillance, and socioeconomic disparities hinder rapid detection and control. Traditional epidemiological models often fail to integrate spatial,

temporal, and relational dynamics of transmission, especially in contexts with incomplete data. New predictive platforms are developed and tested in Arequipa, Peru, a city with an ongoing epidemic of dog rabies.

Objective. To develop and evaluate a spatiotemporal prediction framework for dog rabies outbreaks that integrates multiple sources of spatial and epidemiological information for application in resource-limited settings.

Methods. We constructed a knowledge graph using data from urban infrastructure, health services, historical rabies case reports, and environmental features such as water channels influencing animal mobility. Nodes represent sectors of the city, health posts, and natural corridors, while edges encode spatial proximity, service coverage, and mobility interactions, adapted to the topology of a sector in Arequipa, Peru. The task was formulated as binary classification at the node level using Graph Neural Networks (GNNs), predicting whether a sector would experience a rabies case based on historical observations. A weighted loss was applied to address class imbalance, and the GNN's performance was compared to classical models using temporally disjoint train-test splits.

Results. The GNN outperformed all baseline models, with notable improvements in recall and F1-score, demonstrating its ability to identify high-risk areas before outbreaks occur. The graph representation enabled efficient integration of diverse data sources and showed potential for incorporating interpretability mechanisms.Traditional predictive models for rabies have failed to identify dog rabies outbreaks accurately. Similar to other GNN-based prediction models for other infectious diseases, our predictive framework had good performance metrics and showed high potential. However, those studies were focused on human diseases. In the literature, the use of GNNs for zoonotic diseases is limited.

Conclusions. The proposed framework is modular, scalable, and reproducible, offering a promising approach for outbreak prediction in under-resourced urban settings. Beyond rabies, it can be adapted to other infectious diseases where spatial and relational structures critically shape transmission dynamics.

P1.4 Epidemiology of rabies in Peru, 1984-2018

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Keywords. Animal and human rabies, incidence, surveillance

I**ntroduction.** Rabies is one of the most lethal zoonotic diseases worldwide. Each year, it kills approximately 60,000 people, primarily in Asia and Africa. Although there are multiple reservoirs globally, two stand out in Peru for their epidemiological importance: the vampire bat and the dog.
Objective. To analyze the epidemiology of human and animal rabies in Peru from 1984 to 2018.
Methods. The study population consisted of rabies-positive cases diagnosed in the laboratories of the INS, SENASA, and the Centro Antirrábico de Lima during the specified period.
Results. A total of 10,354 rabies diagnoses were made, of which 97.3% (10,075) corresponded to animal rabies and 2.7% (279) to human rabies. These cases of human and canine rabies occurred in a similar way, in all the departments of Peru with the exception of Huancavelica and Ica, with dogs and bats being reservoirs. The most affected animals were: dogs 65% of cases, cattle 26.2%, cats 2.95%, bats 1.4% and the rest of the animals 4.4%.
Conclusions. During the years from 1984 to 2018, rabies reservoirs (dog and bat) infected people and animals in almost all of the country's departments, with the exception of Huancavelica and Ica where there were no human deaths. The rabies epizootic was transmitted to other animals such as: cattle, cats, bats, etc. Although the incidence of canine rabies has decreased during the study period, the disease remains endemic in the departments of Puno and Arequipa, highlighting the need to maintain canine vaccination, surveillance, and control strategies to prevent the re-emergence of urban outbreaks. In contrast, an increase in the detection of rabies in bats has been recorded in the regions of Apurímac, San Martín, and Ayacucho, suggesting an expansion of the virus's sylvatic cycle. This situation represents a potential risk of transmission to domestic animals and humans, making it essential to strengthen epidemiological surveillance, reservoir monitoring, and intersectoral prevention actions in these areas.

P1.5. Strengthening Rabies Prevention Through Education and Community-Based Vaccination: Insights from Amici Cannis' Efforts in Ecuador

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Keywords. Strategies, elimination, rabies, dogs, Ecuador

Introduction. Amici Cannis has implemented a multi-pronged rabies prevention and elimination program in Ecuador, integrating technology, education, and direct veterinary outreach. Central to our approach is the Be Kind program, implemented in collaboration with Boehringer Ingelheim, which delivers rabies education to schoolchildren through interactive lessons on safe behavior around dogs, bite prevention strategies, and the importance of canine vaccination.
Objective. By targeting young minds, we foster a culture of responsibility and empathy that extends into families and communities.
Methods. Complementing this initiative, our door-to-door rabies vaccination campaigns have deepened our understanding of local barriers to veterinary access and revealed a critical need for population control measures.
Results. These campaigns have proven effective not only in increasing vaccination coverage but in correcting prior gaps left by the national rabies elimination program, including lack of owner awareness, absence of proper vaccination documentation, and inconsistencies in immunization continuity. By building trust with dog owners and tracking individual vaccine histories using phone applications and a reliable PMS, we've strengthened long- term rabies protection across high-risk areas.
Conclusions. Our experiences underscore the indispensable role of nonprofit organizations in the fight against rabies. Positioned between communities and public health systems, NGOs like Amici Cannis bring agility, empathy, and precision to efforts that require both grassroots connection and technical execution. NGOs are poised to play a leading role in dog population management, addressing the root causes of rabies transmission by reducing the number of new and unvaccinated births through targeted spay and neuter

initiatives and educational outreach. NGOs also support the Ministry of Health by aligning efforts across sectors, which strengthens coordination and ensures a unified approach that maximizes impact and resources. Investing in these partnerships is vital to achieving the goal of rabies elimination in the Americas.

P1.6. Geocodificação e Geoespacialização dos dados da Raiva no Estado do Acre entre 2020 e 2025

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Palavras Chave. Raiva, Epidemiologia, Mapas, Geoprocessamento, Ciência de Dados

I**ntrodução.** No Estado do Acre a raiva persiste como uma ameaça latente com morcegos hematófagos mantendo o ciclo silvestre da doença e representando um risco constante para a população humana e animal. Para otimizar a vigilância e a resposta, a geocodificação e a espacialização dos dados de atendimento antirrábico são cruciais. Mapear os locais de agressão e tratamento permite identificar áreas de maior risco, orientar ações de controle e garantir que a profilaxia chegue a tempo, salvando vidas em uma região de vastas distâncias e baixa densidade demográfica.
Objetivo. O estudo tem como objetivo realizar de forma simples e com baixo custo a geocodificação e geoespacialização dos casos notificados de Raiva no estado do Acre de 2020 a julho de 2025. Trabalhando os dados obtidos pelo Sistema de Informações de Agravos de Notificação (SINAN) é possível, com um baixíssimo custo ou, por vezes, sem custo algum, realizar a análise exploratória, geocodificar os endereços em coordenadas de latitude e longitude e geoespacializar os dados epidemiológicos produzindo informações e mapas de extrema relevância para tomada de decisões por parte dos gestores.
Métodos. Estudo observacional, retrospectivo e descritivo com 14.665 registros do Sistema de Informação de Agravos e Notificação (SINAN). Após limpeza, padronização e anonimização, os endereços foram convertidos em

coordenadas. Foram testados três serviços de geocodificação, as API's Nominatim/OpenStreetMap, Geoapify e Google Maps Geocoding, adotando-se a API Google Maps após a comparação das acurácias. As análises utilizaram Python (Pandas, GeoPandas, Folium, Matplotlib) e QGIS para geração de mapas interativos com as notificações individualizadas e mapas de Kernel.

Resultados. Com praticamente nenhum custo, apoio das ferramentas adequadas e de uma robusta análise exploratória, foi possível, a partir dos 14.665 registros analisados, realizar a geocodificação dos dados relativos a endereços em coordenadas. O produto final atesta a robustez do processo de geocodificação adotado e valida a confiabilidade das análises subsequentes. Após a geocodificação, os registros de atendimento antirrábico foram representados em ambiente computacional por meio de ferramentas de visualização geoespacial. Para tanto, utilizou-se o software de licença aberta QGIS e a biblioteca Folium, em linguagem Python, que possibilita a criação de mapas interativos em formato HTML amigáveis ao usuário leigo.

Conclusão. Fica demonstrada a viabilidade de uma metodologia lowcost para a geocodificação e espacialização de dados do SINAN, alcançando elevada acurácia e permitindo transformar dados brutos em conhecimento. Apesar de limitações como a qualidade variável dos registros do SINAN e os custos potenciais de APIs, a metodologia mostrou-se replicável e aplicável a outros agravos. Esse modelo tende fortalecer a vigilância epidemiológica/ambiental e apoiar decisões mais assertivas em saúde pública, mesmo em cenários de recursos limitados.

P1.7. Caracterización epidemiológica de la rabia en Bolivia (2020- 2025)

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Palabras clave: Rabia, Bolivia, Epidemiología, IFD, RT-PCR

Introducción. La rabia es una enfermedad zoonótica viral grave, con alta letalidad en humanos y animales. En Bolivia, representa un problema de salud

pública persistente, en animales domésticos y silvestres y con casos humanos vinculados principalmente a mordeduras de perros infectados. Para su diagnóstico, el Instituto Nacional de Laboratorios de Salud (INLASA), laboratorio de Referencia Nacional de Rabia (LRNR), emplea técnicas de referencia en muestras procedentes de distintas regiones del país contribuyendo a la vigilancia epidemiológica.

Objetivo. Analizar los factores demográficos y geográficos asociados a la rabia animal reportada por el LRNR, para identificar patrones epidemiológicos que contribuyan a mejorar la vigilancia y las intervenciones para la salud pública en Bolivia.

Métodos. Se recopilaron los datos secundarios oficiales del LRNR. Los mismos fueron analizados con RStudio y QGIS. Para el diagnóstico de rabia animal se emplearon muestras de tejido encefálico. Se utilizaron las técnicas de inmunofluorescencia directa y reacción en cadena de la polimerasa de tiempo real.

Resultados. El análisis de 3091 muestrassospechosas de rabia en Bolivia (2020-2025) revela que 219 casos fueron positivos. El 2023 y2025 son las gestiones con mayor número de casos, el índice de positividad es10,42% y 11,63% respectivamente. Asimismo, los caninos son los más afectados con el 88,58%, de los cuales el 59,36% son machos y el 78,87% son menoresde 3 años. Respecto a la condición de los animales, los semi-domiciliados son un 53,88% y vagabundos con 31,96%. Un dato crítico es que el 47% de los animales no estaban vacunados. A nivel departamental Chuquisaca concentra la mayor parte de la carga de la enfermedad, con 60,3% de los casos, seguido de La Paz con el 24,2% de los casos.

Conclusiones. La Rabia es una amenaza persistente, con los caninos como el principal reservorio. Se concentra en machos y en animales con tenencia deficiente, lo que destaca el papel crucial del control de estas poblaciones. La falta de vacunación es un factor de riesgo predominante, subrayando la necesidad de fortalecer las campañas de inmunización. Geográficamente, la enfermedad afecta de manera desproporcionada a Chuquisaca y La Paz, lo que exige una intensificación de las intervenciones de vigilancia y prevención en estas áreas. La presencia de casos en bovinos y fauna silvestre también resalta la complejidad de la epidemiología de la enfermedad, que debe ser abordada con un enfoque integral para proteger tanto la salud animal como la pública.

P1.8. Evaluación de la tolerancia y respuesta inmune a la vacunación antirrábica en caninos y felinos menores de tres meses de edad

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Palabras Clave. Vacuna antirrábica, caninos, felinos, seguridad control de rabia

Intoducción. Las campañas masivas de vacunación son esenciales para el control sostenido de la rabia. En América Latina, el Fondo Rotatorio de la OPS ha desempeñado un papel clave en la provisión y distribución de estas vacunas. Habitualmente, la primera dosis se administra a partir de los 3 meses de edad, de acuerdo con las indicaciones de la mayoría de las vacunas disponibles. Esta recomendación se basa en la falta de datos específicos sobre la seguridad en animales más jóvenes, lo que limita la cobertura vacunal y puede afectar negativamente la inmunidad poblacional.
Objetivo. Evaluar la tolerancia y la respuesta inmune en caninos y felinos menores de tres meses de edad vacunados contra la rabia.
Métodos. Se utilizó una vacuna comercial (Bagovac Rabia - Biogénesis Bagó), aprobada y distribuida en varios países a través del Fondo Rotatorio de OPS. Se incluyeron caninos y felinos menores de tres meses (47 a 84 días de edad – promedio 7 semanas), asignados a dos grupos: uno recibió la dosis recomendada de 1 mL y otro el doble de la dosis recomendada (2 mL). La seguridad se evaluó clínicamente durante 30 días. Los títulos de anticuerpos se midieron mediante kit de ELISA Platelia® Rabies II Kit ad usum veterinarium hasta los 30 días post vacunación en el grupo vacunado con la dosis indicada de 1 mL.
Resultados. No se observaron reacciones locales ni sistémicas posteriores a la vacunación en ninguno de los grupos. El aumento en los niveles de anticuerpos fue significativo para todos los animales, obteniéndose títulos por

encima de 0,5 UE/mL desde los siete días post vacunación.
Conclusiones. El producto bajo evaluación, Bagovac Rabia, resultó seguro tras su administración en caninos y felinos a partir de siete semanas de edad. La respuesta inmune fue muy satisfactoria.

P1.9. Rabia canina en arequipa peru, una mirada gráfica a diez años de trabajo

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Palabras clave: Rabia canina, Arequipa, Vacunación, Control sanitario, Prevención

Introducción. La reintroducción de la rabia en la provincia de Arequipa se dio en marzo de 2015, tras casi 20 años de ausencia, registrándose el primer caso canino en el distrito de Alto Selva Alegre. Actualmente 17 de los 29 distritos (58.62%) han reportado casos, con mayor concentración en el cono Norte (63.6%). Esto activó la respuesta del sector salud en el nivel regional, que inició una labor compleja de control y prevención con recursos humanos nuevos, escasa experiencia, limitado presupuesto y logística deficiente. Se implementaron múltiples estrategias de intervención como la sensibilización y educación de la población, la vacunación canina en múltiples abordajes: campañas masivas, barridos, repasos y abordajes sectorizados. Estas acciones tuvieron resultados variados, con éxitos importantes y otros momentos de decepción por las bajas coberturas.
Objetivo. Mostrar de manera gráfica el desarrollo del programa de control y eliminación de la rabia canina en Arequipa, Perú.
Métodos. Mediante una serie de registros gráficos mostramos los retos,

logros y brechas que quedan por cubrir en la ciudad de Arequipa. Los gráficos registran una población, inicialmente desinformada, que presentaba prácticas inadecuadas en la tenencia de mascotas, incluyendo jaurías en la vía pública y uso de perros como cuidadores de propiedades. También se reporta información sobre un caso humano registrado en el 2023.
Resultado. A la fecha, se observa una mejora sustancial en algunos componentes importantes del control de la rabia canina: la población está sensibilizada, el personal de salud mejor capacitado, y varios de los gobiernos locales involucrados activamente en la estrategia de control.
Conclusiones. Este proceso ha demostrado que, incluso con recursos limitados, es posible revertir una emergencia sanitaria mediante compromiso, innovación y trabajo multisectorial. A pesar de los avances, esta experiencia subraya la necesidad de financiamiento sostenido para preservar los avances logrados.

P1.10. Modelamiento de la vacunación de cachorros menores de 3 meses y su impacto en la cobertura antirrábica canina en Arequipa, Perú

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Palabras clave. Cachorros, inmunidad de rebaño, modelo matemático, rabia canina, vacunación.

Introducción. La vacunación antirrábica canina es la principal estrategia para prevenir la rabia humana. En el Perú y otros países se excluyen cachorros menores de 12 semanas de las campañas de vacunación, por supuesta interferencia de anticuerpos maternales. Pero, diversos estudios demuestran que las vacunas antirrábicas inducen respuesta inmunitaria adecuada desde las 6 semanas. En Arequipa, Perú, donde la rabia canina es endémica y el 30% de perros positivos son jóvenes, bajar la edad mínima de vacunación a 6 semanas incrementaría la población protegida, y podría elevar la proporción de adultos con historial de vacunación, favoreciendo la inmunidad poblacional.
Objetivo. Evaluar el impacto potencial de reducir la edad mínima de vacunación antirrábica canina a 6 semanas sobre la cobertura de vacunación en zonas endémicas.
Métodos. Desarrollamos un modelo matemático parametrado con datos demográficos y epidemiológicos del distrito de Alto Selva Alegre en Arequipa. Se simularon dos escenarios: vacunación desde las 12 semanas (estrategia estándar) y desde las 6 semanas. Los modelos se ajustaron para representar curvas de incidencia observadas, considerando vacunación anual como evento único.
Resultados. Incluir cachorros de entre 6 y 12 semanas incrementó significativamente la cobertura total; 64.9% en la estrategia de 6 semanas en adelante vs 59.3% en la estrategia de 12 semanas en adelante. Aún más, esta diferencia siguió aumentando a lo largo de los años al parecer por la dinámica poblacional local.
Conclusiones. Nuestros resultados iniciales muestran que reducir la edad de vacunación a 6 semanas en las campañas masivas de vacunación antirrábicas caninas podría aumentar la probabilidad de eliminación de la rabia. Futuros estudios podrían incluir predicciones de incidencia, estocasticidad en la transmisión y en los parámetros demográficos, y brindar nueva evidencia sobre el potencial de vacunar cachorros más jóvenes para el control de la rabia urbana.

P1.11. El Perú en camino a ser un país libre de rabia canina. Situación de la rabia canina en el perú, 2015-2025

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Palabras clave: rabia, vigilancia, país libre de rabia

Introducción. En el año 2010, Chile y Perú (abarcando el 88% del territorio peruano) hicieron una declaración para establecer sus territorios libres de rabia canina. Sin embargo, esta situación no logró mantenerse en Perú por la reintroducción de rabia en Arequipa en el año 2014.
Objetivo. La presente investigación tuvo como objetivo describir la prevalencia de rabia canina en el Perú durante el periodo 2015 a 2025 (13/10).
Métodos. Se analizaron los casos de rabia canina diagnosticados por el Laboratorio de Referencia Nacional de Rabia del Instituto Nacional de Salud provenientes del sistema de vigilancia del Ministerio de Salud en el periodo señalado.
Resultados. Entre 2015 y 2025 se registraron 442 casos de rabia en canes a nivel nacional. La gran mayoría de los casos ocurrieron en Arequipa (85,1%, 376 casos), seguido de Puno (16,3%, 72 casos) y Cusco (0,5%, 2 casos). Mientras que los brotes en Cusco (2017 y 2019) fueron rápidamente controlados con amplias campañas de vacunación. Las acciones iniciales en Arequipa fueron insuficientes, permitiendo que la enfermedad se propagara por once años. Por otra parte, el departamento de Puno, a pesar de haber reportado casos por más de 67 años, logró su control definitivo en el año 2022.
Conclusiones. Aunque la vigilancia epidemiológica en el país no es la óptima, es alentador que el Perú haya logrado mantenerse libre de rabia canina por un periodo de siete meses. Es vital establecer nuevas estrategias de vigilancia epidemiológica y control para evitar futuras reintroducciones como, reforzar los controles de tránsito terrestre de animales provenientes de países donde el virus aún es endémico, incluir a los consultorios veterinarios como unidades de notificación y campañas de promoción sobre tenencia responsable de mascotas entre otras.

P1.12. Animal welfare considerations in the release of sterilized street dogs

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Keywords. Street dogs, Safety, Trap, Neuter, Release

Introduction. The "Five Freedoms" refer to a set of principles aimed at defining and ensuring animal welfare. The five include freedom from hunger and thirst, discomfort, pain, fear, and the freedom to express normal behavior. Animal welfare for undomiciled domestic dogs (“street dogs,” “free-roaming dogs,” or “feral dogs”) has historically been low. One outcome is shortened life expectancy. Life expectancy for domiciled dogs is 12.69 years (95% CI: 12.68–12.70). Conversely, the average life expectancy (LE) of a female street dog is 2.4 years and the average LE of a male is 3.5 years. The trap, neuter and release of street dogs is controversial, with many countries wrestling with humane management of street dog populations.

Methods. Tolerance of street animals varies regionally. Responses from sheltering and feeding to killing using unacceptable methods. Available resources, including water, are not constant and change with political upheaval and climate change. Health and safety concerns for people who become victims of bites, maulings and zoonotic diseases are foremost in the discussion.

Results. While some human populations rely on street dogs to scavenge trash, the scavenging includes ingesting refuse, other organic matter and human feces. In addition to a lack of nutrition and dehydration, parasite infestation can be debilitating or fatal. Shared nutrition is required for the most basic level of humane care for dogs. Fertility control may reduce caloric requirements by up to 30 percent.

Conclusion. A lifespan that is typically shortened by roughly 75 percent in both males and females indicates that further consideration of the release of unmanaged street dogs is needed in order to ensure an acceptable level of welfare for the dogs while ensuring safety for people.

P1.13. Comparative diagnosis of rabies using fluorescence antibody test (fat) and rt-q-pcr at the maranhão central public health laboratory (lacen-ma/brazil) during 2023 and 2024

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Keywords. Lyssavirus, RT-qPCR,LN34, Molecular biology, Diagnosis

Introduction. Rabies is a fatal acute encephalitis that affects both animals and humans. An effective and accurate diagnosis is crucial due to its public health implications. The use of molecular biology has grown exponentially since the COVID-19 pandemic, and RT- qPCR has become an important tool for rabies diagnosis due to its specificity and speed. Furthermore, RT-qPCR has successfully replaced the mouse inoculation biological test.
Objective. To analyzethe results of rabies tests using both Fluorescence AntibodyTest (FAT) and RT-qPCR from the Zoon-osis Laboratory of the MaranhãoCentral Public HealthLaboratory (LACEN-MA) for the period from 2023 to 2024.
Methods. Fluorescence Antibody Test (FAT) tests were performed on samples from the municipal and state epidemiological surveillance teams in Maranhão. An anti-rabies conjugate supplied by the Pasteur Institute-SP was used with a Zeiss Axio Scope A.1 IFD microscope. The RT-qPCR was conducted using LN34 primers and a probe on a CFX-96 Bioradthermocycler. Genetic materialwas extracted usingthe Quick-DNA/RNA Viral MagBead commercial kit from ZYMO RESEARCH, following the manufacturer's instructions for automated extraction with the TanBead automated extractor.
Results. A total of 662 tests were performed between 2023 and 2024. Of the 463 samples that were negative on IFD, 95.46% (442) were confirmed by RT-qPCR, while 4.54% (21) were divergent. Of the 103 samples that were positive on IFD, 97.09% (100) were confirmed by RT- qPCR, with 2.91% (3) being divergent. Of the 96 samples (14.50%)that were inconclusive on IFD, 71

(73.96% / 10.73%) were non-detectable by RT-qPCR, and 25 (26.04%/ 3.78%) were detectable.
Conclusion. The RT-qPCR test is concluded to be an important confirmatory tool for rabies diagnosis, especially in cases where IFD results are inconclusive or cannot be performed.

P1.14. Análise espacial da ocorrência de raiva bovina no município de Paracambi, Rio de Janeiro, Brasil

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Palavras chave. Análise espacial, Bovinos, Intervenção, Morcegos, Raiva

I**ntrodução.** O controle da raiva dos herbívoros é um desafio para os serviços oficiais devido à sua epidemiologia. A vigilância epidemiológica da raiva prevê a notificação obrigatória, investigação, coleta de material, diagnóstico, controle, prevenção e educação em saúde, no estado do Rio de Janeiro há regulamentação que ampara essas ações quando da ocorrência de casos. No ano de 2022, houve o atendimento a dois focos no município de Paracambi, em um trabalho em conjunto da Secretaria Municipal de Agricultura de Paracambi e o Núcleo de Defesa Agropecuária do Rio de Janeiro (NUCDARIO) da Secretaria de Estado de Agricultura, Pecuária e Abastecimento.
Objetivo. Descrever a distribuição espacial durante a ocorrência de raiva bovina em Paracambi, no ano de 2022, para a identificação de áreas prioritárias de intervenção.

Métodos. Estudo seccional desenvolvido a partir do registro de dois casos de raiva bovina em 2022, no município de Paracambi, Rio de Janeiro. Foi delimitado um raio de 12 km a partir da localização dos focos, determinando a área de perifoco, para a identificação das propriedades rurais e abrigos de morcegos hematófagos envolvidos. O banco de dados das coordenadas geográficas registradas pelos técnicos do NUCDARIO no município serviu de base para aplicar técnicas de análise espacial, na forma de pontos, do Sistema de Informação Geográfica (SIG) QGIS. A vistoria das propriedades ocorreu para orientação da vacinação dos animais, verificação da espoliação por morcegos hematófagos e presença de abrigos.
Resultados. Foram identificadas como áreas de intervenção 93 propriedades rurais e 7 abrigos de morcegos, dentro da área de perifoco, apresentados no mapa com a localização georreferenciada.
Conclusões. Os achados indicam a importância da análise espacial em saúde única para definição de áreas específicas de atuação e contenção de novos casos, direcionando o trabalho do NUCDARIO na prevenção e controle da raiva dos herbívoros.

P1.15. The Overlooked role of feline rabies in socially unequal contexts: implications for zoonotic disease control

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Keywords. Feline Rabies, Zoonoses, One Health

Introduction. Rabies is one of the deadliest yet preventable zoonotic diseases worldwide. Despite ongoing control efforts, most strategies have historically focused on dogs, overlooking the role of cats in transmission. This omission is especially problematic in socially unequal contexts, where cats roam freely, interact with wildlife reservoirs, and live in close contactt with

Structural barriers such as poverty, limited access to veterinary care, and weak public health systems create gaps in rabies prevention and surveillance. Underestimating feline rabies thus represents both a public health risk and a social justice concern, reinforcing inequities in disease exposure and control.

Objective. To examine the overlooked role of feline rabies in socially unequal contexts and its implications for zoonotic disease prevention and control within a One Health framework.

Methods. A narrative literature review was conducted using PubMed, Scopus, and SciELO, along with reports from the World Health Organization (WHO), the World Organization for Animal Health (WOAH), and national health agencies in rabies-endemic countries. Priority was given to publications from the last 15 years addressing feline rabies, social inequality, and zoonotic control. Studies on vaccination coverage, surveillance, and community-based interventions in low-resource settings were also included.

Results. Evidence shows feline rabies is underreported and underprioritized compared with canine rabies, despite rising cases in Latin America and Asia. In unequal contexts, low vaccination rates, cultural perceptions of cats as independent or expendable, and the absence of tailored policies increase risks for marginalized populations. Surveillance gaps and exclusion of cats from vaccination campaigns further weaken rabies control, perpetuating inequities and human exposure risks.

Conclusions. Feline rabies is a critical but neglected issue. Addressing it through vaccination, stronger surveillance, and socially sensitive interventions is essential. A One Health approach can reduce transmission, advance equity, and promote animal welfare.

P1.16. Tendiendo puentes entre la academia y los productores: método para promover la prevención de la Rabia Paralítica Bovina.

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Palabras clave: vampiros, rabia paralitica bovina, divulgacion, prevención

Introducción: La educación para la salud es una parte fundamental de la epidemiologia y desde nuestro punto de vista también para la "divulgación de la ciencia". Como es sabido, la rabia sigue constituyendo una de las principales zoonosis a nivel mundial. En México, aunque en 2019, la Organización Mundial de la Salud nos declaró como libres de rabia canina, la rabia silvestre es más compleja para controlar.
Objetivo: Actualizar a los ganaderos, estudiantes y al público en general sobre los nuevos conocimientos sobre la rabia paralítica bovina (RPB), su principal transmisor (vampiros) y las buenas prácticas para su control, con participación y trabajo interinstitucional es una manera de hacer equipo en educación y comunicación.
Métodos: Presentación de resultado del 2° Simposio de actualización de rabia paralítica bovina, donde participaron académicos, gobierno federal y la industria farmacéutica como principal patrocinador. Los principales temas que se abordaron y actualizaron fueron: la Cepa ERA, las recientes investigaciones sobre rabia, Diagnóstico y Diagnóstico diferencial, Inmunología y vacunación, Costo – beneficio de vacunación, Biología y conservación de murciélagos en general y los murciélagos hematófagos.
Resultados: La asistencia presencial fue de 425 personas, y 869 conectadas a través de diferentes medios virtuales; los diferentes actores fueron estudiantes y profesionistas, biólogos, veterinarios, agrónomos, además de productores, de seis estados de México, y de países como Costa Rica, El Salvador, Perú y Guatemala.
Conclusiones: Estos resultados demuestran la importancia de organizar y coordinar actividades de difusión y divulgación con la participación conjunta de diferentes instituciones para promover la “Educación para la salud”. Las ventajas de redes sociales permitieron llevar el mensaje de la importancia de la prevención y control de rabia, así como conservación de murciélagos a diferentes ámbitos académicos y sociales, a nivel nacional como internacional.

21 de octubre / October / Octobre

Sesión Oral/ Oral Session / Sessão Oral

RABIES IN THE AMERICAS

RITA 2025 Rabia en las Américas PERÚ

Reflections from 19 years of vampire bat rabies research in Peru

Speaker:
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Keywords. bat rabies, *Desmodus rotundus*, zoonosis, disease ecology, epidemiology

Introduction. As elsewhere in the Americas, vampire bat-transmitted rabies virus (VBRV) constitutes a continual threat to the health of wildlife, domestic animals and humans.
Objective. We propose that mitigating the burden of VBRV requires understanding both the basic epidemiological processes that govern viral circulation in bats and how human activities increase or decrease cross-species transmission risks.
Methods. Over 19 years, we conducted spatially-replicated, longitudinal monitoring of rabies exposures in vampire bats across Peru, epidemiological and genomic analyses of rabies cases reported through national passive surveillance systems, and statistical analyses of interventions and field experiments.
Results. Synthesizing results across this body of work reveals several core insights: (1) at the landscape level, long-term maintenance of VBRV occurs through spatial processes including viral invasions into previously rabies-free populations and extinction-recolonization dynamics, creating periods of viral absence from vampire bat colonies; (2) efforts to control VBRV by reducing vampire bat populations (i.e. culling) ameliorate bat bites but can have positive or negative impacts on rabies transmission, depending on bat responses to culls and the timing of culls relative to rabies circulation; (3) vaccination of bats holds considerable epidemiological potential as an alternative to culling, but requires overcoming technical, operational and regulatory uncertainties.
Conclusions. The study of VBRV in Peru exemplifies how long-term, methodologically diverse, and multi-sectorial research can reveal real-world relevant understanding of a pressing One Health challenge.

O2.1. Is the Nucleoprotein Gene Sufficient for Phylogenetic Inference in Bat-Borne Rabies?

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Keywords. Bat-borne Rabies, Gene tree discordance, N gene, Phylogenomics, molecular surveillance.

Introduction. Rabies virus (RABV) has independently established enzootic cycles in multiple carnivore and bat species. In the Americas, bats are the primary reservoirs, maintaining genetically distinct viral variants and driving frequent cross-species transmission. While whole-genome sequencing has improved understanding of canine RABV evolution, bat-associated lineages remain underrepresented. Moreover, gene-specific phylogenies often differ from whole-genome trees, raising concerns about the reliability of single-gene analyses.

Objectives. To identify the most reliable gene for phylogenetic reconstruction of bat-borne RABV, enabling efficient molecular surveillance in resource-limited settings.

Methods. A curated dataset of 654 complete bat-borne RABV genomes from the Americas was analyzed, encompassing broad geographic, temporal, and host diversity. The five coding genes (N, P, M, G, L) were aligned using MAFFT, and Maximum Likelihood trees were inferred in IQ-TREE under the GTR+F+I+

G4 model with 1,000 ultrafast bootstraps. A concatenated five-gene supermatrix served as genome-wide reference. Topological congruence was Robinson–Foulds (RF) distances, Shimodaira–Hasegawa (SH) tests, and Pearson correlations of patristic distances. Topological differences were visualized with tanglegrams.

Results. The nucleoprotein (N) gene showed the highest congruence with the whole-genome tree (RF=106; SHp=0.6349; r=1.000), whereas the polymerase (L) gene exhibited the greatest discordance (RF=872; r=0.116–0.124). N, P, M, and G genes were strongly correlated (r=0.807–1.000), but only N consistently preserved accurate taxonomic placement across lineages.

Conclusions. The N gene represents a robust and cost-effective proxy for whole-genome phylogenetic reconstruction of RABV. Its high topological concordance supports its use in molecular epidemiology and surveillance, particularly in low-resource contexts. By enabling efficient monitoring of viral evolution, the N gene can strengthen outbreak preparedness and public health strategies against bat-borne rabies, which causes approximately 450 annual cattle deaths across Latin America and poses ongoing threats to food security and human health.

O2.2. The Cousin Across the Pacific: The Bizarre Biogeography of Bat-Borne Rabies

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Keywords. Phylogenetics, Genomic sequencing, Bat lyssavirus, Biogeography, Spillover

Introduction. The biogeographic distribution of lyssaviruses across the Asia-Pacific of lyssaviruses remains perplexing. *Lyssavirus gannoruwa* and L*yssavirus australis*, of Sri Lanka and Australia, respectively, are to date the

most closely related to Lyssavirus rabies, found only in bats of the Americas.
Objective. This study sought to investigate the phylogeography of these three lyssaviruses and seek to explain the origins of Lyssavirus rabies in the Americas.
Methods. Viral sequences from bats diagnosed with Lyssavirus australis, belonging to both Pteropus and Saccolaimus, were obtained at the Biosecurity Sciences Laboratory in Brisbane, Australia, utilizing Illumina NextSeq as well as a novel sequencing scheme. Nucleoprotein sequences were compared to those of publicly available Lyssavirus gannourwa and Lyssavirus rabies, representing both bat-borne and terrestrial lineages. Sequence alignments were conducted with Geneious using MUSCLE, and Bayesian phylogenetic trees were constructed using the GTR+4+I model.
Results. Phylogenetic analyses revealed that Lyssavirus gannoruwa and Lyssavirus australis are more closely related to terrestrial rabies variants circulating in Asia than bat-borne rabies variants in the Americas.
Conclusions. Our analyses indicate that bat-borne rabies likely circulated within Asia, causing multiple spillovers, before subsequently being introduced to bats of the Americas. The possible mechanisms of introduction to the Americas and the broader implications of lyssavirus phylogeography will be discussed.

O2.3. Drivers of sporadic European bat lyssavirus 2 infections in Myotis myotis

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Keywords. European bat Lyssavirus 2, Myotis bats, Bayesian mechanistic model, Transmission mechanism, Zoonosis.

I**ntroduction.** Zoonotic diseases transmitted by wildlife reservoirs pose risks to both public health and biodiversity. Understanding their transmission and persistence is essential for outbreak prevention, assessing demographic impacts and developing conservation strategies on host. Reliable estimates of key epidemiological parameters require an in-depth understanding of host ecology and behaviour. The dynamics of bat-associated European lyssavirus remain poorly understood, with limited data available on critical epidemiological parameters.

Objective. This study aimed to characterise the infection dynamics of European bat lyssavirus (EBLV) in Greater mouse-eared bat (Myotis myotis) maternity colonies, the consequences for host demography, and to identifyecological and behavioural factors influencing its persistence and transmission.

Methods. We conducted longitudinal (8 years) monitoring of five M. myotis maternity colonies in France (Europe). Data collection included individual-based observations, serological and molecular data. We applied integrated Bayesian SEID/SER epidemiological models to estimate transmission parameters, incorporating factors such as seasonal activity, age structure, and contactt patterns.

Results. Neutralising antibodies against EBLV-2 were detected in 10% of bat serumsamples, providing the first indirectevidence of EBLV-2 circulation in this bat species. No lyssavirus was isolated from any saliva sample. Model selection indicated that prevalence shifts were primarily driven by external transmission during mating season, age-dependent transmission variation, and frequency-dependent contacttpatterns. The analysis suggested that lyssavirus outbreaks can result in high annual mortality rates, while affectingrelatively few individuals in the population overall.

Conclusions. Our findingsdemonstrate evidence of EBLV-2 circulation in M. myotis in France and highlight the role of seasonality and behaviour in shaping transmission dynamics. The integration of individual-level ecological data with mechanistic modelling provides valuable insights into zoonotic pathogen persistence in wildlife. These approaches can inform both rabies surveillance and conservation strategies for bat populations.

O2.4. Raiva em morcegos: vigilância laboratorial sob o olhar da saúde única na Amazônia Brasileira

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Palavras-chave: vírus da raiva; Amazônia; saúde única; vigilância epidemiológica; morcegos

I**ntrodução.** Doença infectocontagiosa viral e zoonótica, com ciclo aéreo mantido por morcegos. O impacto global da raiva justifica sua importância em Saúde Pública, dada sua alta letalidade, perdas econômicos na agropecuária e difícil controle entre os animais silvestres, afetando populações humanas em vulnerabilidade socioeconômica e ambiental. Portanto, a vigilância epidemiológica em morcegos é essencial para monitoração da circulação viral no ambiente.
Objetivo. Realizar levantamento de morcegos recebidos para diagnóstico de raiva, oriundos da Região Norte, entre 2021 a junho de 2025.
Métodos. Foram analisados 1.238 morcegos enviados ao Instituto Evandro Chagas (IEC – Ananindeua, PA), para pesquisa de raiva através da realização de Prova Biológica, Imunofluorescência Direta e identificação morfológica de espécie.
Resultados. Do total, 766 amostras foram do Pará, 240 de Rondônia, 126 do Tocantins, 70 do Amazonas, 18 de Roraima, 11 do Amapá e 1 do Acre. 139 são morcegos hematófagos (120 espécimes do Pará) e 1.022 morcegos não hematófagos (632 do Pará, 238 de Rondônia e 122 do Tocantins). O isolamento viral ocorreu em 20 morcegos (9 do Pará, 8 de Rondônia, 1 do Tocantins, 1 do Amazonas e 1 de Roraima), todos não hematófagos, a maioria nas espécies Artibeus lituratus (7), Artibeus planirostris (4) e Molossus molossus (4).
Conclusões. A identificação de morcegos infectados com o vírus da raiva em áreas urbanas ou periurbanas, evidencia a circulação do patógeno em áreas coabitadas por morcegos, humanos e animais domésticos. É notável a discrepância da demanda por diagnóstico de raiva dentro dos estados

analisados, o que sugere subnotificação associada a áreas em vulnerabilidade socioeconômica e ambiental. Nestes termos, a saúde única emerge como ferramenta que implementa ações multidisciplinares que buscam implementar um sistema de vigilância epidemiológica funcional, principalmente em regiões carentes de recursos financeiros e estratégias de controle deste agravo, endêmico na região Amazônica.

O2.5. Avaliação in vitro de diferentes linhagens genéticas de vírus da raiva características de morcegos

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Palavras-chave: raiva, células, morcegos

Introdução. Morcegos são os principais reservatórios da raiva no Brasil e têm sido relacionados com diferentes ciclos epidemiológicos da doença. Além dos morcegos hematófagos Desmodus rotundus, diversas espécies de morcegos insetívoros têm sido identificadas mantendo linhagens genéticas específicas do vírus da raiva (RABV), apesar disso ainda existem lacunas sobre a manutenção da raiva nestes animais.
Objetivo. O objetivo deste trabalho foi avaliar diferentes linhagens genéticas de RABV quando inoculadas em diferentes células.
Metodologia. Para tanto foram utilizadas linhagens de células recentemente estabelecidas, isoladas de rim de morcegos D. rotundus e Carollia perspicillata. Tais células foram utilizadas na titulação viral de duas amostras com linhagens genéticas distintas de RABV, sendo a primeira característica de D. rotundus (IP4005) e a segunda característica de Tadarida brasiliensis (IP3214).
Resultados. Ambas linhagens de células foram sucetíveis ao RABV sendo que a amostra IP4005 apresentou título viral maior quando inoculada nas células de D. rotundus, já o título viral da amostra IP3214 não apresentou diferença significativa nas diferentes células.
Conclusões. Esses resultados indicam que há diferença no comportamento in vitro de amostras do RABV de acordo com a linhagem de células utilizadas. Cabe destacar a importância deste estudo para a compreensão da raiva em morcegos e a possibilidade da realização de experimentos in vitro para esse fim.

O2.6. A Bayesian framework for optimising vampire bat roost discovery and quantifying livestock bite risk

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Keywords. data integration, effort, questionnaires on bat bites, roost surveys, vampire bat rabies.

Introduction. Vampire bat rabies (VBR) poses a major socioeconomic and public health burden across Latin America. Targeting vaccination and bat population management requires knowledge of roost locations. However, most roosts remain undiscovered within complex landscapes, and conventional roost-discovery methods are expensive and time-consuming.
Objectives. Using a field study in Apurimac, the Peruvian region with historically the most livestock VBR cases, we assess the individual and joint predictive utility of two complementary data sources for predicting roost locations: conventional roost-discovery efforts and farmer reports of vampire bat bites on their livestock. We hypothesised that livestock bites offer indirect evidence of bat presence in their vicinity, which may be used to refine the

predicted locations of unknown roosts if combined with environmental characteristics and systematic surveys. We developed a Bayesian model that integrates known roost locations and bat bite data, correcting for survey and reporting effort to accurately estimate roost distribution.

Results. We show that a model integrating both data sources outperforms a model based on survey data alone, despite the roost survey effort covering an area 12 times larger. The probability of a farm signalling a roost and the average bite rate per animal decreased non-linearly with distance from a roost, such that most roosts predicted due to bat bite occurrence were within approximately 1km2 of a farm. By simulating reduced data collection effort, we identified an optimal balance between collecting bat bite data and conducting roost surveys, which could increase the efficiency of future roost detection efforts. Our results also indicate widespread under-detection of roosts via conventional surveys, which may contribute to the inability of past bat population control campaigns in this region to eliminate rabies.

Conclusions. This novel statistical framework and findings have direct implications for rabies control policies in resource-limited settings, demonstrating how integrating ecological and epidemiological data can enhance wildlife-disease management.

O2.7. Expert elicitation on vampire bats and rabies: implications for United States surveillance, management, and research

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Keywords. *Desmodus rotundus*, Expert elicitation, Management and surveillance, Risk planning, Vampire bat rabies

Introduction. The common vampire bat (Desmodus rotundus) is expanding in geographic range, raising concern about potential spread to the United States (U.S.) and the associated risks of rabies virus (RABV) transmission.
Objective. We aimed to assess expert opinion on the risks of vampire bat and vampire bat RABV incursion into the U.S. and to identify priority strategies for surveillance, management, research, and communication.
Methods. In 2020, we convened a panel of experts and used the IDEA protocol, a modified Delphi method, to elicit both quantitative risk estimates and qualitative management insights. For quantitative parameters, experts provided central, high, and low estimates along with confidence ratings which were used to produce a posterior distribution of parameter values.
Results. Experts estimated a low probability of vampire bat establishment in the U.S. within five years (25%) and even lower probability of vampire bat RABV establishment (12%). Over a 20-year horizon those probabilities rose substantially (60% and 48% respectively). Key drivers of increased risk included climate change, land cover change, and human population growth. Experts identified livestock and domestic animals as the most vulnerable to RABV transmission followed by wildlife and humans. Recommended strategies included livestock vaccinations, strengthened rabies surveillance, public education on vampire bat identification, bite recognition, RABV health risks, the importance of reporting, and preventative vaccination.
Conclusions. While short-term risks remain low, longer- term risks are considerable and could have severe economic and public health consequences. Proactive and coordinated surveillance, vaccination, and outreach will be essential to ensure U.S. preparedness. This study demonstrates how expert elicitation can inform evidence-based decision making and provides a foundation for timely prevention and response to future incursions.

O2.9. Whole-genome phylogeography of rabies virus circulating in *Desmodus rotundus* in Mexico

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Introduction. In Latin America, including Mexico, the primary reservoir and potential transmitter of the rabies virus (RABV) to domestic animals and humans is Desmodus rotundus (D. rotundus). RABV remains an urgent public health concern in Mexico. From 2020 to 2024, D. rotundus was the main cause of human rabies cases attributed to direct transmission via bat bites, with two indirect cases resulting from cat bites. Molecular epidemiological studies of RABV conducted in México rely on phylogenies constructed from partial genome sequences. This approach potentially obscures phylogenetic patterns and information concerning the viral strains circulating in vampire bats.
Objetive. To establish the phylogeographic relationship of circulating rabies virus sequences in Desmodus rotundus from Mexico.
Methods. Thirteen WGS from brain simples of D. rotundus (2020-2024; Illumina sequencing at Cenasa) were analyzed. Samples were geolocated (Google Earth). Subsequently, multiple alignment (MAFFT v7.505) and optimal nucleotide substitution model selection (ModelTest-NG v0.1.7) were performed. Phylogenetic inference was conducted via Bayesian analysis (MrBayes v3.2.7), and the tree was visualized with FigTree (v1.4.)
Results. Samples spanned 13 states, spatially coinciding with the distribution of D. rotundus and human cases in Mexico. The phylogenetic tree (terminal nodes: >80% support; internal nodes: 100% for the nodes) revealed four geographic clades: West-Central (Jalisco, Colima, Mexico State, Michoacan, Nayarit), North (Chihuahua, Sinaloa), South-Coast (Guerrero, Oaxaca, Puebla) and Gulf-Central (Tamaulipas, Veracruz, Queretaro). Clustering by geographic proximity suggest regional viral migration.
Conclusions. WGS analysis identified four geographically structured RABV lineages in D. rotundus. Topology suggests viral transmission linked to territorial adjacency among bat colonies. Robust genomic surveillance is essential to strengthen internal node inference and understand viral phylodynamics. This characterization is critical for designing control strategies targeting emerging zoonotic risk associated whit RABV evolution in its primary reservoir.

O2.9. Raiva secundária: cão como vetor de variante silvestre em caso humano no Brasil

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Palavras-chave. Raiva secundária, Variante AgV3, Cão doméstico, Vigilância epidemiológica, Saúde única.

Introdução. A raiva humana é historicamente atribuída à transmissão por cães infectados com variantes clássicas do vírus rábico (AgV1 e AgV2). Contudo, emergem relatos de casos envolvendo a transmissão por cães e gatos domésticos infectados por variantes silvestres, como a AgV3, mantida por morcegos hematófagos (Desmodus rotundus). Nesses casos, os animais domésticos atuam como vetores secundários, representando elo entre os ciclos silvestre e humano.

Objetivo. Descrever o fenômeno da raiva secundária em cães, com foco no caso registrado em Alvorada/Tocantins em 2024, e discutir suas implicações para a vigilância e controle da raiva no Brasil.

Métodos. Foi realizada uma análise documental e descritiva do caso de raiva humana registrado no Tocantins, com revisão de literatura científica relacionada à transmissão secundária do vírus rábico, identificação de variantes e suas vias de disseminação.

Resultados. O caso envolveu um homem de 50 anos, mordido por cão de origem desconhecida em área rural. A vítima não recebeu profilaxia pós-exposição indicada, evoluindo a óbito. A análise laboratorial confirmou a presença da variante AgV3, normalmente associada a morcegos hematófagos. O cão, embora não seja o reservatório primário da AgV3, atuou como transmissor da variante silvestre. Este e outros casos similares reforçam a importância da tipificação genética viral para reconstrução das cadeias de transmissão e do monitoramento em áreas de transição rural-urbana.

Conclusões. A raiva secundária representa um desafio emergente para a saúde pública, exigindo abordagens integradas de vigilância em saúde humana, animal e ambiental. A vacinação sistemática de cães e gatos

continua sendo essencial, mesmo em regiões sem circulação de variantes caninas, devido à persistência de variantes silvestres e sua capacidade de spillover para animais domésticos.

O2.10. Impact of the Implementation of Pre-Exposure Rabies Prophylaxis (PrEP) on the Reduction of Wild-Type Rabies Incidence in Prioritized Regions of Peru, 2011–2024

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Keywords. Wild-type rabies, Pre-exposure vaccination, Primary health care, Peru.

Introduction. Wild-type human rabies remains a major public health problem in Amazonian communities of Peru, with 316 deaths reported between 1975 and 2013, more than 50% of which occurred in the Amazonas region. In response, the Ministry of Health implemented pre-exposure rabies prophylaxis (PrEP) in 2011 as a preventive strategy targeting high-risk indigenous and rural populations.
Objective. This study aimed to evaluate the impact of PrEP on the reduction of wild-type rabies incidence in Peru between 2011 and 2024, and to describe the characteristics of the vaccinated population in primary health care facilities in the regions of Amazonas, Loreto, Junín, and Cusco during 2019–2024.
Methods. A retrospective time-series analysis was conducted using national surveillance records of human wild-type rabies.
Results. Annual incidence rates per 100,000 inhabitants were calculated based on INEI population projections. Additionally, vaccination databases were analyzed to identify regional and age-group trends. In 2011, the first year of implementation, 20 cases were reported (0.069/100,000), the highest in the series. From 2012 to 2014, cases progressively declined to zero, with a

resurgence in 2016 (15 cases; 0.048/100,000) followed by a new decrease and stabilization at very low levels from 2017 onward. During 2017–2024, the annual average was 0.5 cases, with rates ≤0.01/100,000 in most years. More than half of the years after 2016 reported no cases, indicating a sustained impact. Amazonas showed a continuous increase in vaccinated individuals, Loreto initially concentrated the largest coverage, and Junin and Cusco reflected progressive expansion.

Conclusions. The evidence confirms that PrEP has been a determining factor in reducing wild-type rabies in Peru. Its continuity, together with active surveillance and a One Health approach, will be essential to consolidate progress and advance toward the elimination of the disease.

Mesa Redonda 2: Uniendo fuerzas contra la rabia salvaje en la Amazonía/ Round Table 2: Joining Forces Against Wild Rabies in the Amazon/ Mesa Redonda 2: Unindo forças contra a raiva selvagem na Amazônia

Moderadores /Moderators/ Moderadores:
Drs. Felipe Rocha & Marco Vigilato

DECLARACIONES DE PANELISTAS/ DECLARAÇÕES DOS PAINELISTAS/STATEMENTS BY PANELISTS

BOLIVIA
Dr. Grover A. Paredes Martínez
Unidad de Prevención y Control de Enfermedades, Ministerio de Salud y Deportes, Bolivia.

Actualmente, se cuenta con un programa de seguimiento de los casos de rabia silvestre en ganado bovino, el cual forma parte del Servicio Nacional de Sanidad Agropecuaria e Inocuidad Alimentaria (SENASAG), dependiente del Ministerio de Desarrollo Rural y Tierras, y se implementa conforme a los protocolos estabelecidos por esta institución.
Oportunidades:
Existe un trabajo conjunto entre el SENASAG, el Ministerio de Salud y Deportes (MSyD), los Servicios Departamentales de Salud (SEDES) y los Centros Municipales de Zoonosis (CEMZOO) ante la ocurrencia de casos de rabia silvestre. Esta coordinación permite la ejecución de acciones de investigación de casos, tanto en humanos (contacttos y aplicación de profilaxis) como en animales (prevención y control).
Debilidades:
Se identifica una débil investigación de las áreas con presencia de *Desmodus rotundus* (murciélago hematófago), lo cual limita el análisis conjunto del riesgo entre instituciones. Asimismo, existe una cobertura insuficiente de la profilaxis preexposición con vacuna antirrábica en las comunidades en riesgo por parte del MSyD y los SEDES.
Conclusiones: Ambos temas como rabia en perros y rabia silvestre son de prioridad en la prevención, control y eliminación con sostenibilidad de actividades en todos sus ejes. La rabia el 100% letal pero 100% prevenible.

BRASIL
Dr. Fernanda Voietta Pinna
Secretaría de Vigilancia en Salud y Ambiental, Ministerio de Salud, Brasil

Observa-se no Brasil uma mudança no perfil epidemiológico da raiva, com

redução dos casos transmitidos por cães e aumento dos casos associados aos animais silvestres, principalmente morcegos. Entre 2015 e 2025 foram notificados 36 casos de raiva humana, sendo apenas 1 (2,8%) por cão doméstico e todos os demais por animais silvestres, sendo 63,9% deles por morcegos. A vigilância da raiva em mamíferos silvestres foi introduzida nos serviços de saúde brasileiro a partir do ano 2000, e os mais importantes registros de surtos de raiva humana por morcegos hematófagos na região amazônica ocorreram em 2004 e 2005, nos estados do Pará e Maranhão. Nos últimos 10 anos, foi observado aumento dos casos de raiva em populações ribeirinhas da Amazônia Legal e uma alta frequência de espoliação por morcegos hematófagos em áreas indígenas. Frente a essa situação, o Ministério da Saúde vem implantando políticas públicas voltadas a essas populações, a exemplo da PrEp em comunidades de difícil acesso e na melhoria do fluxo de informações da saúde indígena. Apesar dos avanços, ainda há muito a ser feito, especialmente nas áreas indígenas, que passaram a notificar as espoliações por morcegos hematófagos a partir do ano 2022 nos sistemas oficiais, até então desconhecidas.

PERÚ
Dr. Moisés Apolaya
Dirección de Prevención y Control de Enfermedades Metaxénicas y Zoonosis, Ministerio de Salud, Perú

Desde la perspectiva del Ministerio de Salud reconoce que la rabia silvestre sigue siendo una amenaza para la salud pública y que nuestra vigilancia aún no es óptima, debido a serias barreras de acceso, dispersión geográfica, conectividad limitada y rotación de personal en territorios amazónicos y altoandinos. A ello se suma el incremento de brotes de rabia bovina transmitida por *Desmodus rotundus* en regiones como Loreto, Ucayali, Amazonas, San Martín, Huánuco, Cusco y Puno, que afecta la producción ganadera y eleva el riesgo de exposición humana. Pese a avances en articulación intersectorial y en protocolos con enfoque intercultural, persisten subregistro y demoras en la notificación y respuesta. La idea es poder fortalecer un modelo Una Salud con vigilancia comunitaria activa, brigadas móviles y uso de tecnologías simples para incrementar el reporte oportuno; así como ampliar la profilaxis pre-exposición en poblaciones de riesgo, incrementando extensión y cobertura con cadenas de frío adaptadas; y consolidar alianzas con gobiernos regionales, locales y organizaciones indígenas para intervenciones culturalmente pertinentes.

COLOMBIA

Dra. Stephany Yepes
Subdirección de Salud Ambiental, Ministerio de Salud y Protección Social, Colombia

La rabia silvestre en la región amazónica colombiana —que comprende Amazonas, Putumayo, Caquetá, Vaupés, Guainía y Guaviare— representa un desafío de salud pública por las características epidemiológicas de la zona: alta dispersión poblacional, presencia de múltiples reservorios silvestres y comunidades indígenas con acceso limitado a servicios de salud. Colombia, con el apoyo técnico de la OPS, desarrolló en años previos una intervención piloto basada en el enfoque de Una Salud que incluyó focalización de comunidades en riesgo, esquemas de vacunación antirrábica pre-exposición, vigilancia epidemiológica comunitaria y estrategias educomunicativas intersectoriales. Las lecciones aprendidas de esta experiencia constituyen insumos valiosos para el diseño de futuras intervenciones sostenibles, tanto en la Amazonía como en otras zonas del país con barreras geográficas y culturales similares.

Un elemento crítico es que la rabia silvestre no reconoce fronteras político-administrativas. Las comunidades indígenas amazónicas habitan territorios que trascienden límites nacionales, lo que exige estrategias binacionales y trinacionales coordinadas con autoridades indígenas, culturalmente apropiadas y orientadas al fortalecimiento de capacidades locales para garantizar el acceso oportuno a profilaxis post-exposición.

Persisten barreras estructurales y epidemiológicas significativas: la dispersión geográfica extrema, situaciones de orden público que limitan el acceso a comunidades, la minería ilegal que altera ecosistemas y aumenta el contactto humano-fauna silvestre, y la condición de país megadiverso con vacíos importantes en la caracterización de especies reservorias. Si bien existen esfuerzos institucionales para documentar la biodiversidad nacional, el conocimiento sobre la ecología de los quirópteros hematófagos y otros potenciales reservorios en la Amazonía aún es limitado, lo que dificulta estrategias de vigilancia y control más precisas. Abordar estos determinantes requiere coordinación sostenida con la OPS y sus Centros Colaboradores, así como articulación intersectorial con instituciones científicas nacionales mediante agendas regionales integradas

Sesión de Pósters 2 / Posters 2 / Pósteres

21 de octubre / October / Octobre

Rabia en murciélagos, diagnóstico y herramientas moleculares, y desarrollo de vacunas/ Bat rabies, diagnostics and molecular tools, and vaccine development/ Raiva em morcegos, diagnósticos e ferramentas moleculares e desenvolvimento de vacinas

RABIES IN THE AMERICAS

RITA 2025 Rabia en las Américas PERÚ

P2.1. Distribuição geográfica da raiva em morcegos não hematófagos na cidade do Rio de Janeiro-RJ, Brasil, no período de 2015-2025.

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Palavras Chave. Vigilância Passiva, Morcego não hematófago, Raiva, Epidemiologia, Rio de Janeiro

Introdução: Recentemente, o Brasil alcançou o controle da raiva urbana através das ações previstas no Programa Nacional de Controle da Raiva (PNCR) implantado em 1973 objetivando eliminar a raiva humana transmitida por cães e gatos. Entretanto, nos últimos anos, o aumento da detecção de casos de raiva transmitido por morcegos vem aumentando, representando um novo cenário epidemiológico da doença no Brasil.
Objetivos: Este trabalho objetivou realizar um diagnóstico de situação da ocorrência da raiva em morcegos no município do Rio de Janeiro.
Métodos: Foi realizada uma análise retrospectiva de casos de raiva em morcegos não hematófagos enviadas pelo Centro de Controle de Zoonoses Paulo Dacorso Filho para o Centro Municipal de Medicina Veterinária Jorge Vaitsman, no período de 2015 a junho de 2025, provenientes dos bairros do município do Rio de Janeiro-Rio de Janeiro, Brasil. As amostras foram separadas por localização nos 165 bairros da cidade e 33 regiões administrativas (RA), a fim de se fazer o mapeamento das amostras positivas, visando o planejamento das ações de vigilância e controle da doença.
Resultados: No período avaliado foram encaminhadas 1931 amostras de morcegos não hematófagos. Dessas, 113 (5,85%) foram positivas para o vírus da raiva e, em sua totalidade, provenientes de morcegos da espécie

Artibeus lituratus de; 1707 (88,40%) resultaram negativos e 111 (5,75%) foram consideradas inapropriadas e foram descartadas. Os bairros com maior ocorrência foram Campo Grande (8) , Grajaú (7) e Barra da Tijuca (7) de um total de 54 bairros (32,72%) com ocorrência somando 22 casos (19,46%) dentre os 113 totais.
Conclusões: A doença foi detectada em 1/3 dos bairros e exclusivamente no morcego *Artibeus lituratus*. A vigilância passiva realizada pela população vem aumentando e medidas de educação em saúde devem ser implementadas para incrementar a vigilância da doença.

P2.2. Espoliações Causadas por Morcegos Hematófagos em Comunidade do Alto Rio Negro, Amazônia Brasileira.

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Palavras-chave: Raiva; Desmodus rotundus; Espoliações; Profilaxia antirrábica; Amazônia Brasileira.

Introdução. A raiva é uma zoonose viral grave, transmitida principalmente pelo contato da saliva de mamíferos infectados com mucosas ou pele lesionada. No Brasil, os surtos de raiva por espoliação humana por morcegos hematófagos são atribuídos à espécie Desmodus rotundus, que se alimenta preferencialmente de sangue de mamíferos de médio e grande porte. Em situações de redução da disponibilidade desses hospedeiros, esses quirópteros podem atacar seres humanos, especialmente em áreas rurais e comunidades indígenas da Amazônia, onde predominam condições insalubres de moradia e a presença de abrigos naturais ou artificiais favoráveis à permanência desses quirópteros.

Objetivo. Este estudo descreve as ações de vigilância e resposta à raiva em áreas afetadas por espoliações por morcegos hematófagos em comunidades indígenas do Distrito Sanitário Especial Indígena Alto Rio Negro (DSEI-ARN), com ênfase nas medidas adotadas pelo Ministério da Saúde (MS) e pela Secretaria de Estado da Saúde do Amazonas (SES/AM).
Metodologia. Trata-se de um estudo descritivo com base nos registros de 2025, envolvendo 14 comunidades indígenas.
Resultados. As 100 espoliações notificadas, atingindo indivíduos de 2 a 75 anos, receberam a profilaxia pós-exposição (PEP) com vacina antirrábica. A vacinação pré-exposição (PrEP) foi ampliada para cerca de 600 pessoas, incluindo a imunização de 25 cães e 5 gatos. As ações abrangeram ainda captura de morcegos, busca ativa de casos retrospectivos (julho/2023 a julho/2025) para avaliar a vacinação e atividades de educação em saúde.
Conclusões. Considerando o histórico de surtos de raiva humana, por meio de política pública do MS, a PrEP foi incluída no calendário vacinal de populações indígenas da Amazônia, implementando as ações de manejo de morcegos e com previsão de expansão da estratégia para áreas circunvizinhas de difícil acesso. Nesse contexto, a vigilância integrada entre saúde humana, animal e ambiental é crucial para prevenir casos e responder de forma eficaz aos desafios da raiva silvestre no Brasil.

P2.3. Vampire Bats and Maize: Exploring Traditional Agricultural Practices with Implications for Rabies Management

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Keywords. Vampire bats, Traditional Ecological Knowledge, One-Health.

Introduction. In the Sacred Valley of the Incas (Cusco, Peru), vampire bats are perceived in a markedly different way than elsewhere, viewed as protectors of the region's most culturally and economically significant crop: maize. For generations, farmers in the Valley have used vampire bat guano to protect and fertilize maize seeds, associating the bats' presence with healthier crops and lower production costs.
Objective. Mapping the social and ecological dimensions of the traditional use of vampire bat guano, as a natural seed protector and fertilizer in maize cultivation, to assess its implications for community health, and bat conservation.
Methods. We employ interviews and ethnographic observation to characterize the cultural and practical aspects of this tradition across the Sacred Valley, qualitatively assessing its implications for human and bat health. In parallel, we have developed a preliminary analysis of vampire bat guano, examining its pathogenic and nutrient composition to explore its potential value.
Results. Current users of vampire bat guano and farmers with a family history of the practice maintain positive perceptions of bats and non-negative behavioral intentions, different from those registered in other rural communities in the area. The once-a-year extraction and the small quantities required in guano use could minimize the opportunities for direct human–bat contactt. However, the close connection between farmers and wildlife obscures recognition of the specific threats bats pose compared to other species, showing a lack of rabies risk awareness. The guano composition analysis shows a high salt content, which may inhibit fungal growth (protection) and a high nitrogen concentration (fertilization).
Conclusions. This preliminary mapping offers an overview of the tradition, initiating discussion on its implications for human and bat health, particularly concerning rabies risk and management. If proven effective, vampire bat guano could strengthen human–vampire bat relationships and support bat population surveillance.

P2.4. Notification of *Desmodus rotundus* attacks in an urban area in the capital of Maranhão, São Luís (Brazil)

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Keywords. *Desmodus rotundus*, One Health, Rabies virus, encephalitis, prophylaxis.

Introduction. The *Desmodus rotundus* is the main transmitter of rabies in Brazil and is typically found in rural areas. Their presence is well-documented in mangrove areas along the Brazilian coast, which makes us consider how the species might be maintained in urban environments. Reports of attacks by hematophagous bats in metropolitan areas are scarce. The presence of *D. rotundus* in urban areas of Maranhão's capital, combined with a lack of feeding options for these bats, could lead to the consumption of human blood, making it a public health concern that falls under the 'One Health' approach.
Objective. To monitor the presence of *Desmodus rotundus* in densely populated areas of Maranhão's capital using drone imagery and mist-net captures.
Methods. A capture operation was carried out at a small property in a neighborhood of São Luís, Maranhão. Real-time images and videos were obtained using a drone during a two-hour period of evaluation and animal surveillance. For bat captures, two mist nets were set up around a chicken coop. Another net was also placed near at the back of the residence.
Results. On July 4, 2025, the dispersion of the animals on the property was evaluated. It was possible to observe the proximity of large residential condominiums, the Maranhão State Legislative Assembly, and a large mangrove area. Seven bats were captured including one *Desmodus rotundus*, three *Sturnira lilium*, two *Artibeus hirsutus*, one *Phyllostomus hastatus*. There is an imminent risk of attacks on humans if the food source for these hematophagous bats disappears. The community should be sensitized to report cases of attacks on humans or pets.
Conclusion: The spatial evaluation of the property using a drone proved to be epidemiologically effective. Continuous monitoring of *D. rotundus* and other bats in urban areas is necessary to prevent the transmission of human rabies.

P2.5. La variante antigénica V3 asociada a Desmodus rotundus en el noroeste de México.

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Palabras clave: Inmunofluorescencia indirecta (IFI), Desmodus rotundus V3,

Introducción: En México, *Desmodus rotundus* murciélago hematófago del orden Chiroptera y familia Phyllostomidae, se encuentra distribuido en zonas tropicales, subtropicales y principalmente en áreas ganaderas todas como su fuente de alimento. Habitan en colonias de 50- 100 individuos en cuevas y minas al noroeste de México; se han identificados poblaciones en la parte sureste de Sonora (Álamos y Yécora). En México se ha utilizado la Inmunofluorescencia indirecta (IFI) como método de caracterización antigénica del virus de la rabia; utilizando el panel de 8 anticuerpos monoclonales donados por el CDC; esta metodología evidenciar a los reservorios que mantienen la enzootia de la enfermedad.
Objetivo: Aislar y caracterizar el virus de la rabia en cultivo celular (CCL-131, N2a del ATCC) de muestras sospechosas.
Materiales y métodos: En 2010 y 2018 se aisló y caracterizo el virus en dos murciélagos en la localidad de Guachochi, Chihuahua y Novojoa, Sonora. En 2016 y 2025 aislamos el virus de 2 *Desmodus rotundus* en Álamos, Sonora.
Resultados: En 2017 obtuvimos aislamientos de un asno y un bovino de Hermosillo y Álamos, Sonora, respectivamente; además, de un murciélago *Artibeus jamaicensis* en Zapotlán el Grande y un caso humano en El Salto, ambos en Jalisco. Los resultados de caracterización antigénica obtenidos de los aislamientos tuvieron en común la variante antigénica V3 asociada a *Desmodus rotundus*.
Conclusiones: La presencia del reservorio de la rabia *Desmodus rotundus* V3 mantiene la enzootia de la enfermedad en los estados de Chihuahua, Sonora y Jalisco desde el 2010 hasta 2025.

P2.6. Advancing Rabies Molecular Diagnostics: Evaluation of a compact automated extraction platform for use inside the Wadsworth Center rabies suite

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Keywords. Molecular, RT-PCR, Secondary

Introduction. The gold standard for rabies detection is the direct fluorescent antibody (DFA) test. While DFA is proven and reliable, it requires specialized training, equipment, and high quality, undegraded samples.
Results. Public health laboratories are increasingly adopting molecular testing using real-time RT-PCR methods to improve time-to-result and sensitivity. In some laboratories, including Wadsworth Center, PCR has already become the secondary testing method replacing the labor intensive tissue culture inoculation test and ethically questionable mouse inoculation test. However, this molecular transition could present major practical challenges.
Conclusions. In some rabies labs, staff are rarely trained in molecular assays and instrumentation. Molecular labs, meanwhile, do not have rabies-inoculated staff or space to perform animal necropsy, and their automated equipment is typically designed for high-throughput testing, which is a poor match to the low test volume of rabies samples.

P2.7. Punción retro-orbital en el diagnóstico post-mortem de rabia humana

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Palabras clave: Punción retro-orbital, *Desmodus rotundus* V3, Trucut con coaxial.

Introducción. México aisló el virus de seis casos confirmados de rabia humana; tres asociadas a *Desmodus rotundus* V3 en El Salto, Jalisco y Palo de Lima en Oaxaca en 2022; en 2024 la V5 en Benito Juárez, Q. Roo y tres V8 asociada a zorrillo en Aquila, Michoacán en 2024 y para 2025 la aislamos en Mezquital del oro, Zacatecas y Tonila, Jalisco.
Objetivo. Realizar el aislamiento y la caracterización antigénica del virus utilizando anticuerpos monoclonales donados por el CDC.
Métodos. Los aislamientos del virus de la rabia se realizaron infectando cultivos celulares (CCL-131, N2a del ATCC) con una suspensión del tejido cerebral (asta de Ammón, cerebelo y médula) al 20% en D-MEM y se hizo el seguimiento por Inmunofluorescencia directa (IFD) en los días 3, 6 y 9 de inoculación logrando así; la replicación el aislamiento y la caracterización del virus. Para los casos de Benito Juárez y Tonila, únicamente se trabajó con material biológico extraído por punción retro-orbital utilizando instrumental médico (Trucut con coaxial; aguja calibre 16 G X 20 cm de longitud), la cantidad de tejido obtenido fue de aproximadamente 0.5 g de masa encefálica, pues no se proporcionó encéfalo completo.
Resultados. De estas muestra se preparó una suspensión viral en D-MEM quedando a una concentración del 2%, con lo que se infectaron [3X106] células de N2-CCL-131/ATCC. Su seguimiento por IFD fue a los días 3, 6, 9, 12, y 15, logrando el aislamiento viral al día 12 de la infección; para su caracterización se prepararon portaobjetos de 8 pozos con células infectadas.
Conclusiones. La punción retro-orbital utilizando el instrumental médico Trucut con coaxial es una buena alternativa, cuando no contamos con el encéfalo completo.

P2.8. Technical evaluation of rapid kits for rabies diagnosis

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Keywords. rabies, diagnosis, immunochromatography, rapid test

Introduction. The European Union Reference Laboratory (EURL) for rabies regularly conducts a monitoring of rabies diagnostic tools that are available on the market. The offer of Lateral Flow Assays (LFAs), or immunochromatographic tests, is constantly enriched by many references that can be easily purchased. These LFAs are considered as rapid tests giving that they provide diagnostic results in generally 5 to 10 minutes and have the advantage to be easy to use. They do not request any special storage temperature and equipments making them adequate for field use or in laboratories with limited resources to carry-out rabies diagnosis.
Objective. The objective of the present study is to give a review of the technical performance of several commercially available rapid kits evaluated by the EURL during the past 6 years.
Methods. The immunochromatographic tests technical performance was estimated on infected/uninfected mammal brain samples obtained either experimentally or from collection of archived specimens tested in the frame of passive surveillance. Rapid kit results were compared to those obtained with the Fluorescent Antibody Test, a conventional gold standard technique.
Results. Whereas all rapid kits demonstrated quite good specificity indexes (not less than 97.8% and up to 100%), sensitivities of products were quite heterogeneous (with indexes ranging from 7% to 92.2%) as well as Cohen's Kappa values, a commonly statistical measure used to assess the agreement between two raters.
Conclusions. The present review is an additional demonstration of the uneven performance of LFAs that need to be validated, standardized and quality controlled. These kits are still not recommended as replacement of gold standard techniques, but their use may offer an alternative for on-site diagnosis to overcome limited animal surveillance in remote areas and resource-limited settings in a context of elimination of canine-mediated human rabies.

P2.9. Establecimiento de la técnica de rt-PCR en tiempo real en diferentes estructuras de cerebros de *Desmodus rotundus*, inoculados en cautiverio

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Palabras clave. Virus de la rabia, *D. rotundus*, RT-qPCR, Genoma, Copias virales, Estructuras anatómicas.

Introducción. La rabia, es una encefalomielitis progresiva aguda y mortal, a la fecha en América Latina el principal transmisor es el *Desmodus rotundus*. La capacidad de diagnosticar con rapidez y precisión la infección puede ser vital y un método que ofrece estas ventajas es la detección del material genético mediante RT/PCR. Cuando este ensayo es cuantitativo (RT-PCR en tiempo real) permite conocer la concentración de copias virales presentes en una muestra. Se ha demostrado que es tan específica como la inmunofluorescencia directa.

Objetivo. Determinar el número de copias del genoma del virus de la rabia mediante RT-PCR en tiempo real en diferentes estructuras de cerebros de *Desmodus rotundus* inoculados experimentalmente con virus de rabia homólogo.

Métodos: Los murciélagos se inocularon con 106 por vía intra escapular. Se diseccionó el cerebro de los vampiros en cuatro estructuras seccionadas sagitalmente. Se realizó la extracción de ARN de cada porción, para determinar el número de copias del genoma del virus de la rabia en cada sección; se empleó un ensayo de RT-PCR en tiempo real utilizando una sonda tipo TaqMan y un par de iniciadores que amplifican un fragmento del gen N del virus.

Resultados: Para la cuantificación se realizó una curva de calibración con un transcrito in vitro del mismo gen, los resultados demostraron que en la parte posterior del cerebro y en el cerebelo de *D. rotundus* se encontraron una mayor cantidad de partículas virales.

Conclusiones: Estas deberían ser las estructuras por excelencia, para detectar al virus en el principal transmisor de la rabia en México y en otros países de América Latina.

P2.10. Structural Equation Modeling of Human Rabies Prophylaxis in São Paulo: A Latent Variable Approach

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Keywords. Post exposure prophylaxis, Rabies vaccine, Multivariate Analysis.

Introduction. Rabies is a neglected and deadly zoonosis that affects all mammals. Prevention can be achieved through pre-exposure and post-exposure protocols using rabies immunobiologicals .
Objective. This study was to investigate the interactions between variables observed in the notification forms of rabies treatment in the state of São Paulo from 2013 to 2017, and the latent variable representing the potential exposure to rabies in patients who received treatment, using Structural Equation Modeling (SEM).
Methods. Based on data from 572,889 notification forms, a structural model was developed, which showed acceptable fit indices: SRMS = 0.028, RMSEA = 0.061 (95% CI: 0.061–0.0616), CFI = 0.970, and TLI = 0.954. The antecedent variables with the highest standardized regression coefficients for the latent variable of potential exposure to rabies were animal condition (β = 0.627; $p < 0.00001$) and animal observation (β = -0.349; $p < 0.00001$).
Results. Among the consequent variables, the highest factor loadings were current treatment (β = 0.936; $p < 0.00001$), number of doses (β = 0.774; $p < 0.00001$), animal outcome (β = 0.575; $p < 0.00001$), and treatment with rabies serum (β = 0.546; $p < 0.00001$).
Conclusion. Was concluded that the structural model used is valid for estimating variables involved in human rabies prophylaxis, demonstrating a relationship between the profile of the aggressor animal and the potential exposure to the rabies virus, which can be measured by the type of treatment indicated.

P2.11. Pseudotyped Baculoviruses with Chimeric Rabies Glycoprotein G: An Innovative Platform to Activate Innate and Cellular Immunity

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Keywords. Rabies, Pseudotyped baculovirus, Glycoprotein G, dendritic cells (BMDC), cellular immunity.

Introduction. Rabies remains a lethal zoonosis of high priority in both public and veterinary health, driving the search for safe and innovative vaccine platforms capable of eliciting immune responses that extend beyond humoral responses. Among emerging technologies, pseudotyped baculoviruses expressing chimeric designs of the rabies virus glycoprotein G (gG) stand out for their biosafety and immunological potential.
Objective. To evaluate the ability of three pseudotyped baculoviruses carrying different chimeric gG designs (gG-TM, gG-AN, and gG-FL) to induce innate and cellular immune responses in a murine model.
Methods. BALB/c mice were immunized intraperitoneally using a prime–boost regimen on days 0 and 14, while a control group received PBS. On day 28, splenocytes were harvested for ELISpot assays measuring IFN-γ and IL-4 secretion. In parallel, bone marrow-derived dendritic cells (BMDCs) were analyzed by flow cytometry to assess activation through MHC-II, CD40, CD86, and CD80 expression after in vitro stimulation.
Results. The gG-FL variant significantly increased the frequency of IFN-γ–producing cells compared with gG-AN ($p = 0.04$), gG-TM ($p = 0.006$), and control, indicating a clear Th1-biased response. All variants promoted BMDC activation, with upregulation of MHC-II, CD40, and CD86. Notably, gG-FL and gG-AN induced higher CD80 expression, suggesting enhanced antigen-presenting capacity and stimulation of adaptive immunity.
Conclusions. Pseudotyped baculoviruses expressing chimeric rabies gG variants, particularly gG-FL, effectively activate innate and cellular immune

responses with Th1 predominance. These results support their potential as an innovative vaccine platform against rabies, supporting regional initiatives for rabies elimination across the Americas.

P2.12. Optimization of the production of a pseudotyped baculovirus with the rabies virus glycoprotein G

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Keywords. Rabies vaccine, Baculovirus, Glycoprotein G, Viral titer, Optimization.

Introduction. Baculoviruses are widely used in research and have been consolidated as promising vaccine vectors by displaying antigens on their surface through pseudotyping. Optimizing production parameters is essential to maximize productivity.
Objective. Optimize cell culture conditions and the multiplicity of infection (MOI) for the production of a baculovirus pseudotyped with the rabies virus glycoprotein G (FarvacRab).
Methods. Sf-9 insect cell cultures were infected at different cell densities and MOIs, and production was further evaluated in cultures with presence or absence of 5% fetal bovine serum (FBS). Cultures were analyzed at 24, 48, and 72 hours post-infection (hpi) by cell counting, viral titration through plaque assay, and gG detection by Western blot; all assays were performed in triplicate.
Results. Results showed that higher titers of Farvac-RAB (4×10^8 PFU/mL) and gG expression were obtained at 48 hpi in cultures seeded at 2.5×10^6 cells/mL. Variation in MOI did not significantly affect viral titers; however, a MOI of 0.4 yielded higher gG expression. In the absence of FBS, titers decreased by an average of 63.6%.

Conclusions. The optimal condition for baculovirus production was a density of 2.5×10^6 cells/mL with a MOI of 0.4 and harvest at 48 hpi. The absence of FBS significantly reduced yield, a relevant aspect for the design of serum-free vaccine formulations. These parameters favor high viral titers and are adaptable to medium-scale and large-scale processes for the production of a potential rabies vaccine.

P2.13. Evaluation of concentration strategies for a baculovirus pseudotyped with the rabies virus glycoprotein G

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Keywords. Rabies, vaccine, Pseudotyped baculovirus, Downstream processes, Concentration.

Introduction. Rabies remains a significant threat to both public and veterinary health, underscoring the need for safe and cost-effective vaccines. Among emerging strategies, pseudotyping baculoviruses with the rabies virus glycoprotein G (gG) (FarVac-RAB) represents a safe and versatile alternative to traditional platforms. The performance of this technology, however, relies on downstream processes capable of concentrate and purify viral particles while preserving their integrity and functionality.
Objective. In this study, we evaluated the recovery yield of three laboratory-scale concentration methods for FarVac-RAB baculovirus.
Methods. A sucrose density gradient ultracentrifugation, tangential flow filtration (TFF), and ultrafiltration using a 10 kDa cutoff membrane were used in FarVac-RAB baculovirus. Glycoprotein G integrity was assessed by western blot, and pseudotyped baculovirus recovery was determined by plaque assay.
Results. All methods achieved recovery rates above 50%. Ultrafiltration reached 62%, whereas TFF and ultracentrifugation yielded 54% each. Although differences were not statistically significant, TFF provided the most

favorable balance between operational efficiency and scalability; ultrafiltration was suitable for small volumes (50–200 mL) with good yield; and ultracentrifugation produced the purest concentrate by removing fetal bovine serum, despite longer processing times and limited scalability.
Conclusions. These findings suggest that the optimal concentration method should be selected according to the stage of vaccine development: ultrafiltration for early formulation studies, TFF for process scale-up, and ultracentrifugation when purity is critical. This work contributes to the optimization of downstream processing for baculovirus-based rabies vaccines.

P2.14. Improving rabies virus production as antigen for horse anti-rabies immunization to enhance the serum manufacturing at Instituto Butantan

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Keywords. Anti-rabies serum, Rabies virus, Improvement, Post-exposure prophylaxis, Rabies virus production.

Introduction. Rabies is a lethal viral zoonosis that remains a significant public health concern, especially in regions with limited access to post-exposure prophylaxis. Anti- rabies serum is essential therapeutic for preventing death after virus exposures. In Brazil, Instituto Butantan is the only certified producer of anti-rabies serum. However, recent rabies virus production process presented operational issues, showing low virus productivity affecting the delivery of immunoglobulin to Brazilian Ministry of Health.
Objective. The objective was to optimize the rabies virus production process, a critical step in the manufacturing of anti-rabies immunoglobulin and enhance the delivery of anti-rabies serum to Brazilian Ministry of Health.

Methods. We evaluated cell expansion steps as cell bank quality, culture media, temperature, % CO2 and number of cell passage. For virus production, we evaluated the virus bank, temperature, pH, volume, MOI, time of infection, time and number of harvest processes. We also evaluated the virus concentration and purification parameters.

Results. Low productivity with viral titers below 102-3 FFD_{50}/mL was observed (2021- 2022). We setup new parameters for the entire production process to reach satisfactory yields on virus and antigen production. After systematic optimization of the process parameters, 103 – 104 fold increases in viral yield per harvest were obtained, with average titers reaching 105-6 FFD_{50}/mL. The annual virus production increased from 2,7 millions (2021) to 8,7 billions (2024) of total virus particles. Robustness and reproducibility of the process were strongly improved, enabling routine and a more cost- effective production of rabies viruses and anti-rabies immunoglobulins.

Conclusions. In conclusion, optimization processes of production led to a strong improvement in rabies virus yields, directly impacting the efficiency of rabies virus manufacturing and, consequently, anti-rabies serum production. These findings allowed the routine delivery of anti-rabies serum to Brazilian Ministry of Health, contributing to broader access to a life-saving immunobiological treatment.

22 de octubre / October / Octobre

Sesión Oral/ Oral Session / Sessão Oral





O3.1. Proposing a system for rabies detection in terrestrial wild mammals in Guatemala

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Keywords. Surveillance, Spillover, Molecular characterization, Wildlife

Introduction. Canine rabies control and elimination is ongoing in Guatemala with almost cero official cases in dogs in the last five years. However, there is evidence of rabies canine variant spillover to livestock and wildlife.
Objective. Evaluate the use of wildlife roadkill surveillance to detect rabies circulation in animal populations in areas with high domestic animal-wildlife contact rate (i.e livestock farming and ranching areas) in where rabies outbreaks in cattle are reported.
Methods. In rabies high risk defined areas, in the Peten department, transects of approximately 30 km over the roads were selected and transited once a day during three consecutive days to collect encephalic tissue of roadkill mammals find in the path. Samples were collected, stored and transported to the CES lab using operative standard procedures for rabies detection. Samples suitable for rabies diagnosis by LFD and PCR techniques were tested.
Results. In one month of the pilot survey, a total of 232 dead animals were spotted, 150 domestic species and 74 wild species. Of these, only 11 met the testing criteria, and were screened for rabies. All LFD tests were negative, and two of the samples were positive by PRC test. Further sequencing of the positives is needed.
Conclusions. The roadkill sampling allows to detect cases in species that are not included in the rabies national surveillance system, and it could be provide evidence of the circulation of the canine variant in the Guatemala animal populations.

O3.2. The westernmost detection of Lyssavirus rabies raccoon variant in the United States: Genomics as a tool for rabid pet source tracking

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Keywords. Lyssavirus rabies, population genomics, phylogenetics, domestic cat, raccoon variant

Introduction. In the United States, the predominant source of human and pet exposure to Lyssavirus rabies is the raccoon (Procyon lotor) variant (RRV). While the northern raccoon is the reservoir of RRV, spillover infections of unvaccinated pets can increase human exposure risk. In September 2023, a rabid 6-week-old domestic cat (Felis catus) was found in Omaha, Nebraska, USA. The cat was confirmed positive for RRV, a detection over 1000 km from the closest known case in the eastern USA. A large, multi-agency emergency response was mobilized to contain this possible outbreak.
Objective. Our objective was to determine if the rabid cat was infected locally, or a recent translocation, using cat and RRV genomic data.
Methods. Genomic DNA from the rabid cat was genotyped using the Wisdom Panel™ proprietary single nucleotide polymorphism (SNP) genotyping array.

Genetic cluster analysis was used to determine probable geographic origin through comparison to a database with more than 60,000 cat genotypes. The RRV nucleoprotein and glycoprotein genes were sequenced, and a phylogenetic tree was constructed with RRV sequences from enzootic regions of the eastern USA.

Results and Conclusions. The rabid cat was a high probability match to genotypes from the eastern USA. The most similar RRV sequences to the infected cat virus were from the southeastern USA. Neither dataset indicated origins of the cat, nor RRV, in Nebraska or other midwestern states. The combined datasets suggested the cat was a recent translocation and likely infected in an eastern state. To date, there have been no further detections of RRV in Nebraska indicating low risk for RRV transmission in raccoon populations. We discuss how domestic cats are an increasingly recognized rabies exposure risk and how pet population genomic data can be valuable to rabies molecular epidemiology and wildlife rabies management.

O3.3. Ecology and Epidemiology of Vampire Bat-borne Rabies

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Keywords. Americas, bat-borne rabies, *Desmodus rotundus*, rabies ecology, cattle.

Introduction. Rabies virus (RABV) threatens public health and livestock economies in the Americas, with Desmodus rotundus as the primary wildlife transmitter to cattle. Up-to-date, continent-wide research on its ecology and the most extreme cases. Peru, El Salvador, and Brazil exhibited correlation between rabies incidence in vampire bats followed by rabies reports in cattle (R=0.73, p=0.01). Use of anticoagulants for *D. rotundus* control showed up to 100% of bat lethality, but anticoagulant effectiveness for rabies control remains questionable. Climate change analyses revealed potential northward expansion of *D. rotundus* in response to reduced differences among seasonality in the Northern Hemisphere, supporting expansion of RABV spillover risk in northern North America.
Conclusion: Rabies transmission by *D. rotundus* is increasing in the Americas due to ecological, epidemiological, and climatic factors. Revising current bat control methods and implementing integrated, multi-species surveillance are crucial to reduce the growing outbreak risk driven by climate-related range shifts.

O3.4. Comparative rabies diagnostic findings in gestating mongooses and a bat

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Key words: Mongoose, Bats, DFA, LFD & PCR.

Introduction. Rabies is a fatal viral encephalitis affecting mammals worldwide. In Puerto Rico, the small Indian mongoose (Urva auropunctata) is the primary reservoir, while rabies in bats remains poorly documented.
Objective. To describe the findings from three incidental cases involving gestating specimens: two mongooses and one bat, from distinct regions of the

island analyzed at the Puerto Rico Public Health Laboratory (PR PHL) using three different diagnostic methodologies.

Methods. Three diagnostic tests used were: lateral flow device (LFD), direct fluorescent antibody (DFA), and real-time reverse transcription polymerase chain reaction (RT-PCR) assay for rabies (LN34). LFD and LN34 were performed per CDC protocol. Brainstems and cerebellum were extracted when possible; umbilical cords from mongoose fetuses were tested by LN34 only

Results. Adult female mongooses 27-2024 and 45-2025 tested positive by LFD and DFA. Mongoose 45-2025 was also positive by LN34, while her two fetuses tested negative across all assays. Fetuses from mongoose 27-2024 tested negative by LFD and DFA; LN34 yielded two inconclusive and two positives. All six umbilical cords tested with LN34 gave inconclusive results. In the bat case, all tests on mother and fetus were negative.

Conclusions. Although LN34 detected rabies virus RNA in fetal and cord tissues, this likely reflects cross-contamination during extraction rather than true infection. Despite using sterile equipment for each fetus, contamination-free retrieval from infected mothers remains uncertain. The absence of neural connections between mother and fetus argues against in transplacental transmission, a conclusion reinforced by negative DFA results. Further support comes from Ct value analysis: fetal and cord samples, whether inconclusive or positive consistently showed high values, more indicative of contamination than true viral presence. These findings underscore the importance of stringent molecular protocols and cautious interpretation of molecular results especially when investigating potential novel transmission routes.

O3.5. Evidencia de transmisión sostenida sugiere a Potos flavus como reservorio de un antiguo linaje de rabia, relacionado con el clado de murciélagos

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Palabras clave: Filogenia, RABV, Potos flavus, Divergencia genética, linaje, reservorio

Introducción: El virus de la rabia (RABV) se mantiene en ciclos silvestres, principalmente asociados a quirópteros y mesocarnívoros. En el sureste peruano, se documentó infección por RABV en Potos flavus, mamífero arborícola considerado un hospedero no convencional, lo que plantea la necesidad de establecer si estos casos representan eventos recientes de spillover o la circulación de un linaje propio.
Objetivo: Caracterizar filogenéticamente el RABV en P. flavus y evaluar su relación con linajes de murciélagos y otros mamíferos silvestres.
Métodos: Se analizaron 23 genomas de RABV de P. flavus (Cusco y Madre de Dios, 2002–2022). La matriz de datos (n=1868) incluyó secuencias del gen de la nucleoproteína (>300 nt) y genomas completos de RABV de murciélagos y otros mamíferos americanos. Se aplicó la clasificación de linajes MADDOGv3, y se realizó una reconstrucción filogenética por máxima verosimilitud (ML) y por métodos bayesianos en IQ-TREE2 (1,000 bootstrap) y MrBayes (7×10^6 generaciones MCMC), respectivamente. Se estimaron las distancias patrísticas en R.
Resultados: El análisis con MADDOG reveló que RABV de P. flavus (Perú) no pertenecen a linajes previamente descritos. La filogenia por ML y bayesiana mostró un clado monofilético (bootstrap=100; PP=1) compuesto por dos subgrupos geográficos (Cusco y Madre de Dios). Este clado forma una politomía con murciélagos insectívoros, *Cebus apella* y *P. flavus* de Brasil (PP=0.999). Las distancias patrísticas (≈0.05; percentil >95%) evidenciaron

divergencia significativa.
Conclusión: El RABV de *Potos flavus* (Perú) corresponde a un linaje filogenéticamente independiente con divergencia significativa respecto a virus que circulan actualmente en murciélagos insectívoros y otros hospederos silvestres. La estructura en subclados monofiléticos, congruente con la segregación geográfica de las poblaciones de *P. flavus*, y la ausencia de una asociación con variantes recientes respaldan una circulación prolongada y apoyan la hipótesis de un salto de hospedador antiguo.

O3.6. Rabies in Canada, 2013 - 2022: A decade in review.

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Keywords. Rabies, zoonoses, surveillance, One Health, Public Health

Introduction. In Canada, rabies virus is maintained in specific wildlife reservoirs, with occasional spillover to domestic animals and, rarely, humans. Despite its low incidence, rabies remains a priority due to its high fatality rate, and high cost of post-exposure prophylaxis (RPEP).
Objective. This 10-year review examines national trends in human and animal rabies cases to support evidence-based decision-making, inform One Health stakeholders of evolving rabies virus variant (RVV) patterns, and highlight public health (PH) risks.
Methods. As a nationally reportable disease, rabies diagnostic testing and RVV identification is performed by the Canadian Food Inspection Agency (CFIA) for suspect animal and human cases. Provinces and territories lead comprehensive animal rabies control programs (including wildlife surveillance in some jurisdictions), disease investigations, risk assessments, sample submission to CFIA, and RPEP in humans. This analysis reviewed all rabies cases confirmed between January 1, 2013, and December 31, 2022, using descriptive methods.

Results. Between 2013 and 2022, CFIA tested 27,330 animal samples, confirming 1,634 rabies cases. Wildlife consistently accounted for the vast majority of these cases (1,499 [91.7%]), while the remaining 135 (8.3%) consisted of livestock and companion animals (dogs, cats, horses). Most animal samples were submitted following potential human exposures. Canada reported one domestically-acquired human rabies case in 2019, linked to a bat exposure. To prevent human cases, significant PH resources are dedicated to assessing exposures and administering RPEP. Of the nine reporting jurisdictions, the highest average annual RPEP initiation rates per 100,000 were in the Northwest Territories (26.7), Ontario (17.0), and Saskatchewan (13.1).
Conclusion. This 10-year review highlights the ongoing burden on public health systems due to the continued presence of rabies in wildlife in Canada. It reinforces the need for a strong coordinated approach to surveillance and control efforts, and timely risk assessments, to mitigate the risk of rabies transmission and ensure rapid response to emerging threats.

O3.7. Recent developments in rabies epidemiology in Canada

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Keywords. Rabies, Surveillance, Canada, Wildlife, Incursions

Introduction. Rabies, specifically wildlife rabies, poses a significant public health concern in Canada due to the potential for animal and human exposure and associated economic losses including control operations and human postexposure prophylaxis.

Objective. This presentation will provide an overview of rabies epidemiology in Canada for January 2024 to July 2025, highlighting events including new incursions of raccoon and fox variant rabies virus, as well as an indigenously acquired human rabies case.
Methods. Testing data (including from fluorescent antibody, direct/indirect rapid immunohistochemistry, and RT-PCR tests, along with antigenic and molecular variant typing) were compiled from laboratories of the Canadian Food Inspection Agency and the provinces of Ontario and Quebec.
Results. The CFIA laboratories tested 4172 samples. Two hundred and sixty (6.2%) tested positive; of these, 82 (31.5%) were confirmatory tests on wildlife surveillance samples from Ontario and Quebec. Another 18 cases positive on immunohistochemistry were reported but were not submitted to CFIA for confirmatory testing. After15 years without a detection of the raccoon rabies virus variant (RRVV) in Quebec, a new incursion (n= 41) has been detected in southern part of the province, near the Vermont border. Although arctic fox rabies virus variant (ARVV) cases declined in 2024 (n= 3, 12 in 2023), case detection increased in 2025 (n= 19), notably with some in areas of ON and QC that have not seen cases over a decade. Bat cases have continuously increased (79 in 2023, 126 in 2024). Nine human suspect cases from 5 provinces were investigated with various tests. Of these, one linked to a bat exposure in Ontario was positive.
Conclusions. Re-incursion of RRVV, increased ARVV and bat cases, and the recent human rabies case illustrate the animal and public health threats posed by wildlife rabies in Canada. All stakeholders' active contribution is critical to preventing human and animal deaths, and economic losses.

O3.8. Saguis: risco crescente de transmissão da raiva na cidade de São Paulo

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Palavras chave. Callithrix, Vacina antirrábica, Cuidados Médicos.

Introdução. A rotina de um Centro de Referência para a profilaxia da Raiva Humana no maior centro urbano do país tem enfrentado uma expressiva parcela de acidentes com animais silvestres, em especial saguis (Callithrix spp).
Objetivos. Ratificar numericamente esta maior incidência e alertar para as devidas consequências.
Métodos. Análise retrospectiva dos casos atendidos no IIER entre 01/01/2023 e 30/06/2025, a partir das anotações em prontuário e fichas de notificação (SINAN).
Resultados. De um universo de 2.120 atendimentos pós-exposição a acidentes da "Categoria 3", 382 (18,0%) envolveram animais silvestres, dos quais 246 eram saguis. O número absoluto e o percentual de acidentes com saguis aumentou de 86 (10,5%) em 2023 para 94 (12,0%) em 2024 e 66 (12,7%) só no primeiro semestre de 2025. A mediana do tempo entre a exposição e o atendimento médico destes 246 pacientes foi dois dias (entre 0 e 33), sendo que em 90,7% dos casos as lesões corporais eram únicas. Soro antirrábico humano (SAR) foi administrado a 112 pacientes (45,5%), enquanto 134 (54,5%) receberam imunoglobulina humana antirrábica (IGHAR), sempre associados à prescrição do esquema vacinal completo (VERO 0-3-7-14). A dose total do imunobiológico (calculada em função do peso de cada pessoa) foi integralmente infiltrada na lesão em cinco pacientes (2,0%), enquanto na grande maioria (93,1%) o volume residual foi complementarmente administrado por via intramuscular; outros 11 (4,5%) receberam a dose total exclusivamente por via sistêmica. Antibióticos foram prescritos a 51 indivíduos (20,7%); 162 (65,9%) receberam profilaxia vacinal para tétano e 12 (4,9%) precisaram da imunoglobulina antitetânica. Não foi realizada profilaxia para herpesvírus ou hepatite virais em nenhum caso.
Conclusão. Este aumento expressivo de acidentes com primatas atendidos num serviço eminentemente urbano merece preocupação e conduta especializada não apenas pelo risco de transmissão da raiva, mas também por outras doenças associadas a estes animais.

O3.9. Progress in elimination of fox-mediated rabies in Türkiye

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Keywords. Türkiye, fox, Rabies, Oral vaccination

Introduction. Türkiye is considered the only European country with dog-mediated rabies and regular dead-end spill-over infections in wildlife and livestock. Since the 1980s, intensified efforts were implemented to control the disease and the number of reported cases dropped from 2,260 in 1981 to 128 in 1998. These efforts were jeopardized in 1999 when a sustained spill-over event from dogs to foxes occurred near Izmir, a city on the west coast. From here, fox-mediated rabies spread approximately 700km eastwards and the disease re-appeared in areas that had been free of rabies for many years. The number of cases started to increase again and reached a peak in 2014 (n=737).

Objective. To control fox-mediated rabies using oral vaccination (ORV) in Türkiye.

Methods. During a large EU-funded rabies research project the feasibility of ORV was investigated (2008 – 2010). During the next phase (2014 – 2016) a vaccination corridor was established in the attempts to halt further spread of fox-mediated rabies, followed by a third phase (2019 – 2022) to eliminate this variant from Türkiye. A fourth round of campaigns, starting in 2023, were initiated to control rabies in wild canids in East Türkiye as well. Unfortunately, rabies re-emerged in two independent foci in the western part of the country during 2024 and several emergency ORV campaigns were initiated

Results. The last reported rabies case in a fox occurred in December 2024. So far in 2025 (till June), except for one rabid dog (January) close to the capital, only 94 cases in dogs and livestock were reported in 16 provinces in the south-eastern part of the country.

Conclusions. Although many different challenges like budgetary constraints, delays due to tender procedures, limited surveillance data in wildlife incl. post-campaign monitoring, etc. were encountered, the rabies situation has greatly improved as a result of these ORV-efforts.

O3.10. Large-Scale Oral Rabies Vaccination (ORV) Campaigns in Namibia: A Scalable Tool for Dog-Mediated Rabies Control

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Key words. Canine rabies control, Oral vaccination, Free-roaming dogs, Efficiency

Introduction. Dog-mediated rabies causes tens of thousands of human deaths annually, particularly in resource-limited settings where achieving sufficient vaccination coverage through parenteral methods remains challenging. Oral rabies vaccination (ORV) offers a promising alternative, particularly for reaching free-roaming and hard-to-handle dogs.
Objective. To evaluate the feasibility, effectiveness, operational efficiency, and scalability of large-scale ORV campaigns in rural Namibia as a complementary tool to parenteral vaccination for dog-mediated rabies control.

Methods. Field trials were conducted in 2018, 2023, and 2024 in Namibia's Zambezi region using a third-generation oral vaccine delivered via standardized egg-flavored baits. Baits were distributed door-to-door (D2D) and via owner-assisted approaches. Vaccination success was assessed by direct observation of bait acceptance, operational efficiency, spatial coverage, and household surveys.
Results. In 2018, 90% of 1,115 dogs consumed the bait, with 73% assessed as vaccinated. In 2023, 3,097 dogs were vaccinated in four days with an 88% success rate. In 2024, Namibia's largest ORV campaign distributed 9,393 baits over a similar period, achieving up to 56.8% vaccination coverage when combined with parenteral efforts. Spatial analysis showed 60% coverage across 10×10 km grids, reaching 81% of the regional population. Teams averaged 25.5 baits/hour and 164 baits/day—highly efficient for a D2D approach. Vaccinated dogs per team per day were over three times higher than in a concurrent parenteral campaign (53 dogs) and five times higher than in 2018 (33 dogs). Namibia's ORV outperformed comparable campaigns elsewhere in Africa and Asia, which is particularly notable given its rural context. Few studies report such high effectiveness in rural areas, where traditional campaigns typically reach only 8–73 dogs/team/day.
Conclusions. ORV is a scalable, efficient, and impactful tool for rabies control in remote, underserved areas. These results support integrating ORV into national rabies control programs, especially where parenteral strategies alone fall short.

O3.11. Collaborative study on the rabies antibody detection in wildlife samples in Europe

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Keywords. Rabies, ELISA kits, ORV monitoring, Wildlife, Europe

Introduction. Since several years, different trends were observed during the oral rabies vaccination (ORV) monitoring campaigns conducted in European Union (EU) Member States, when comparing the tetracycline detection with the level of rabies antibodies. Indeed, the seroconversion level seems to have

decreased while the bait-uptake seems to remain stable over the years. The results of the analysis of seroconversion and bait-uptake after ORV recently published concluded on the difficulty to interpret seroconversion results at EU scale, due to the variety of tests and thresholds used by laboratories. Following this, the possibility of continuing this study by correcting the seroprevalence data using modelling was raised, to potentially succeed in 'erasing' this bias.

Objective. The aim of the European collaborative study launched by the European Union Reference Laboratory for Rabies was to provide sufficient data to assess the variations between the two commercial ELISA kits currently used on the same field samples of animals collected after the ORV campaigns. This will allow at a later stage a better in-depth study of serological field data considering the variation due by the tests themselves.

Methods. The samples were fox samples received by the laboratories as part of the monitoring of their ORV campaigns. Seven participants took part in this study. The Bio-Rad and BioPro kits were used on the same samples. The validation criteria are those provided by the manufacturers.

Results and conclusions. More than 1600 fox samples were analysed by both kits. For the BioPro kit, all the laboratories used the same threshold (%PB=40) whereas different thresholds were applied for the Bio-Rad kit (ranging from 0,125 EU/mL to 0,5 EU/mL). Different coefficient of concordance between the two ELISA kits were obtained ranging from 59.2% to 97.8%. For each laboratory, the number of positive results increases when the BioPro kit is used.

O3.12. Evaluation of oral rabies vaccination using a higher titer vaccinia virus rabies recombinant product in North Carolina and Maine, USA

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Keywords. Oral rabies vaccination, Procyon lotor, RABORAL V-RG® HT, Raccoon rabies, Wildlife rabies control

Introduction. Wildlife rabies control principally involves a landscape strategy of oral rabies vaccination (ORV) to reduce and eliminate Lyssavirus rabies (RABV) transmission in specific mesocarnivore populations and regions. The RABORAL V-RG® product has been successfully used for ORV to prevent appreciable westward spread of raccoon RABV variant from the eastern United States since the 1990s, although periodic breaches of the ORV population immunity barrier have occurred and required use of contingency action strategies including enhanced ORV.
Objective. We experimentally evaluated RABORAL V-RG® High Titer (hereafter V-RG HT) in rural areas of North Carolina and Maine, which were naïve to ORV management prior to the study, for a proof-of-concept ORV application and contingency action scenario. Materials and methods We compare the performance of V-RG HT in rural areas using pre- and post-ORV sampling associated with annual fixed-wing aerial deployment of 75 baits/km2 and 500m line spacing across three years to estimate raccoon population immunity from ORV using V-RG HT in comparison to the long-term historical ORV monitoring trends using V-RG in these two states.
Results. The impact of ORV with V-RG HT across three years varied by state and was influenced by differences in the local density of raccoon populations, as well as the capture frequencies of secondary target and nontargets between North Carolina and Maine.
Conclusions. The raccoon population immunity estimated from ORV with V-RG HT in rural areas to control raccoon RABV was significantly better in comparison to historical ORV monitoring associated with V-RG in both states respectively, and V-RG HT may be considered for use in contingency action management.

Premio Ivanete Kotait a estudiantes/jóvenes investigadores latinoamericanos/ Ivanete Kotait Award Latin American student/young researcher / Prêmio Ivanete Kotait de Estudante/Jovem Pesquisadora Latino-Americana

El Premio Ivanete Kotait reconoce a un estudiante o joven investigador de América Latina por su destacada labor en el estudio de la rabia. Lleva el nombre de la Dra. Ivanete Kotait, una investigadora apasionada que dedicó su vida a mejorar el diagnóstico y control de esta enfermedad, dejando un legado fundamental para la salud pública y animal en Brasil y otras regiones en desarrollo.

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O3.13. Susceptibility and antiviral gene expression of immortalized *Desmodus rotundus* Kidney Cells (FKDR) upon Lyssavirus rabies Infection

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Keywords. Vampire bat cell, rabies virus, Pasteur vaccine strains, FKDR cell, MDA5

Introduction. The common vampire bat (Desmodus rotundus) constitutes the principal reservoir of Lyssavirus rabies (RABV) in Latin America, contributing to recurrent transmission events to livestock and humans. While these bats maintain viral circulation, the mechanisms enabling host-virus coexistence remain unclear. This study addresses critical gaps in understanding cellular responses to RABV infection in this reservoir species.
Objective. This study aimed to establish and characterize an immortalized fetal kidney-derived cell line (FKDR) from D. rotundus, evaluate its susceptibility to RABV infection, and investigate the expression of key innate immune genes (ifih1 and ifit5) in response to infection.
Methods. Primary fetal kidney cells were obtained from D. rotundus and immortalized using the SV40 large T antigen, resulting in the FKDR cell line. Markers of senescence and cell growth were evaluated and compared between primary and immortalized cells. Susceptibility to RABV (Pasteur Vaccine strain) was assessed via direct fluorescent antibody testing (dFAT). FKDR cells were infected at a multiplicity of infection (MOI) of 1, and total RNA was extracted at 6, 12, 24, and 48 hours post-infection (hpi). Quantitative real- time PCR was performed to determine relative expression levels of ifih1 (MDA5) and ifit5, normalized to actb gene, using the 2^(-ΔΔCt) method.
Results. Fetal primary cells (Figure 1A) were successfully immortalized, and the resulting FKDR cell line showed enhanced proliferation and absence of

senescence-associated β-galactosidase activity (Figure 1B) compared to primary cells. FKDR cells were infected by RABV, as confirmed by dFAT, without displaying cytopathic effects (Figure 1C). Analysis of gene expression revealed that ifit5 exhibited a transient increase at 6 hpi (approximately 1.5–2.0-fold), followed by a rapid decline to baseline or lower levels by 12 to 48 hpi (Figure 2B). Expression levels of ifih1 remained consistently low, ranging between 0.9- and 1.0-fold relative to mock-infected controls across all timepoints (Figure 2A). No sustained upregulation of these antiviral genes was observed.

Discussion: The limited transcriptional activation of ifih1 and ifit5 suggests that FKDR cells exhibit a weak innate immune response to RABV. This phenotype may reflect an evolved tolerance in D. rotundus, enabling viral persistence without overt immune-mediated pathology. Such findings are consistent with the role of this species as a reservoir host.

Conclusion: The FKDR cell line provides a relevant in vitro model for investigating viral persistence, immune evasion, and host tolerance to RABV in D. rotundus. The observed susceptibility to infection, coupled with restricted immune gene induction, highlights its utility in elucidating mechanisms of antiviral response and transmission in natural reservoirs. Understanding these dynamics is critical to rabies surveillance and control strategies in Latin America, where bat-borne rabies threatens public and animal health.

O3.14. Análise filogenética do gene N do vírus da raiva no Brasil: Diversidade molecular e distribuição geográfica

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Palavras chave. Filogenia, Diversidade, Raiva, Brasil

Introdução: A raiva é uma zoonose ocasionada pelo Lyssavirus rabies (RABV) que acomete todos os mamíferos. Diversos estudos filogenéticos sobre o RABV já foram realizados no Brasil, porém algumas regiões e/ou reservatórios carecem de informações precisas, sendo escassos estudos recentes que reportem a epidemiologia molecular do RABV circulante em diferentes hospedeiros e em todo território.
Objetivo: O objetivo deste estudo foi analisar a nucleoproteína do RABV a fim de traçar um panorama amplo sobre a raiva no território nacional.
Metodologia: Para tanto 83 amostras de RABV, foram submetidas a extração de RNA, RT-PCR (gene N) e sequenciamento genético. Tais amostras foram isoladas de diferentes hospedeiros e algumas coletadas há mais de 20 anos, em sete estados de diferentes regiões do Brasil. As sequências obtidas somadas a sequências recuperadas do GenBank foram submetidas a análise filogenética.
Resultados: Para a construção das árvores filogenéticas foram gerados dois datasets, um composto por 1.184 sequências (1.353 pb) e um segundo composto por 1.647 sequências (440 pb), ambas árvores geradas apresentaram topologias concordantes. A análise filogenética revelou a formação de dois clados principais relacionados a linhagens genéticas de RABV características de morcegos e cães. Além disso, foram identificadas 17 sublinhagens genéticas de RABV, o que evidencia a complexidade dos ciclos

epidemiológicos no país.
Conclusões: A concordância das duas análises, reforça o potencial uso de pequenos fragmentos do gene N em estudos moleculares. A desigualdade na distribuição dos dados, identificada neste estudo compromete a abrangência das análises filogenéticas e limita a compreensão da verdadeira diversidade viral presente no país. A ausência de sequências representativas de estados com registros da doença dificulta a identificação de linhagens genéticas de RABV, sendo um ponto crítico sobre a epidemiologia molecular do RABV no Brasil. A análise destas amostras ressalta a importância da vigilância epidemiológica contínua para o monitoramento e controle da circulação do RABV.

O3.15. In silico prediction of rabies virus-specific B-cell epitopes for the development of immune-based diagnostic assays

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Keywords. Human rabies, Proteome mining, B-cell epitopes, In silico, ELISA.

Introduction. The proteome of the rabies virus contains the target antigens of the humoral immune response. Accurate identification of epitopes is crucial for developing high-specificity serological diagnostic tools that can discriminate between lyssavirus infections and other etiologies, while also laying the groundwork for designing peptide immunogens.
Objective. To implement a comprehensive bioinformatic approach to identify and validate rabies virus-specific linear B-cell epitopes for application in the development of diagnostic tests.
Materials and Methods. Viral proteome protein sequences were obtained from the UniProt database. After homology filtering (BLASTp) against the human proteome to ensure specificity, linear B-cell epitopes were predicted

using a consensus of machine learning algorithms (AAP, ABCpred, BCpred, BepiPred-2.0, and FBCPred). Candidate epitopes were biophysically characterized (ProtParam). Subsequently, their 3D structures were modeled (PEP-FOLD 3.5) and molecularly docked (HPEPDOCK, HawkDock) with the paratope of human immunoglobulins, previously defined using specialized tools (IMGT, Parapred, and LYRA).
Results. The protocol identified 8 high-confidence consensus epitopes from the analysis with the 5 prediction tools used. Among these, molecular docking revealed that only one formed a stable complex with the Fab fragment of human antibodies, characterized by high predicted binding affinity and favorable stereochemical orientation.
Conclusion: This study reveals the utility of computational approaches for prioritizing specific diagnostic epitopes. The identified peptide shows promising potential for the development of accurate serological assays for rabies. Future molecular dynamics and in silico maturation analyses will further optimize their affinity and stability for translational applications.

O3.16. Comparative diagnosis of rabies using fluorescence antibody test (FAT) and RT-q-PCR at the Maranhao Central public health laboratory (LACEN-MA/BRAZIL) during 2023 and 2024

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Keywords. Lyssavirus, RT-qPCR, LN34, molecular biology, diagnosis

Introduction. Rabies is a fatal acute encephalitis that affects both animals and humans. An effective and accurate diagnosis is crucial due to its public health implications. The use of molecular biology has grown exponentially since the COVID-19 pandemic, and RT- qPCR has become an important tool for rabies diagnosis due to its specificity and speed. Furthermore, RT-qPCR

has successfully replaced the mouse inoculation biological test.

Objective. To analyze the re-sults of rabies tests using both Fluorescence Antibody Test (FAT) and RT-qPCR from the Zoon-osis Laboratory of the Maranhão Central Public Health Laboratory (LACEN-MA) for the period from 2023 to 2024.

Materials and Methods. Fluorescence Antibody Test (FAT) tests were performed on samples from the municipal and state epidemiological surveillance teams in Maranhão. An anti-rabies conjugate supplied by the Pasteur Institute-SP was used with a Zeiss Axio Scope A.1 IFD microscope. The RT-qPCR was conducted using LN34 primers and a probe (Gigante et al., 2025) on a CFX-96 Biorad thermocycler. Genetic material was extracted using the Quick-DNA/RNA Viral MagBead commercial kit from ZYMO RESEARCH, following the manufacturer's instructions for automated extraction with the TanBead automated extractor.

Results. A total of 662 tests were performed between 2023 and 2024. Of the 463 samples that were negative on IFD, 95.46% (442) were confirmed by RT-qPCR, while 4.54% (21) were divergent. Of the 103 samples that were positive on IFD, 97.09% (100) were confirmed by RT- qPCR, with 2.91% (3) being divergent. Of the 96 samples (14.50%) that were inconclusive on IFD, 71 (73.96% / 10.73%) were non-detectable by RT-qPCR, and 25 (26.04%/ 3.78%) were detectable.

Conclusion: The RT-qPCR test is concluded to be an important confirmatory tool for rabies diagnosis, especially in cases where IFD results are inconclusive or cannot be performed.

O3.17. Deep Learning Models for Rabies Virus Detection in Cell Cultures

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Keywords. Rabies lyssavirus, Artificial Intelligence, Cell Culture, Automation

Introduction. Rabies remains a critical public health concern, particularly in low-resource settings where diagnostic capacity is limited. Cell culture-based assays are central to rabies virus (RABV) detection and antibody quantification, yet their reliance on manual fluorescence microscopy interpretation introduces subjectivity, labour intensity, and scalability challenges.

Objective. This study aimed to develop and evaluate an artificial intelligence (AI)-driven framework for automated classification of RABV infection in BHK-21 cell cultures, addressing key limitations in current diagnostic workflows and paving the way for broader implementation in other cell culture-based assays.

Methods. BHK-21 cells were co-seeded with the RABV strain CVS-11 and subjected to immunostaining using FITC-conjugated antibodies. Fluorescence microscopy images were acquired using an automated high throughput imaging system, generating 2,344 annotated images. A large and diverse dataset of cell culture exhibiting varying degrees of rabies virus infection, variations in staining reagents, and image quality was compiled to ensure biological and technical variability. These images were segmented into 36,704 patches and stratified for training, validation, and testing. Four deep learning architectures, ResNet50, EfficientNet-B2, Xception, and Swin Transformer, were trained using five-fold cross-validation. Model performance was assessed using accuracy, F1-score, AUC-ROC, precision, and recall. Ambiguous cases were evaluated against expert consensus to benchmark interpretability.

Results. All models achieved high classification performance, with Swin Transformer consistently outperforming others (mean accuracy: 0.997; F1-score: 0.994; AUC-ROC: 1.000). In ambiguous cases, Swin Transformer aligned most closely with expert-level decisions, reinforcing its diagnostic reliability.

Conclusions. This study introduces an AI-based system for automated RABV detection in cell cultures, offering a scalable, objective, and an automated alternative to manual microscopy. This work strengthens the scientific foundation for applying computer vision to cell-based rabies research and diagnostics. Ultimately, it underscores the transformative potential of artificial intelligence in laboratory diagnostics, bridging the gap between expert interpretation and accessible, scalable technology.

O3.18. Identification of single nucleotide polymorphisms (SNP´s) in whole genomes of rabies virus and vaccine strains in Mexico

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Keywords. Rabies virus, Single Nucleotide Polymorphism (SNP), Whole-Genome Sequencing (WGS)

Introduction. Rabies is an acute, fatal zoonotic disease that causes about 60,000 human deaths per year. It has a worldwide distribution and a wide range of hosts and reservoirs. In Mexico, the main strategy for its prevention and control is the vaccination of cattle and other domestic species, commonly with ERA and SAD vaccine strains. However, studies suggest that some cases of rabies, mainly in cattle, could originate from vaccination or from mutations in the rabies virus (RABV) genome that limit the efficacy of current strains. Genomic analysis through the identification of SNPs in whole genome sequences (WGS´s), offers powerful tools to determine genetic variation in antigenicity determinant sites between vaccine and field strains against new outbreaks.

Objective. To identify and classify by genomic region the SNPs in WGS of mexican field strains of RABV associated with Desmodus rotundus, using two reference genomes of vaccine strains. Materials and Methods. Twenty-two RABV WGS´s obtained from public databases were analyzed. Variant calling was performed with Samtools using two vaccine strains (ERA and SAD) and one field strain as references. SNP classification was performed in RStudio.

Results. Three data sheet VCF files were generated, one for each reference strain. The highest number of SNPs was identified in the assemblies obtained with the vaccine strains. In the characterization by genomic region, the greatest variability was identified in the L gene.

Conclusions. Our results suggest that the L gene could be used as a molecular marker for the genotyping of field strains of RABV circulating in Mexico; however, the greater variability of SNP´s detected between field and vaccine strains that could be susceptible links for the vaccination strategy raises concern.

O3.19. Long-term persistence and boostability of immune responses following different rabies pre-exposure prophylaxis priming schedules of a PCEC rabies vaccine

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Keywords. Pre-exposure prophylaxis, PCECV rabies vaccine, Immune Persistence, Booster response

Introduction. Rabies is a vaccine preventable lethal viral disease that is usually transmitted through the bite of an infected animal. Rabies remains a significant public health issue, particularly in regions where the disease is endemic, necessitating effective and lasting vaccination strategies.

Objective. This study aims to evaluate the long-term persistence of rabies virus-neutralizing antibody (RVNA) responses in subjects following different rabies pre- exposure prophylaxis (PrEP) primary schedules and the antibody responses to a booster dose using the purified chick embryo cell rabies vaccine (PCEC-RV).

Methods. Adults who completed the parent study (NCT01662440; safety and immunogenicity of different primary PrEP regimens with PCEC and Japanese encephalitis [JE] vaccine) and received full rabies PrEP regimens (Rabies+JE-Accelerated, Rabies+JE-Conventional, and Rabies-Conventional) were enrolled in this phase III, open-label extension study (NCT02545517). Immunogenicity was assessed by rabies virus neutralizing antibody (RVNA)

concentrations <0.5 IU/mL were eligible to receive a PCEC-RV booster. **Results.** After 10 years, the probability of detecting adequate RVNA concentrations was 57.8% for the Rabies + JE-Accelerated group, 60.2% for the Rabies + JE-conventional, and 62.0% for the Rabies-Conventional group. **Conclusion:** Approximately 69% of study participants received no PCEC-RV rabies vaccine booster (68.6%) during the 10-year follow-up period. The study demonstrated a strong immunogenic response to a PCEC rabies vaccine booster dose, irrespective of the primary regimen received. Furthermore, the response was independent of the time elapsed since the last primary vaccine dose administration. This clinical trial was funded by GlaxoSmithKline Biologicals SA.

O3.20. Immunogenicity of an adjuvanted, combination inactivated rabies-vectored, Lassa fever vaccine in healthy adults: interim results of a first-in-human Phase 1 trial

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Introduction. Lassa fever is a zoonotic disease endemic to West Africa caused by the Lassa virus. The World Health Organization (WHO) estimates up to 300,000 infections and 5,000 deaths annually. Rabies is a neglected vial disease. A vaccine against LASV and Rabies would be beneficial, especially in West Africa.
Methods. We conducted a randomized, controlled Phase 1 trial of an inactivated rabies virus vectored Lassa virus glycoprotein complex (GPC) vaccine (LASSARAB) formulated with a synthetic oil-in-water TLR-4 agonist adjuvant (3D-6acyl PHAD-SE). In dose-escalating cohorts, participants received two intramuscular doses of LASSARAB at 700 rU (n=15), 1400 rU (n=15), or 2800 rU (n=14), or a licensed rabies vaccine control (n=10), administered 28 days apart. This interim analysis reports the primary objective of safety and reactogenicity evaluation and the secondary objective of immunogenicity assessment through Day 61.
Results. All vaccine doses were well tolerated. After two doses, Lassa GPC enzyme-linked immunosorbent assay (ELISA) seroconversion rates were 100% in all LASSARAB groups and 0% in the control group. Rabies glycoprotein ELISA and neutralizing antibody seroconversions were 100% across all groups, including controls.
Conclusions. This first-in-human study demonstrates that LASSARAB+3D-6acyl PHAD-SE is well tolerated and highly immunogenic, supporting further clinical evaluation. ClinicalTrials.gov identifier: NCT06546709.

O3.21. Antibody response to a Baculovirus-Based Rabies Vaccine Candidate in Cattle

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Keywords. Vaccine, Cattle, Baculovirus, Antibodies, ELISA

Introduction. Rabies transmission to cattle causes significant economic losses in Central and South America. The cost and cold-chain requirements

of inactivated vaccines limit their widespread use in rural areas. Pseudotyped baculoviruses displaying the rabies virus glycoprotein G (gG) offer a promising, low-cost alternative but have been tested only in laboratory animals.

Objective. To assess the humoral immunogenicity of a lyophilized rabies vaccine formulation based on a baculovirus pseudotyped with a chimeric rabies gG (FarvacRAB) in cattle.

Methods. Each dose contained 3×108 PFU of gG-FL and was reconstituted in 1 mL of diluent. Groups of animals were immunized with 1, 2, or 3 mL of the formulation, followed by a booster on day 35. A group receiving a conventional inactivated rabies vaccine under the same schedule served as control. Rectal temperatures were monitored at 24 and 48 hours post-immunization, and sera were collected at days 0, 35, and 51 to detect anti-gG antibodies by ELISA.

Results. No animal developed fever (temperatures <40 °C) after prime or booster immunization. Antibody levels measured by ELISA (Optical Density values) were significantly higher in cattle receiving 2 mL of gG-FL compared with the 1 mL and 3 mL groups. Moreover, antibody levels in the 2 mL group was similar to that elicited by the inactivated vaccine.

Conclusions. These findings demonstrate that the gG-FL baculovirus vaccine is well tolerated and induces humoral responses comparable to those elicited by currently available vaccines in cattle. Combined with the reduced production costs associated with the baculovirus platform, this supports its potential as a cost-effective alternative for rabies control in endemic livestock regions.

O3.22. Industrial development of human Rabies Vaccine - Scale up and improvements of virus production in cell-based platform

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Keywords. Human rabies vaccine, Industrial manufacture, scale up production, improvement of vaccine production, rabies virus.

Introduction. Rabies is a zoonotic and neglected tropical disease, considered a global public health concern affecting over 150 countries with almost 60,000 human deaths annually worldwide. Shortages of the vaccine were reported in Europe (2016 to 2019). The World Health Organization (WHO) and GAVI are working to improve access to rabies vaccines.
Objective. The aim of this study was to develop the industrial production process for rabies vaccine production in single-use systems as well as the production process improvement.
Methods. We evaluated the cell culture using a combination of parameters in T-flasks as media composition, volume, temperature, pH, % CO2, virus adsorption volume, multiplicity of infection, time to the first and last harvests. After setting up the best condition in T-flask we scale up to different multilayer flasks, followed by scaling up in single use bioreactors using microcarriers, first in a benchtop agitated bioreactor and later in a 50L bioreactor.
Results and Conclusion. We performed 85 different conditions tests in T-flask for initial screening for the best parameters and the best condition was confirmed in labscale bioreactors. The CIT titer varied from less than 10^1 to 10^5.1 FFD50/50 ul or 10^2.3 to 10^6.4FFD50/ml considering all the systems tested. We could harvest up to 10 times the virus-containing media, though on average, the number of harvests was between 6-8 times for each infection. The produced antigen was characterized by Western-blot. All platforms showed consistent results, achieving the same viral harvest pattern, which was successfully transferred to 50 L single use bioreactor with maximum viral titer reaching 10^4.8 FFD50/50ul or 10^6.1 FFD50/mL. Next steps also include the virus production in 250-500 L bioreactors. These results are promising and we estimate that we will be able to produce 5-10 million doses/year of rabies vaccines using only 1 bioreactor of 250-500 L.

O3.23. From days to hours: flow cytometry as a rapid tool for titrating pseudotyped baculoviruses as a vaccine platform against rabies

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Keywords. Spectral flow virometry, Pseudotyped baculovirus, Rabies vaccine, Viral titration, Plaque assay

Introduction. Baculovirus is a widely used expression vector in the production of experimental rabies vaccines. Viral titration is essential for the manufacture of these bioproducts. Conventional methods have limitations: qPCR overestimates viral load by quantifying both infectious and non-infectious particles, while the plaque assay, though reliable, is slow and operator dependent.
Objective. To develop a rapid and accurate method for detecting and quantifying a baculovirus pseudotyped with rabies virus glycoprotein G (gG) using spectral flow virometry.
Methods. We performed spectral flow virometry using a Northern Light™ cytometer equipped with ESP modification. Baculovirus particles were identified through a combination of specific fluorescent markers: FM™ 4-64 to label the lipid envelope, an anti-gp64 antibody to detect the constitutive envelope protein gp64, and SYTO 9 to stain viral nucleic acids. SYTO 9 staining specifically enabled the detection of infectious viral particles. Viral titers obtained by spectral flow virometry were compared with those determined by the plaque assay (Gold Standard), and Pearson's correlation analysis was used to evaluate concordance between both quantification methods.
Results. Individual viral particles were detected with high resolution using the combination of three stains. Titration based on SYTO 9 fluorescence showed a strong correlation with the plaque assay ($r = 0.998$; $p < 0.0001$), confirming the reliability of the method for quantifying infectious viral particles. The total processing and analysis time was reduced to 3–4 hours, compared to the 7 days required for plaque assays.
Conclusions. Spectral flow virometry provides a rapid, accurate, and reproducible alternative for the quantification of pseudotyped baculoviruses expressing rabies virus gG. This approach overcomes the technical limitations of qPCR and plaque assays, drastically reduces analysis time, and offers a promising strategy for quality control in the production of baculovirus-based rabies vaccine platforms.

O3.24. SYN023 mAb Cocktail for Rabies Prophylaxis

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SYN023 is a mixture of two anti-rabies humanized monoclonal IgG1κ antibodies which bind to distinct and non-overlapping antigenic sites on the rabies virus glycoprotein. A Phase 2b and a Phase 3 randomized double-blinded trials were conducted to demonstrate the safety and efficacy of SYN023 in 1448 Category III rabies patients. The analysis of the safety profile of SYN023 based on the integrated data from all 6 clinical trials demonstrated that SYN023 was generally safe and well tolerated when administered alone or with rabies vaccine in subjects with rabies exposure as well as healthy subjects. SYN023 was granted market authorization by the China NMPA in 2024 for adult population. As part of the post-marketing commitments, a Phase 1 trial was conducted to study PK, PD, and safety profiles in healthy pediatric subjects (<18 years old). The results demonstrated that the PK, PD, and safety profiles in the pediatric population were similar to those of the adult population. A Real-World Evidence (RWE) study in WHO Category III pediatric patients was initiated to study the efficacy of SYN023 in pediatric population. The combination of these two trials is expected to support the expansion of the label to pediatric population. To further demonstrate the efficacy of SYN023, we initiated an RWE study on the use of SYN023 in post-exposure prophylaxis of single-dog-multiple patients in Nanyang, China.The Category III patients will be followed up for 12 months. The dogs that caused wounds in multiple patients will be captured and examined to determine the status of rabies infection. The advantages of high circulating antibodies provided by administering SYN023 will be discussed.

Sesión Pósters/ Posters / Pósteres

22 de octubre / October / Octobre

Rabia humana, patogénesis y PEP/PrEP /Human rabies, Pathogenesis, and PEP/PrEP/ Raiva humana, patogênese e PEP/PrEP

RABIES IN THE AMERICAS

RITA 2025 Rabia en las Américas PERÚ

P3.1. A review of pediatric rabies cases reveals a unique clinical presentation associated with bat-borne infections

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Keywords. Rabies, Clinical, Pediatric, Bat-borne, Review

Introduction. Children are disproportionately impacted by rabies in the Americas as well as in other endemic regions. As prodromal symptoms are ambiguous, and clinical decisions and palliative care are impacted by the prompt suspicion of rabies infection.
Objective. This study sought to review and analyse clinical presentation of pediatric rabies to summarise known and atypical symptomology.
Methods. This review utilized peer- reviewed studies as well as grey literature to compile case studies and clinical descriptions of pediatric rabies disease. Clinical descriptions were condensed into 130 symptom elements, and analysed using multivariate regression analyses.
Results. An analysis of pediatric rabies cases showed that >50% did not exhibit pathognomonic symptoms, e.g. hydrophobia or aerophobia. Dogs were the leading source of exposure, followed by bats. Rashes were found to be significantly associated with bat-borne rabies infections.
Conclusions. There was a significant association between the presentation of rashes in pediatric rabies infections resulting from bat-borne rabies in North America, the majority specifically being the Ln/Ps variant. Additional pediatric cases with rashes had 'unknown' infection origin, which may be indicative of bat exposure, suggesting certain bat-borne lyssavirus variants may stimulate particular immune reactions.

P3.2. No evidence of vertical transmission of rabies virus in bats

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Keywords. Fetuses, Bats and Vertical transmission

Introduction. Rabies is a lethal zoonosis caused by the rabies virus (RABV), which infects the central nervous system (CNS) of mammals and is almost invariably fatal after the onset of clinical signs. Bats are recognized as important reservoirs of RABV, maintaining viral circulation in both urban and wild environments. Vertical transmission refers to the passage of a pathogen from the mother to the offspring during pregnancy, either via transplacental route, during birth, or through lactation. Although vertical transmission is well-documented for viruses such as Zika, Cytomegalovirus and Ebola, evidence for this mechanism involving RABV has been rare.

Objective. The present study aims to investigate the possible occurrence of vertical transmission of RABV.

Methods. For this the presence of the virus in fetuses of two pregnant bats previosusly diagnosed positive for rabies in CNS was investigated. The samples were submitted to RNA extraction RT-PCR targeting the nucleoprotein gene of RABV.

Results. Both tested samples were negative for rabies, therefore, within the studied sample set, no evidence of vertical transmission of the RABV was confirmed. Despite of previous studies, described the detection of RABV in maternal and fetal tissues of *Desmodus rotundus*, this phenomenous is a rare.

Conclusions. Our results reinforcing the hypothesis that this mechanism may occur under specific conditions according to the specie of bat analyzed.

P3.3. Animal aggressions on humans in the municipality of Pedreiras, Maranhão (Brazil), from January 2021 to May 2025

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Keywords. Encephalitis, Transmission, Prophylaxis, Zoonosis, One Health

Introduction. Human rabies is an acute, progressive and fatal encephalitis, which within the One Health System is seen under the animal, environment and human triad.
Objective. to survey the occurrence of animal attacks on humans treated in the municipality of Pedreiras and contribute to the prevention of human rabies.
Methods. Data on aggressions against humans caused by domestic and wild animals were provided by the Municipal Health Department of the municipality of Pedreiras, Maranhão. MS Excel spreadsheets version 2013 were used to prepare a database and calculate percentages.
Results. In the period from January 2021 to May 2025, 2,360 attacks on people were reported. Of these, 939 (39.5%) were by dogs, 268 (11.3%) by cats, 08 (0.3%) by non-hematophagous bats, 15 (0.6%) by monkeys, 04 (0.17%) by fox, 05 (0.2%) by pig, 01 (0.04%) by horse, 01 (0.04%) by raccoon and another 05 (0.2%) by rats. There were no cases in humans. According to the Brazilian Ministry of Health, canines and felines are the main sources of infection. Bats, monkeys, raccoons and foxes in rural areas are the main responsible for the transmission of rabies to humans. Domestic production animals constitute a medium risk and rats are considered low risk. Rabies prophylaxis consists of pre-exposure treatment (people at risk of permanent exposure to the virus) or post- exposure treatment (in cases of aggression), the conduct of which consists of careful cleaning and disinfection of the wound

site and immediate initiation of the prophylactic protocol with Anti-Rabies Serum (SAR) or Human Anti-Rabies Immunoglobulin (IGHAR). If the attacks were caused by bats and other wild mammals, 4 (four) doses of anti-rabies vaccine.
Conclusion: Dogs and cats are the biggest attackers (96.7%) in urban areas, and foxes, monkeys, raccoons and chiropractors are important in rural areas.

P3.4. Analysis of the inmune response profile in the central nervous system of a patient who died due to rabies transmitted by *Callithrix jacchus* - Case Report

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Keywords. Rabies, Marmoset, Immune response, Cytokines, Transcription factors.

Introduction. Rabies is a nearly always fatal encephalomyelitis, responsible for approximately 60.000 deaths worldwide each year. The epidemiological profile of the disease has evolved over the decades, and in Brazil, human rabies transmitted by wild animals currently predominates.
Objective. To report a case of human rabies transmitted by a white-tufted marmoset (Callithrix jacchus) and to analyze the immune response within the central nervous system (CNS) of the patient.
Methods. Brainstem sample from a patient who died of marmoset-transmitted rabies was analyzed using immunohistochemistry to characterize the immune response. Cellular markers, cytokines, and transcription factor were evaluated in situ, and positive immunostaining was quantified using a graticule with an area of 0.0625 mm2. Results were expressed as the number of cells immunostaining per mm2.
Results. Large number of CD4+ and CD8+ T cells, as well as macrophages

was observed. There was immunostaining of B cells (CD20+) in situ. The prevalent cytokine profile was Th17, with expression of IL-1 beta, IL-6, TGF-beta and mainly IL-17 and IL-23, beyond the expression of cMAF. Transcription factors associated with the innate immune response RIG-I, IRF-2 and STING were also expressed in CNS, as well as IFN-I.
Conclusions. RIG-I is a key cytoplasmic sensor of viral RNA in the innate immune response, while IRF2 can act as either an activator or repressor of interferon signaling, potentially contributing to immune regulation. However, IRF2 may also lead to CD8+ T cell exhaustion and impair their ability to combat infection. Despite the increased presence of CD4+ and CD8+ T cells, their collaborative interaction with B cells for antibody production may be compromised, likely due to viral evasion strategies that induce immune cell apoptosis. The exacerbated Th17 response may contribute to irreversible tissue damage, ultimately leading to the patient's death.

P3.5. Genetic Clustering of Rabies Virus Variants: Proximity among Samples from Brazilian Reservoirs.

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Keywords. Rabies, variants, Pathogenesis, Gene expression

Introduction. Rabies virus (RABV) isolated from different mammalian hosts displays unique characteristics that influence infection outcome. Considering the increase in wild rabies in Brazil and the distinct pathogenicity patterns of RABV strains.
Objective. To characterize street RABV variants isolated from the main Brazilian reservoirs.
Methods. Mice were intracerebrally inoculated with $50LD_{50}$/30 µL of RABV variants derived from dog, cattle, bat, marmoset, and crab-eating fox. Clinical

signs and lethality were recorded, and brain gene expression profiling was performed using PCR arrays followed by bioinformatics analyses. This experimental design enabled comparison of gene regulation across RABV variants with distinct origins and pathogenic potential.
Results. Lethality analysis revealed significant differences among variants: dog- and bat-derived isolates exhibited high lethality, whereas bovine- and marmoset-derived isolates were associated with higher survival. When lethality, neuroinvasiveness, and inflammatory response were integrated into a composite aggressiveness score, dog and fox variants ranked as the most aggressive, followed by the bat variant, while marmoset and bovine variants showed reduced pathogenic potential. PCA revealed clustering patterns mainly driven by the reservoir of origin: samples from the same variant grouped together, dog and fox clustered closely, bovine and bat showed partial overlap, and marmoset was clearly separated, reflecting a distinct transcriptional profile.
Conclusions. These findings highlight that the reservoir origin of RABV variants directly impacts infection outcome, shaping distinct pathogenicity signatures.

P3.6. Particularidades do atendimento para profilaxia da raiva humana a profissões de risco

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Palavras chave: Vacina antirrábica, Médicos Veterinários, Cuidados Médicos, Farmacoeconomia, Sistema Único de Saúde.

Introdução. Sendo um dos seis centros de referência na cidade de São Paulo para a profilaxia da raiva humana em acidentes da “Categoria 3”, por vezes atendemos pessoas cujas atividades sabidamente representam maior risco exposicional.
Objetivos. Alertar para algumas particularidades preocupantes observadas

no atendimento a estes profissionais.

Métodos. Análise retrospectiva dos casos atendidos entre 01/01/2023 e 30/06/2025 a partir das anotações do Serviço e fichas de notificação do SINAN.

Resultados. De um total de 2.120 pacientes atendidos no período, 79 (3,7%) exerciam profissões de maior risco (veterinários formados e estudantes, auxiliares, biólogos, cuidadores, tratadores, bombeiros etc). A mediana da idade destes indivíduos foi 32 anos (variou de 17 a 75), sendo 41 mulheres (51,9%). Quarenta acidentes (50,6%) envolveram cães e gatos, 31 (40,5%) animais de produção e 8 (10,1%) animais silvestres. A mediana do tempo entre a exposição e o atendimento foi cinco dias (variou de 0 a 43), sendo maior que sete dias em 16 casos (20,3%). Dentre os 40 profissionais atuantesna área de veterinária, apenas cinco (12,5%) haviam recebido vacinação prévia (PrEP) para a raiva: um único com sorologia comprobatória atual, dois cuja última dosagem de anticorpos neutralizantes foi há 20 anos e outros dois que receberam uma única dose da vacina. Houve aplicação intralesional e/ou intramuscular de soro antirrábico humano (SAR) em 26 pacientes (32,9%) e imunoglobulina humana antirrábica (IGHAR) em 52 (65,8%), sempre associados à prescrição do esquema vacinal completo (VERO 0-3-7-14). O diagnóstico de raiva foi confirmado em 26 dos 36 animais (72,2%) encaminhados à necrópsia nesta casuística. Quanto à profilaxia do tétano, somente 23 dos 79 profissionais (29,1%) estavam adequadamente imunizados, sendo indicada imunoglobulina antitetânica em 12 (15,2%).

Conclusão. Estes dados infelizmente demonstram a falta de esclarecimento e/ou de adesão destes profissionais aos necessários e bem estabelecidos esquemas preconizados de PrEP.

P3.7. Perfil Epidemiólogico dos Atendimentos Antirrábicos Causados por Primatas-Não-Humanos no Brasil

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Palavras chave. Primatas-não-humanos, Raiva, Profilaxia pós-exposição, Vigilância em saúde, Uma Só Saúde.

Introdução. A raiva transmitida por primatas não humanos (PNH), especialmente saguis (*Callithrix jacchus*), tem sido registrada no Brasil de forma esporádica, com destaque para os estados do Ceará e Piauí. A expansão desses animais em áreas urbanas e seu uso como animais de estimação elevam o risco de transmissão. Apesar da obrigatoriedade de profilaxia completa em exposições envolvendo PNH, falhas no atendimento e no preenchimento de notificações podem comprometer a vigilância da doença.
Objetivo. Este trabalho descreve o perfil epidemiológico dos atendimentos antirrábicos humanos relacionados às agressões por primatas não humanos no Brasil.
Metodologia. Estudo transversal com dados secundários do Sistema de Informação de Agravos de Notificação (Sinan), do período de janeiro de 2015 e novembro de 2024. Foram analisadas variáveis da ficha de notificação individual (FNI), incluindo dados do paciente, características da agressão, profilaxia prescrita e condição do animal. A análise foi feita com Tabwin 3.6, Power BI e Excel, com avaliação de frequência, médias e consistência da profilaxia indicada conforme normas do Ministério da Saúde e da OMS.
Resultados. Crianças do sexo feminino foram mais frequentemente atendidas por agressões de PNH, com mordeduras em pescoço e orelhas, classificados como acidente grave. Observou-se alta taxa de inconsistência nos registros, com campos ignorados ou em branco, especialmente na identificação do animal agressor e na prescrição da profilaxia preconizadapelas normas. Em muitos casos, a prescrição foi inadequada, contrariando as normas vigentes.
Conclusões. As falhas nos registros e na prescrição da profilaxia podem resultar em riscos graves, inclusive óbito. É necessário fortalecer a capacitação das equipes de saúde, integrar ações de vigilância e adotar estratégias baseadas no conceito “Uma Só Saúde”, promovendo educação em saúde e melhor preenchimento das fichas de notificação. O uso adequado dos dados epidemiológicos é essencial para ações oportunas de prevenção e controle da raiva no Brasil.

P3.8. Situación de la vacunación antirrábica humana esquema pre exposición en la selva central 2023. Región Junín

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Palabras clave. Rabia, Esquema pre exposicion, Alto riego, Vacuna, Suceptible.

Introduction. La rabia es una enfermedad mortal que afecta a mamíferos, incluido los humanos. En la Selva Central de Junín, la rabia silvestre es una preocupación por las mordeduras de murciélagos hematófagos. La vacunación antirrábica de preexposición es vital para proteger a las poblaciones vulnerables, especialmente aquellos que trabajan o viven en áreas de alto riesgo. El estudio identifico fortalezas, debilidades y acciones de mejora para aumentar la cobertura y efectividad de la vacunación.
Objectivo. Evaluar la situación del esquema de vacunación antirrábica humana de preexposición en la Selva Central de Junín durante el año 2023.
Metodos. Se realizo un estudio descriptivo transversal, se recolectaron registros de vacunación para evaluar las coberturas según las dosis por edad, sexo y procedencia. Población de estudio Personas de áreas rurales, urbanas y de alto riesgo. Recolección de datos Recolectados entre enero y noviembre de 2023, se dieron charlas y análisis estadístico.
Resultados. Barreras sobre la efectividad del esquema: • Cobertura insuficiente: 100% de la población recibió 1 dosis, 67.5% 2 dosis y 36.4%. 3 dosis • Falta de acceso: la distancia, costumbres y hábitos. • Baja percepción de riesgo: subestiman la rabia y no se vacunan. • Capacitación insuficiente: la comunidad desconoce la vacunación.
Conclusiones. La implementación del esquema de vacunación antirrábica de preexposición en la Selva Central de Junín aún tiene desafíos importantes que permitan aumentar la sensibilización en las comunidades de riesgo, mejorar el acceso a las vacunas y capacitar al personal de salud sobre la enfermedad. Recomendamos la implementación de campañas educativas para incrementar la cobertura y proteger a la población de esta enfermedad mortal.

P3.9. Profile of Human Rabies Prophylaxis in the Brazil-Peru International Border Zone, 2007–2020

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Keywords: Epidemiology, Notifications, Public Health, Zoonotic Accidents, Prophylactic Control

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Introduction. Border regions are not effective natural barriers to preventing the spread of microorganisms. For example, little is known about human rabies prophylaxis (HRP) in the Brazil-Peru border areas.
Objective. To analyze the HRP profile in Brazilian municipalities along the Brazil-Peru border.
Methodology. This is a descriptive, quantitative, and retrospective study based on HRP data (DATASUS – Ministry of Health), categorized by municipality of residence, from 2007 to 2020. The study covered 14 municipalities along the Brazil-Peru border, 11 in Acre/BR (77.27% of its municipalities are border areas) and three in Amazonas/BR. Only Assis Brasil-AC constitutes the Brazil-Peru-Bolivia tri-border.
Results. A total of 8,892 cases were reported, with 57.06% in Acre and 42.94% in Amazonas. Cases occurred in all municipalities, primarily in Tabatinga-AM (2,489; 27.99%), Cruzeiro do Sul-AC (1,951; 21.94%), and Sena Madureira-AC (1,741; 19.58%). Assis Brasil accounted for 3.88% of cases. Most cases occurred in 2014 (878; 9.87%) and the fewest in 2007 (245; 2.76%), primarily during the first semester (4,466; 50.22%). They were mainly caused by dogs (7,916; 89.02%), cats (346; 3.89%), and bats (320; 3.60%). The majority of victims were male (5,372; 60.41%), aged 20–34 years (1,933; 21.74%), of mixed race (6,442; 72.45%) or Indigenous (1,055; 11.86%), suffering bites (7,353; 82.69%) on lower limbs (4,919; 55.32%). Missing or blank information predominated regarding scheme interruption (66.91%), reasons for interruption (93.66%), and whether the health unit conducted active case searches (8,461; 95.15%).
Conclusions. The study identified Tabatinga- AM, Cruzeiro do Sul-AC, and Sena Madureira-AC as the main recorders among Brazilian municipalities on the Brazil-Peru border. It highlighted gaps in HRP records and reinforced the

need to improve health surveillance and case follow-up, contributing to better knowledge and future strategies for human rabies control in these regions.

P3.10. An OutRAGEous proposal: Could Rabies Virus suppress the fever response? Implications for disease pathogenesis and possible rabies treatment using fever therapy

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Keywords. Rabies treatment, Rabies virus, Fever, Fever therapy, Immunosuppression

Introduction. Human rabies remains a significant threat around the world, particularly affecting the medically underserved. Low cost and accessible therapies represent an unmet medical need - when education and prophylactic interventions fail. Rabies Virus (RABV) works by multiple mechanisms to circumvent the host immune response, leading to the development of a lethal encephalitis. From a clinical perspective, observational studies have shown a comparative lack of or limited fever response; compared with other encephalidities such as HSV-1 encephalitis. Indeed, rabies patients are sometimes described as having 'poikilothermia' – or variable body temperatures reflective of ambient temperatures – suggesting viral induced temperature dysregulation.
Objectives. Investigate whether RABV suppresses the fever response in human rabies clinical subjects. Hypothesize that directed 'fever therapy' may have a clinical role in defeating RABV and rabies encephalitis through reconstitution of the fever response and associated innate immunity.
Methods. Review clinical human rabies cases specifically with regard to fever expression- and then compare and contrast with other brain infections. Survey mechanisms and procedures for fever induction in a simulated rabies case.
Results. Published human rabies cases show a general trend of absence or reduced fever response in patients compared to other encephalidities. Heating blankets seem to offer the best 'low cost' and effective method for fever induction, particularly in resource constrained areas.

Conclusions. Clinical data suggests RABV appears to suppress the fever response, part of the host innate immunity, in human rabies patients. A reflexive hypothetical question appears: “Could fever therapy be used as a standalone and/or adjunctive intervention in part of a pre-existing clinical protocol?” - as outrageous as that seems. Fever induction may help overcome a surmised viral pathogenetic effect of RABV induced fever suppression. Whatever role the application of fever therapy might have in human rabies treatment remains unknown – but deserves further scrutiny.

23 de octubre / October / Octobre

Sesión Oral/ Oral Session / Sessão Oral

RABIES IN THE AMERICAS

RITA 2025 Rabia en las Américas PERÚ

O4.1. Epidemiological panorama of human rabies in the Americas: analysis of regional averages from 1970 to 2025

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Keywords. Disease control, Epidemiology, Human infection rates, Lyssavirus, Public health surveillance, Zoonotic diseases.

Introduction. Rabies remains a zoonosis of global relevance and a challenge to public health, particularly in Latin America, the Caribbean, and regions with limited access to vaccination programs. Despite significant advances in disease control, human cases still persist in some countries, highlighting regional inequalities in the fight against the rabies virus.
Objectives. The objective of this study was to analyze the average rates of human rabies infection in the Americas from 1970 to 2025, identifying the most and least affected countries and regions.
Methods. Data were obtained from the Regional Information System for Epidemiological Surveillance of Rabies (SIRVERA), organized in Microsoft Excel, and used to calculate country averages. Subsequently, countries were grouped into three regions—North America, Central America & Caribbean, and South America—allowing regional comparisons.
Results. The results revealed differences among regions. Central America & Caribbean showed an average rate of 3.07%, with El Salvador (9.8%) presenting the highest rate, while Granada and Puerto Rico (1.0%) recorded the lowest values. North America had an average of 11.8%, with Mexico (31.9%) standing out with the highest rates, contrasting with Canada (1.0%) as the lowest. South America registered an average of 9.59%, with Brazil (43.6%) emerging as the country with the highest human infection rate across the continent, while Chile and Suriname (1.0%) recorded the lowest rates.

Conclusion: In conclusion, despite regional efforts toward the control and elimination of human rabies, there remain significant epidemiological disparities across the Americas. Brazil and Mexico appear as critical areas requiring intensified strategies for surveillance, prevention, and control, whereas several nations already demonstrate minimal levels of occurrence.

O4.2. Human Rabies Care in Attacks/Accidents Caused by Bats in Brazilian Municipalities Along the Brazil-Peru Border, 2007-2020

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Keywords. Epidemiological surveillance, Zoonoses, Public Health, Border regions, Rural exposure

Introduction. Bats are responsible for maintaining the sylvatic aerial cycle of the rabies virus. In an international border region, it is essential to analyze the epidemiological profile of human rabies prophylaxis (HRP) in Brazilian border municipalities.
Objective. To analyze the HRP profile of attacks/accidents caused by bats in Brazilian municipalities along the Peru border.
Methods. A descriptive, quantitative, and retrospective study was conducted using HRP data (DATASUS – Ministry of Health), categorized by residence municipality, from 2007 to 2020. The study covered 14 municipalities along the Brazil-Peru border, 11 in Acre/BR (77.27% of its municipalities are border areas) and three in Amazonas/BR. Only Assis Brasil-AC forms part of the Brazil-Peru-Bolivia tri-border.
Results. A total of 320 bat-related attacks/accidents were observed out of 8,892 notifications involving various species. 93.13% of cases occurred in Amazonas and 6.88% in Acre. The municipalities with the most records in Amazonas were Tabatinga (62.19%), Atalaia do Norte (24.38%), and Benjamin Constant (6.56%). In Acre, 45.45% of municipalities reported cases: Cruzeiro do Sul (4.06%), Marechal Thaumaturgo (0.94%), Sena Madureira (0.94%), Manoel Urbano (0.63%), and Rodrigues Alves (0.31%). Assis Brasil, Feijó, Jordão, Mâncio Lima, Porto Walter, and Santa Rosa do Purus reported no cases. Most notifications occurred in 2015 (52; 16.25%) and the fewest in

2007 and 2008 (1; 0.31% each), frequently in the first semester (60.31%) and in May (20.94%). Male victims predominated (63.75%), followed by adults aged 19-59 (42.50%), children aged 1-11 (32.19%), Indigenous ethnicity (60.94%), rural residents (76.88%), and bite incidents (91.88%) on hands/feet (54.06%) or lower limbs (27.81%).
Conclusions. The study highlighted the predominance of cases in Amazonas, in rural areas, involving Indigenous people, adults, and children, emphasizing the need for surveillance in Brazilian border municipalities.

O4.3. Autopsy findings of patients with Rabies Encephalitis--- A study from a Tertiary Care Hospital in North India

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Keywords. Human Rabies, Autopsy

Introduction. Rabies encephalitis is a universally fatal viral infection, with existing knowledge of its autopsy findings limited to scattered case reports and small case series.
Methods. This prospective observational study involved 36 patients with Rabies encephalitis. Detailed clinical evaluations were performed, and diagnostic testing included contrast-enhanced MRI (CEMRI) of the brain and analysis of CSF, saliva, serum, skin, and brain biopsies. Autopsies were conducted in 8 patients.
Results. A total of eight patients underwent autopsy. Of these, three patients underwent complete (whole-body) autopsy, while five underwent brain-only autopsy. Examination of the upper cervical spinal cord was performed in three

cases. Neuropathological involvement was most consistently observed in the hippocampus, which was affected in all eight cases (100%). Other regions of involvement included Cerebral cortex: 7/8 cases (87.5%),Midbrain: 7/8 cases (87.5%), Pons: 7/8 cases (87.5%),Medulla: 6/8 cases (75%),Cerebellum: 6/8 cases (75%),Basal ganglia: 4/8 cases (50%), Cervical spinal cord: 2/3 examined cases (66.7%).Extra-cranial organ involvement was noted in two of the three patients who underwent complete autopsy. Adrenal gland involvement was seen in 2 of 3 complete autopsies. Four consistent histopathological patterns were identified: namely Negri bodies (8/8), Perivascular lymphocytic cuffing (8/8), Neuronophagia (7/8), Microglial activation (8/8). Six patients had both antemortem MRI and postmortem brain examination. Concordant findings were noted in the thalamus (66.7%), brainstem (66.7%), hippocampus, cerebellum, and basal ganglia (33.3% each), and cortex (16.7%). Interestingly one patient demonstrated basal ganglia abnormalities on MRI that were not confirmed on histopathological examination. Similarly, two cases with thalamic hyperintensities on MRI exhibited no corresponding pathological abnormalities at autopsy.
Conclusion: This is the first comprehensive prospective study integrating clinical, neuroimaging, and autopsy findings in rabies encephalitis. The study highlights consistent involvement of limbic and brainstem structures, typical histopathological changes, and the partial concordance between MRI and neuropathology, offering valuable insights into disease pathogenesis and diagnostic challenges.

O4.4. Retraction of a Journal Article Reporting the Successful Treatment of a Rabies Patient

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Keywords. Human, Intrathecal, Rabies, Rabies immune globulin, Recovery

Introduction. In 2023 a manuscript by Ing et al. was published in BMJ Case Reports. The case of an adolescent girl was reported who was bitten by her dog, which disappeared after the incident. The authors indicated that the girl

developed clinical rabies and was treated with intrathecal rabies immune globulin by the lumbar route and made a complete recovery.
Objective/Methods. The validity of report was evaluated by an international team: CE Rupprecht, RS Mani, N Aréchiga-Ceballos, DL Knobel.
Results/Conclusions. The report had numerous flaws, including the clinical aspects, the diagnostic laboratory evaluation, and the therapy administered. ACJ asked the editor-in-chief if she would consider publishing a letter to the editor in the journal pointing out the flaws. She replied that letters would not be published in the journal, but that a comment could be added to the journal's website with a reply from the authors. ACJ subsequently approached the editor-in-chief of the Canadian Journal of Neurological Science (CJNS), who agreed to consider a letter for publication with peer review. Our letter was accepted and published in the CJNS (initially in press and open access). ACJ subsequently again wrote the editor-in-chief of BMJ Case Reports indicating our publication in the CJNS and requested that the journal retract the flawed report. Her reply was that the report was now under review and the BMJ subsequently retracted the article. ACJ had an addendum published in the CJNS indicating that the BMJ retracted the report over three months after our letter to the editor was published. This flawed report could potentially have been detrimental to the care of many future rabies patients with repetition of the therapeutic approach, given that many treating physicians of clinical rabies cases have little knowledge about the disease and would search the literature for potential promising approaches.

O4.5. Rabia zoonótica en Loreto, Perú: evidencia de transmisión persistente por murciélagos

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Keywords. Rabia silvestre, Murciélagos, Brote, Amazonía, Perú

Introducción: La rabia es una zoonosis viral letal que en América Latina setransmite principalmente por murciélagos hematófagos (*Desmodus rotundus*). La región amazónica del Perú, caracterizada por comunidades indígenas en áreas de difícil acceso, enfrenta brotes recurrentes que ponen en riesgo la salud pública.
Objetivo: Describir el brote de rabia silvestre transmitida por murciélagos en la comunidad de Yankuntich, distrito de Morona, Loreto, y las acciones de control implementadas.
Métodos: Entre enero y febrero de 2016, una brigada multidisciplinaria realizó investigación epidemiológica, clínica y veterinaria en la comunidad achuar de Yankuntich. Se aplicaron autopsias verbales a familiares de fallecidos, evaluación clínica a pacientes con síndrome neurológico agudo, toma de muestras biológicas (suero, LCR, biopsia de piel) analizadas por IFI en el Instituto Nacional de Salud, y vigilancia animal. Se efectuó vacunación antirrábica humana post exposición, inmunización de animales y sesiones de educación comunitaria.
Resultados: Se confirmaron 10 defunciones humanas (2015– 2016), principalmente en menores de 15 años, con sintomatología compatible con rabia. De cinco pacientes referidos al Hospital Regional de Loreto, tres fallecieron en UCI; el INS confirmó tres casos por laboratorio y uno por clínica y nexo epidemiológico. Se registraron 41 mordeduras por murciélagos (18% de la población), con tasa de exposición del 48,2% y bajo nivel de conocimiento comunitario (78,6% desconocimiento). En paralelo, murieron 98 bovinos y dos canes con signos compatibles. En total se aplicaron 323 dosis de vacuna antirrábica humana, además de 63 bovinos y 34 canes vacunados.
Conclusiones: El brote de rabia silvestre en Loreto evidenció alta letalidad infantil y múltiples factores de riesgo en comunidades amazónicas aisladas. La intervención rápida permitió contener la transmisión, pero se requiere fortalecer la vigilancia epidemiológica, garantizar disponibilidad sostenida de vacunas humanas y animales e implementar planes permanentes de prevención en la Amazonía peruana con enfoque transfronterizo.

O4.6. Milwaukee Protocol, versions (v.) 7A-7K.

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Keywords. Human rabies, therapy, Milwaukee protocol, survival analysis; drug repurposing

Introduction. The Milwaukee Protocol (MP) was improvised in 2004, leading to the first survivor of human rabies without post-exposure prophylaxis. With improved survival, clinical and laboratory investigations suggested that human rabies is consistent with a virally acquired metabolic disorder that varies by virus phylogeny, vector, and receipt of biologicals. More phenotypes are anticipated.
Objective. Summarize Milwaukee protocol (MP) version 7
Methods. Case reviews; comparison with controls in literature and professional list-serves; survival analysis; drug repurposing; hypothesis-building
Results. There are now 45 laboratory-confirmed human rabies survivors, 19 associated with MP versions 2-6. We know of 118 uses of the MP over 20 years. We applied two investigational therapies and propose a third. The MP is superior to other intensive care in survival ($p<0.0001$) and functional outcomes. Survival approximates 20%. Given accrued experience and the increasing complexity of rabies care across phenotypes, 10 different versions of MP were developed to streamline rabies management by local providers encountering a new protocol under stressful conditions.
Conclusions. Rabies survival is regular with limited resources. The MP offers a therapeutic platform for evaluating novel therapies singly or comparatively. Small numbers are required to show benefit. The main challenges to rabies care include the ethics of developing new biologicals for a highly fatal disease, dispersion of rabies patients in time and space vs. clinical trials, no applied genomics (virus, host), and biosamples limited by number and geography.

O4.7. Profilaxis antirrábica preexposición en comunidades nativas amazónicas del Perú (2017–2024): implementación y resultados en la prevención de la rabia silvestre

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Palabras clave. PrEP, cobertura Vacunas, Rabia humana Silvestre

Introducción. La rabia, zoonosis viral, ataca el SNC, es 100% letal tras el inicio de síntomas, y 100% prevenible con atención oportuna. La profilaxis antirrábica preexposición (PrEP)——es la intervención más costo-efectiva para prevenir la rabia silvestre. En el Perú, la PrEP se aplica en comunidades nativas amazónicas (CNA) desde 2011 y escaló en 2017 en áreas de alto riesgo (antecedente de RHS, áreas de difícil acceso, presencia de murciélagos, viviendas vulnerables y barreras socioculturales).
Objetivos. Evaluar la aplicación de la PrEP en CNA de 24 provincias (Amazonas, Loreto, Ucayali, Cusco, Ayacucho, Madre de Dios, Junín y Pasco) 2017–2024 y su contribución al control de la rabia humana silvestre (RHS).
Materiales y métodos. Se integraron informes regionales (2017), HIS/MINSA 2019–2024, población REUNIS, centros poblados del MINCUL y casos de RHS. El análisis se realizó mediante cruces y agregaciones en Excel.
Resultados. En ciclos de ocho años desde 1993 se observaron promedios de 9, 4 y 10 casos de RHS anuales. Tras la PrEP en 2017, el período 2017–2024 promedió 1 caso/año, con tasas anuales <0.01/100 000. Se identificaron 822 EE.SS. que atienden 189 545 personas en CNA. Las tasas de mordedura mostraron picos de 13.2, 10.8 y 16.5/100 000, con <0.1 en el 2024. Las coberturas PrEP pico fueron 59.8% (2017; 28 819 personas) y 24.1% (2018; 9 391) financiadas por MINSA. Entre 2019–2024, las coberturas fueron <0.3% (salvo 2022: 1.4% y 2023: 1.3%) y 0.6% en 2024; se notificaron 2 casos en 2019 (Loreto) y 2 en 2024 (Amazonas).
Conclusiones. La PrEP masiva en CNA se asocia a control sostenido de la RHS (2017–2024). Las bajas coberturas o interrupciones reactivan el riesgo;

se requiere sostenibilidad técnico-financiera continua y abordaje intercultural para cerrar brechas y proteger a toda la población en áreas de alto riesgo.

O4.8. Infiltração lesional de imunobiológicos para a profilaxia da raiva humana: opção segura e econômica

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Palavras chave. Vacina antirrábica, Cuidados Médicos, Farmacoeconomia, Sistema Único de Saúde.

Introdução. Diante da escassez de imunobiológicos, a Nota Técnica 134/2022 propôs o uso racional da profilaxia da Raiva Humana nos acidentes da “Categoria 3”.
Objetivos. Estimar o impacto logístico e econômico desta conduta em um único Serviço de Referência da cidade de São Paulo.
Método. Análise retrospectiva dos casos atendidos entre 01/01/2023 e 30/06/2025 a partir das anotações do Serviço e das fichas de notificação do SINAN.
Resultados. De um total de 2.120 acidentes da “Categoria 3” atendidos no período, 1.738 (82,0%) envolveram cães, gatos ou animais de produção - situações onde, de fato, pode-se racionalizar o uso dos imunobiológicos. Dez pacientes recusaram a sorovacinação, restando 1.728 como nosso denominador final. A idade variou de 1 a 90 anos (mediana de 38). As lesões corporais foram únicas em 81,8% dos casos. O intervalo entre a exposição e o atendimento variou de 0 a 46 dias (mediana de 3). Dos 902 (52,2%) pacientes que receberam soro antirrábico humano (SAR), o volume infiltrado na(s) lesão(ões) variou de 0,1 a 26,0 ml. Dos 826 (47,8%) que receberam imunoglobulina humana antirrábica (IGHAR), o volume variou entre 0,1 e 14,0 ml. Este volume infiltrado correspondeu à dose total pré-calculada para cada indivíduo em 36 casos, enquanto em 77 pacientes o volume residual desta dose (além do que foi infiltrado) foi administrado por injeção intramuscular;

outros 85 foram medicados exclusivamente por via sistêmica. Nos demais 1.530 casos, estimamos que o volume economizado de SAR foi 10.847 ml (2.169 frascos) e 5.349 ml (2.674 frascos) de IGHAR. O esquema vacinal (VERO 0-3-7-14) seguiu a preconização de rotina. Um único paciente foi internado para reversão de choque anafilático ao SAR, sem sequelas.
Conclusão. A segurança e, sobretudo, a economia evidenciada ao longo destes 30 meses num único serviço são bastante expressivos e ratificam esta nova rotina.

O4.9. Profilaxia da raiva humana: quatro condutas distintas para um mesmo acidente envolvendo 22 pessoas – Relato de Caso

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Palavras chave. Vacina antirrábica, Cuidados Médicos

Introdução. Uma égua e seu potro comprovadamente infectados (não vacinados) foram sacrificados e demandaram 22 atendimentos para profilaxia da raiva humana num mesmo serviço.
Objetivo. Exemplificar as diferentes condutas adotadas frente a um único acidente com distintos contextos de exposição.
Método. Revisão das fichas de atendimento e notificação compulsória.
Resultados. A Conduta #1 {duas doses (2x) da vacina VERO intradérmica (ID)} foi adotada em um veterinário com esquema vacinal pré-exposição (PrEP) completo e recente, mas sem sorologia de controle; e um auxiliar de sepultamento dos animais que havia recebido esquema vacinal pós-exposição (PEP) completo há quatro anos. A Conduta #2 {imunoglobulina humana (IGHAR) intralesional + intramuscular (IM) + 4x (0-3-7-14) VERO ID} foi adotada em outro veterinário ferido, não imunizado com a PrEP preconizada para sua profissão; em mais sete pessoas com ferimentos que mantiveram contato direto com os animais desde o adoecimento até a eutanásia; e em um cuidador com ferimentos e PEP incompleta há cinco anos. A Conduta #3 {IGHAR IM + 4x VERO ID} foi adotada em outro

auxiliar de sepultamento que não teve ferimentos, mas tratava psoríase com secuquinumabe; e em duas pessoas sem ferimentos que, entretanto, mantiveram contato indireto (saliva e aerossóis) e prolongado com os animais. A Conduta #4 {"apenas orientação"} correspondeu a oito pessoas que não tiveram contato direto ou indireto com os animais, somente com os demais pacientes. Quatro das 22 pessoas estavam com o esquema vacinal para tétano (DT) adequado; 11 precisaram de uma única dose de reforço; para três foi prescrito esquema completo 3x DT; e outros quatro pacientes precisaram receber IGHAT + 3x DT. Ninguém recebeu antibioticoterapia.
Conclusão. A complexidade assistencial no contexto da profilaxia da raiva humana demanda a individualização de condutas médicas além de incluir outras preocupações como a prevenção do tétano e infecções bacterianas.

O4.10. Barriers to Accessing Rabies Post-Exposure Prophylaxis in Nepal

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Keywords. Treatment seeking behaviour, PEP, Nepal, Health system, Access barriers

Introduction. Rabies is a fatal zoonotic disease endemic to Nepal, causing an estimated 200 to 400 deaths annually. Although the government provides rabies vaccines and immunoglobulins free of cost, deaths persist due to delayed or incomplete post-exposure prophylaxis (PEP). To investigate barriers to timely PEP, a community-based household survey was conducted in Lalitpur district.
Objective. To assess patient experiences with PEP access, identify treatment-seeking patterns and barriers, and evaluate gaps between rabies control policy and on-ground implementation in Nepal.
Methods. A community-based household survey was conducted in Lalitpur

district of Nepal using a structured questionnaire with both open- and closed-ended questions. Human victims of WHO category II and III animal bites within the past year were included. The survey covered 2,421 households (approximately 9,500 individuals), identifying and interviewing 354 bite victims.

Results. Among the 354 bite victims, 85% (n=300) sought care at formal medical centres. Of these, 70% (n=210) received anti-rabies vaccines, while only 4% (n=13) received rabies immunoglobulin. Incomplete PEP was frequently due to the absence of provider recommendation, reflecting limited awareness among healthcare workers. Despite government claims of free PEP, some centres lacked ARV or charged for it. Victims often navigated a centralized system, requiring multiple visits, resulting in travel time, financial cost, and inconvenience. The most common first point of contactt was a private pharmacy (62%, 187/300), but only 43% received ARV at their first facility. Despite these challenges, 93% completed the full ARV course, and 97% adhered to the recommended schedule. Public awareness of rabies and the need for treatment was generally high.

Conclusions. The study reveals critical gaps in PEP delivery and provider knowledge. Strengthening health worker training, decentralizing vaccine access, and improving service consistency are essential to reduce preventable rabies deaths in Nepal.

Premio George M. Baer para la Investigación Latinoamericana / George M. Baer Prize for Latin American Research / Prêmio George M. Baer de Pesquisa Latino-Americana

El Dr. Baer, conocido como el "Padre de la Vacunación Oral contra la Rabia", dedicó su carrera en el CDC al estudio de la rabia y otras zoonosis. Contribuyó a crear programas nacionales de control en América Latina y escribió el libro The Natural History of Rabies. El premio que lleva su nombre reconoce aportes sobresalientes a la investigación y la salud pública.

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O4.11. Technical academic training for health personnel and training of rabies trainers in Lázaro Cárdenas, Michoacán, in response to a case of human rabies.

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Keywords. Human rabies, Training, Rabies instructors, Risk perception

Introduction. Rabies is a threat to public health, animal production, and wildlife. In the Americas, human rabies transmitted by dogs has decreased by 98%; however, hematophagous bats are now the main source. In 2024, Mexico reported 4 cases of human rabies from wildlife; one occurred on April 8 in a child from Aquila, Lázaro Cárdenas, Michoacán, bitten by a hematophagous bat. In 2007, two people in this jurisdiction died from bat bites. It is urgent to train personnel and the community to prevent the disease.
Objective. Increase risk perception, ensure fast response and care for bites from rabies-transmitting animals, and strengthen knowledge about prevention.
Methods. A quasi-experimental before-and-after study was conducted in Lázaro Cárdenas, Michoacán, where an eight-hour academic session on rabies was held on February 21, 2025. The session covered epidemiology, regulations, prophylaxis, and transmission of rabies through animals, with an

emphasis on bats. It also included a clinical case workshop and a 20-question exam. Materials were adapted to facilitate replication, initiating the CDMX-LZCM collaboration and identifying indicators and strategies to strengthen prevention.

Results. Two hundred seventy professionals were trained, and sessions were replicated with healthcare workers, schools, the community, and authorities. Medical care, prophylaxis, and vaccination indicators for dogs and cats increased, and cooperation was promoted to vaccinate cattle. Additionally, processes began to train 203 rabies instructors. Results showed a significant increase in scores, rising from 3.2 to 8 out of 10 following the intervention.

Conclusions. After the intervention, the criteria were unified, and confidence in prevention efforts increased. Previous deaths due to a lack of risk perception prompted improvements in education and care. Rabies control requires a “One Health” approach and collaboration among academia, community, and health systems. Disseminating knowledge strengthens protection, enabling rapid and effective responses to prevent new rabies cases in the population.

O4.12. Identification of rabies virus polymerase inhibitors that block viral replication in human brain organoids

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Keywords. Rabies, Antivirals, Brain organoids

Introduction. Rabies post-exposure prophylaxis (PEP), which consists of vaccination together with administration of anti-rabies immunoglobulins at the site of infection is highly effective when started in time. However, once neurological symptoms appear, PEP is no longer effective and the mortality rate is >99.99%.
Objective. Our goal is to develop small molecule antivirals against rabies virus (RABV) for the treatment of those patients who present with neurological symptoms, for whom PEP is no longer effective.
Methods. A phenotypic high-throughput screen was performed using a subset (120k molecules) of the CD3/CISTIM diversity small molecule library. Molecules were spotted in 384-well plates after which BHK-21 cells and RABV (SADB19 with mCherry reporter) were added. Viral replication was quantified at day 5 post infection.
Results. Two hits were obtained of which the antiviral activity was validated in various orthogonal assays. A hit-explosion effort was conducted to obtain even more potent/selective analogues, this resulted in two hit series (A and B). Antiviral activity was also confirmed in human brain organoids infected with the RABV. Time-of-drug-addition experiments revealed that molecules from

both series inhibit viral replication at a post-entry step. In vitro resistance selection experiments revealed that one series (A) selects for two amino acid substitutions in the C-terminal domain of the RNA dependent RNA polymerase (RdRp) (encoded by the L-gene) and one series (B) that selects for a substitution in the capping domain.

Conclusion. By using a high-throughput phenotypic antiviral screen, we identified two classes of small molecules that inhibit RABV. These molecules act by targeting the RdRp and show efficacy in a human brain organoid model. Optimization of the antiviral potency and pharmacokinetics of both series are ongoing with the aim to demonstrate efficacy in RABV animal infection models.

O4.13. Antibody Gene Therapy for Rabies

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Keywords. Gene therapy, AAV vector, anti-rabies virus antibody, rabies encephalitis.

Introduction and Objective. Rabies virus neutralizing antibodies in serum do not cross the blood-brain barrier (BBB), making them ineffective in treating rabies encephalitis. We designed a recombinant adeno-associated virus vector (AAV-Rab) that crosses the BBB and expresses broadly neutralizing antibodies to rabies virus, independent of the host immune system, in serum and brain to protect the nervous system from infection.

Methods. Mice received a single intravenous injection of AAV-Rab as low (1x1012) or high (1x1013 vg/kg) doses, with or without a lethal intramuscular challenge infection using an African canine rabies virus variant. Rabies virus-neutralizing antibodies were analyzed in serum and brain. Additionally, cats were treated intravenously with low (2x1012) or high (1x1013 vg/kg) doses to evaluate antibody production.

Results. Mice treated with AAV-Rab 14 days before virus challenge demonstrated dose-dependent protection: all mice (16 of 16) receiving the high dose survived to the experimental endpoint ≥52 days post-challenge, while 14 of 16 mice of low-dose cohort survived. When mice were challenged with rabies virus three days prior to high-dose treatment, 11 of 12 animals survived. Untreated controls (11/12) died within 16 days. In additional study, AAV-Rab produced rabies neutralizing antibodies in mouse serum up to 24 IU/ml and 181.34 IU/ml as soon as 48 and 72 hours post administration, respectively. AAV-Rab treated cats reached titers up to 140 IU/ml in the serum, which persisted for 15 months. Antibodies to rabies virus were detected by immunohistochemistry in neurons of numerous brain regions in mice and cats.

Conclusions. A single intravenous dose of AAV-Rab expressed rabies virus neutralizing antibodies in serum as soon as 48 hours post administration and protected mice from lethal infection and encephalitis. Cats treated with the same AAV-Rab produced neutralizing antibodies for over one year. AAV-Rab has potential to be both a preventive and treatment for rabies infection.

O4.14. Diseño y caracterización de candidatos a proteínas señuelo contra la rabia: un estudio in silico bioinformático

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Palabras clave: Rabia, Virus de la Rabia, Proteínas Recombinantes, Diseño de Fármacos, Bioinformática

Introducción. La rabia es una enfermedad viral altamente letal. Se requieren nuevas terapias neutralizantes basadas en bioinformática para su abordaje en estadíos avanzados.
Objetivo. Diseño in silico proteínas señuelo para la neutralización del virus de la rabia.
Métodos. Se diseñaron 4 proteínas señuelo bajo 2 modelos de diseño: El primero es vía dominio receptor soluble; se extrae los fragmentos extracelulares de los receptores putativos de la rabia, estos mismos se integran con un péptido señal y un fragmento corto de IgG1; a uno de estos diseños se le añadió una proteína lanzadera para la barrera hematoencefálica (BBB). El segundo diseño es mediante un dominio Variable Pesado Pesado (VHH), con una secuencia obtenida de una patente experimental en camélidos, se realizó un proceso de humanización mediante edición con Blastp y alineamiento múltiple mediante DNASTAR conservando las regiones de complementariedad determinantes (CDR). Los diseños de proteínas fueron acoplados mediante ClusPro y las características de unión se obtienen mediante el servidor Prodigy.
Resultados. Se obtuvieron 4 señuelos: Proteína p75NTR con receptor soluble, proteína p75NTR con receptor soluble y lanzadera BBB, proteína ACHA mediante Receptor Soluble, proteína editada de VHH con conservación de CDR, las energías de enlace fueron desde -1004.0 kcal/mol hasta -1140.6 kcal/mol en su punto menor; las constantes de disociación (Kd) respectivamente fueron: 6.3e-11M, 3.2e-12M, 6.7e-12M y 5.3e-12M destacando al señuelo p75NTR+BBB y el basado en VHH como los más favorables.
Conclusiones. Bajo nuestras limitantes, y con la aplicación de la proteómica bioinformática, se han propuesto 4 diseños de proteínas con capacidad de competir con el receptor biológico, que sugiere bloqueo del virus. Los resultados justificarían la experimentación in vitro e in vivo de las proteínas señuelo, proponiendo un freno a la rabia en estadíos avanzados.

O4.15. From Bioinformatics to bench: repurposing approved drugs for anti-rabies activity in Latin America

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Keywords. Rabies, antivirals, Drug repurposing, Molecular dynamics, Latin America

Introduction. Rabies is a fatal zoonotic disease caused by the rabies virus (RABV), a negative-sense, single-stranded RNA virus of the genus Lyssavirus. Once clinical symptoms appear, the disease is almost invariably lethal, causing tens of thousands of deaths annually, with a major burden in Latin America. Although vaccines are highly effective for post-exposure prophylaxis, no antiviral therapy exists for symptomatic cases. In remote areas, delayed access to vaccination and ongoing viral circulation in wildlife and domestic animals underscore the need for complementary therapeutic options.

Objectives. To establish a rapid drug-repurposing pipeline integrating in silico screening and in vitro validation to identify antivirals against RABV and create a framework applicable to other regional viral pathogens.

Methods. A library of approved or clinically tested drugs was screened in silico against five RABV proteins. Top hits were tested in vitro for antiviral activity, cytotoxicity, and mechanism of action. Molecular docking and molecular dynamics simulations evaluated ligand affinity and stability. Ofloxacin, Diclazuril, and Pitstop2 were selected for infectivity and cytotoxicity assays, qRT-PCR quantification, and time-of-addition studies.

Results. Diclazuril reduced viral titers by 0.55 $\log_{10}$ (~3.6×) at 0.39 µM, with IC_{50} = 0.19 µM, CC_{50} = 0.42 µM, and SI = 2.2. Ofloxacin reduced titers by 6.0 $\log_{10}$ (~1.0 × 10^6-fold) at 2.77 µM, with IC_{50} = 0.92 µM, CC_{50} = 4.6 µM, and SI = 5.0. Pitstop2 reduced titers by 9.25 $\log_{10}$ (~1.8 × 10^9-fold) at 0.04 µM, with IC_{50} = 0.04 µM, CC_{50} = 0.16 µM, and SI = 4.

Conclusions. Computational screening accurately predicted antiviral activity.

The compounds showed complementary mechanisms: binding inhibition (Diclazuril), replication suppression (Ofloxacin), and entry interference (Pitstop2). This bioinformatics-to-bench pipeline offers a cost-effective, adaptable strategy for antiviral discovery in Latin America, strengthening regional preparedness against zoonotic diseases.

O4.16. Specific glycan residues modulate the neutralizing function of anti-Rabies antibodies

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Keywords. Neutralizing IgG1, glycosylation, rabies vírus glycoprotein, Lectin

Introduction. Previous studies have shown that complete removal of glycans from human IgG1 antibodies abolishes their neutralizing activity against the rabies virus, even without affecting antigen binding. However, the specific contribution of individual glycan residues to antibody function remains unclear.

Objective. To evaluate the impact of selectively removing fucose, sialic acid and galactose residues from neutralizing IgG1 antibodies on their ability to bind the rabies virus glycoprotein (RABV-G) and neutralize the vírus in vitro.

Methods. Neutralizing and non-neutralizing IgG1 antibodies were purified by affinity chromatography from the serum of individuals who received a PrEP for rabies. These antibodies were enzymatically treated to selectively remove fucose, sialic acid and galactose. Deglycosylation was confirmed by reverse lectin based ELISA assay and total carbohydrate quantification. Antibody binding to purified RABV-G was assessed using indirect ELISA, and neutralizing activity was measured by the Rapid Fluorescent Focus Inhibition Test (RFFIT).

Results. The complete neutralizing IgG1 showed strong binding to RABV-G (0.420) and high neutralizing activity (12.08 IU/mL), when compared with the non-neutralizing IgG1, which showed low binding (0.077) and no detectable neutralizing activity. Removal of sialic acid, fucose, or galactose reduced

antigen binding (0.082–0.084). Corresponding reductions in neutralizing activity were observed: 85.1% loss with sialic acid removal, 51.2% with fucose, and 75.6% with galactose. Lectin-binding assays confirmed the successful removal of the targeted glycans. All experiments were performed twice and in triplicate to ensure reproducibility and reliability.
Conclusions. Specific glycan residues, particularly sialic acid and galactose, are critical for the neutralizing activity of IgG1 against rabies vírus, suggesting that glycan modifications can directly influence the therapeutic efficacy of antiviral antibodies. These findings support the rational design of monoclonal antibodies with optimized glycosylation for improved efficacy, especially in the context of post-exposure prophylaxis and public health strategies in resource-limited settings.

O4.17 Lovastatin Decreases the Size of Negri Bodies: A Potential Regulator in Rabies Infection?

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Keywords. Antiviral, Rabies, Lovastatin, Negri bodies, Cholesterol

Introduction. Rabies is a lethal zoonosis responsible for nearly 59,000 human deaths annually worldwide, with children being the most affected group. Rabies virus (RABV) induces the formation of Negri bodies in infected cells, cytoplasmic inclusions essential for viral replication. Lovastatin, a cholesterol synthesis inhibitor, has shown antiviral effects against other viruses, suggesting a potential impact on the biogenesis of these structures.
Objective. To evaluate the effect of lovastatin on the formation and size of Negri bodies induced by RABV in cell cultures.
Methods. BHK-21 cells were infected with the PV strain of RABV at different

infectious doses ($10^{2.18}$ to $10^{-1.18}$ $TCID_{50}$/mL) and treated with lovastatin (0.5, 1, and 2.5 µg/mL). After 72 h, the presence and diameter of Negri bodies were analyzed using direct immunofluorescence, and fluorescence intensity was recorded as an indicator of infection.

Results. Lovastatin treatment reduced the size of Negri bodies compared with untreated controls. The effect was most evident at 1 and 2.5 µg/mL, particularly at a viral dose of $10^{1.18}$ $TCID_{50}$/mL, where the greatest reduction in inclusion body diameter was observed. A moderate correlation was found between increasing lovastatin concentrations and decreased Negri body size under high viral load conditions ($R^2 = 0.65$).

Conclusions. Lovastatin exerts a dose-dependent effect in reducing the size of Negri bodies, possibly by limiting cholesterol availability required for their formation. These findings suggest a modulatory role of the cholesterol pathway in the morphogenesis of RABV inclusion bodies.

O4.18. Differences in transmission rates leading to endemicity and host adaptation are correlated with neurophysiological activity of different rabies virus variants

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Introduction. Rabies virus, which is maintained in distinct species-specific cycles of infection, has a high case fatality rate, manipulates host behavior to facilitate transmission, and can serve as a model to understand adaptations to different hosts. How rabies variants are functionally adapted to their specific host species is not well understood.
Objective. We test if pathogenicity (inhibition of nicotinic receptors) is linked to host adaptation.
Material and Methods. We use a multidisciplinary approach of agent-based modeling, electrophysiology, and phylogenetic analysis.
Results. Rabies virus requires distinct transmission rates in two hosts with different ecologies to establish endemicity. In arctic foxes, a host species with very low host densities, a higher transmission rate is required than in raccoons, which are characterized by high population densities. Host density drives these differences in agent-based modeling, while dispersal distance does not influence the transmission rate leading to endemicity. The higher transmission rate required for endemicity in arctic foxes correlates with higher functional potency of arctic fox rabies-derived neurotoxin-like peptides in

inhibiting nicotinic acetylcholine receptors, a property of the rabies virus glycoprotein associated with behavior modifications. Furthermore, a residue in the neurotoxin-like region of the mature rabies virus glycoprotein (residue 183) is associated with pathogenicity, host switching, and disease ecology, and residues in the neurotoxin-like region are overrepresented among sites potentially involved in driving host jumping and adaptation.
Conclusions. We propose a model in which the adaptation of the rabies virus to new hosts involves adjusting behavior modification and transmission rate to the host ecology and physiology of the new reservoir host. Other mechanisms of adaptation to a new host are likely also involved, especially for host pairs with alternate differences in host ecologies, which has posed difficulty in identifying general evolutionary signals associated with rabies virus host switching across host switching events.

O4.19. Neuroimaging/MRI findings of patients with Rabies Encephalitis. A study from a Tertiary Care Hospital in North India

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Keywords. Human Rabies, Imaging MRI

Introduction. Rabies remains a highly fatal infectious disease, with existing knowledge of its MRI characteristics largely confined to isolated case reports and small case series.
Methods. Of the 46 patients enrolled, 29 underwent contrast-enhanced MRI of the brain and spinal cord.

Results. The brainstem was the most frequently involved region, with abnormalities observed in 14 patients (48.2%) across the midbrain, pons, and medulla. Specifically, midbrain and pons involvement was noted in 14 patients each (48.2%), while the medulla was affected in 12 patients (41.3%).The peri-aqueductal grey matter and cervical spinal cord were each involved in 11 patients (37.9%), reflecting contiguous spread rostrally and caudally from the brainstem. Basal ganglia lesions were observed in 9 patients. Among these, the putamen was affected in 7 (33.3%), caudate nucleus in 6 (28.6%), and globus pallidus in 4 (19.0%). Thalamic abnormalities were seen in 6 patients (28.6%). Other supratentorial findings included subcortical white matter involvement in 8 patients (27.5%), cortical involvement in 6 (20.6%), corona radiata in 3 (10.3%), and internal capsule in 1 (3.4%). Thoracic spinal cord lesions were present in 4 patients (13.7%), with cauda equina nerve root involvement in another 4 (13.7%). Plexus involvement was rare (1 patient; 3.4%).Diffusion restriction on DWI was seen in 8 patients (27.5%), while none showed gadolinium contrast enhancement. Univariate logistic regression indicated a higher likelihood of MRI abnormalities with increasing duration from symptom onset.

Conclusion: To date, this represents the largest prospective study (29 cases) evaluating MRI findings in patients with rabies encephalitis. Imaging was performed at a single time point for each patient in our study. Future studies incorporating serial or follow-up MRIs in the same individuals may help delineate the natural progression of radiological abnormalities, both in terms of extent and severity, offering deeper insights into disease evolution.

O4.20. G and L genes of rabies virus regulate viral myotropism and neuroinvasiveness

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Keywords. Street strain, Myotropism, Neuroinvasiveness, Pathogenicity, Peripheral infection

Introduction. While peripheral muscle tissue is the initial target of rabies virus (RABV) infection and considered to be involved in the neuroinvasiveness, the underlying mechanism remains poorly understood.
Objective. This study aimed to compare the infectivity of fixed and street RABV strains in muscle and identify viral genes that contribute to the myotropism and neuroinvasiveness.
Methods. The growth of the Toyohashi street strain and CVS fixed strain in mouse myoblasts was assessed by measuring virus titers. The infectivity in the hindlimb and the mortality rate of these strains were compared following intramuscular (i.m.) inoculation into ddY mice. Recombinant chimeric viruses were constructed by exchanging viral genes between Toyohashi and CVS strains to examine viral proteins involved in the myotropism, infectivity and pathogenicity of RABV. Entry efficiency into myoblasts mediated by RABV G protein was evaluated by entry assay using replication-incompetent vesicular stomatitis virus (VSV △ G*) pseudotyped with RABV-G. Replication/transcription efficiency mediated by L protein was assessed by minigenome assay.
Results. The Toyohashi strain replicated more efficiently in myoblasts and showed higher infectivity and mortality in mice following i.m. infection than the CVS strain, showing typical properties of RABV street strain. Chimeric viruses carrying CVS-derived G or L gene showed reduced infectivity to muscle and mortality in mice. VSVΔG* pseudotyped with Toyohashi-G showed higher entry efficiency into myoblasts compared to that with CVS-G. In the minigenome assay, the Toyohashi-L demonstrated greater replication efficiency of RABV minigenome than CVS-L.
Conclusions. Our study demonstrated that the G and L proteins of the Toyohashi strain contribute to efficient viral entry and replication in muscle cells, respectively, which are associated with the myotropism and neuroinvasiveness of the street strain.

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Evaluación de la tolerancia y respuesta inmune a la vacunación antirrábica en caninos y felinos menores de tres meses de edad

3er puesto - Gian Franco Joel Condori Luna

Spatiotemporal Modeling of Rabies Using Graph Neural Networks: A Proposal to Enhance Epidemiological Surveillance in Low-Supervision Contexts

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XXXVI CONFERENCIA ANUAL **RITA**

RABIA EN LAS AMÉRICAS

LIMA, PERÚ **2025**

19 AL 24 OCTUBRE

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Deep Learning Models for Rabies Virus Detection in Cell Cultures

2do puesto - Alejandra Dávila-Barclay

Understanding canine rabies virus transmission using genomics in a decade-long epidemic in Arequipa, Peru

3er puesto - Rita Ribeiro

A Bayesian framework for optimising vampire bat roost discovery and quantifying livestock bite risk

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Sesión de clausura/ Closing session/ Sessão de encerramento

Dr. Charles Rupprecht

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Research Directions in Rabies Prevention & Control - 'Days of Future Past'…?

Dr. Charles Rupprecht
Auburn University, College of Veterinary Medicine, Auburn, Alabama, USA.

The XXXVI Rabies in the Americas (RITA) Conference in Lima, Peru demonstrated the continued benefits of open scientific communications and united biomedical advocacy for renewed prevention and control of this global zoonosis. Besides continued representation from the Americas, active participation by professionals from Australia, Eurasia, etc. exemplified the international flavor of RITA. Inarguably, great progress occurred throughout the region towards the elimination of canine rabies. However, critical remaining foci maintain a source of infection to surrounding countries and prevent acquisition of the global goal of 'zero by thirty'. Greater collaboration and engagement by all stake holders focused on enhanced surveillance, mass dog vaccination, and human prophylaxis would be a worthy enterprise. Prevention is virtually assured by timely and appropriate application of biologics before or after exposure. Modern cell culture vaccines are pure, potent, safe, and efficacious. Dose-sparing and shorter schedules equate to broader economical use. Moreover, monoclonal antibodies are licensed in Asia and should be considered in the Americas as an alternative to expensive human rabies immune globulins. While prevention is a priority, there is also an urgent need to better understand the pathobiology of lyssaviruses and to develop anti-viral drugs to be used in combination with biologics that would ensure neutralization and clearance of virions within the central nervous system. Application to naturally infected domestic animals should be pursued at veterinary centers of excellence as a routine application of care based upon best practices and knowledge gained to date on experimental therapy. Regarding novel methods of wildlife management, transmissible viral vaccines may hold promise for application to bats and the possible control of Hendra virus in Australia, Nipah virus in Asia, filoviruses in sub-Saharan Africa, MERS virus in the Middle East, and multiple lyssaviruses in Europe. However, their applicability to vampire bats remains highly controversial on a variety of regulatory, ethical, and ecological fronts. For example, there would be no impact upon acquired bites. Scars inflicted upon children involve lifelong trauma and stress. Impacts to livestock include blood loss, decreased milk and meat production, ruined hides, and secondary infections exacerbated by fly strike. Even if successful in limited control of rabies in the

long term, bitten individuals would still receive PEP and livestock at risk would still be vaccinated because of other wildlife reservoirs. Appropriate, proactive, preventative control of vampire bats remains the strategy of choice, combined with human and domestic animal vaccination. Future strategies include a recombinant 'anti-vampire bat' biologic administered by a rabies virus expression vector for the dual prevention of the disease and development of immunity against vital bat antigens that would interfere physiologically with the act of predation. Preexposure vaccination of indigenous communities at risk is a valuable necessity throughout Amazonia which will benefit from the development of safe and potent vaccines based upon a single dose. Continued models on the predicative spread of vampire bat rabies will continue to provide useful epizootiological data on where and when to apply ideal lethal control, together with other biomedical, anthropological, social, political, and health economics tools in the most optimal One Health context.

Seminario Web/ Webinar/ Webinário

24 de octubre / October / Octobre

"Consideraciones para la profilaxis humana preexposición a la rabia en comunidades desatendidas de Sudamérica"

“Considerations for Pre-exposure Human Prophylaxis Against Rabies in Neglected Communities in South America"

"Considerações sobre a profilaxia humana pré-exposição contra a raiva em comunidades negligenciadas na América do Sul"

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The historical precept & modern concept of pre-exposure prophylaxis against rabies

Dr. Charles Rupprecht
Auburn University, College of Veterinary Medicine, Auburn, Alabama, USA.

Historically, traditional healers have employed countless remedies and wielded diverse extracts from soil, plants, and animals in attempts to ward off or minimize the impact of various maladies. For example, during the 15th to 17th centuries, physicians practiced the art of personal 'variolation' in attempts to prevent smallpox, which Edward Jenner formalized in 1796 by using cowpox material in a milkmaid's lesion as a first human pre-exposure prophylaxis (PrEP) 'vaccine'. Building upon this broad idea, Louis Pasteur extended the concept with the first animal vaccine in 1872, using fowl cholera as a model in poultry, followed by his monumental achievement in rabies during 1885. While Pasteur's dried rabbit spinal cords were construed primarily for postexposure prophylaxis (PEP) in bitten people, he and his staff also practiced PrEP, given the obvious biohazards in their laboratory. In the 1920s, canine rabies PrEP vaccines were utilized to build herd immunity (unlike the post-facto rationale in humans). Understandably, public health experts were loath to recommend adult nerve tissue-based products for human PrEP, due to major safety concerns. Even the 'improved' inactivated avianized vaccines suffered from low immunogenicity and local adverse events. Creation of the human diploid cell vaccine revolutionized the field. Since the 1970s, all such modern vaccines adhered to high standards of purity, potency, safety, and efficacy, enlisted for both PEP and PrEP, administered either by the intramuscular or intradermal routes. The original concept of PrEP was intended for those at occupational risk of viral exposure, such as veterinarians, animal handlers, diagnosticians, producers, and researchers. This was later broadened to include other groups, such as cavers and travelers. The idea for expansion to children in canine-enzootic countries was not limited by need or safety, but rather by health economics and a necessity for concentration upon mass dog vaccination. While canine rabies is the major global burden, other scenarios are evident that do not benefit significantly from programs dedicated to canine rabies elimination. For example, throughout Amazonia, vampire bat rabies is enzootic. The

successful example of One Health in public health. Extending this approach to the control of wildlife rabies may further strengthen intersectoral capacity and serve as a broader model of One Health in action.

Development of an ideal preventative rabies vaccine

Dra. Hildegund Ertl
Wistar Institute, Philadelphia, PA, USA

Rabies, a viral disease that is nearly always fatal, can be prevented by pre- (PrEP) or post-exposure (PEP) vaccination with the latter in case of severe exposure requiring additional treatment with hyperimmune serum or monoclonal antibodies to rabies virus. Although efficacious vaccines are available the death toll due to rabies virus transmitted mainly by infected dogs and to a lesser extent wildlife, such as foxes, raccoons, bats and others remains high in less developed countries and disproportionally affects children. This is in part caused by ignorance, medical financial hardship and lack of speedy access to health care faculties. Preventative vaccination of children in highly endemic areas would reduce the death toll as was shown in the Peruvian Amazon rainforest where human rabies cases were common due to transmission by vampire bats.
We developed a chimpanzee-derived replication-defective adenovirus vector vaccine that pre-clinically upon a single modest dose provides long-term protection against an otherwise fatal rabies virus infection. This vaccine that is currently undergoing clinical testing meets the requirements for a PrEP rabies vaccine. It is cost-effective, well-tolerated, provides sustained antibody and memory B cell responses after a single dose, and procedures for scale-up GMP production and testing are available.

Don't let the perfect be the enemy of the good: how PrEP could save lives

Dr. Alexander (Sandy) Douglas
Jenner Institute, University of Oxford, UK

With tens of thousand of rabies deaths each year and decreasing global health and development funding, now is the time to revisit approaches to

rabies control. Increasing access to PEP and controlling rabies exposure through improved dog vaccination rates form the cornerstone of current Gavi, WHO and OIE-supported efforts to reduce human rabies deaths to zero. Human PrEP, conversely, is not a major part of current strategies for rabies control, with its cost-effectiveness usually regarded as inadequate for it to be implemented as part of routine vaccination for residents in areas with high rabies risk. This contrasts starkly with the belief that PrEP is sufficiently efficacious and cost-effective to be used routinely for high-income-country travellers making brief visits to the same areas, and indeed for animals.

PrEP is used in contexts where prompt and complete PEP cannot be relied upon. For obvious ethical reasons, it is difficult to study the effectiveness of human rabies PrEP in the absence of PEP. This has led to a conservative assumption in various models that PrEP will not save lives on its own, making it appear cost-ineffective. Both animal and observational human data suggest that this assumption is incorrect: PrEP does in fact have meaningful efficacy in the absence of PEP, even after virus neutralising antibody titres wane.

We recently re-assessed the cost-efficacy of human PrEP across a range of scenarios of rabies risk, access to PEP, PrEP cost, and PrEP efficacy. We found that costs of <1000 USD per quality adjusted life year (QALY) saved were achieved under a range of plausible scenarios. Under scenarios of rabies incidence as low as 0.3 per 100 000 per year and PrEP efficacy as low as 30% over 15 years, costs <3000 USD/DALY were still achieved.

We have also been developing a novel, single-visit rabies PrEP vaccine. This was found to be safe, well-tolerated and immunogenic in a published study of UK adults. Recently, in an ongoing study of Tanzanian adults and children, we have found our candidate to induce stronger and better maintained VNA responses than one or two-visit regimens using currently licensed vaccines. Cheap to manufacture and with excellent single-dose immunogenicity, this vaccine offers hope that effective, next generation vaccines can be made available much more cheaply to those who are most at risk of rabies.

Affordable, accessible, effective? The dilemma of rabies serological testing in under-resourced high risk areas

Dra. Susan M. Moore
Veterinary Medical Diagnostic Laboratory, University of Missouri, MO, USA

Rabies prevention and control campaigns, including the provision of pre-exposure prophylaxis (PrEP) in at-risk communities, benefit from the integration of serological testing. Such testing supports the determination of booster necessity, evaluation of vaccination response rates, assessment of antibody longevity, and offers valuable data to inform future public health strategies.
However, the rabies serology methods recommended by the World Health Organization (WHO) are not always feasible within the environments or locations where monitoring is most effective—particularly in terms of patient accessibility for sample collection and requirements for temperature-controlled transport to centralized laboratories. The practical implementation of rabies serological testing is further challenged by limited infrastructure and constrained spatial resources in many settings.
To address these barriers, alternative techniques and modifications to established protocols may facilitate the acquisition of necessary immunological data. Nevertheless, such approaches must yield results that are both reliable and interpretable—not only in isolated instances but also longitudinally—to enable trend analysis and substantiate either the efficacy or need for enhancement of ongoing campaigns.
This presentation will summarize these considerations and introduce practical methodologies for monitoring serological responses in under-resourced, high-risk regions.

Massive rabies PrEP program in the peruvian amazon basin: advances, challenges & lessons learned after 14 years

Dr. Sergio Recuenco
Departamento de Medicina Preventiva, Facultad de Medicina San Fernando, Universidad Nacional Mayor de San Marcos, Lima, Perú

Rabies transmitted by hematophagous bats represents a challenge to control in Amazonia. The hardship of the remote populations living in the Peruvian Amazon Basin to get healthcare access, makes that almost all bat bites stay unattended, and unable to get timely life-saving rabies prophylaxis. IN 2011, after years of repeated human outbreaks, Peru changed the paradigm for rabies prophylaxis and started a program for massive preexposure (PreEP) rabies vaccination for all population in high-risk areas. The program was successful to stop human outbreaks among vaccinated individuals even after

even 13 years, demonstrating long duration of immunity among population that continued to be exposed, but not receiving any booster vaccine dose. Unfortunately, cohorts of population born after the intervention did not receive the PreEP, and a new outbreak was reported among non-vaccinated children in an intervened area, renovating the discussion on how to achieve sustainability of successful rabies prevention and control programs in Latin America.

New countries are developing their massive PreEP program. In view of the Peruvian experience, those new programs must include analyses of the requirements to make the program sustainable after achieving control, and proposed strategies and policies suited for the population that will be benefitted. Anticipation of scenarios in which funding and other influential issues may pause or stop the program need to be approached. Peru, have over a decade of experience, and lesson from the success and barriers to implement program strategies can be used to shape future programs in countries endemic for vampire bat rabies in Latin America. New technologies can assist in developing better delivery solution for PreEP in tropical environments, for remote population lacking healthcare access.

Rabies control in remote regions of the Brazilian amazon: strategies for riverine communities

Dra. Silene Manrique Rocha
Department of Health and Environment Surveillance, Ministry of Health, Brazil.

In Brazil, cases of human rabies mediated by dogs have been eliminated, the last record occurring in 2015 in the state of Mato Grosso do Sul. However, the disease persists as a serious public health problem in remote areas of the Legal Amazon, especially among riverine, indigenous and quilombola populations exposed to transmission of the rabies virus by hematophagous bats (*Desmodus rotundus*). Between 2004 and 2024, 76 cases of human rabies resulting from this route of transmission were reported in the northern region, with the highest concentration in the state of Pará. The victims lived in hard-to-reach communities with poor infrastructure and limited access to post-exposure prophylaxis. Given this scenario, the Ministry of Health incorporated the Pre-exposure to rabies (PreP) strategy as a public policy in 2024, expanding it to the routine of the Federated Units of the Legal Amazon, based

on the recommendations of the World Health Organization (WHO). Vaccination, carried out with two doses of inactivated immunobiologicals, has proven to be safe, effective and operationally viable, especially in communities with a history of cases or raids by chiroptera.
The use of river-based mobile teams has resulted in an increase of up to 70% in vaccination coverage in some locations. The integrated approach includes human Prep, immunization of dogs and cats, active epidemiological surveillance, bat management, educational campaigns adapted to the local context and coordination between health surveillance, primary care, agricultural defense and community leaders.
Despite the progress made, significant challenges remain, such as the logistics of preserving and transporting the vaccine in remote areas, the shortage of trained health professionals and the socio-cultural barriers that make it difficult for the population to adhere. Even so, the expansion of PreP represents a milestone in the fight against human rabies in the Legal Amazon, reinforcing the protection of vulnerable populations, preventing new outbreaks and consolidating an integrated and sustainable preventive approach in the territory.

The health economics of human rabies pre-exposure rabies vaccination

Dra. Stephanie Shwiff
USDA/National Wildlife Research Center , Fort Collins, Colorado, USA

Rabies, although preventable, presents a global public health concern, with an estimated 59,000 to 69,000 human deaths each year. The economic burden imposed by rabies and its management can be significant due to the reactive nature of rabies vaccination in humans. This study presents a review of current literature on the economics of Pre-exposure prophylaxis (PrEP) and proposes a model which would place PrEP as a primary preventive strategy rather than a supplemental one in select contexts. Understanding the potential cost-effectiveness of PrEP, considering its potential to save lives in resource-poor settings and its ability to reduce reliance on emergency care, is crucial for developing sustainable and effective rabies control strategies, particularly in the challenging context of eliminating zoonotic diseases.

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